INDEPENDENT ORBITER ASSESSMENT

ASSESSMENT OF THE ORBITAL MANEUVERING SUBSYSTEM VOLUME 1 OF 2

26 FEBRUARY 1988

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MCDONNELL DOUGLAS ASTRONAUTICS COMPANY HOUSTON DIVISION

SPACE TRANSPORTATION SYSTEM ENGINEERING AND OPERATIONS SUPPORT

WORKING PAPER NO. 1.0-WP-VA88003-30

INDEPENDENT ORBITER ASSESSMENT ASSESSMENT OF THE ORBITAL MANEUVERING SYSTEM FMEA/CIL

26 FEBRUARY 1988

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Independent Orbiter Assessment Assessment of the Orbital Maneuvering System

1.0 EXECUTIVE SUMMARY

The McDonnell Douglas Astronautics Company (MDAC) was selected in June 1986 to perform an Independent Orbiter Assessment (IOA) of the Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL). Direction was given by the STS Orbiter and GFE Projects Office to perform the hardware analysis using the instructions and ground rules defined in <u>NSTS 22206</u>, Instructions for Preparation of FMEA and CIL, 10 October 1986.

The IOA effort first completed an analysis of the Orbital Maneuvering System (OMS) hardware and electrical power distribution and control (EPD&C), generating draft failure modes and potential critical items. To preserve independence, this analysis was accomplished without reliance upon the results contained within the NASA FMEA/CIL documentation. The IOA results were then compared to the proposed post 51-L NASA FMEA/CIL baseline. This report documents the results of that comparison for the Orbiter OMS hardware and EPD&C systems.

The IOA product for the OMS analysis consisted of two hundred eighty-four (284) hardware and six hundred sixty-seven (667) EPD&C failure mode worksheets that resulted in one hundred sixty (160) hardware and two hundred sixteen (216) EPD&C potential critical items (PCIs) being identified. A comparison was made of the IOA product to the NASA FMEA/CIL baseline as of 23 December 1987 which consisted of one hundred one (101) hardware and one hundred forty-two (142) EPD&C FMEAs, and sixty-eight (68) hardware and forty-nine (49) EPD&C CIL items. In order to facilitate comparison, additional IOA analysis worksheets were generated as required. IOA mapped one hundred thirty-eight (138) hardware and one hundred forty-seven (147) EPD&C FMEAs, and ninety-three (93) hardware and forty-seven (47) EPD&C CILs and PCIs into the NASA FMEAs and CILs. The IOA and NASA FMEA/CIL baselines were compared and discussions were held with the NASA subsystem managers in an effort to resolve the identified issues. A majority of the initial hardware issues were resolved, however, forty-seven (47) hardware issues, twenty-nine (29) of which concern CIL items or PCIs, and seventy (70) EPD&C issues, thirtyone (31) of which concern CIL items or PCIs, remain unresolved.

Many of the unresolved EPD&C issues result because of differences in interpretation of NSTS 22206. The NASA/RI definition of redundancy allowed the selection of specific unrelated failures which were required to cause known problems, e.g., failures required to cause continuous power to a valve. The IOA redundancy string included only items that were capable of performing the specific function of the item being analyzed. IOA considers many NASA/RI redundancy strings to include multiple unrelated failures.

A number of the unresolved hardware and EPD&C issues involve failure modes identified by IOA which are not currently addressed on the NASA FMEA/CIL baseline. IOA considers each of these failure modes to be credible, and recommends that they be added.

The remaining unresolved OMS hardware and EPD&C issues result because of differences between the IOA and NASA/RI analyses of the OMS subsystem which resulted in criticality, redundancy screen, or failure effect differences.

IOA recommends that the unresolved issues presented in this report be considered for incorporation into the NASA FMEA/CIL baseline.

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Figures 1 and 2 present comparisons of the proposed post 51-L NASA OMS hardware and EPD&C baselines with the IOA recommended OMS hardware and EPD&C baselines, respectively, and associated issues.

NASA ISSUES **OMS ENGINE SUBSYSTEM** 32 35 OMS HARDWARE ASSESSMENT OVERVIEW **N** 75 FMEA GL OMS HARDWARE ASSESSMENT SUMMARY ISSUES 29 47 NASA ISSUES PROPELLANT STORAGE & DISTRIBUTION SUBSYSTEM 9 2 NASA¹ 101 68 33 138 **IOA** PA 33 93 ⁹99⁹8899 FMEA Ę FMEA NASA BASELINE AS OF 23 DECEMBER 1987 G NASA ISSUES HELIUM PRESSURIZATION SUBSYSTEM n r **18 IOA** 24 18 FMEA ฮ

Figure 1 - OMS HARDWARE OVERVIEW

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IOA AND NASA TOTALS DO NOT INCLUDE INSTRUMENTATION AND THERMAL CONTROL ITEMS. IOA ANALYZED

AND ASSESSED THESE ITEMS AS EPD&C ITEMS.





Figure 2 - OMS EPD&C OVERVIEW

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2.0 INTRODUCTION

2.1 Purpose

The 51-L Challenger accident prompted the NASA to readdress safety policies, concepts, and rationale being used in the National Space Transportation System (NSTS). The NSTS Office has undertaken the task of re-evaluating the FMEA/CIL for the Space Shuttle design. The MDAC is providing an independent assessment of the Orbiter FMEA/CIL reevaluation results for completeness and technical accuracy.

2.2 Scope

The scope of the independent FMEA/CIL assessment activity encompasses those Shuttle Orbiter subsystems and GFE hardware identified in the Space Shuttle Independent FMEA/CIL Assessment Contractor Statement of Work. Each subsystem analysis addresses hardware, EPD&C, functions, internal and external interfaces, and operational requirements for all mission phases.

2.3 Analysis Approach

The independent analysis approach is a top-down analysis utilizing as-built drawings to divide the respective subsystem into components and low-level hardware items. Hardware and EPD&C items are evaluated for failure mode, effects, and criticality. These data are documented in the respective subsystem analysis report, and are used to assess the NASA and Prime Contractor FMEA/CIL reevaluation results. The IOA analysis approach is summarized in the following Steps 1.0 through 3.0. Step 4.0 summarizes the assessment of the NASA and Prime Contractor FMEA/CILs which is documented in this report.

Step 1.0 Subsystem familiarization

- 1.1 Define subsystem functions
- 1.2 Define subsystem components
- 1.3 Define subsystem specific ground rules and assumptions

Step 2.0 Define subsystem analysis diagram

- 2.1 Define subsystem
- 2.2 Define major assemblies
- 2.3 Develop detailed subsystem representations
- Step 3.0 Failure events definition
 - 3.1 Construct matrix of failure modes
 - 3.2 Document IOA analysis results

| | 4.4 Forward findings to Project Manager |
|-----------|---|
| .4 | OMS Ground Rules and Assumptions |
| he nal | OMS-specific ground rules and assumptions used in the IOA ysis are presented in Appendix B. |
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3.0 SUBSYSTEM DESCRIPTION

3.1 Design and Function

The Orbital Maneuvering System (Figure 3) provides propulsive thrust for orbit insertion, on-orbit translations, and deorbit. The OMS is housed with the aft RCS in two pods on either side of the tail. The OMS utilizes the hypergolic propellants, monomethyl hydrazine (MMH, fuel) and nitrogen tetroxide (NTO, oxidizer), to provide a total delta V capability of up to 1000 ft/s. The OMS is also used during aborts to dump OMS propellants. Figures 4 and 5 present an overview of the OMS breakdown hierarchy and Figure 6 presents the OMS schematic.

The IOA analysis has defined the OMS as being comprised of the following subsystems.

- o Helium Pressurization
- o Propellant Storage and Distribution
- o Orbital Maneuvering Engine
- o Electrical Power Distribution and Control

3.1.1 Helium Pressurization Subsystem

The helium pressurization subsystem is used to maintain pressure in the propellant tanks to feed propellants to the OMS engines. The subsystem consists of a helium tank, two helium pressurization valves, two dual pressure regulator assemblies, two parallel vapor isolation valves, a dual series-parallel check valve assembly, and couplings. A schematic diagram of the OMS helium pressurization subsystem is shown in Figure 7.

3.1.1.a Helium Tanks

Each pod contains one helium supply tank for the purpose of pressurizing the oxidizer and fuel tanks. The helium supply tank is a spherical pressure vessel consisting of a titanium liner with a Fiberglas structural overwrap. The maximum diameter of the tank is 40.2 inches producing a usable volume of 17.03 cubic feet. The tank operating pressure ranges from a low of 460 psia to a maximum of 4800 psia.

3.1.1.b Helium Isolation Valves

The helium isolation valves (Figure 8) are continuousduty solenoid-operated valves. The valves are energized open and spring-loaded closed. The OMS HE PRESS/VAPOR ISOL switches on Panel 08 permit automatic or manual control of the valves. With the switches in the General Purpose Computer (GPC) position, the valves are automatically controlled by the GPC during an engine firing sequence. The valves are controlled **ORBITAL MANEUVERING SYSTEM**



Figure 3 - ORBITAL MANEUVERING SYSTEM OVERVIEW

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Figure 4 - OMS HARDWARE BREAKDOWN HIERARCHY

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ORBITAL MANEUVERING ENGINE SUBSYSTEM THERMAL CONTROL - GN2 ASSEMBLY - TVC ASSEMBLY - OME ASSEMBLY - POD - CROSSFEED SUBSYSTEM ORBITAL MANEUVERING SYSTEM EPD&C HI - A AN A R - AF PROPELLANT STORAGE & DISTRIBUTION SUBSYSTEM HELIUM PRESSURIZATION SUBSYSTEM

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Figure 5 - OMS EPD&C BREAKDOWN HIERARCHY



Figure 6 - OMS SCHEMATIC



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Figure 7 - HELIUM PRESSURIZATION SUBSYSTEM



manually by placing the switches in the OPEN or CLOSE position. Each valve contains a position feedback that is sent to the GPC for display on the Cathode Ray Tubes (CRTs).

3.1.1.c Helium Pressure Regulator Assemblies

Pressure regulation is accomplished by two pressureregulating assemblies, one downstream of each helium tank isolation valve. Each assembly contains a primary and secondary regulator in series, and a flow limiter (Figure 9). The primary regulator is normally the controlling regulator. The secondary regulator is normally open and will not become the controlling regulator until the primary regulator allows a higher pressure than normal. The flow limiter allows a minimum of 104 scfm and a maximum of 304 scfm. All regulator pressures are in reference to a bellows assembly that is vented to ambient (Figure 9).

Outlet Press

Primary Secondary

o Normal flow (0 to 265 scfm)255+/-4 psig262+/-4 psigo High flow (304 scfm)245 psig min.252 psig min.o Lockup264 psig271 psig

3.1.1.d Vapor Isolation Valves

These values are low-pressure, two-position, two-way, solenoid-operated values (Figure 10). The values are energized open and spring-loaded closed. These values are used to isolate the helium system and fuel tank from the oxidizer tank.

These valves can be commanded manually or by the GPC depending on the position of the HE PRESS/VAPOR ISOL switches on Panel 08. Either of the two (A or B) switches in the OPEN position energize both VAPOR ISOL valves to the open position. With the switches in GPC or CLOSE positions the GPC is allowed to open or close the valves automatically.

3.1.1.e Quad Check Valve

The check valve unit is mounted between the regulators and the propellant tank to pass ullage pressure demand flow downstream and to preclude upstream backflow of helium and propellant vapors, or liquids. Each unit consists of four check valve elements arranged as two parallel assemblies of two series check valve elements (Figure 11). External test/checkout ports allow functional checkout without disassembly of the unit. Filter elements are located at unit's inlet and test ports.



Figure 9 - HELIUM PRESSURE REGULATOR ASSEMBLY

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Figure 10 - VAPOR ISOLATION VALVE

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Figure 11 - QUAD CHECK VALVE

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3.1.2 Propellant Storage and Distribution Subsystem

This subsystem consists of one fuel and one oxidizer tank, tank and crossfeed isolation valves, pressure relief assembly, manual isolation valve, corresponding feedlines, and couplings. The subsystem is capable of several propellant feed configurations. These include nominal OMS feed, OMS crossfeed, OMS/RCS interconnect and mixed crossfeed. The OMS engines can be operated individually using propellant from either pod. All valves can be controlled manually by switches located in the forward flight deck, with GPC software sequences or GPC memory write procedures. A schematic of the OMS propellant storage and distribution subsystem is shown in Figure 12.

3.1.2.a Propellant Tanks

The propellant supply is contained in domed, cylindrical titanium tanks within the OMS pod. The forward and aft sections of each tank has a fluid volume of 63 and 27 cubic feet, respectively.

The tank operating pressure is 250 psia with a maximum operating pressure of 313 psia. The propellant tanks contain the propellant gaging and the propellant acquisition and retention assemblies.

3.1.2.a.1 Propellant Acquisition and Retention Assembly

Each propellant tank is divided into two compartments: forward and aft. The propellant acquisition and retention assembly (Figure 13) is located in the aft compartment and consists of a communication screen and a trap reservoir.

The communication screen allows propellant flow while preventing helium gas from crossing through the screen, and retains propellant in the aft compartment during zero g.

The trap reservoir contains four stub galleries and a collector manifold. The stub galleries acquire wallbound propellant at OMS startup. The stub galleries also have screens which allow propellant flow while preventing gas ingestion. The collector manifold is connected to the four stub galleries and contains a gas arrester screen to further prevent gas ingestion.

3.1.2.a.2 OMS Gaging

A capacitance system is used to measure the amount of propellant in the OMS tanks. The system consists of forward and aft capacitance probes and an electronic



Figure 12 - PROPELLANT STORAGE AND DISTRIBUTION SUBSYSTEM

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Figure 13 - PROPELLANT TANKS WITH ASSEMBLIES

totalizer. Propellant quantities are updated only during OMS burns. Figure 13 shows an overview of the OMS gaging system.

The design of the probes uses the electrical properties of the propellant to measure the height of propellant between two concentric tubes. Fuel is a conductor and forms one capacitor plate; the other plate is the inner tube of the probe, which is a glass tube with a metalized silver coating on the inside. The oxidizer is dielectric, and the capacitor plates are the outer and inner nickel tubes of the probe.

An ungageable region exists between the top of the bulkhead screen and the bottom of the forward probe. This represents the tank quantity between 30 percent and 44 percent. An integration routine using burn time and a preset flowrate is used by the totalizer to update the quantity of this region.

Forward Probe - The forward probe measures the propellant above the bulkhead screen. The forward probe consists of the concentric capacitance probes, probe electronics, helium pressurization gas inlet, and the gas inlet diffuser screen.

<u>Aft Probe</u> - The aft probe measures the propellant below the bulkhead screen. The aft probe consists of the concentric capacitance probes and the probe electronics.

<u>Totalizer</u> - The totalizer receives inputs from the forward probe, aft probe, tank isolation valves, crossfeed valves, engine control valves and outputs total and aft quantities for each tank. A block diagram of the totalizer logic flow is shown in Figure 13.

An OMS to RCS gaging program calculates the OMS propellant used by the aft RCS from each pod during interconnect operations.

3.1.2.b Pressure Relief Valves

The pressure relief valve is located upstream of the propellant tanks but downstream of the helium quad check valves. The pressure relief valve (Figure 14) consists of a relief valve, burst diaphragm, and a filter.

In the event excessive helium and/or propellant vapor pressure ruptures the burst diaphragm, the relief valve opens and vents the system. The relief valve will close and reseal after the excessive pressure has returned to the operating level.



The burst diaphragm provides a more positive seal of helium than a relief valve. The filter prevents any fragments from the nonfragmentation type diaphragm from entering the relief valve seat.

The diaphragm rupture pressure is 305+/-8 psig. The relief valve will open at a minimum of 291 psig and a maximum of 307 psig. The minimum reseat pressure is 285 psig.

3.1.2.c Propellant Feed and Interconnect Lines

The propellant feed lines connect each of the left and right pod's propellant tanks to their corresponding engine. The crossfeed lines are connected to the feed lines to allow the crossfeeding of propellant from one pod's propellant tanks to the other pod's engine. Furthermore, the OMS propellant interconnect lines are connected to the RCS crossfeed lines to feed propellant from either OMS pod's tanks to the RCS aft jets.

3.1.2.d Tank Isolation and Crossfeed Valves

These valves are ac motor operated with bistable ball type flow control (Figure 15). They serve to isolate the propellant tank from the feed and crossfeed lines. The TANK ISOLATION and the CROSSFEED switches on Panel 08 permit GPC or manual control of the valves. With the switch in the GPC position, the valves can be automatically controlled by the computers. The valves are controlled manually by placing the switches in the OPEN position allowing an electric signal to provide power to the ac motors to open the valves. With the switches in the CLOSE position a signal is sent to allow power to the ac motor to drive the valves closed.

The ac motor valve operates on 115 volt ac, 400 Hz three-phase power but will operate with only two phases if required. The microswitch position indicators utilize 28 volt dc power to generate the open and close position discretes. The valves are activated by logic circuits in the Orbiter Motor Control Assemblies (MCA). Valves may be moved by manual or GPC command.

A valve will operate when ac power to the motor is turned on by a set of relays in the MCA logic. The high rpm input of the ac motor is stepped down by the planetary gears to turn a semicircular gear sector (not shown). The gear sector in turn drives the brake/clutch (rocker assembly) on the top of the valve assembly. The brake/clutch turns a torsion rod, which is connected to an actuator finger. The actuator finger is the device that moves the valve ball.



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When the valve drives to the command position, cams on the bottom of the semicircular gear sector activate microswitch position indicators. These discretes are fed back to the MCA logic to remove power from the valve within 50 msec after reaching the commanded position.

The actuation time for a valve is from 1.1 to 1.3 seconds for three-phase operation and approximately 1.5 seconds for two-phase operation. Propellant flow through the valve is established within 0.5 seconds of the first valve motion.

3.1.2.e Manual Isolation Valve

The ground manual isolation valve is used to isolate the propellant tank from the helium pressurization subsystem for ground operations. The nonpowered valve can only be opened with a special tool which cannot be detached with the valve in the closed position. Open during all flight phases, the valve has redundant seals to external leak paths (Figure 16).

3.1.3 Orbital Maneuvering Engine Subsystem

The OMS engine is a pressure fed, hypergolic reacting bipropellant, regenerative-cooled, fixed thrust rocket engine. The engine can be gimbaled to provide thrust vector control (TVC). Major assemblies are the GN2 (pneumatic), bipropellant ball valves, injector, combustion chamber, nozzle extension, engine purge valve, fuel/oxidizer lines, couplings, and gimbal system (Figure 17). Two OMS engines are installed on the Orbiter vehicle, one per pod.

Engine operation is controlled via GPC software sequences. Ignition is commanded only after specific crew system configurations (switch positions and CRT inputs) have been completed. However, shutdown can be commanded manually at any time during a burn. Crew/flight controller insight into engine operation is via pressure, temperature, and valve position instrumentation provided with the engine.

3.1.3.a Gaseous Nitrogen (GN2) Assembly

The purpose of the OMS GN2 (pneumatic) assembly is to store pressurized nitrogen gas and supply on command regulated GN2 to actuate the bipropellant ball valves and purge the fuel side of the injector assembly. Also, sufficient regulated GN2 is stored in an accumulator for a minimum of one engine start.

The GN2 assembly consists of a fill and vent valve, storage tank, engine pressurization valve, check valve, pressure regulator, relief valve, accumulator, and associated instrumentation (Figures 18 and 19).



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Figure 16 - MANUAL ISOLATION VALVE

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Figure 18 - GN2 PNEUMATIC PACK ASSEMBLY


Figure 19 - GN2 PRESSURIZATION ASSEMBLY SCHEMATIC

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3.1.3.a.1 Fill and Vent Valve

The fill and vent valve is a two-way, high-pressure coaxial, single solenoid-operated valve (Figure 20). The valve is used only during ground operations to pressurize or vent the GN2 (pneumatic) assembly. There is no electrical power to the solenoid coil during flight. The valve is designed to fail closed via an internal spring. During fill operations the GN2 is filtered through sintered stainless steel wire filters at the inlet and outlet ports. The valve is bolted directly to the GN2 storage tank. There is no instrumentation on this valve.

3.1.3.a.2 Storage Tank

The GN2 storage tank is a fracture-critical component. The tank is manufactured from titanium bar stock in two halves, then welded together. One half incorporates the mounting flange for the fill and vent valve. The second half incorporates the mounting flanges and flow passages for the remaining GN2 components. Initial GN2 loading is 0.43 pounds at 3000 psia and 70 degrees F. Nominally, this loading will supply 17 engine start/purge cycles. Instrumentation consists of two strain gage-type pressure transducers, which can be monitored on CRT display "GNC SYS SUMM 2" and the cockpit dedicated meter "OMS PRESS N2/He" on Panel F7. The tank pressure transducer designated P1 is hardwired to this meter. The transducer outputs are limit sensed in the PASS (OPS 2 and 8) and the BFS (OPS 1, 3, and 6) and will trigger an SM alarm (class 3) if one or both go out of limits. These pressures are included in the Guidance, Navigation, and Control (GNC) downlist for ground monitoring.

3.1.3.a.3 Engine Pressurization Valve

The OMS engine pressurization (PRESS) valve is a twoway, high-pressure, dual solenoid-operated shutoff The purpose of this valve is to start and stop valve. the flow of GN2 in the pneumatic actuation system. The valve will open with the application of electrical power (23-28 V dc) and only one solenoid is required for nominal operation. With the loss of electrical power the valve is designed to fail closed via an internal During GN2 flow conditions, the gas is spring. filtered through a sintered stainless steel wire filter at the inlet port. Instrumentation consists of a leaf spring switch, which is activated by a push rod integral to the valve poppet assembly. Closure of the switch completes an electrical circuit to indicate an open valve. Valve open/closed status can be monitored





Figure 20 - GN2 FILL AND VENT VALVE

on CRT display "GNC SYS SUMM 2" in the PASS (OPS 2 and 8) and BFS (OPS 1, 3, and 6). The switch's open/closed status is in the GNC downlist and is available for ground monitoring.

The engine pressurization valve is not controlled by the GPC software. Activation of the valve can only be accomplished by manual control of the "OMS ENG" switch on cockpit Panel C3. Placing the "OMS ENG" switch in the "ARM/PRESS" position will open the "ENG PRESS VLV" and allow GPC software to activate the engine control valves for a burn, open the purge valves at burn completion, and repressurize the GN2 accumulator. With the "OMS ENG" switch in the "ARM" position the software will inhibit opening of the purge valves.

3.1.3.a.4 Pressure Regulator/Relief Valve

The GN2 pressure regulator is a modulating, pressure reducing, direct acting pressure-operated mechanical regulator with an integral pressure operated relief valve. The purpose of the regulator is to reduce high upstream GN2 tank pressure (470 to 3000 psig) to the downstream nominal on-orbit ball valve actuator pressure (310 +/- 10 psig). If downstream pressure does increase, (at 360 psig maximum) the regulator will lock up stopping GN2 back-flow. If the regulator fails open or if downstream pressure rises to 450 psig, the integral relief valve will open to vent GN2. At 400 psig the relief valve will reseat to stop venting. During active GN2 flow the gas is filtered through a sintered stainless steel wire filter at the inlet port. There is no instrumentation on this device. However, actual operation can be inferred from the GN2 storage tank and reservoir outlet pressures. The operating pressure levels of the regulator and relief valve may be mechanically reset.

3.1.3.a.5 Check Valve

The GN2 check valve is a one-way flow, cartridge type valve. The purpose of this valve is to prevent GN2 accumulator back flow from occurring if a leak occurs upstream of the check valve. The valve is held close by a mechanical spring and will open with a pressure 6 psig above the downstream level. Reseat pressure is 1 psig delta across the valve. There is no instrumentation associated with this component.

3.1.3.a.6 GN2 Reservoir

The GN2 reservoir (accumulator) is a fracture-critical component manufactured from titanium bar stock. Manufacturing is done in two halves, which are welded together. The assembly is then bolted to a mounting

flange, which is part of the GN2 storage tank. The reservoir nominally holds about 0.0008 pounds of GN2 at 320 psia and 70 degrees F. This quantity is enough to guarantee a minimum of one engine start. Instrumentation consists of one strain gage-type pressure transducer located between the check valve and the reservoir inlet/outlet. This measurement is titled "GN2 REG P", and is monitored on the CRT display "GNC SYS SUMM 2" in the PASS (OPS 2 and 8) and BFS (OPS 1, 3, and 6). This pressure is also limit sensed and will trigger an SM alert (class 3) if it goes out of limits. GNC downlist of this pressure, for ground monitoring, is also available.

3.1.3.a.7 Engine Control Valve

The engine control valve is a three-way, two-position, dual solenoid-operated valve (Figure 21). The valve is normally closed to the bipropellant valve pneumatic actuator inlet port. Upon receipt of electrical power (23-32 V dc) redundant solenoids in tandem will open the valve allowing the flow of pressure regulated GN2 into the actuator, deflecting a piston and opening the bipropellant valves. Removal of electric power will close the valve. Closure is accomplished mechanically by an internal spring. Under flow conditions the GN2 is filtered through a sintered stainless steel wire filter located in the inlet port. The valve is bolted to an integral attach flange on the actuator assembly. Purge of pressurized GN2 from the valve and the actuator cylinder is done during the close cycle. Instrumentation for the control valve is a leaf spring switch. Activation is by a push rod, which is an integral part of the valve poppet assembly. Design and operation of the switch is identical to the "ENG PRESS VLV". However, this switch is not monitored in the cockpit but is in the OI downlist for ground monitoring.

3.1.3.a.8 Actuator

The bipropellant ball valve actuator is a pneumatically operated rack for opening the fuel and oxidizer ball valves (Figure 22). The actuator is mechanically closed via internal spring forces. Comprising the assembly are an actuation piston/cylinder, a toothed rack for mating with the ball valve pinion, closure springs, and a Linear Variable Differential Transformer (LVDT). The LVDT is calibrated to show the percentage of ball valve rotation as a function of the rack's linear motion. Output of the LVDT can be monitored on the "GNC SYS SUMM 2" in the PASS (OPS 2 and 8) and BFS (OPS 1, 3, and 6). The output is also in the GNC downlist for ground monitoring.





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Figure 21 - ENGINE CONTROL VALVE

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Figure 22 - ACTUATOR ASSEMBLY CROSS SECTION

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3.1.3.a.9 Bipropellant Ball Valve Assembly

The bipropellant ball valve was analyzed as part of the OME assembly but is discussed here for continuity. The OMS engine bipropellant ball valve is a rotating open/ close flow valve used to control the flow of propellant to the OMS engine. The assembly consists of four valves; pairs of fuel and oxidizer valves in series. Each pair is linked mechanically to its actuator via a pinion that mates with the actuator rack. Valve pairs are rotated simultaneously 90 degrees for 100 percent open. There is no instrumentation on these valves. However, nominal valve operation is inferred by engine start, stop, and performance levels.

3.1.3.a.10 Engine Purge Valve

The purpose of the engine purge valve is to allow, on command, the flow of regulated GN2 into the engine's fuel (MMH) cooling passages. The GN2 purge is done, nominally after every burn, to minimize the possibility of fuel freezing in the internal cooling and injector flow passages. The assembly consists of two valves in series, a check valve, and instrumentation for monitoring the open-closed status of the purge valves.

The purge valve is a two-way solenoid-operated shutoff valve (Figure 23). With the application of electrical power (23-32 V dc), the valve will open to allow GN2 flow. With the removal of power, internal spring forces will close the valve. During the active GN2 flow conditions the gas is filtered through a sintered stainless steel wire filter at the valve inlet port. Instrumentation consists of a leaf spring switch. The switch is activated by a push rod that is an integral part of the poppet assembly. Closure of the switch completes an electrical circuit to indicate an open This signal is part of the GNC downlist for position. monitoring the valve position by the ground. The purge valve operation is not monitored in the cockpit; however, a purge operation can be inferred by monitoring the "GN2 TK P", "GNC REG P" on GNC SYS SUMM 2, Pc, and injector temperature readings. Integral to the second valve is a check valve of identical design to the check valve of 3.1.3.a.5.

Purging of the OMS engine fuel lines, cooling passages, and injector head is accomplished systematically by the OMS GPC firing sequencer software. Nominally the OMS ENG switch is placed in the "ARM/PRESS" position for a burn. This action opens the ENG PRESS VLV, repressurizing the GN2 reservoir and allowing the GPC to issue the open command to the purge valves following the burn.



Figure 23 - PURGE VALVE ASSEMBLY CROSS SECTION

If the OMS ENG switch is placed in the "ARM" position, the open commands are inhibited by the GPC.

3.1.3.b OME Assembly

The OME assembly consists of an injector, combustion chamber, nozzle extension, and plumbing. The assembly feeds fuel and oxidizer at the design mixture ratio, confines the combustion of the propellants, and provides for the expansion of the combustion gases to produce thrust. There is one OME assembly in each pod.

3.1.3.b.1 Injector

The OMS engine injector meters, atomizes, and directs fuel and oxidizer into the combustion chamber, at the design mixture ratio. This produces efficient and stable combustion that will provide the required thrust without endangering hardware durability. The injector consists of an oxidizer/fuel manifold, core, fuel distribution ring, platelet injector, and manifold covers (Figure 24). All fuel and oxidizer passages are separated by parent metal or redundant metallurgical joints.

All oxidizer and fuel manifold passages are machinedinto the stainless steel core billet. The distribution ring mates with the combustion chamber regenerative cooling passages and delivers fuel to the fuel manifold. The injector is made up of six 8-mil thick platelet disks (one external, one face, three metering, and one orifice). Each platelet hole pattern is photographically etched to assure no metal chips or burns remain in the electron beam welded stack. The injector hole pattern consists of 16 concentric alternating rings of oxidizer and fuel orifices. Ring 16 sprays fuel on the combustion chamber wall for film cooling. The manifold covers incorporate attachment bosses for installation of instrumentation (pressure and temperature). All are sealed off except two, one for a combustion chamber pressure transducer and the second for a fuel injector inlet temperature thermocouple. The fuel injector inlet temperature is on "PRPLT THERMAL (DISP 89)" in the PASS (OPS 2) and on "GNC SYS SUMM 2" in the BFS (OPS 1, 3, and 6). The combustion chamber pressure is hardwired to "OMS PRESS PC" meter on panel F7 (output in percent). Both parameters are part of the GNC downlist for ground monitoring. The fuel injector temperature is limit sensed and will trigger an SM alert (class 3) if it exceeds a high limit.



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3.1.3.b.2 Combustion Chamber

The OMS engine combustion chamber confines the hot combustion gases in a fixed volume producing the required pressure and temperature that provides the design thrust. The combustion chamber consists of an acoustic resonator, inner and outer walls, nozzle throat, fuel inlet distribution ring, thrust-gimbal ring mounting pads, clevis mounts for attachment of other assemblies and a nozzle attachment flange (Figure 25). Fuel is used to cool the assembly during engine burns by regenerative and film cooling methods.

One hundred twenty longitudinal grooves are machined into the combustor's stainless steel inner wall. When mated to the outer wall these grooves make up the regenerative cooling passages. These passages are aligned and mated to the injector assemblies' fuel distribution ring during final chamber assembly. The remaining part of the regenerative cooling system is the fuel inlet-distribution ring, which is an integral part welded to the outer wall. The nozzle attachment flange is an integral part of the distribution ring. The thrust-gimbal ring mounting pads are also welded to the distribution ring while the hardware-subsystem clevis mounts are welded to the outer chamber wall.

Integral to the inner wall of the combustion chamber is the converging-throat-diverging (initial) section of the engine's nozzle. The converging section has an area ratio (Ac/At) of 1.934:1, which blends into the throat area (approx. 26.5 square inches). The diverging section is the initial section of the engine's bell-shaped exhaust nozzle. The area ratio of this section is 5.866:1 with a mean divergence angle of about 30.5 degrees.

3.1.3.b.3 Nozzle Extension

The nozzle extension, when bolted to the combustion chamber, completes the engine's bell-shaped exhaust nozzle (Figure 26). It is fabricated from a columbium alloy sheet stock. Nominal thickness is 0.030 inch. However, the attach flange is made from 0.10 inch sheet and the exhaust plane stiffener ring is from 0.0775 inch sheet. These two sections are tapered to match the 0.030 sheet at the girth welds. The final assembly is coated with a silicide compound as a corrosion preventive. Attachment to the combustion chamber is by a split retainer ring with a graphite gasket. Thirtysix bolts hold the extension in place.

The nozzle exit plane area is about 1458 square inches, resulting in an expansion ration (Ae/At) of 55:1. The



Figure 25 - COMBUSTION CHAMBER ASSEMBLY



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Figure 26 - NOZZLE EXTENSION

exit plane divergent angle is 0.55 degrees, which gives a radial thrust component of about 900 pounds (symmetric). At steady state operation, the exhaust gas exit velocity is approximately 10,100 ft/sec.

3.1.3.b.4 Plumbing

Plumbing for the OMS engine is divided into GN2 (pneumatic), fuel, and oxidizer lines. These lines are fabricated from titanium alloy tubing incorporating integral end fittings.

The fuel and oxidizer inlet lines are fabricated from 1.50-in.-O.D. stainless steel tube. Fittings are welded to the tube for attachment in the propellant feed lines and the inlet side of the bipropellant ball valve assembly. The inlet lines also incorporate bellows to allow for line flexing during gimbal operations and engine assembly. At the attachment to the feed lines, a flow balancing orifice and filter are fitted to each line.

Outlet lines for the fuel and oxidizer are made from 1.250-in. O.D. titanium alloy tubing. End fittings are welded in place for mating to the bipropellant ball valve assembly, the oxidizer inlet manifold, and the fuel's inlet distribution ring. Bellows are incorporated in the lines to allow for engine alignment during vehicle/engine mating.

Instrumentation for the plumbing consists of strain gage type pressure transducers and thermocouples on the fuel and oxidizer inlet lines. The pressure measurements can be monitored in the cockpit on "GNC SYS SUMM 2" in the PASS (OPS 2 and 8) and in the BFS (OPS 1, 3, and 6). The temperatures can be monitored in the cockpit on "PRPLT THERMAL (DISP 89)" in SM OPS 2. The pressures and temperatures are part of the GNC/OI downlist for ground monitoring. The temperatures are also limit sensed and will trigger an SM alert (class 3) if the limits are exceeded.

3.1.3.c TVC (Gimbal) Assembly

Each OMS engine is attached to the Orbiter via a pivoting mount, which can be gimbaled up-and-down (pitch) and side-to-side (yaw) to provide 3-axis thrust vector control (Figure 27). Gimbaling is driven by two electromechanical actuators on each engine (Figure 28). Gimbal travel in the pitch and yaw axes is approximately +/-7 degrees and +/-8 degrees, respectively, about the null. Since the engines are mounted on opposite sides of the Orbiter's centerline (X-axis), pointing one engine up and one down produces a roll



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Figure 27 - THRUST RING TO TCA ATTACHMENT

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POD STRUCTURE INTERFACE

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Figure 28 - OMS GIMBAL ACTUATOR

moment. With both engines firing, coordinated 2-axis gimbaling of the two engines produces 3-axis Orbiter flight control. The yaw gimbals control only yaw, whereas the pitch gimbaling produces both a pitch and a roll moment together. 3-axis TVC control is impossible with only one engine. For a one-engine OMS burn, TVC controls pitch and yaw and the RCS is used to control roll. The crew can read the current engine gimbal pitch and yaw angles on the CRT XXXX MNVR YYYY display. The pitch and yaw angles are included in the OI downlist for ground monitoring.

Each gimbal actuator has two channels: primary and secondary. If the active channel stops running, the other can take over. Both channels operate at the same speed, taking four seconds to steer an engine through its entire gimbal range at top speed. The crew can select actuator drive via the CRT XXXX MNVR YYYY display.

3.1.4 Electrical Power Distribution and Control Subsystems

3.1.4.a Thermal Control

Thermal control for the OMS is achieved by insulation of propellant lines and walls that enclose OMS hardware components, and by line-wraparound heaters and blankettype heaters. The heater system is divided into two areas: the OMS/RCS pods, and the aft fuselage crossfeed and bleed lines. Each of the heater systems has two redundant heater systems, A and B, and are controlled by switches on Panel A14.

3.1.4.a.1 Pod Thermal Control

The OMS/RCS pods use heater patches to provide thermal control. Each heater patch consists of a redundant set of wires, or elements, which have been formed into a flat, tightly spiraled patch. The patch is then mounted on existing hardware, and as electricity flows through the highly resistant wires, the heat generated warms the hardware as well as radiating into the surrounding open areas. Each of the OMS/RCS pods are divided into nine heater areas. Each of the heater patches in the pods contain an A and a B element. Each element has a thermostat which controls the temperature from 55 degrees to 75 degrees, +/-5degrees F. Temperature sensors are located throughout the pods and supply temperature information to the propellant thermal CRT display and to telemetry. The crew can monitor this display only in SM OPS 2, whereas the ground can monitor the temperature in all OPS.

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3.1.4.a.2 Crossfeed and Bleedline Thermal Control

The aft fuselage is divided into eleven heater areas. Each area is heated in parallel by heater systems A and B, and each areas has a control thermostat to maintain temperature at 55 degrees to 75 degrees, +/-5 degrees F. Temperature sensors are located on the control thermostats and on the crossfeed and bleed lines. The temperature sensors supply temperature to the propellant thermal CRT display in SM OPS 2, and to telemetry to all OPS.

3.2 Interfaces and Locations

The OMS engine interfaces with the Shuttle's Data Processing System (DPS), Pulse Code Modulator Master Unit (PCMMU), Caution and Warning System (C&W), Displays and Controls (D/C), and the Electrical Power Distribution and Control System (EPDCS).

Data from the OMS engine consisting of pressures, temperatures, actuator position, and valve position are sent to the DPS via the Flight Critical (FC) Multiplexer/Demultiplexers (MDMs) for processing by the GPCs. Display and annunciation of the health and status of the engine is accomplished by the DPS via CRT displays, cockpit meters, C&W, and telemetry. The DPS system in turn provides the engine with commands for valve configurations, engine ON/OFF, and Thrust Vector Control (TVC).

A subset of the engine data is sent to the PCMMU via the Operational Instrumentation (OI) MDMs to be telemetered. The PCMMU combines these data with other OMS parameters, output from the GPCs as part of the downlist, and routes them to the onboard recorders and to the S-band to be transmitted to the ground as part of the downlink.

A carefully selected subset of OMS engine data is sent to the C&W for fault determination and alarm annunciation. The C&W processes these data against present limits to determine anomalies in engine performance. When anomalies are found, hardware C&W signals are issued that activate indicator lights in the C&W panel and the master alarm pushbuttons and turn on the C&W tone.

Dedicated cockpit meters in the D&C panels are used to display engine data either sent directly from the engine or routed through the GPCs. The D&C panels also have switches and circuit breakers that are used for manual valve configuration and power routing. In the manual TVC mode, crew deflection of the Rotational Hand Controller (RHC) is routed through the GPC for scaling and then to the engine gimbal actuators to provide TVC.

Electrical power is provided to the engine by the EPDCS. Logic power and dc power is provided to valve relays and TVC servoactuators. The OMS also interfaces with the aft RCS through propellant interconnect lines. OMS propellant can be fed to RCS jets for attitude holds, maneuvers, and translations on-orbit, and during aborts for more rapid OMS propellant dumping. RCS propellant is not fed to the OMS.

3.3 Hierarchy

Figures 4 and 5 illustrate the hierarchy of the OMS hardware and EPD&C components, respectively. Figures 6 through 28 depict the functional details of the OMS subsystem components.

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4.0 ASSESSMENT RESULTS

The IOA analysis of the OMS hardware initially generated two hundred eighty-four (284) failure mode worksheets and identified one hundred sixty (160) potential critical items (PCIs) before starting the assessment process. The EPD&C subsystem analysis initially generated six hundred sixty-seven (667) worksheets with two hundred sixteen (216) PCIs. These analysis results along with additional analysis results generated during the assessment (Appendix E) were compared to the proposed NASA baseline of one hundred one (101) hardware and one hundred forty-two (142) EPD&C FMEAs, and sixty-eight (68) hardware and forty-nine (49) EPD&C IOA mapped one hundred thirty-eight (138) hardware CIL items. and one hundred forty-seven (147) EPD&C FMEAs, and ninety-three (93) hardware and forty-seven (47) EPD&C CILs and PCIs into the NASA FMEAS and CILs. Upon completion of the assessment, and after discussions with the NASA subsystem manager, forty-seven (47) hardware issues, twenty-nine (29) of which concern CIL items or PCIs, and seventy (70) EPD&C issues, thirty-one (31) of which concern CIL items or PCIs, remain unresolved. Each of these unresolved issues are presented in sections 4.1 and 4.2, as well as in the detailed assessment worksheets (Appendix C). Any IOA issues which were resolved with the NASA subsystem managers are documented as such on the detailed assessment worksheets, and are summarized in section 4.3.

Appendix C presents detailed assessment worksheets for each failure mode identified and assessed. These worksheets detail the assessments of each failure mode and document unresolved issues, resolved issues, plus any additional non-issue recommendations and comments. Appendix D highlights the IOA recommended critical items list and corresponding IOA worksheet ID. Appendix E contains IOA analysis worksheets supplementing previous analysis results reported in Space Transportation System Engineering and Operations Support (STSEOS) Working Paper No. 1.0-WP-VA86001-21, Analysis of the Orbital Maneuvering System, January 12, 1987. Appendix F provides a cross reference between the NASA FMEAs and corresponding IOA worksheet(s) along with IOA recommendations and an issues "flag" to denote the FMEAs with which IOA has unresolved issues.

Following the hierarchy breakdown shown in Figures 4 and 5, the OMS assessment results are summarized in the tables below.

Tables I-A and I-B present summaries of the IOA FMEA assessments for the OMS hardware and OMS EPD&C, respectively. The IOA INTL column is the initial number of IOA failure modes for each OMS component. The recommended IOA FMEA baseline (IOA MAP) versus the NASA FMEA baseline, and resulting unresolved issues are presented in the subsequent columns. The unresolved failure mode issues for each OMS component are discussed in the associated section 4 paragraph referenced in the final column. Tables II-A and II-B present summaries of the IOA CIL assessments for the OMS hardware and OMS EPD&C, respectively. The IOA INTL column is the initial number of IOA PCIs for each OMS component. The recommended IOA CIL baseline (IOA MAP) versus the NASA CIL baseline, and resulting unresolved issues are presented in the subsequent columns. Again, the unresolved failure mode issues for each OMS component are discussed in the associated section 4 paragraph referenced in the final column.

Tables III-A and III-B present summaries of the recommended IOA FMEA baselines for the OMS hardware and OMS EPD&C, respectively.

Tables IV-A and IV-B present summaries of the recommended IOA CIL baselines for the OMS hardware and OMS EPD&C, respectively.

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| TABLE I-A Summary of IOA F | TEA Asse | essmen | t - 0M8 | 5 Hardwa | are |
|---|--|--|--|--|---|
| Components | IOA INTL | IOA MAP | NASA FMEAS | ISSUES | PARAGRAPHS FOR ISSUES |
| HE PRESS SUBSYSTEM STORAGE TANK TANK ISOLATION VALVE REGULATOR VAPOR ISOLATION VALVE QUAD CHECK VALVE COUPLINGS (SINGLE SEAL) COUPLINGS (DOUBLE SEAL) LINES AND FITTINGS | 26565395 | 1 3 2 4 5 5 1 | 1 2 3 2 3 3 3 1 | 0 1 1 2 2 2 0 | 4.2.1.A 4.2.1.A.1 4.2.1.A.2 4.2.1.A.3 4.2.1.A.4 4.2.1.A.5 4.2.1.A.5 |
| PROP STOR & DIST SUBSYSTEM PRESSURE RELIEF ASSEMBLY GROUND MANUAL ISOLATION VALVE PROPELLANT TANK GAGING PROBES TOTALIZER COMMUNICATION SCREEN GALLERY LEG SCREEN COLLECTOR MANIFOLD SCREEN TANK ISOLATION VALVE CROSSFEED VALVE COUPLINGS (SINGLE SEAL) COUPLINGS (DOUBLE SEAL) GIMBAL BELLOWS FLEX LINE ASSEMBLY ALIGNMENT BELLOWS LINES AND FITTINGS | 5 3 2 10 3 2 1 1 8 8 33 3 3 15 2 3 8 | 5 1 2 3 1 1 1 4 4 10 0 2 1 1 2 | 5 1 2 3 1 1 1 3 6 0 2 1 1 2 | 0 0 0 0 0 0 0 0 1 1 4 0 0 0 0 0 | 4.2.2.A 4.2.2.A.1 4.2.2.A.2 4.2.2.A.3 |
| OME SUBSYSTEM OME ASSEMBLY INLET FILTER & ORIFICE BIPROPELLANT VALVE ASSEMBLY BIPROP CAVITY PRESS RLF VALVE PLATELET INJECTOR COMBUSTION CHAMBER NOZZLE EXTENSION COUPLINGS (SINGLE SEAL) TVC GIMBAL BELLOWS ALIGNMENT BELLOWS LINES AND FITTINGS | 2 27 5 3 2 2 12 3 3 1 | 2 8 4 2 1 8 1 1 0 | 2 6 0 2 1 3 1 1 0 | 1 2 4 0 0 5 0 0 0 | 4.2.3.A 4.2.3.A.1 4.2.3.A.2 4.2.3.A.3 4.2.3.A.4 |

| TABLE I-A Summary of IOA FMEA Assessment - OMS Hardware (cont'd) | | | | | | | | |
|--|-------------|------------|---------------|--------|--------------------------|--|--|--|
| Criticality: | IOA INTL | IOA MAP | NASA FMEAS | ISSUES | PARAGRAPHS FOR ISSUES | | | |
| OME SUBSYSTEM | | | | | 4.2.3.A | | | |
| TANK FILL/VENT VALVE | 3 | 2 | 2 | 1 | 4.2.3.A.5 | | | |
| STORAGE TANK | 2 | | | 0 | | | | |
| PRESSURE ISOLATION VALVE | 6 | 3 | 2 | 2 | 4.2.3.A.6 | | | |
| REGULATOR | 5 | 2 | 2 | 0 | | | | |
| CHECK VALVE | 3 | 2 | 2 | 0 | | | | |
| ACCUMULATOR | 2 | 2 | | 1 | 4.2.3.A.7 | | | |
| COUPLINGS (SINGLE SEAL) | 3 | 0 | 0 | 0 | | | | |
| COUPLINGS (DOUBLE SEAL) LINES & FITTINGS | 6 7 | 10 1 | 6 1 | 4 0 | 4.2.3.A.8 | | | |
| OME SUBSYSTEM | | | | | 4.2.3.A | | | |
| GIMBAL RING | 1 | 1 | 1 | 0 | | | | |
| GIMBAL RING BEARING | 1 | 2 | 1 | 2 | 4.2.3.A.9 | | | |
| GIMBAL RING MOUNTING PAD GIMBAL DRIVE MOTOR | 2 | 2 | | 1 | 4.2.3.A.10 | | | |
| GIMBAL DRIVE ASSEMBLY | 7 | 2 | 2 | 1 | 4.2.3.A.11 | | | |
| REDUCTION GEAR ANTIBACK DEVICE | 2 | 2 | | 2 | 4.2.3.A.12 4.2.3.A.13 | | | |
| GIMBAL DRIVE THRUST BEARING | 2 | 3 | 1 | 3 | 4.2.3.A.14 | | | |
| MECHANICAL STOP, SNUBBER CONTROLLER, GIMBAL ACTUATOR | 1 2 | 1 1 | | 1 0 | 4.2.3.A.15 | | | |
| TOTAL | 284 | 138 | 101 | 47 | | | | |

| TABLE I-B Summary Of IOA FMEA Assessment - OMS EPD&C | | | | | | | | |
|---|--------------------------------|-----------------------------|-----------------------------|-----------------------------|--|--|--|--|
| Criticality: | IOA INTL | IOA MAP | NASA FMEAS | ISSUES | PARAGRAPHS FOR ISSUES | | | |
| HE PRESS SUBSYSTEM CONTROLS VALVES | | | | | 4.2.1.B | | | |
| CONTROLLER DIODE DRIVER | 16 20 4 | 2 4 2 | 2 4 2 | 1 0 0 | 4.2.1.B.1 | | | |
| FUSE RESISTOR SWITCH, TOGGLE | 2 12 6 | 1 2 3 | 1 2 2 | 0 0 1 | 4.2.1.B.2 | | | |
| METER SENSOR, PRESSURE SENSOR, TEMPERATURE SWITCH, TOGGLE | 1 2 2 1 | 1 1 1 1 | 1 1 1 1 | 1 1 1 1 | 4.2.1.B.3 4.2.1.B.4 4.2.1.B.5 4.2.1.B.6 | | | |
| PROP STOR & DIST SUBSYSTEM CONTROLS VALVES DIODE DRIVER FUSE RELAY RESISTOR SWITCH, TOGGLE INSTRUMENTATION | 8 16 8 32 72 12 | 25 3 2 7 9 6 | 25 3 2 7 9 5 | 17 3 1 5 6 5 | 4.2.2.B.1 4.2.2.B.2 4.2.2.B.3 4.2.2.B.4 4.2.2.B.5 4.2.2.B.6 | | | |
| INSTRUMENTATION FUSE INDICATOR, EVENT METER SENSOR, PRESSURE SENSOR, TEMPERATURE SWITCH, ROTARY | 2 4 2 2 2 | 1 2 3 1 1 2 | 1 2 2 1 1 2 | 0 2 2 0 1 1 | 4.2.2.B.7 4.2.2.B.8 4.2.2.B.9 4.2.2.B.10 | | | |

| TABLE I-B Summary Of IOA F | MEA Asso | essmen | t - 0MS | S EPD&C | (cont'd) |
|---------------------------------|-------------|------------|---------------|---------|--------------------------|
| Criticality: | IOA INTL | IOA MAP | NASA FMEAS | ISSUES | PARAGRAPHS FOR ISSUES |
| OME SUBSYSTEM | | | | | |
| CONTROLS | | | | | |
| GN2 ASSEMBLY | | | | | |
| VALVES | | | _ | | |
| DIODE | 8 | 2 | 2 | 0 | |
| DRIVER | 22 | 8 | 8 | 1 | 4.2.3.B.1 |
| FUSE | 8 | 3 | 3 | 0 | |
| RESISTOR | 20 | 3 | 3 | 0 | |
| SWITCH, TOGGLE | 5 | 4 | 4 | 2 | 4.2.3.B.2 |
| TVC ASSEMBLY | _ | | | | |
| CONTROLLER | 8 | 2 | 2 | | |
| FUSE | 2 | | 1 | | 4.2.3.8.3 |
| INSTRUMENTATION | | | | | |
| GN2 ASSEMBLY | | | | - | |
| SENSOR, PRESSURE | 3 | - | | | 4.2.3.8.4 |
| OME ASSEMBLY | | | | | |
| FUSE | | | | 0 | |
| METER | | | | 1 | 42285 |
| SENSOR, POSITION | 2 | | | 1 | 4.2.3.8.5 |
| SENSOR, PRESSURE | 3 | 2 | 2 | | 4.2.3.D.0 |
| SENSOR, TEMPERATURE | 4 | . | | | 4.2.3.D.7 |
| SIGNAL CONDITIONER | | L T | - | - | 4.2.5.0.0 |
| TVC ASSEMBLI SENSOD DOSTUTON | | 1 | 1 | 0 | |
| SENSOR, FOSITION | | - | | | |
| THERMAL CONTROL SUBSYSTEM | | | | | |
| POD | 44 | 2 | 2 | 1 | 4.2.4.B.1 |
| FUCE | 32 | 2 | 3 | ō | 1.2.1.0.1 |
| LOOF LOOF | 64 | 1 | 1 | 1 | 4.2.4.B.2 |
| DELAV | 8 | 2 | 2 | 1 | 4.2.4.B.3 |
| RELAT | 28 | 3 | 3 | ō | |
| SENSOR TEMPERATURE | 12 | 1 | 0 | 1 | 4.2.4.B.4 |
| SWITCH THERMAL. | 32 | 2 | 2 | 1 | 4.2.4.B.5 |
| SWITCH, THENRE | 4 | 2 | 2 | 1 | 4.2.4.B.6 |
| CROSSFEED | | 1 | | - | |
| DRIVER | 12 | 2 | 2 | 1 | 4.2.4.B.7 |
| FUSE | 10 | 3 | 3 | ō | |
| HEATER | 22 | l ī | ĺī | 1 | 4.2.4.B.8 |
| RELAY | 4 | 2 | 2 | 0 | |
| RESISTOR | 12 | 2 | 2 | Ō | |
| SENSOR, TEMPERATURE | 13 | 2 | 2 | 2 | 4.2.4.B.9 |
| SWITCH, THERMAL | 44 | 2 | 2 | 1 | 4.2.4.B.10 |
| SWITCH, TOGGLE | 4 | 2 | 2 | 1 | 4.2.4.B.11 |
| | | | | | |
| TOTAL | 667 | 147 | 142 | 70 | |

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| TABLE II-A Summary of IOA | CIL Asse | essmen | Anticipation NASA CILS ISSUES PARAGRAPHS FOR ISSUES 1 0 4.2.1.A 1 0 4.2.1.A 2 1 4.2.1.A.1 3 1 4.2.1.A.2 1 1 4.2.1.A.3 2 2 4.2.1.A.3 2 2 4.2.1.A.5 1 1 4.2.1.A.5 1 0 4.2.1.A.5 1 0 4.2.1.A.5 1 0 4.2.1.A.5 1 0 1 0 0 0 1 0 1 1 0 1 2 0 4.2.2.A.3 0 0 4.2.2.A.3 | | | | | |
|---|---|--|---|---|---|--|--|--|
| Components | IOA INTL | IOA MAP | NASA CILS | ISSUES | PARAGRAPHS FOR ISSUES | | | |
| HE PRESS SUBSYSTEM STORAGE TANK TANK ISOLATION VALVE REGULATOR VAPOR ISOLATION VALVE QUAD CHECK VALVE COUPLINGS (SINGLE SEAL) COUPLINGS (DOUBLE SEAL) LINES AND FITTINGS | 2 5 5 5 1 0 4 | 1 3 2 4 2 2 1 | 1 2 3 1 2 1 1 | 0 1 1 2 1 1 0 | 4.2.1.A 4.2.1.A.1 4.2.1.A.2 4.2.1.A.3 4.2.1.A.4 4.2.1.A.5 4.2.1.A.5 | | | |
| PROP STOR & DIST SUBSYSTEM PRESSURE RELIEF ASSEMBLY GROUND MANUAL ISOLATION VALVE PROPELLANT TANK GAGING PROBES TOTALIZER COMMUNICATION SCREEN GALLERY LEG SCREEN COLLECTOR MANIFOLD SCREEN TANK ISOLATION VALVE CROSSFEED VALVE COUPLINGS (SINGLE SEAL) COUPLINGS (DOUBLE SEAL) GIMBAL BELLOWS FLEX LINE ASSEMBLY ALIGNMENT BELLOWS LINES AND FITTINGS | 5 2 0 0 2 1 1 5 3 11 0 15 2 3 7 | 4 0 2 0 1 1 1 3 1 4 0 2 1 2 | 4 0 2 0 1 1 1 3 1 2 0 2 1 1 2 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 4.2.2.A 4.2.2.A.3 | | | |
| OME SUBSYSTEM OME ASSEMBLY INLET FILTER & ORIFICE BIPROPELLANT VALVE ASSEMBLY BIPROP CAVITY PRESS RLF VALVE PLATELET INJECTOR COMBUSTION CHAMBER NOZZLE EXTENSION COUPLINGS (SINGLE SEAL) TVC GIMBAL BELLOWS ALIGNMENT BELLOWS LINES AND FITTINGS | 2 26 2 3 2 2 4 3 2 4 3 2 1 | 2 8 4 2 1 2 1 1 0 | 1 6 0 2 1 1 1 1 0 | 1 2 4 0 0 0 1 0 0 0 | 4.2.3.A 4.2.3.A.1 4.2.3.A.2 4.2.3.A.3 4.2.3.A.4 | | | |

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| TABLE II-A Summary of IOA CIL Assessment - OMS Hardware (cont'd) | | | | | | | |
|--|-------------|------------|--------------|--------|--------------------------|--|--|
| Criticality: | IOA INTL | IOA MAP | NASA CILS | ISSUES | PARAGRAPHS FOR ISSUES | | |
| OME SUBSYSTEM | | | | | 4.2.3.A | | |
| GN2 ASSEMBLY TANK FILL/VENT VALVE | 0 O | 1 | 1 | 1 | 4.2.3.A.5 | | |
| STORAGE TANK | 1 | 1 | 1 | 0 | | | |
| GN2 PNEUMATIC PACK HOUSING | 1 | 0 | 0 | 0 | 4 2 2 3 6 | | |
| PRESSURE ISOLATION VALVE | 1 2 | 1 1 | | | 4.2.J.A.0 | | |
| PRESSURE RELIEF VALVE | 0 | 2 | 2 | 0 | | | |
| CHECK VALVE | 3 | 2 | 2 | 0 | | | |
| ACCUMULATOR | 2 | 2 | 1 | 1 | 4.2.3.A.7 | | |
| PURGE VALVE ASSEMBLY | 3 | 2 | 2 | 0 | | | |
| COUPLINGS (SINGLE SEAL) | 0 | 0 | 0 | 0 | 4 2 2 3 0 | | |
| LINES & FITTINGS | 3 | 4 | 1 | 0 | 4.2.3.4.8 | | |
| OME SUBSYSTEM | | | | | 4.2.3.A | | |
| CIMBAL RING | 1 | 1 | 1 | 0 | | | |
| GIMBAL RING BEARING | ī | 2 | 1 | 2 | 4.2.3.A.9 | | |
| GIMBAL RING MOUNTING PAD | 1 | 1 | 1 | 0 | | | |
| GIMBAL DRIVE MOTOR | 0 | 0 | 0 | 0 | | | |
| GIMBAL DRIVE ASSEMBLY | 5 | 2 | 2 | | 4.2.3.A.11 | | |
| ANTIBACK DEVICE | 1 | 1 | | 1 | 4.2.3.A.13 | | |
| GIMBAL DRIVE THRUST BEARING | ō | 2 | ŏ | 2 | 4.2.3.A.14 | | |
| MECHANICAL STOP, SNUBBER | 1 | 1 | 0 | 1 | 4.2.3.A.15 | | |
| CONTROLLER, GIMBAL ACTUATOR | 0 | 0 | 0 | 0 | | | |
| TOTAL | 160. | 93 | 68 | 29 | | | |

| TABLE II-B Summary of IOA CIL Assessment - OMS EPD&C | | | | | | | | |
|---|--|---|---|---|--|--|--|--|
| Criticality: | IOA INTL | IOA MAP | NASA CILS | ISSUES | PARAGRAPHS FOR ISSUES | | | |
| HE PRESS SUBSYSTEM CONTROLS VALVES CONTROLLER DIODE DRIVER FUSE RESISTOR SWITCH, TOGGLE INSTRUMENTATION METER SENSOR, PRESSURE SENSOR, TEMPERATURE SWITCH, TOGGLE | 1 6 0 0 4 0 0 0 0 | 1 1 0 0 1 0 0 0 0 0 | 0 1 0 0 1 0 0 0 0 0 | 1 0 0 0 0 0 0 0 0 | 4.2.1.B.1 | | | |
| PROP STOR & DIST SUBSYSTEM CONTROLS VALVES DIODE DRIVER FUSE RELAY RESISTOR SWITCH, TOGGLE INSTRUMENTATION FUSE INDICATOR, EVENT METER SENSOR, PRESSURE SENSOR, TEMPERATURE SWITCH, ROTARY | 8 0 12 28 2 2 0 0 0 0 0 0 2 0 | 5 0 1 6 0 2 0 0 0 0 0 1 0 | 14 0 1 6 4 3 0 0 0 0 0 0 | 3 0 1 5 4 4 4 0 0 0 0 1 0 | 4.2.2.B.1 4.2.2.B.3 4.2.2.B.4 4.2.2.B.5 4.2.2.B.6 4.2.2.B.6 | | | |

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| TABLE II-B Summary of IOA | CIL Ass | essmen | t - 0M | S EPD&C | (cont'd) |
|---------------------------|-------------|------------|--------------|---------|--|
| Criticality: | IOA INTL | IOA MAP | NASA CILS | ISSUES | PARAGRAPHS FOR ISSUES |
| OME SUBSYSTEM | | | | | |
| CONTROLS | | | | | |
| GN2 ASSEMBLY | | | | | |
| VALVES | | | | | |
| DIODE | 0 | 2 | 2 | 0 | |
| DRIVER | 14 | 6 | 5 | 1 | 4.2.3.B.1 |
| FUSE | 8 | 2 | 2 | 0 | |
| RESISTOR | 6 | | | | 4 2 2 2 2 |
| SWITCH, TOGGLE | 5 | 4 | 2 | 2 | 4.2.J.D.2 |
| TVC ASSEMBLY | | | 0 | | |
| CONTROLLER FUCE | | | | 0 | |
| FUSE TNETDIMENTATION | | | | | |
| GN2 ASSEMBLY | | | | | • |
| SENSOR PRESSURE | 1 1 | 0 | 0 | 0 | |
| OME ASSEMBLY | - | | | | |
| FUSE | 0 | 0 | 0 | o | |
| METER | 0 | 0 | 0 | 0 | |
| SENSOR, POSITION | 0 | 0 | 0 | 0 | |
| SENSOR, PRESSURE | 0 | 1 | 0 | 1 | 4.2.3.B.6 |
| SENSOR, TEMPERATURE | 1 | 0 | 0 | 0 | |
| SIGNAL CONDITIONER | 0 | 1 | 0 | 1 | 4.2.3.B.8 |
| TVC ASSEMBLY | | | | | • |
| SENSOR, POSITION | 0 | 0 | 0 | 0 | |
| THERMAL CONTROL SUBSYSTEM | | | | | |
| POD | | - | | - | 4 2 4 2 1 |
| | | | | | 4.2.4.0.1 |
| LEYWED | | | | 0 | |
| DELAV | A 1 | 1 | 1 | 1 | 4.2.4.B.3 |
| RESTSTOR | | | | 0 | T • C • T • D • J |
| SENSOR, TEMPERATURE | l õ | ō | õ | ŏ | |
| SWITCH. THERMAL | 16 | ĺ | Ō | 1 | 4.2.4.B.5 |
| SWITCH, TOGGLE | 2 | 1 | 1 | 1 | 4.2.4.B.6 |
| CROSSFEED | | | | | |
| DRIVER | 0 | 0 | 0 | 0 | |
| FUSE | 0 | 0 | 0 | 0 | |
| HEATER | 10 | 0 | 0 | 0 | ÷ |
| RELAY | 1 | 1 | 1 | 0 | |
| RESISTOR | 0 | 0 | 0 | 0 | |
| SENSOR, TEMPERATURE | 5 | 2 | 0 | 2 | 4.2.4.B.9 |
| SWITCH, THERMAL | 17 | 1 | 0 | | 4.2.4.B.10 |
| SWITCH, TOGGLE | 0 | 0 | 0 | 0 | |
| <u>ም</u> ርምል ፲ | 216 | 47 | 49 | 31 | |

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| TABLE III-A IOA Recommended | d Crit | cicali | ities | - OMS | 5 Hard | lware | |
|---|--|---|---|--|--|--|--|
| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL |
| HE PRESS SUBSYSTEM STORAGE TANK TANK ISOLATION VALVE REGULATOR VAPOR ISOLATION VALVE QUAD CHECK VALVE COUPLINGS (SINGLE SEAL) COUPLINGS (DOUBLE SEAL) LINES AND FITTINGS | 1 0 0 1 0 0 1 | 0 2 1 2 2 0 0 | 0 0 0 0 0 0 0 0 | 0 1 1 1 0 2 0 | 0 0 1 0 0 0 0 0 | 0 0 0 0 3 3 0 | 1 3 2 4 5 5 1 |
| PROP STOR & DIST SUBSYSTEM PRESSURE RELIEF ASSEMBLY GROUND MANUAL ISOLATION VALVE PROPELLANT TANK GAGING PROBES TOTALIZER COMMUNICATION SCREEN GALLERY LEG SCREEN COLLECTOR MANIFOLD SCREEN TANK ISOLATION VALVE CROSSFEED VALVE COUPLINGS (SINGLE SEAL) COUPLINGS (DOUBLE SEAL) GIMBAL BELLOWS FLEX LINE ASSEMBLY ALIGNMENT BELLOWS LINES AND FITTINGS | 1 0 0 1 0 0 1 1 0 0 2 1 1 2 | 2 0 1 0 0 0 0 2 0 4 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 | 0 1 0 3 1 0 0 0 0 0 0 0 0 0 0 0 0 0 | 5 1 2 3 1 1 1 4 4 10 0 2 1 1 2 |
| OME SUBSYSTEM OME ASSEMBLY INLET FILTER & ORIFICE BIPROPELLANT VALVE ASSEMBLY BIPROP CAVITY PRESS RLF VALVE PLATELET INJECTOR COMBUSTION CHAMBER NOZZLE EXTENSION COUPLINGS (SINGLE SEAL) TVC GIMBAL BELLOWS ALIGNMENT BELLOWS LINES AND FITTINGS | 1 0 3 2 2 1 0 1 1 0 | 1 7 1 0 0 0 2 0 0 0 | 0 0 0 0 0 0 0 0 0 | 0 1 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 6 0 0 0 | 2 8 4 2 2 1 8 1 1 0 |

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| TABLE III-A IOA Recommended Criticalities - OMS Hardware (cont'd) | | | | | | | |
|---|-----|------|-----|------|------|-----|-------|
| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL |
| OME SUBSYSTEM | | | | | | - | |
| GN2 ASSEMBLY | | | _ | _ | | _ | |
| TANK FILL/VENT VALVE | 0 | 0 | 0 | 1 | 0 | 1 | 2 |
| STORAGE TANK | 1 | 0 | 0 | 0 | 0 | 0 | |
| GN2 PNEUMATIC PACK HOUSING | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PRESSURE ISOLATION VALVE | 0 | 1 | 0 | 2 | 0 | 0 | 3 |
| REGULATOR | 0 | 1 | 0 | 1 | 0 | 0 | 2 |
| PRESSURE RELIEF VALVE | 0 | 1 | 0 | 2 | 0 | 0 | 3 |
| CHECK VALVE | 0 | 1 | 0 | 1 | 0 | 0 | 2 |
| ACCUMULATOR | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| PURGE VALVE ASSEMBLY | 0 | 0 | 0 | 1 | 0 | 1 | 2 |
| COUPLINGS (SINGLE SEAL) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| COUPLINGS (DOUBLE SEAL) | 0 | 0 | 0 | 4 | 0 | 6 | 10 |
| LINES & FITTINGS | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| OME SUBSYSTEM | | | | | | | |
| TVC ASSEMBLY | | | | | | _ | |
| GIMBAL RING | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| GIMBAL RING BEARING | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| GIMBAL RING MOUNTING PAD | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| GIMBAL DRIVE MOTOR | 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| GIMBAL DRIVE ASSEMBLY | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| REDUCTION GEAR | 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| ANTIBACK DEVICE | 0 | 1 | 0 | 2 | 0 | 0 | 3 |
| GIMBAL DRIVE THRUST BEARING | 0 | 2 | 0 | 1 | 0 | 0 | 3 |
| MECHANICAL STOP, SNUBBER | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| CONTROLLER, GIMBAL ACTUATOR | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| TOTAL | 31 | 40 | 1 | 32 | 3 | 31 | 138 |

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| TABLE III-B IOA Recommended | a Crit | ticali | ities | - OMS | S EPD | кC | |
|---|---------|--------|--------|--------|--------|---------|----------|
| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL |
| HE PRESS SUBSYSTEM CONTROLS VALVES | | | | | | | |
| CONTROLLER DIODE | 0 0 | 0 0 | 0 0 | 2 3 | 0 | 0 1 | 24 |
| DRIVER FUSE | 0 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| RESISTOR SWITCH, TOGGLE | 0 | 01 | 0 | 0 2 | 0 | 2 | 2 3 |
| INSTRUMENTATION METER SENSOR, PRESSURE | 0 | 0 0 | 0 0 | 0 0 | 1 1 | 0 0 | 1 1 |
| SENSOR, TEMPERATURE SWITCH, TOGGLE | 0 0 | 0 0 | 0 0 | 0 0 | 1 | 0 0 | 1 1 |
| PROP STOR & DIST SUBSYSTEM CONTROLS | | | | | | | |
| DIODE DRIVER | 0 0 | 1 0 | 0 | 8 0 | 4 3 | 12 0 | 25 3 |
| FUSE RELAY | 0 0 | 02 | 0 | 1 3 | 1 | 01 | 2 7 |
| RESISTOR SWITCH, TOGGLE | 0 .0 | 01 | 0 | 03 | 6 1 | 3 | 9 6 |
| INSTRUMENTATION FUSE | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| INDICATOR, EVENT METER | | | | | 2 | | 3 |
| SENSOR, PRESSURE SENSOR, TEMPERATURE SWITCH, ROTARY | 0 | 0 | 1 0 | 0 | 0 | 0 | · 1 2 |

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| TABLE III-B IOA Recommended | d Crit | ticali | ities | - oms | - OMS EPD&C (cont' | | | |
|---|--------|--------|-------|-------|--------------------|-----|------------|--|
| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL | |
| OME SUBSYSTEM CONTROLS GN2 ASSEMBLY | | | | | | | | |
| VALVES DIODE | 0 | 0 | 0 | 2 | 0 | 0 | 2 | |
| DRIVER | | 0 | 0 | 3 | 0 | Ő | 3 | |
| RESISTOR | Ō | 0 | 0 | 0 | 0 | 3 | 3 | |
| SWITCH, TOGGLE | 0 | 2 | 0 | 2 | 0 | 0 | 4 | |
| TVC ASSEMBLY | _ | | _ | | _ | | | |
| CONTROLLER | | 0 | 0 | 1 | 0 | | 2 | |
| FUSE | | 0 | U | L | U | 0 | - - | |
| CN2 ASSEMBLY | | | | | | | | |
| SENSOR PRESSURE | · 0 | 0 | 0 | 0 | 1 | o | 1 | |
| OME ASSEMBLY | | _ | | _ | | | | |
| FUSE | 0 | 0 | 0 | 0 | 0 | 1 | 1 | |
| METER | 0 | 0 | 0 | 0 | 0 | 1 | 1 | |
| SENSOR, POSITION | 0 | 0 | 0 | 0 | 1 | 0 | | |
| SENSOR, PRESSURE | 0 | 0 | 1 | 0 | 2 | | 3 | |
| SENSOR, TEMPERATURE | | 0 | 0 | | 2 | . 1 | د ٦ | |
| TWC ASSEMBLY | | 0 | * | | U | 0 | - | |
| SENSOR POSITION | 0 | 0 | 0 | 1 | 0 | 0 | 1 | |
| | | | | | | | | |
| THERMAL CONTROL SUBSYSTEM | | | | | | | | |
| POD | | - | 0 | | - | _ | 2 | |
| | | | 0 | | 1 | | 2 | |
| LOF Heywed | | 0 | 0 | | ·1 | ŏ | 1 | |
| RELAV | ŏ | 1 | Ő | ŏ | 1 | ŏ | 2 | |
| RESISTOR | Ō | Ō | 0 | 0 | 2 | 1 | 3 | |
| SENSOR, TEMPERATURE | 0 | 0 | 0 | 0 | 0 | 1 | 1 | |
| SWITCH, THERMAL | 0 | 1 | 0 | 0 | 1 | 0 | 2 | |
| SWITCH, TOGGLE | 0 | 1 | 0 | 0 | 1 | 0 | 2 | |
| CROSSFEED | | | • | | 2 | _ | | |
| | | 0 | 0 | 0 | 2 | | 2 | |
| FUSE UENTED | | 0 | 0 | 0 | ר ר | 0 | 1 | |
| RELAY | ŏ | ŏ | ŏ | ŏ | 2 | ŏ | 2 | |
| RESISTOR | Ō | Ō | Ō | 0 | 1 | 1 | 2 | |
| SENSOR, TEMPERATURE | 0 | 0 | 2 | 0 | 0 | 0 | 2 | |
| SWITCH, THERMAL | 0 | 0 | 0 | 0 | 2 | 0 | 2 | |
| SWITCH, TOGGLE | 0 | 0 | 0 | 0 | 2 | 0 | 2 | |
| TOTAL | 0 | 11 | 5 | 41 | 54 | 36 | 147 | |

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| TABLE IV-A IOA Recommended Critical Items - OMS Hardware | | | | | | | | | |
|--|----------|----------|----------|--------|------|-----|----------|--|--|
| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL | | |
| HE PRESS SUBSYSTEM | _ | | • | 0 | 0 | 0 | - | | |
| STORAGE TANK | | 0 | 0 | | | | | | |
| TANK ISOLATION VALVE | 0 | 2 | | 1 1 | 1 | | 2 | | |
| REGULATOR | | | 0 | | L L | | 2 | | |
| VAPOR ISOLATION VALVE | 0 | | 0 | | 0 | | | | |
| QUAD CHECK VALVE | | 2 | | I I | | | 4 | | |
| COUPLINGS (SINGLE SEAL) | 0 | 2 | | | | | 2 | | |
| COUPLINGS (DOUBLE SEAL) | 0 | 0 | 0 | 2 | | | 2 | | |
| LINES AND FITTINGS | 1 | 0 | 0 | 0 | 0 | | L | | |
| PROP STOR & DIST SUBSYSTEM | | | | | | | | | |
| PRESSURE RELIEF ASSEMBLY | 1 | 2 | 0 | 1 | 0 | 0 | 4 | | |
| GROUND MANUAL ISOLATION VALVE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| PROPELLANT TANK | 1 | 1 | 0 | 0 | 0 | 0 | 2 | | |
| GAGING PROBES | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| TOTALIZER | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| COMMUNICATION SCREEN | 1 | 0 | 0 | 0 | 0 | 0 | 1 | | |
| GALLERY LEG SCREEN | 0 | 0 | 0 | 0 | 1 | 0 | 1 | | |
| COLLECTOR MANIFOLD SCREEN | 0 | 0 | 1 | 0 | 0 | 0 | 1 | | |
| TANK ISOLATION VALVE | 1 | 2 | 0 | 0 | 0 | 0 | 3 | | |
| CROSSFEED VALVE | 1 | 0 | 0 | 0 | 0 | 0 | 1 | | |
| COUPLINGS (SINGLE SEAL) | 0 | 4 | 0 | 0 | 0 | 0 | 4. | | |
| COUPLINGS (DOUBLE SEAL) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| GIMBAL BELLOWS | 2 | 0 | 0 | 0 | 0 | 0 | 2 | | |
| FLEX LINE ASSEMBLY | 1 | 0 | 0 | 0 | 0 | 0 | 1 | | |
| ALIGNMENT BELLOWS | 1 | 0 | 0 | 0 | 0 | 0 | 1 | | |
| LINES AND FITTINGS | 2 | 0 | 0 | 0 | 0 | 0 | 2 | | |
| OME SUBSYSTEM | | | | | | 1 | | | |
| OME ASSEMBLY | | | | | | • | | | |
| INLET FILTER & ORIFICE | 1 | 1 1 | 0 | 0 | 0 | 0 | 2 | | |
| BIPROPELLANT VALVE ASSEMBLY | ō | 7 | Ō | 1 | Ō | 0 | 8 | | |
| BIPROP CAVITY PRESS RLF VALVE | 3 | 1 1 | Ō | Ō | 0 | 0 | 4 | | |
| PLATELET INJECTOR | 2 | Ō | Ō | Ō | 0 | 0 | 2 | | |
| COMBUSTION CHAMBER | 2 | Ō | Ō | Ō | Ō | 0 | 2 | | |
| NOZZLE EXTENSION | ĭ | Ō | Ō | Ō | Ō | Ō | 1 | | |
| COUPLINGS (SINGLE SEAL) | ō | 2 | Ō | Ō | Ō | Ō | 2 | | |
| TVC CIMBAL BELLOWS | 1 | | Ŏ | Ō | Ō | Ō | ī | | |
| ALTCHMENT BELLOWS | 1 | Ĭŏ | Ö | Ō | Ō | Ō | | | |
| LINES AND FITTINGS | 1 5 | ŏ | Ö | ŏ | ŏ | ŏ | ō | | |
| TIMES WAD LITIINGS | <u> </u> | <u> </u> | <u> </u> | Ľ | Ľ | L Č | <u> </u> | | |

| TABLE IV-A IOA Recommended | Critical Items - OMS HDW (cont'd) | | | | | | c'd) |
|---|---|---|---|--|---|---|--|
| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL |
| OME SUBSYSTEM GN2 ASSEMBLY TANK FILL/VENT VALVE STORAGE TANK GN2 PNEUMATIC PACK HOUSING PRESSURE ISOLATION VALVE REGULATOR PRESSURE RELIEF VALVE CHECK VALVE ACCUMULATOR PURGE VALVE ASSEMBLY | 0 1 0 0 0 0 1 | 0 0 1 1 1 1 1 0 | 0 0 0 0 0 0 0 | 1 0 2 0 1 1 0 | 000000000000000000000000000000000000000 | | 1 1 0 3 1 2 2 2 2 |
| COUPLINGS (SINGLE SEAL) COUPLINGS (DOUBLE SEAL) LINES & FITTINGS | 0 | 0 | 0 | 4 0 | 0 | 0 | 4 1 |
| OME SUBSYSTEM TVC ASSEMBLY GIMBAL RING GIMBAL RING BEARING GIMBAL RING MOUNTING PAD GIMBAL DRIVE MOTOR GIMBAL DRIVE MOTOR GIMBAL DRIVE ASSEMBLY REDUCTION GEAR ANTIBACK DEVICE GIMBAL DRIVE THRUST BEARING MECHANICAL STOP, SNUBBER CONTROLLER, GIMBAL ACTUATOR | 1 1 0 1 0 0 0 0 0 | 0 1 0 1 0 1 2 1 0 | 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 | 1 2 1 0 2 0 1 2 1 0 |
| TOTAL | 31 | 40 | 1 | 18 | 2 | 1 | 93 |

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| TABLE IV-B IOA Recommende | ed Cr: | itical | llter | ns - (| OMS EI | PD&C | |
|---|-----------------------|-----------------------|-----------------------|----------------------------|----------------------------|-----------------------|------------------------------|
| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL |
| HE PRESS SUBSYSTEM CONTROLS VALVES | | | | | | | |
| CONTROLLER DIODE DDIVER | 0 | 000 | 000 | 1 | 0 0 | 0 0 | 1 1 0 |
| FUSE RESISTOR | 000 | 001 | 0 | 0 | 0 | 0 | 0 0 1 |
| INSTRUMENTATION METER SENSOR, PRESSURE SENSOR, TEMPERATURE | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 | 0 0 0 |
| SWITCH, TOGGLE PROP STOR & DIST SUBSYSTEM | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CONTROLS VALVES DIODE DRIVER FUSE RELAY RESISTOR SWITCH, TOGGLE INSTRUMENTATION | 0 0 0 0 0 | 1 0 2 0 1 | 0 0 0 0 0 | 3 0 0 3 0 1 | 1 0 1 1 0 0 | 0 0 0 0 0 | - 5 0 1 6 0 2 |
| FUSE INDICATOR, EVENT METER SENSOR, PRESSURE SENSOR, TEMPERATURE SWITCH, ROTARY | 0 0 0 0 0 | 0 0 0 0 0 | 0 0 0 1 0 | 0 0 0 0 0 | 0 0 0 0 0 | 0 0 0 0 0 | 0 0 0 1 0 |

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| TABLE IV-B IOA Recommended C | ritica | al Ite | ems - | OMS I | EPD&C | (con | t'd) |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL |
| OME SUBSYSTEM CONTROLS GN2 ASSEMBLY | | | | | | | |
| VALVES DIODE DRIVER | 0 | 0 | 0 | 2 5 | 0 | 0 | 2 |
| FUSE RESISTOR | 0 | 0 | 0 | 2 0 | 0 | 0 1 | 2 1 |
| SWITCH, TOGGLE TVC ASSEMBLY | 0 | 2 | 0 | 2 | 0 | 0 | 4 |
| FUSE INSTRUMENTATION | 0 0 | 0 | 0 | 0 | 0 | ō | 0 |
| GN2 ASSEMBLY SENSOR, PRESSURE OME ASSEMBLY | o | 0 | 0 | o | 0 | ο | 0 |
| FUSE METER | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SENSOR, POSITION SENSOR, PRESSURE SENSOR, TEMPERATURE | 0 | 0 | 1 0 | 0 | 0 | 0 | 0 1 0 |
| SIGNAL CONDITIONER TVC ASSEMBLY SENSOR POSITION | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| THERMAL CONTROL SUBSYSTEM | | | | _ | - | | |
| POD DRIVER FUSE | 0 | 1 0 | 0 | 0 | 02 | 0 | 1 2 |
| RELAY RESISTOR SENSOR TEMPEDATURE | 0 | 1 0 0 | 0 | 000 | 0 2 0 | 0 | 1 2 0 |
| SWITCH, THERMAL SWITCH, TOGGLE | 0 | 1 1 | 0 | 0 0 | 0 0 | 0 0 | 1 1 |
| DRIVER FUSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HEATER RELAY RESISTOR | 0 0 | 0 | 0 | 0 | 0 1 0 | 0 | 0 1 0 |
| SENSOR, TEMPERATURE SWITCH, THERMAL SWITCH, TOGGLE | 0 0 0 | 0 0 0 | 2 0 0 | 0 0 0 | 0 1 0 | 0 0 0 | 2 1 0 |
| TOTAL | 0 | 11 | 5 | 20 | 9 | 2 | 47 |

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4.1 General Unresolved Issues

Many of the unresolved issues which exist on individual FMEAs and CILs are linked to several "general" issues identified by IOA during the OMS FMEA/CIL assessment. These general issues concern either the groundrules used by NASA/RI to perform the FMEA/CIL analysis, or the NASA/RI analysis of the OMS subsystem. Each of the general IOA issues may result in several FMEA and CIL issues.

The general issues identified by IOA in the OMS hardware and EPD&C assessments are discussed in the following sections.

4.1.A Hardware

Because the majority of the original IOA OMS hardware issues have been resolved, only two general hardware issues remain. Most of the remaining specific issues exist independently and cannot, for the most part, be linked to any general groundrule or analysis differences.

4.1.A.1 Loss of TVC During TAL Abort

The OMS activities during a TAL abort include a pre-MECO OMS dump and, beginning with STS-26, a post-MECO 100 fps ET separation burn. For some TAL aborts (late TAL), the post-MECO ET sep burn may need to be lengthened to complete an OMS dump which could not be completed before MECO. During the pre-MECO dump, the OMS engines remain in the ascent stow position and TVC is inactive. For the post-MECO activities, the OMS engines are driven to an Iloaded CG position and TVC is, again, inactive. IOA and NASA/RI agree on a groundrule that two OMS engines are required to ensure the successful completion of all OMS dumps and burns during RTLS and TAL aborts. Thus, single failures which result in the loss of one OMS engine are classified as abort 1/1's.

However, IOA also considers a single TVC failure which results in the inability to move an OMS engine from the pre-MECO stow position to the post-MECO CG position to be a possible 1/1 during a TAL abort. The increased RCS activity required to maintain orbiter control during the post-MECO OMS operations, with one OMS engine out of position, may consume RCS propellant needed to complete the abort. Shutting the affected engine down results in a 1/1 (per above groundrule), and using the engine may consume needed RCS propellant. IOA does not consider RCS control authority to be a problem, but is concerned about RCS propellant over-consumption with this failure scenario.

No RCS consumption data appears to exist for the failure scenario in question: one OMS engine failed out of position; other OMS engine in correct I-loaded CG position. The scenarios which have been analyzed include: 1) one engine failed out of position; other engine has active TVC, and 2) both engines in CG position (TVC inactive); RCS maintaining orbiter control (normal TAL post-

MECO situation).

Because of a lack of data which indicates that RCS propellant over-consumption is not a problem for the failure scenario in question, IOA recommends that the TAL abort criticality be classified as a 1/1 on applicable FMEAs. If it is determined that, for the worst case TVC failure during two engine post-MECO OMS activities, the orbiter can be adequately controlled within RCS capabilities and with no RCS consequences for the remainder of the abort, then IOA would have no TAL crit 1 issues for TVC failures.

4.1.A.2 Additional Items and Failure Modes

A number of OMS hardware subsystem items and failure modes identified by IOA during the analysis phase are not covered in the current NASA FMEA/CIL. IOA recommends that these items and failure modes be incorporated into the FMEA/CIL. These issues are identified in Appendix F by issue codes HDW 4 and HDW 5.

4.1.B EPD&C

4.1.B.1 Loss of Valve Talkbacks

IOA considers the loss of data to determine the actual position of a valve to be a 3/2R PPP criticality. Valve position data is provided by the GPC/MDM discretes and the event indicators, which provide redundancy for each other. Loss of all redundancy may lead to falsely failing the valve closed or open which could effect mission operations. NASA FMEAs have a 3/3 criticality for these failures.

The IOA does not consider pressure or temperature sensors to be redundant to event indicators and discretes to determine valve position.

See JSC 10588 pages 5-18.

4.1.B.2 Multiple Unrelated Failures in Redundancy String

IOA considers the redundancy strings on several current FMEAs to include "multiple unrelated failures", which is beyond the scope of the IOA's interpretation of NSTS 22206. On FMEAs to which this issue applies, IOA recommends that a bellows failure not be considered in the redundancy string and the criticality thus be downgraded. The NASA is right that this failure could cause continuous power on the associated valve(s), since the signal through this item would inhibit closing or opening when the valves reach full closed or open. However, NASA's scenario with another failure consisting of bellows rupture is irrelevant. A bellows rupture anytime exposing electrical components and valve motor to propellant is serious, not just when the valve motor is continuously on and hot. That is, this failure does not significantly contribute to the bellows rupture failure.

Furthermore, the valves are protected from continuous power by an electrical thermal shutoff device within the valve motor at no more than 352 F, and according to the specs, "the motor and actuation mechanism shall not fail as a result of prolonged power application."

See AC Motor Valve Spec MC284-0430 Sect. 3.1, 3.2.1.2.9, 3.2.1.2.11

4.1.B.3 Multiple Unrelated Failures in Effects

IOA considers the effects on several current FMEAs to include "multiple unrelated failures", which is beyond the scope of the IOA's interpretation of NSTS 22206. IOA concurs with the NASA's criticalities and screens, but recommends that a bellows failure not be considered in this FMEA's effects field. The NASA is right that this failure could cause continuous power on the associated valve(s), since the signal through this item would inhibit closing or opening when the valves reach full closed or open. However, the NASA's scenario with another failure consisting of bellows rupture is irrelevant. A bellows rupture anytime exposing electrical components and valve motor to propellant is serious, not just when the valve motor is continuously on and hot. That is, this failure does not significantly contribute to the bellows rupture failure.

Furthermore, the values are protected from continuous power by an electrical thermal shutoff device within the value motor at no more than 352 F, and according to the specs, "the motor and actuation mechanism shall not fail as a result of prolonged power application."

See AC Motor Valve Spec MC284-0430 Sect. 3.1, 3.2.1.2.9, 3.2.1.2.11

4.1.B.4 Additional Items and Failure Modes

A number of OMS EPD&C subsystem items and failure modes identified by IOA during the analysis phase are not covered in the current NASA FMEA/CIL. The IOA recommends that these items and failure modes be incorporated into the FMEA/CILs. These issues are identified in Appendix F by issue codes EPD&C 4 and EPD&C 5.

4.1.B.5 Failure Mode Differences

Several EPD&C issues exist because of differences in the failure modes defined by the IOA and the NASA for these items. See the applicable issues.

4.1.B.6 Failed-On Heaters Detected Too Late

Several issues on current thermal control component FMEAs exist because of the detectability of failed-on heaters. IOA recommends upgrading the criticality of these FMEAs based on the following argument. The first failure results in the associated heater set failed on. A second failure in the same heater group would result in both elements of two or more heaters on simultaneously when the redundant heater group is active. This results in a temperature exceeding the pod structural qualified limit of 425 F in approximately two minutes and possible loss of crew/vehicle due to structural damage.

The NASA baseline FMEA hazards field partially supports this: "Failed on heater may cause potential fracture mechanical problem depending on heater location and application of increased propellant pressure (crit 3 - alternative action and time to abort after second failure). Not detectable unless multiple heaters failed on." The NASA's baseline Time to Effect field is "Immediate to Hours".

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See Flight Rules 6-72a, and JSC NASA Heater Book.

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4.2 Specific Unresolved Issues

The specific OMS hardware and EPD&C unresolved issues are presented in the following sections and paragraphs which were referenced in tables I and II. The organization of the sections and paragraphs follow the OMS breakdown hierarchy shown in Figures 4 and 5, and used in tables I and II.

Unresolved issues which are related to general issues discussed in section 4.1 contain a reference to the applicable general issue. Each issue is presented in a standard format which gives the failure mode, applicable FMEA number and IOA assessment ID, the NASA and IOA criticality and screen assignments, and the rationale behind the IOA issue. Refer to the detailed assessment sheets in Appendix C for further information on each issue.

4.2.1 Helium Pressurization Subsystem

4.2.1.A Hardware

4.2.1.A.1 Tank Isolation Valves

1) FAILURE: RESTRICTED FLOW

03-3-1003-2 2/1R PPP, CIL OMS-111 2/1R PFF, CIL

ISSUE: IOA recommends that the restricted flow failure mode be placed on a new FMEA separate from the fails closed mode since the restricted flow mode fails the B and C redundancy screens. Both isolation valves are open during ascent (OMS-1 and OMS-2), and restricted flow through one valve would not be detectable (fail B screen). Also, any upstream contamination source could affect the parallel isolation valves simultaneously (fail C screen).

4.2.1.A.2 Regulators

1) FAILURE: FAILS CLOSED, RESTRICTED FLOW, LOW OUTPUT

| 03-3-1004-2 | | | 2/1R | PPF, | CIL |
|-------------|------|-----|------|------|-----|
| OMS-119, | 120, | 121 | 2/1R | PFF, | CIL |

ISSUE: IOA recommends that the B redundancy screen be failed for these failure modes. These regulator failures would not be detectable during times when both parallel flow paths are open (e.g., ascent).

4.2.1.A.3 Vapor Isolation Valves

1) FAILURE: FAILS TO CLOSE, INTERNAL LEAKAGE

| 03-3-1006-1 | 3/3 | |
|-------------|---------------|--------------------|
| OMS-127 | 3/1R PFP, CIL | (Fails to close) |
| OMS-128 | 3/1R PFP, CIL | (Internal leakage) |

ISSUE: IOA recommends that this item and these failure modes be upgraded to 3/1R PFP and placed on the CIL. The current 3/3 criticality does not reflect the worst case potential effects of propellant migration into the helium subsystem due to the loss of all redundancy (vapor isol valve and check valve assembly). IOA contends that the contamination of upstream components by prop or prop vapors which could occur during a mission could result in the inability to repressurize the OMS prop tanks. Contamination of the regulator sensing ports could cause the regulators to fail closed. A failed open redundant quad check valve poppet is not detectable during flight (fail B screen). IOA also recommends that the crossover of prop or prop vapors resulting in a hypergolic reaction in the lines be added as a possible effect on this FMEA.

This issue is supported by the fact that these failures and/or "prop vapor exposure" are listed as causes on other functional crit 1R FMEAs (03-3-1003-2, 1004-1, 1004-2, and 1006-2). The criticality assigned to a failure mode should reflect the worst case ultimate effects of the failure. Since the loss of all redundancy can result in the inability to repressurize the prop tanks, these failures should be classified as a 3/1R PFP. IOA does not consider the potential severity of these failures to be adequately addressed by their listing as a cause on the above 1R FMEAs.

4.2.1.A.4 Quad Check Valves

1) FAILURE: FAILS TO CLOSE, INTERNAL LEAKAGE

| 03-3-1007-1 | 3/3 | | | |
|-------------|------|------|-----|--------|
| OMS-133 | 2/1R | PFP, | CIL | (Fuel) |
| OMS-134 | 3/1R | PFP, | CIL | (Oxid) |

ISSUE: IOA recommends that a 2/1R PFP FMEA and CIL for the fuel assembly and a 3/1R PFP FMEA and CIL for the oxidizer assembly. The current single 3/3 criticality does not reflect the worst case potential effects of propellant migration into the helium subsystem due to the loss of all redundancy (series poppets for fuel leg; series poppets and vapor isol valve for oxidizer leg). IOA contends that the contamination of upstream components by prop or prop vapors which could occur during a mission could result in the inability to repressurize the OMS prop tanks. Contamination of the regulator sensing ports could cause the regulators to fail closed. A failed open quad check valve poppet is not detectable during flight (fail B screen).

IOA also recommends that the crossover of prop or prop vapors resulting in a hypergolic reaction in the lines be added as a possible effect on these proposed FMEAs.

This issue is supported by the fact that these failures and/or "prop vapor exposure" are listed as causes on other functional crit 1R FMEAs (03-3-1003-2, 1004-1, 1004-2, and 1006-2). The criticality assigned to a failure mode should reflect the worst case ultimate effects of the failure. Since the loss of all redundancy can result in the inability to repressurize the prop tanks, these failures should be classified as 2/1R PFP (fuel assembly), and 3/1R PFP (oxidizer assembly). IOA does not consider the potential severity of these failures to be adequately addressed by their listing as a cause on the above 1R FMEAs.

4.2.1.A.5 Quick Disconnect Couplings

1) FAILURE: EXTERNAL LEAKAGE

03-3-1002-1 2/1R FFP, CIL OMS-102 2/1R FFP, CIL

ISSUE: IOA recommends that "poppet fails open (during flight)" be added as a failure mode on this FMEA. This is a credible failure mode and is addressed on RCS QD coupling FMEAs.

2) FAILURE: EXTERNAL LEAKAGE

03-3-1205-1 3/1R FFP, CIL OMS-113,123,137,146 3/1R FFP, CIL

ISSUE: IOA recommends that "poppet fails open (during flight)" be added as a failure mode on this FMEA. This is a credible failure mode and is addressed on RCS QD coupling FMEAs.

3,4) FAILURE: FAILS TO COUPLE

03-3-1002-3, 1205-3 OMS-103,114,124,138,147 3/3 ---

ISSUE: IOA recommends that "fails closed" and "restricted flow" be added to the failure modes on this FMEA. These are credible failure modes and are addressed on RCS QD coupling FMEAs.

4.2.1.B EPD&C

4.2.1.B.1 Remote Power Controllers

1) FAILURE: FAILS HIGH

05-6L-2176-2 3/1R PPP OMS-399 3/1R PFP, CIL

ISSUE: The IOA recommends failing the <u>B</u> screen. This failure is not detectable until the associated switch is <u>put</u> in OPEN position, but this causes valve to be stuck open. If the crew had known about the failure, they might not have thrown the switch into OPEN, to avoid sticking the valve open. Therefore, failure is detected but detected too late.

4.2.1.B.2 Toggle Switches for Valves

1) FAILURE: FAILS TO SWITCH (STUCK IN THE "OPEN" POSITION)

NO FMEA OMS-438,442 3/1R PPP

ISSUE: The IOA recommends that the NASA generate a FMEA with this "Stuck in open position (Both contact sets)" Failure Mode. The closest existing match available is the NASA's FMEA 05-6L-2026-1 with a "FAILS TO TRANSFER, FAILS TO CLOSE, FAILS TO CONDUCT (ONE CONTACT SET)" Failure Mode, which is already matched to OMS-440 and 443. See 4.1.B.4.

4.2.1.B.3 Meters

1) FAILURE: ERRONEOUS OUTPUT

| 05-6L-2153-1 | 3/3 | |
|--------------|------|----------------|
| OMS-444 | 3/2R | \mathbf{PPP} |

ISSUE: The IOA does, but the NASA does not, imply that CRT displays and Mission Control Center are redundant to item to get nitrogen and helium pressure measurements. Loss of function can lead to falsely failing one OMS HE tank or two OMS GN2 tanks, and thus loss of mission or an ATO.

4.2.1.B.4 Pressure Sensors

1) FAILURE: ERRONEOUS OUTPUT (OPEN, SHORTED, FAILS OUT OF TOLERANCE)

03-3-1801-1 3/3 ---OMS-445,446 3/2R PPP

ISSUE: Loss of all redundancy can result in falsely failing the Helium Tank during ascent requiring an ATO be called, since there may not be enough time to verify the failure. See Flight Rule 6-1.

4.2.1.B.5 Temperature Sensors

1) FAILURE: ERRONEOUS OUTPUT (SHORTED, OPENED, FAILS OUT OF TOLERANCE)

03-3-1802-1 3/3 ---OMS-447 3/2R PPP

ISSUE: Loss of all redundancy can result in falsely failing the Helium Tank during ascent requiring an ATO be called, since there may not be enough time to verify the failure. See Flight Rule 6-1.

4.2.1.B.6 Toggle Switches for Instrumentation

1) FAILURE, NASA: ALL CREDIBLE MODES (FAILS TO TRANSFER, SHORTS, OPENS) FAILURE, IOA: FAILS TO SWITCH (POLES STUCK IN ONE OF THREE POSITIONS OR POLES FAIL TO MAKE CONTACT IN ANY POSITION)

05-6L-2033-1 3/3 ---OMS-449 3/2R PPP

ISSUE: The IOA does, but the NASA does not, imply that CRT displays and Mission Control Center are redundant to item to get Nitrogen and Helium Pressure measurements. Loss of function can lead to falsely failing one OMS HE tank or two OMS GN2 tanks, and thus loss of mission or an ATO.

4.2.2 Propellant Storage & Distribution Subsystem

4.2.2.A Hardware

4.2.2.A.1 Tank Isolation Valves

1) FAILURE: RELIEF DEVICE FAILS CLOSED

NO FMEA OMS-20014X 3/1R PNP

ISSUE: This failure mode is not currently addressed on the NASA FMEA/CIL. Failure of the propellant tank isolation valve internal relief device is listed as a cause on current prop line and gimbal bellows external leakage FMEAs, however IOA recommends that a new 3/1R PNP FMEA be generated for this failure mode. The potential 1R effects of this failure (overpressurization and rupture of prop lines and components) warrant a separate FMEA to give this failure the proper amount of attention. AC motor valve relief device failures are currently addressed as failure modes on individual FMEAs (however, IOA takes issue with the criticalities assigned).

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The OMS propellant tank isolation valves are nominally open during a mission, therefore a previous failure is required for the valves to be closed and this failure mode to be applicable.

4.2.2.A.2 Crossfeed Valves

1) FAILURE: RELIEF DEVICE FAILS CLOSED

NO FMEA OMS-20015X 3/1R PNP

ISSUE: This failure mode is not currently addressed on the NASA FMEA/CIL. Failure of the crossfeed valve internal relief device is listed as a cause on current crossfeed line external leakage FMEAs, however IOA recommends that a new 3/1R PNP FMEA be generated for this failure mode. The potential 1R effects of this failure (overpressurization and rupture of crossfeed lines) warrant a separate FMEA to give this failure the proper amount of attention. AC motor valve relief device failures are currently addressed as failure modes on individual FMEAs (however, IOA takes issue with the criticalities assigned).

The OMS crossfeed values are nominally open during a mission, therefore a previous failure is required for the values to be closed and this failure mode to be applicable.

4.2.2.A.3 Quick Disconnect Couplings

1,2) FAILURE: EXTERNAL LEAKAGE

03-3-2001-1, 2009-1 2/1R FFP, CIL OMS-150,156,165,168,171,174 2/1R FFP, CIL 207,210,213,231,234

ISSUE: IOA recommends that "poppet fails open (during flight)" be added as a failure mode on this FMEA. This is a credible failure mode and is addressed on RCS QD coupling FMEAs.

3,4) FAILURE: FAILS TO COUPLE

03-3-2001-3, 2009-3 OMS-151,157,166,169,172,175 208,211,214,232,235 3/3 ---

ISSUE: IOA recommends that "fails closed" and "restricted flow" be added to the failure modes on this FMEA. These are credible failure modes and are addressed on RCS QD coupling FMEAs.

4.2.2.B EPD&C

4.2.2.B.1 Diodes

1) FAILURE: FAILS OPEN

05-6L-2253A-1 2/1R PPP, CIL OMS-450A,452A 3/1R PPP

ISSUE: The IOA's recommended criticality is driven by OMS Hardware FMEA 03-3-2007-1, since this failure causes Tank Isol valve to fail open. According to the last available NASA criticality, this FMEA should be in the new NASA CIL list but is not. The IOA assumes that the NASA downgraded this to a non-CIL.

2) FAILURE: FAILS SHORT

05-6L-2253A-2 2/1R PPP, CIL OMS-451A,453A 3/3 ---

ISSUE: The IOA recommends removing this FMEA from the CIL. The IOA believes this failure has no effect, since only a Multiplexer-Demultiplexer (MDM) is behind the "GPC close" diodes, and that is well protected internally from reverse current. According to the last available NASA criticality, this FMEA should be in the new NASA CIL list but is not. The IOA assumes that the NASA downgraded this to a non-CIL, and tentatively concurs.

05-6L-2253C-1 3/1R PPP OMS-450C,452C 3/1R PFP, CIL

ISSUE: The IOA recommends failing the B screen, thus adding this to the CIL list, since the MCA status of relay positions are not readily accessible by the crew. Therefore, "close" relays which do not open and "open" relays which do not close because of a failed open diode are not detectable and the failed diode is not detectable inflight.

4) FAILURE: FAILS OPEN

05-6L-2253D-1 3/2R PPP OMS-450D,452D 3/1R PPP

ISSUE: The IOA's recommended criticality is driven by OMS Hardware FMEA 03-3-2007-1, since this failure causes Tank Isol valve to fail open.

5) FAILURE: FAILS OPEN

05-6L-2255 -1 3/1R PFP, CIL OMS-450E,452E 3/3 ---

ISSUE: See 4.1.B.2.

6) FAILURE: FAILS OPEN

05-6L-2256 -1 2/1R PFP, CIL OMS-450F,452F 3/3 ---

ISSUE: See 4.1.B.2.

7) FAILURE: FAILS OPEN

05-6L-2256A-1 3/1R PFP, CIL OMS-450G,452G 3/3 ---

ISSUE: See 4.1.B.2.

8) FAILURE: FAILS SHORT

05-6L-2256B-2 3/1R PFP, CIL OMS-451C,453C 3/3 ---

ISSUE: See 4.1.B.2.

05-6L-2257-1 3/1R PPP OMS-454,456 3/2R PFP, CIL

ISSUE: The IOA's recommended criticality is indirectly driven by OMS Hardware FMEA 03-3-2008-2, since loss of redundancy causes crossfeed valve to fail closed. The IOA recommends failing the B screen, thus adding this to the CIL list, since the MCA status of relay positions are not readily accessible by the crew. Therefore, "close" relays which do not open and "open" relays which do not close because of a failed open diode are not detectable and so the failed diode is not detectable inflight.

10) FAILURE: FAILS SHORT

05-6L-2257-2 3/1R PPP OMS-455,457 3/2R PPP

ISSUE: The IOA's recommended criticality is driven by OMS Hardware FMEA 03-3-2008-2, since this failure causes the crossfeed valve to fail closed.

11) FAILURE: FAILS OPEN

05-6L-2257A-1 2/1R PPP, CIL OMS-454A,456A 3/2R PPP

ISSUE: The IOA's recommended criticality is driven by OMS Hardware FMEA 03-3-2008-2, since this failure causes the crossfeed valve to fail closed. According to the last available NASA criticality, this FMEA should be in the new NASA CIL list but is not. The IOA assumes that the NASA downgraded this to a non-CIL.

12) FAILURE: FAILS SHORT

05-6L-2257A-2 2/1R PPP, CIL OMS-455A,457A 3/3 ---

ISSUE: The IOA recommends removing this FMEA from the CIL. The IOA believes this failure has no effect, since only a Multiplexer-Demultiplexer (MDM) is behind the "GPC close" diodes, and that is well protected internally from reverse current. According to the last available NASA criticality, this FMEA should be in the new NASA CIL list but is not. The IOA assumes that the NASA downgraded this to a non-CIL, and tentatively concurs.

05-6L-2257C-1 3/1R PPP OMS-454C,456C 3/1R PFP, CIL

ISSUE: The IOA recommends failing the B screen, thus adding this to the CIL list, since the MCA status of relay positions are not readily accessible by the crew. Therefore, "close" relays which do not open and "open" relays which do not close because of a failed open diode are not detectable and the failed diode is not detectable inflight.

14) FAILURE: FAILS OPEN

05-6L-2259 -1 3/1R PFP, CIL OMS-454F,456F 3/3 ---

ISSUE: See 4.1.B.2.

15) FAILURE: FAILS OPEN

05-6L-2260 -1 2/1R PFP, CIL OMS-454G,456G 3/3 ---

ISSUE: See 4.1.B.2.

16) FAILURE: FAILS OPEN

05-6L-2260A-1 3/1R PFP, CIL OMS-454H,456H 3/3 ---

ISSUE: See 4.1.B.2.

17) FAILURE: FAILS OPEN

05-6L-2260B-2 3/1R PFP, CIL OMS-454I,456I 3/3 ---

ISSUE: See 4.1.B.2.

4.2.2.B.2 Hybrid Drivers

1) FAILURE: FAILS OPEN

 05-6L-2202-1
 3/3
 --

 OMS-466,470
 3/2R
 PPP

ISSUE: The IOA recommends 3/2R. Worst case would be falsely failing the A or B valve closed resulting in loss of mission due to safety considerations. See 4.1.B.1.

2) FAILURE: FAILS HIGH

05-6L-2202-2 3/3 ---OMS-469,473 3/2R PPP

ISSUE: The IOA recommends 3/2R. Worst case would be falsely failing the A or B valve closed resulting in loss of mission due to safety considerations. See 4.1.B.1.

3) FAILURE: FAILS OPEN

05-6L-2204-1 3/3 ---OMS-458,459,460,461,462,463,464,465 3/2R PPP

ISSUE: The IOA recommends 3/2R. Worst case is valve declared failed closed and redundant valve is used to complete crossfeed. Loss of all redundancy could result in falsely failing the crossfeed system resulting in loss of mission. See 4.1.B.1.

- 4.2.2.B.3 Fuses
- 1) FAILURE: OPENS, INADVERTENTLY OPENS

05-6L-2004-1 3/1R PFP, CIL OMS-474,475,476,477 3/2R PFP, CIL

ISSUE: See 4.1.B.2.

4.2.2.B.4 Relays

1) FAILURE: FAILS OPEN (RELAY FAILS TO ENERGIZE)

05-6L-2126-1 3/1R PNP OMS-492,496,508,513 3/1R PFP, CIL

ISSUE: The IOA recommends failing the B screen, thus adding this to the CIL list. These relays are not Standby Redundant to any other items since they are normally operational. Some of these relays failing have no immediate effect and cannot be detected except via MCA status signals which are not readily used by the crew.

2) FAILURE: INADVERTENT OPERATION, INADVERTENTLY TRANSFERS, FAILS CLOSED

05-6L-2126-2 2/1R PFP, CIL OMS-493,497,509,510 2/1R PFP, CIL

ISSUE: The IOA's recommended criticality is driven by OMS Hardware FMEA 03-3-2007-1. See 4.1.B.3.

3) FAILURE: FAILS CLOSED (STUCK IN ENERGIZED POSITION)

05-6L-2127 -2 3/1R PFP, CIL OMS-491,495,507,512 3/1R PFP, CIL

ISSUE: See 4.1.B.3.

4) FAILURE: INADVERTENT OPERATION, INADVERTENTLY TRANSFERS, FAILS CLOSED

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05-6L-2130-2 2/1R PFP, CIL OMS-485,489,501,505 3/2R PFP, CIL

ISSUE: See 4.1.B.2.

5) FAILURE: FAILS CLOSED (ENERGIZED)

05-6L-2131 -2 3/1R PFP, CIL OMS-483,487,499,503 3/3 ---

ISSUE: See 4.1.B.2.

4.2.2.B.5 Resistors

1) FAILURE: FAILS OPEN

05-6L-2078-1 3/3 ---OMS-530,537,576,584 3/2R PPP

ISSUE: Worst case would be falsely failing the A or B valve closed resulting in loss of mission due to safety considerations. See 4.1.B.1.

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2) FAILURE: FAILS OPEN

| 05-6L-2079-2 | 2/1R | PPP, | CIL | |
|--------------|------|------|-----|--|
| OMS-572,578 | 3/2R | PPP | | |

ISSUE: The IOA's recommended criticality is driven by OMS Hardware FMEA 03-3-2007-1. See 4.1.B.2.

3) FAILURE: FAILS OPEN and the second s

05-6L-2079A-2 2/1R PFP, CIL OMS-526,532,570,580 3/2R PPP

ISSUE: The IOA's recommended criticality is driven by OMS Hardware FMEA 03-3-2007-1. The IOA recommends passing the B screen since the effect of the failure (barberpole indicated on a valve position indicator) is readily detectable. The problem remains to determine if the valve or this item failed. See 4.1.B.2.

05-6L-2082-1 3/3 ---OMS-518,524,562,568 3/2R PPP

ISSUE: The IOA recommends 3/2R. Worst case is valve declared failed closed and redundant valve is used to complete crossfeed. Loss of all redundancy could result in falsely failing the crossfeed system resulting in loss of mission. See 4.1.B.1. See JSC 10588 pg. 5-18.

5) FAILURE: FAILS OPEN

05-6L-2083-1 2/1R PPP, CIL OMS-514,520,558,564 3/2R PPP

ISSUE: The IOA's recommended criticality is driven by OMS Hardware FMEA 03-3-2007-1. See 4.1.B.2.

6) FAILURE: FAILS OPEN

 05-6L-2083A-1
 2/1R PFP, CIL

 OMS-538,544
 3/2R PPP

ISSUE: The IOA's recommended criticality is driven by OMS Hardware FMEA 03-3-2007-1. The IOA recommends passing the B screen since the effect of the failure (barberpole indicated on a valve position indicator) is readily detectable. The problem remains to determine if the valve or this item failed. See 4.1.B.2.

4.2.2.B.6 Toggle Switches

1) FAILURE: FAILS TO SWITCH (STUCK IN THE "OPEN" POSITION)

NO FMEA OMS-593,596 3/3 ---

ISSUE: The IOA recommends that the NASA generate a FMEA with this "STUCK IN OPEN POSITION (BOTH CONTACT SETS)" Failure Mode. The closest existing match available is the NASA's FMEA 05-6L-2027-1 with a "FAILS TO TRANSFER, FAILS TO CLOSE, FAILS TO CONDUCT (ONE CONTACT SET)" Failure Mode, which is already matched to OMS-592 and 595. See 4.1.B.4.

2) FAILURE, NASA: INADVERTENT OPERATION, SHORTS, INADVERTENTLY CLOSES (ONE CONTACT SET) FAILURE, IOA: FAILS TO SWITCH (STUCK IN THE "CLOSED" POSITION)

05-6L-2027-2 3/1R PNP OMS-594,597 2/1R PPP, CIL

ISSUE: The IOA's recommended criticality is driven by OMS Hardware FMEA 03-3-2007-2, since this failure causes the tank isolation valve to fail closed. Also, the NASA failed only one pole, considering the other pole as redundant, whereas the IOA considered the worst case failure mode by failing a part common to both poles (e.g. toggle lever). This is the reason for the IOA's higher criticality. The NASA considered one pole to be standby redundant to the other and so had "Not Applicable" for B screen. See 4.1.B.5.

3) FAILURE, NASA: FAILS TO TRANSFER, FAILS TO CLOSE, FAILS TO CONDUCT (BOTH CONTACT SETS) FAILURE, IOA: FAILS TO SWITCH (STUCK IN GPC POSITION)

05-6L-2028-1 3/1R PFP, CIL OMS-586,589 3/1R PFP, CIL

ISSUE: According to the last available NASA criticality, this FMEA should be in the new NASA CIL list, but it is not. Therefore, the IOA assumes that the NASA downgraded this FMEA to a non-CIL. The IOA recommends that the NASA use the previous (last available to the IOA) criticality and screens (3/1R PFP) and reinstate this FMEA as a CIL.

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4) FAILURE, NASA: INADVERTENTLY OR PREMATURELY TRANSFERS TO CLOSE, FAILED IN THE "CLOSE" POSITION (BOTH CONTACT SETS) FAILURE, IOA: FAILS TO SWITCH (STUCK IN CLOSED POSITION)

05-6L-2028-2 3/1R PFP, CIL OMS-588,591 3/1R PPP

ISSUE: The IOA concurs with the NASA's criticality, since it agrees with OMS Hardware FMEA 03-3-2008-2 (causes crossfeed valve to fail closed). However, the NASA failed the B screen because one of the two poles failing is undetectable. The IOA believes this is a carry-over from when the NASA failed only one contact set, and recommends passing this B screen. See 4.1.B.5.

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5) FAILURE, NASA: INADVERTENTLY TRANSFERS TO OPEN, FAILED IN THE "OPEN" POSITION (BOTH CONTACT SETS). FAILURE, IOA: FAILS TO SWITCH (STUCK IN OPEN POSITION)

05-6L-2028-3 3/1R PFP, CIL OMS-587,590 3/2R PPP

ISSUE: The IOA recommends passing the B screen, and thus removing this as a CIL, since the effect of this failure (inability to close a valve) is detectable via the valve position indicator. See 4.1.B.2.

4.2.2.B.7 Event Indicators

1) FAILURE: ERRONEOUS INDICATION (FAILS HIGH, FAILS LOW, FAILS MIDTRAVEL)

05-6L-2151-1 3/3 ---OMS-602,603 3/2R PPP

ISSUE: The IOA recommends 3/2R. Worst case would be falsely failing the A or B valve closed resulting in loss of mission due to safety considerations. See 4.1.B.1.

2) FAILURE: ERRONEOUS INDICATION (FAILS HIGH, FAILS LOW, FAILS MIDTRAVEL)

05-6L-2152-1 3/3 ---OMS-600,601 3/2R PPP

ISSUE: The IOA recommends 3/2R. Worst case is valve declared failed closed and redundant valve is used to complete crossfeed. Loss of all redundancy could result in falsely failing the crossfeed system resulting in loss of mission. See 4.1.B.1. See Malfunction Procedure RCS 103a and JSC 10588 pg. 5-18.

4.2.2.B.8 Meters

1) FAILURE: ERRONEOUS OUTPUT

05-6L-2155-1 3/3 ---OMS-605,607 3/2R PPP

ISSUE: The IOA recommends 3/2R. Loss of all redundancy in prelaunch and onorbit phases would result in OMS Helium tank being declared failed resulting in a loss of delta velocity and loss of mission capability, unless sensor failure is determined. See 4.1.B.1. See Flight Rule 6-41.

2) FAILURE: ERRONEOUS OUTPUT

05-6L-2157-1 OMS-604 3/2R PPP

ISSUE: The NASA's Review Comments stated "Delete this FMEA". The IOA recommends that the NASA not delete this FMEA. This item is associated with the flight-dependent Payload Bay Kit, but also displays Forward RCS and OMS tank pressures which are not flight-dependent. The IOA also recommends a change from NASA's original 3/3 criticality to 3/2R, because false indications of OMS tank pressure giving an appearance of a leak could lead to loss of mission for safety reasons.

4.2.2.B.9 Temperature Sensors

1) FAILURE: ERRONEOUS OUTPUT (SHORTED, OPENED, FAILS OUT OF TOLERANCE)

03-3-2803-1 3/3 ---OMS-610,611 2/2 ---, CIL

ISSUE: The IOA recommends 2/2 since loss of mission could occur in the liftoff phase with no redundancy. A temperature sensor failure could lead to wrongly failing the OMS fuel propellant tank leading to the establishment of a shallow ATO before sensor failure is determined. See JSC 20923 PCN-1 and Flight Rule 6-2 then 6-40k.

4.2.2.B.10 Rotary Switches 1) FAILURE: FAILS TO SWITCH (POLES STUCK IN ONE OF THREE POSITION OR POLES FAIL TO MAKE CONTACT IN ANY POSITION)

05-6L-2034-1 3/3 ---OMS-612 3/2R PPP

ISSUE: The IOA does, but the NASA does not, imply that CRT displays and MCC are redundant to this item to get OMS propellant tank ullage, (and RCS R/L/FWD prop ullage and RCS R/L/FWD Helium Tank pressure) measurements. Loss of redundancy can result in loss of mission for safety reasons since the actual status of the systems are unavailable, implying a criticality of 3/2R.

4.2.3 OME Subsystem Issues

4.2.3.A Hardware

4.2.3.A.1 Engine Inlet Filter and Orifice

1) FAILURE: STRUCTURAL FAILURE, CONTAMINATION PASSAGE

03-3-4002-2 3/3 ---OMS-248 1/1 ---, CIL

IOA recommends that this failure mode be upgraded to a ISSUE: 1/1 and placed on the CIL. The current 3/3 criticality does not reflect the worst case potential effects of engine Contamination of contamination due to an inlet filter failure. the OMS engine injector orifices or cooling channels could result in combustion chamber burn-through. This issue is supported by the fact that this failure is listed as a cause on other 1/1 FMEAs (03-3-4004-1, 4005-2). The criticality assigned to a failure mode should reflect the worst case ultimate effects of the failure. Since this failure can result in burn-through of the engine, it should be classified as a IOA does not consider the potential severity of this 1/1. failure to be adequately addressed by its listing as a cause on the above 1/1 FMEAs.

This failure should <u>at least</u> be upgraded to a 2/1R PPP, 1/1 abort since it could result in the loss of one OMS engine.

4.2.3.A.2 Bipropellant Valve Assembly

1) FAILURE: RESTRICTED FLOW OF ENGINE CONTROL VALVE

NO FMEA OMS-330 2/1R PPP, 1/1 ABORT, CIL

ISSUE: This failure mode is not currently addressed on the NASA FMEA/CIL. IOA recommends that a 2/1R PPP, 1/1 abort FMEA and CIL be generated for this item and failure mode. IOA does not consider this failure to be adequately addressed on 03-3-4001-2, which lists "plugged opening orifice" as a cause for a failed closed control valve resulting in failed closed biprop valves. IOA considers restricted flow to be a credible failure mode for components with integral filters and/or orifices, and recommends that it be addressed as a failure mode (as opposed to a cause) to ensure that it gets the proper amount of attention. IOA does not consider the potential severity of this failure to be adequately addressed by its listing only as a cause on the above FMEA. 2) FAILURE: PROP LEAKAGE INTO ACTUATOR

NO FMEA OMS-342 3/1R PFP, CIL

ISSUE: This failure mode is not currently addressed on the NASA FMEA/CIL. IOA recommends that a 3/1R PFP FMEA and CIL be generated for this failure mode. Leakage of propellant past the biprop ball valve seals and actuator seals could result in mixing of hypergolic propellants in actuator cavities or venting of propellant into the pod causing possible corrosion, fire, explosion, and exposure of EVA and ground crews. Seal failures not detectable in flight (fail B screen).

4.2.3.A.3 Biprop Cavity Pressure Relief Valve

1,2) FAILURE: FAILS CLOSED, RESTRICTED FLOW

NO FMEA OMS-262 1/1 ---, CIL (Fails closed) OMS-20005X 1/1 ---, CIL (Restricted flow)

ISSUE: These failure modes are not currently addressed on the NASA FMEA/CIL. IOA recommends that these failure modes be addressed as 1/1's on the FMEA/CIL. The fails closed mode is currently listed as a cause on 03-3-4001-6, however IOA does not consider the potential severity of this failure to be adequately addressed by its listing only as a cause. These failures each result in overpressurization of the biprop valve cavity during post OMS burn heat soak-back. IOA considers the worst case effect of overpressurization to be structural failure of the biprop valve housing resulting in leakage of propellant into the pod causing possible corrosion, fire, explosion, and exposure of EVA and ground crews.

Less severe (2/1R PPP, 1/1 abort) effects of these failures would be loss of the affected OMS engine or failure of the ball valve seals causing subsequent biprop valve internal leakage. However, tests have shown that the ball valve seals may not fail and relieve the pressure build-up until 1700 psi. The valve housing is designed only to 825 psi. Therefore, a housing leakage could occur before the ball valve seals fail. Per NSTS 22206 (p. 2-11, item h), any external leakage of propellant should be classified as a crit 1.

NO FMEA OMS-263 2/1R PFP, CIL

ISSUE: This failure mode is not currently addressed on the NASA FMEA/CIL. It is addressed as a cause on 03-3-4001-6, however IOA does not consider the potential severity of this failure to be adequately addressed by its listing only as a cause. The internal leakage mode is adequately addressed as a failure mode on 03-3-4001-6. IOA recommends that the "fails open" mode also be addressed as a failure mode on a new 2/1R PFP FMEA and CIL to ensure that it gets the proper amount of attention. A failed open relief valve would not be detectable in flight (fail B screen).

4) FAILURE: STRUCTURAL FAILURE, RUPTURE, EXTERNAL LEAKAGE

NO FMEA OMS-265 1/1 ---, CIL

ISSUE: This failure mode is not currently addressed on the NASA FMEA/CIL. IOA recommends that this valve housing be added to the other valve housings listed on 03-3-2101-1, with corresponding retention rationale. Failure of this valve housing would also result in leakage of propellant into the pod causing possible corrosion, fire, explosion, and exposure of EVA and ground crews.

4.2.3.A.4 Propellant Quick Disconnect Couplings

1) FAILURE: EXTERNAL LEAKAGE

03-3-4507-1 2/1R FFP, CIL OMS-253,267,273,277 2/1R FFP, CIL

ISSUE: IOA recommends that "poppet fails open (during flight)" be added as a failure mode on this FMEA. This is a credible failure mode and is addressed on RCS QD coupling FMEAs.

2) FAILURE: FAILS TO COUPLE

03-3-4507-3 OMS-254,268,264,278 3/3 ---

ISSUE: IOA recommends that "fails closed" and "restricted flow" be added to the failure modes on this FMEA. These are credible failure modes and are addressed on RCS QD coupling FMEAs. 3) FAILURE: EXTERNAL LEAKAGE OF ENGINE PORTS

NO FMEA OMS-345 3/3 ---

ISSUE: Leakage of these engine ports (CP001, CP002, CP005, CP006, CP007, and CP008) does not appear to be addressed on the current NASA FMEA/CIL. IOA recommends that leakage of all engine ports be addressed on the FMEA/CIL and/or the OMRSD. Leakage of these ports would expose internal engine parts to ambient, and could lead to contamination. However, leakage by itself is no effect.

4) FAILURE: FAILS TO COUPLE (ENGINE PORTS)

NO FMEA OMS-346 3/3 ---

ISSUE: Failure of these engine ports (CP001, CP002, CP005, CP006, CP007, and CP008) does not appear to be addressed on the current NASA FMEA/CIL. IOA recommends that "fails to couple" of all applicable engine ports be addressed on the FMEA/CIL for completeness. Failure has no effect.

5) FAILURE: FAILS TO OPEN, FAILS TO CLOSE, RESTRICTED FLOW (ENGINE PORTS)

NO FMEA OMS-347 3/3 ---

ISSUE: Failure of these engine ports (CP001, CP002, CP005, CP006, CP007, and CP008) does not appear to be addressed on the current NASA FMEA/CIL. IOA recommends that these failures be addressed for all engine ports on the FMEA/CIL for completeness. Failures have no effect.

4.2.3.A.5 GN2 Fill/Vent Valve

1) FAILURE: INTERNAL LEAKAGE, FAILS OPEN, FAILS TO REMAIN CLOSED

03-3-4511-1 3/1R PFP, CIL OMS-294 3/1R PFP, CIL

ISSUE: IOA recommends that the redundancy string listed in the "E" effects be revised. IOA considers the string to include only the fill/vent coupling seal and cap, accumulator, and other engine. There are no additional redundant valves or couplings.

4.2.3.A.6 GN2 Isolation Valve

1) FAILURE: FAILS TO OPEN, FAILS TO REMAIN OPEN, FAILS CLOSED

03-3-4503-2 3/1R PPP, 1/1 ABORT, CIL OMS-299 3/1R PPP, 1/1 ABORT, CIL

ISSUE: IOA recommends that the "E" effects on this FMEA be revised. The downstream regulator is not redundant for a failed closed isolation valve.

2) FAILURE: RESTRICTED FLOW

03-3-4503-2 3/1R PPP, 1/1 ABORT, CIL OMS-303 2/1R PFP, 1/1 ABORT, CIL

ISSUE: IOA recommends that the restricted flow failure mode be upgraded to a 2/1R PFP, 1/1 abort criticality, and placed on a new FMEA separate from the fails closed mode. Restricted flow would not be detectable until the start of an OMS burn when the crew would get a C&W alert 3 seconds after the regulator pressure drops and is not replenished. The crew may then not have time to inhibit the engine purge (to save engine restart capability) if the burn duration is short, thus depleting the accumulator and resulting in inability to restart the affected engine (engine redundancy lost). This is the same scenario which drove 03-3-4505-2 and 03-3-4551-2 to 2/1R PFP, 1/1 abort criticalities.

The fails closed mode for the isolation valve is detectable prior to the start of a burn, and the remaining engine start can be saved (engine redundancy not lost).

4.2.3.A.7 GN2 Accumulator

1) FAILURE: RUPTURE, EXTERNAL LEAKAGE

 03-3-4552-1
 2/1R PPP, 1/1 ABORT, CIL

 OMS-322
 1/1 ---, CIL (Rupture)

 OMS-323
 2/1R PPP, 1/1 ABORT, CIL (External leakage)

ISSUE: IOA recommends that the "rupture" mode be upgraded to a 1/1 and placed on a new FMEA and CIL to distinguish the potential effects form the 2/1R PPP, 1/1 abort effects of external leakage. NSTS 22206 requires that the criticality assigned to non-filament-wound pressure containers with design limit pressures greater than 100 psi include the effects of potential shrapnel damage. The accumulator is a non-filamentwound titanium tank which stores GN2 at 325 psi. Based on the NSTS 22206 groundrule and the possibility of material flaws, IOA makes the above recommendation.

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4.2.3.A.8 GN2 Quick Disconnect Couplings

1,2) FAILURE: EXTERNAL LEAKAGE

03-3-4502-1, 4506-1 3/1R FFP, CIL 3/1R FFP, CIL OMS-287,312

ISSUE: IOA recommends that "poppet fails open (during flight)" be added as a failure mode on these FMEAs. This is a credible failure mode and is addressed on RCS QD coupling FMEAs.

3,4) FAILURE: FAILS TO COUPLE

03-3-4502-3, 4506-3 3/3 ---3/3 OMS-288,313

ISSUE: IOA recommends that "fails closed" and "restricted flow" be added to the failure modes on these FMEAs. These are credible failure modes and are addressed on RCS QD coupling FMEAs.

4.2.3.A.9 TVC Gimbal Ring Bearings

1) FAILURE: PHYSICAL BINDING/JAMMING

03-3-6409-1 2/1R PPP, CIL 2/1R PPP, 1/1 ABORT, CIL OMS-363

ISSUE: IOA recommends that this failure mode be classified as a crit 1/1 for TAL aborts. Failure results in loss of TVC for the affected engine. See 4.1.A.1.

2) FAILURE: STRUCTURAL FAILURE, DISATTACHMENT OF GIMBAL RING AND MOUNTING PAD

NO FMEA OMS-20002X 1/1 ---, CIL

ISSUE: This failure mode is not currently addressed on the NASA FMEA/CIL. FMEA 03-3-6409-1 addresses only the physical binding/jamming failure mode. IOA recommends that a new 1/1 FMEA and CIL be generated for a structural failure of a gimbal ring bearing which results in disattachment of the gimbal ring and mounting pad. IOA considers the worst case structural failure of a bearing at an attachment point to result in disattachment. Such a failure of a gimbal bearing would result in loss of OMS engine restraint and possible prop line rupture or vehicle damage.

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4.2.3.A.10 TVC Actuator Gimbal Drive Motors

1) FAILURE: ERRONEOUS/ERRATIC OPERATION

NO FMEA OMS-366 3/1R PPP

ISSUE: This failure mode is not currently addressed on the NASA FMEA/CIL. IOA considers this to be a credible failure mode and recommends that it be added to 03-3-6401-1. A severe rotation of the motor synchro armature with respect to the motor shaft could result in motor output opposite of that commanded (CAR AB9612). Therefore, IOA also recommends that "motor synchro armature rotation" be included as a cause on 03-3-6401-1.

4.2.3.A.11 TVC Actuator Gimbal Drive Assembly

1) FAILURE: PHYSICAL BINDING/JAMMING

03-3-6402-2 OMS-367, 376, 379, 20009X, 20011X 2/1R PPP, CIL 2/1R PPP, 1/1 ABORT, CIL

ISSUE: IOA recommends that this failure mode be classified as a crit 1/1 for TAL aborts. Failure results in loss of TVC for the affected engine. See 4.1.A.1.

4.2.3.A.12 TVC Actuator Reduction Gears

1,2) FAILURE: PHYSICAL BINDING/JAMMING, STRUCTURAL FAILURE

NO FMEA OMS-369 3/1R PPP (Physical binding/jamming) OMS-370 3/1R PPP (Structural failure)

ISSUE: This item and failure mode are not currently addressed on the NASA FMEA/CIL. IOA recommends that these credible reduction gear failure modes be addressed. The reduction gear is a moving, load-bearing component whose failure would result in the loss of one channel. IOA recommends a that new 3/1R PPP FMEA be generated for each of these reduction gear failure modes. The reduction gears in the TVC actuator assembly are at the same level of detail as other TVC hardware items which are addressed on the current NASA FMEA/CIL.

4.2.3.A.13 TVC Actuator Anti-Back Devices

1) FAILURE: STRUCTURAL FAILURE, FAILS TO TRANSMIT TORQUE OR FAILS TO STOP ROTATION OF INACTIVE CHANNEL

NO FMEA OMS-372 3/1R PPP

ISSUE: "Structural failure" of the antiback device is not currently addressed on the NASA FMEA/CIL. FMEA 03-3-6403-1 addresses only the physical binding/jamming failure mode. A structural failure causing the inability to transmit motor torque would result in the loss of the operational channel (crit 3/1R). A structural failure causing the inability to stop rotation of the unused channel would also result in the loss of one channel (crit 3/1R). IOA recommends that a new 3/1R PPP FMEA be generated for these anti-back device failure modes.

2) FAILURE: STRUCTURAL FAILURE, FAILS TO TRANSMIT TORQUE AND FAILS TO STOP ROTATION OF INACTIVE CHANNEL

NO FMEA OMS-373 2/1R PPP, 1/1 ABORT, CIL

ISSUE: "Structural failure" of the antiback device is not currently addressed on the NASA FMEA/CIL. FMEA 03-3-6403-1 addressed only the physical binding/jamming failure mode. A structural failure causing both the inability to transmit motor torque and the inability to stop rotation of the unused channel would result in the loss of the actuator and the effected OMS engine. IOA recommends that a new 2/1R PPP, 1/1 abort FMEA and CIL be generated for this anti-back device failure mode. See 4.1.A.1.

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4.2.3.A.14 TVC Actuator Thrust Bearings

1) FAILURE: PHYSICAL BINDING/JAMMING

| 03-3-6404-1 | 3/1R PPP | |
|-------------|--|--|
| OMS-375 | 3/1R PPP (Thrust bearings) | |
| OMS-20007X | 3/1R PPP (Secondary drive gear bearings) | |

ISSUE: SSM states that the bearings on either side of the secondary drive gear are thrust bearings and are covered by 03-3-6404-1. However, the quantity on 03-3-6404-1 shows only two bearings per actuator, and the "functional description" portion of the FMEA describes only two bearings per actuator. The correct quantity is four per actuator. IOA recommends that the quantity and "functional description" on 03-3-6404-1 be corrected to include the thrust bearings on either side of the secondary drive gear. IOA was unable to confirm that these bearings are thrust bearings. 2) FAILURE: STRUCTURAL FAILURE

NO FMEA OMS-374 2/1R PPP, 1/1 ABORT, CIL

ISSUE: Structural failure of the thrust bearings is a credible failure mode which is not currently addressed on the NASA FMEA/CIL. FMEA 03-3-6404-1 addresses only the physical binding/jamming failure mode. A structural failure of a bearing could cause binding of the gimbal drive or loss of gear meshing with one channel, and subsequent loss of TVC for one OMS engine. IOA recommends that a new 2/1R PPP, 1/1 abort FMEA and CIL be generated for this thrust bearing failure mode. See 4.1.A.1.

3) FAILURE: STRUCTURAL FAILURE (SECONDARY DRIVE GEAR BEARINGS)

NO FMEA OMS-20008X 2/1R PPP, 1/1 ABORT, CIL

ISSUE: The SSM states that the bearings on either side of the secondary drive gear are also thrust bearings. IOA was unable to confirm that these bearings are thrust bearings. Structural failure of the thrust bearings is a credible failure mode which is not currently addressed on the NASA FMEA/CIL. FMEA 03-3-6404-1 addresses only the physical binding/jamming failure mode. A structural failure of a bearing could cause binding of the gimbal drive or loss of gear meshing with one channel, and subsequent loss of TVC for one OMS engine. IOA recommends that a new 2/1R PPP, 1/1 abort FMEA and CIL be generated for this thrust bearing failure mode. See 4.1.A.1.

4.2.3.A.15 TVC Actuator Mechanical Stop, Snubber

1) FAILURE: STRUCTURAL FAILURE

03-3-6406-1 3/3 NNN OMS-378 2/1R PPP, 1/1 ABORT, CIL

ISSUE: IOA recommends that this failure mode be upgraded to a 2/1R PPP, 1/1 abort and placed on the CIL. IOA maintains concern that a snubber structural failure could result in binding or jamming of the gimbal output drive assembly or incorrect TVC resulting in loss of the affected engine. See 4.1.A.1. The "remarks" section on the 3/7/87 FMEA page also supports a higher criticality for this item and failure mode.

4.2.3.B EPD&C

4.2.3.B.1 Hybrid Drivers

1) FAILURE: FAILS HIGH

05-6L-2206-2 3/1R PPP OMS-633,641 3/1R PFP, CIL

ISSUE: The IOA recommends failing the B screen, thus adding this to the CIL list, since the first failure's effect (GN2 Pressure Isolation Valve stuck open) is not detectable, except via an MDM valve position signal. But since the FSSRs do not mention that signal, the IOA assumed that the software does not use the signal to detect valve stuck open.

| 1) | FAILURE, | NASA | ł: | INADV | ORTS, CONTACT SET | | | | | |
|----|-----------|------|--------------|----------------|----------------------|--------|--------|----|-----------|---|
| | FAILURE, | IOA | 672: | FAILS | TO | SWITCH | (STUCK | IN | ARM/PRESS | ; |
| | FAILURE, | IOA | 673 : | FAILS POSIT | TO | SWITCH | (STUCK | IN | ARM | |
| | 05-6L-202 | 29-2 | 3/11 | 2 ??? | | _ | | | | |

OMS-672,673 3/1R PFP, CIL

ISSUE: The IOA concurs with the NASA's criticality, since it agrees indirectly with OMS Hardware FMEA 03-3-4001-1. This NASA FMEA's Redundancy Screens were missing from the latest available NASA report. Since this FMEA did not appear in the NASA's new CIL package, the IOA assumes that the NASA passed all of the screens. The IOA recommends failing the B screen, since this failure is not detectable except during an OMS burn, which could be too late. The IOA also recommends considering both contact sets in the Failure Mode.

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2) FAILURE, NASA: INADVERTENT OPERATION - SHORTS (ONE CONTACT SET) FAILURE, IOA: FAILS TO SWITCH (STUCK IN "ON" POSITION) 05-6L-2030-2 3/1R PNP OMS-676 3/1R PFP, CIL

ISSUE: The IOA concurs with the NASA's criticality, since the NASA's crit agrees indirectly with OMS Hardware FMEA 03-3-4001-1. The NASA failed only one pole, considering the other pole as redundant, whereas the IOA considered the worst case failure mode by failing a part common to both poles (e.g. toggle lever). The NASA considered one pole to be standby redundant to the other and so had "Not Applicable" for B screen. The IOA recommends failing the B screen since this failure would not be readily detectable until it is too late.

4.2.3.B.3 Fuses

1) FAILURE: FAILS OPEN

05-6L-2008-1 3/1R PPP OMS-685,686 3/1R PNP

ISSUE: The fuse in the STANDBY circuit is Standby Redundant to the fuse in the ACTIVE circuit. Therefore, since B screens will differ ("NA" and "P"), the IOA recommends splitting this FMEA into two FMEAs.

4.2.3.B.4 Pressure Sensors for GN2 Assembly

1) FAILURE: ERRONEOUS OUTPUT (OPEN, SHORTED, FAILS OUT OF TOLERANCE)

03-3-4581-1 3/3 ---OMS-687,688 3/2R PPP

ISSUE: The IOA recommends 3/2R. If lose all redundancy, the real status of the OMS Engine Gaseous Nitrogen Tank will be unavailable or falsely indicated (loss of N2) and can result in falsely failing two OMS GN2 Tanks as leaking or failed. Therefore, mission capabilities could be lost or an ATO could be called, implying crit 3/2R. See Flight Rule 6-40.

4.2.3.B.5 Position Sensors

1) FAILURE: ERRONEOUS OUTPUT (OPEN, SHORTED, FAILS OUT OF TOLERANCE)

03-3-4081-1 3/3 ---OMS-693,694 3/2R PPP

ISSUE: The IOA recommends 3/2R. False indication of valve position could lead to limiting OMS engine use, especially when little time to verify. The engine will be used only if the other engine has failed and then only for deorbit burn. Loss of all redundancy during LiftOff or OnOrbit phase would lead to failure to reach desired altitude (limit altitude to RCS redlines to ensure deorbit capability) so could lose some altitude-sensitive missions, implying crit 3/2R.

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The NASA Review Comment's Action Item partially supports this: "Will use engine if LVDT > 70%. Between 8 and 70% will not use engine unless no other option available for deorbit." See OMS Training Manual 2102 page 79.

4.2.3.B.6 Pressure Sensors for OME Assembly

1) FAILURE: ERRONEOUS OUTPUT (OPEN, SHORTED, FAILS OUT OF TOLERANCE)

NO FMEA OMS-689 2/2 ---, 1/1 ABORT, CIL

ISSUE: The IOA recommends adding a FMEA for this item with a 2/2, 1/1 Abort criticality, thus adding to the CIL list. The NASA has no apparent FMEA to explicitly cover this item. The closest NASA FMEA is 03-3-4581-1 for "OMS Engine Pneumatic Pressure Sensor" instead of "OMS Engine Regulator Outlet Pressure Sensor". See 4.1.B.4.

This failure could lead to falsely failing one OMS engine or preventing its use for non-critical burns (see Flight Rule 6-4, Line Failure), possibly resulting in loss of mission. The 1/1 Abort is a weak or tentative recommendation. Loss of one OMS engine during RTLS or TAL could result in inability to performtime critical propellant dump.

4.2.3.B.7 Temperature Sensors

1) FAILURE: ERRONEOUS OUTPUT (SHORTED, OPENED, FAILS OUT OF TOLERANCE)

03-3-4802-1 3/3 ---OMS-698 3/2R PPP, 1/1 ABORT, CIL

ISSUE: The IOA recommends crit 3/2R and crit 1/1 for aborts, thus adding this FMEA to the CIL list. After this failure, the associated OMS engine would be declared failed because of apparent engine temperatures outside the desired limits (<25 F or >130 F), unless sensor failure was determined. Failure of all redundancy (the other OMS engine's sensor failed) could lead to incorrectly failing both OMS engines and possible early mission termination and loss of mission. However, this is an especially serious criticality 1/1 during aborts because of insufficient time to determine failure. See JSC 20923 PCN-1 Rule 6-3

4.2.3.B.8 Signal Conditioners

1) FAILURE: LOSS OF OUTPUT

03-3-8001-1 3/2R PPP OMS-21001X 2/2 ---, 1/1 ABORT, CIL

ISSUE: The IOA recommends upgrading this FMEA to 2/2, 1/1 Abort, thus adding this to the CIL list. The IOA's crit is based on the highest criticality of the signals routed through the signal conditioners. These worst case signals are from the OMS engine temperature and pressure sensors (e.g. Engine Regulator Outlet Pressure Sensor; see OMS-689 or Section 4.2.3.B.6). Loss of a vital engine measurement will prevent the crew from using that OMS engine for non-critical burns, resulting in loss of mission.

4.2.4 Thermal Control Subsystem Issues

4.2.4.A Hardware

IOA analyzed and assessed thermal control subsystem items as EPD&C items. See 4.2.4.B for assessment results.

4.2.4.B EPD&C

4.2.4.B.1 Pod Hybrid Drivers

1) FAILURE: FAILS HIGH

05-6L-2210-2 OMS-706,708,710,712,714,715,718,720, 722,724,726,728,730,732,734,736, 738,740,742,744,746,748 3/2R PPP 2/1R PPP, CIL

ISSUE: The IOA recommends raising this criticality to 2/1R, thus adding this to the CIL list, since this failure is one failure away from loss of crew/vehicle and damage may occur before it is detected. See 4.1.B.6. See Flight Rules 6-72a, and JSC NASA Heater Book.

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4.2.4.B.2 Pod Heaters

1) FAILURE: FAILS CLOSED

03-3-7001-1 OMS-783,785,787,789,791,793,795,797, 815,817,819,821,823,825,827,829, 831,835,837,807,809,811,813 3/2R PPP ---- --- (NON-CREDIBLE)

ISSUE: The IOA recommends deleting these FMEAs, since Heater elements cannot fail closed or short such that they are continuously on.

4.2.4.B.3 Pod Relays

1) FAILURE: FAILS HIGH (ENERGIZED POSITION)

05-6L-2134-2 3/2R PFP, CIL OMS-846,848,850,852 2/1R PFP, CIL

ISSUE: The IOA recommends raising this criticality to 2/1R, thus adding this to the CIL list, since this failure is one failure away from loss of crew/vehicle and damage may occur before it is detected. See 4.1.B.6. See Flight Rules 6-72a, and JSC NASA Heater Book.
4.2.4.B.4 Pod Temperature Sensors

- 1) FAILURE: ERRONEOUS OUTPUT (SHORTED, OPENED, FAILS OUT OF TOLERANCE)
 - NO FMEA OMS-882,883,884,885,886,887, 3/3 ---888,889,890,891,892,893

ISSUE: The IOA recommends adding a FMEA. The NASA has no apparent FMEA to explicitly cover these pod temperature sensors. The closest FMEA is 03-3-2804-1 for Crossfeed instead of Pod temperature sensors.

4.2.4.B.5 Pod Thermal Switches

1) FAILURE: FAILS SHORT

03-3-7002-2 3/2R PPP OMS-895,897,899,901,903,905,907,909, 2/1R PPP, CIL 911,913,915,917,919,921,923,925

ISSUE: The IOA recommends raising this criticality to 2/1R, thus adding this to the CIL list, since this failure is one failure away from loss of crew/vehicle and damage may occur before it is detected. See 4.1.B.6. See Flight Rules 6-72a, and JSC NASA Heater Book.

The IOA also recommends splitting this FMEA since this FMEA covers both pod and crossfeed thermal switches, but their criticalities and effects are quite different. See 4.2.4.B.10.

4.2.4.B.6 Pod Toggle Switches

1) FAILURE, NASA: INADVERTENTLY OR PREMATURELY TRANSFERS TO "AUTO" POSITION (ONE CONTACT SET) FAILURE, IOA: FAILS TO SWITCH (STUCK IN "ON" POSITION)

05-6L-2031-2 3/2R PFP, CIL OMS-926,927 2/1R PPP, CIL

ISSUE: The IOA recommends raising this crit to 2/1R and passing the B screen. The NASA failed only one pole or contact set, considering the other pole as redundant, whereas the IOA considered the worst case failure mode by failing a part common to both poles (e.g. toggle lever). This is the reason for the IOA's higher criticality and the NASA's failed B screen, since one pole may be undetectable, but not both. Also, the NASA's ITEM field mentions GROUP1 only, but has no separate FMEA for GROUP2 heater system. The IOA assumes this FMEA was meant to cover both groups.

4.2.4.B.7 Crossfeed Hybrid Drivers

1) FAILURE: FAILS HIGH

05-6L-2137-2 3/2R PNP OMS-931,933,935,937,939,941 3/2R PPP

ISSUE: The NASA implies, with a B Screen of Not/Applicable, that this item is Standby Redundant to some other item. The IOA disagrees and recommends passing the B screen, since this driver operates normally in the string, not passively waiting for another item to fail before it operates.

4.2.4.B.8 Crossfeed Heaters

1) FAILURE: FAILS SHORT

03-3-7011-1 OMS-953,955,957,965,973,959, 961,963,967,969,971 3/2R PPP ---- (NON-CREDIBLE)

ISSUE: The IOA recommends deleting these FMEAs, since Heater elements cannot fail closed or short such that they are continuously on.

4.2.4.B.9 Crossfeed Temperature Sensors

1) FAILURE: ERRONEOUS OUTPUT (SHORTED, OPEN, FAILS OUT OF TOLERANCE)

03-3-2804-1 OMS-994A,997A,998A,1001A,1002A 2/2 ---, CIL

ISSUE: The IOA recommends raising this crit to 2/1R, thus adding this to the CIL list. The IOA assumed no launch if a sensor indicates crossfeed temps outside the desired limits (<50 F or >90 F) unless sensor failure was determined and the risks of loss of detectability for the thermal system is accepted (this ensures crossfeed for aborts). Worst case effect would be a false indication of heater system failed off on a mission critical crossfeed line, leading to delayed launch and/or possible loss of mission due to loss of interconnect/crossfeed capability. This implies a crit 2/2 since there is no redundancy. See Flight Rules 6-9a (vs) 6-73d and Malf. Proc. OMS 11.5a notes 2,3,4.

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2) FAILURE: ERRONEOUS OUTPUT (SHORTED, OPEN, FAILS OUT OF TOLERANCE)

03-3-7801-1 OMS-994,997,998,1001,1002 2/2 ---, CIL

ISSUE: The IOA recommends raising this crit to 2/1R, thus adding this to the CIL list. The IOA assumed no launch if a sensor indicates crossfeed temps outside the desired limits (<50 F or >90 F) unless sensor failure was determined and the risks of loss of detectability for the thermal system is accepted (this ensures crossfeed for aborts). Worst case effect would be a false indication of heater system failed off on a mission critical crossfeed line, leading to delayed launch and/or possible loss of mission due to loss of interconnect/crossfeed capability. This implies a crit 2/2 since there is no redundancy. See Flight Rules 6-9a (vs) 6-73d and Malf. Proc. OMS 11.5a notes 2,3,4.

4.2.4.B.10 Crossfeed Thermal Switches

1) FAILURE: FAILS SHORT

03-3-7002-2 OMS-1004,1006,1008,1010,1012,1016, 3/2R FFP, CIL 1024,1026,1030,1038,1040,1044

ISSUE: The IOA recommends failing the A screen and B screen, thus adding this to the CIL list. The IOA also recommends splitting this FMEA, since this FMEA covers both pod and crossfeed thermal switches, but their crits and effects are quite different (see 4.2.4.B.5). This FMEA covers both 'Control Temp' and 'Over Temp' thermal switches. Over Temp is Standby Redundant to Control Temp. Since there are NO TEST POINTS between them, and no way to artificially fail a Control Temp thermal switch, there is no way to test on the ground or inflight for a failed closed Over Temp thermal switch.

4.2.4.B.11 Crossfeed Toggle Switches

1) FAILURE, NASA: FAILS TO CONDUCT, FAILS TO TRANSFER, FAILS OPEN FAILURE, IOA: FAILS TO SWITCH (STUCK IN "OFF" POSITION) 05-6L-2036-1 3/3 ---OMS-1047,1049 3/2R PPP.

ISSUE: The IOA recommends criticality of 3/2R since the loss of all redundancy (other switch fails) is a possible loss of mission due to loss of interconnect/crossfeed capability.

4.3 Resolved Issues

4.3.A Hardware

Several meetings and/or data exchanges between IOA and the NASA OMS and OMS TVC subsystem managers occurred between June and December 1987 in an effort to resolve the OMS hardware FMEA/CIL issues. During this period, resolution was reached on the majority of the issues originally identified by IOA. All resolved hardware issues are documented in the detailed assessment sheets (Appendix C). Those resolved issues which resulted in changes to the OMS hardware FMEA/CIL are also denoted in Appendix F with "resolution codes".

The forty-seven (47) OMS hardware FMEA/CIL issues which remain unresolved are presented in sections 4.1 and 4.2.

4.3.B EPD&C

Resolution of the OMS EPD&C FMEA/CIL issues with the OMS subsystem manager was not initiated due to time constraints. Therefore, all of the EPD&C issues identified by IOA remain unresolved, and are presented in section 4.1 and 4.2.

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4.4 Additional Comments and Concerns

During the assessment of the NASA OMS FMEA/CIL, IOA identified several areas of concern which may not be evinced by the individual failure mode issues presented in this report. These concerns are discussed in the following hardware and EPD&C sections. Several general comments about the IOA assessment and resolution process are also given.

4.4.A Hardware Comments and Concerns

The assessment of both the OMS and OMS TVC subsystems are included in this report. IOA interfaced with both the OMS and OMS TVC subsystem managers to obtain data and resolve issues. Unless otherwise noted, general discussions in this report about the "OMS subsystem" pertain to the combined OMS and OMS TVC subsystems.

The IOA OMS hardware FMEA and CIL assessments were performed on the NASA/RI FMEA/CIL reevaluation information received by IOA as of 1/01/88. Any updates or changes in this information made by The IOA NASA/RI after this date are not reflected in this report. assessment of the OMS hardware CILs was performed against the post-CCB CIL package dated 12/05/87. This information was Assessment of the OMS presented at OMS PRCB on 23 December 1987. TVC CILs was performed against the 11/14/87 versions of the CIL As of 1/01/88, the OMS TVC CILs had not been presented to sheets. The IOA assessment of the OMS hardware FMEAs (nona CCB or PRCB. CILs) was performed against a criticality and screen summary package dated 10/22/87. Assessment of the OMS TVC FMEAs (non-CILs) was performed against FMEA pages received as of 1/01/88, with revision dates ranging from 3/7/87 to 11/14/87.

The NASA/RI FMEA/CIL reevaluation was primarily concerned with CIL items. FMEA (non-CIL) criticalities and screens were also reviewed, however updated FMEA sheets (except for TVC FMEAs) were not generated. Instead, summary sheets showing only criticalities and screens were produced. Therefore, IOA assessed FMEA (non-CIL) crits and screens only. The "effects" and other areas listed on a FMEA sheet could not be assessed. Issues identified on FMEAs (non-CILs) which were agreed to by the subsystem manager are documented in this report as resolved, even though incorporation of the issues on updated FMEA sheets could not be verified.

OMS thermal control and instrumentation items are covered on the NASA OMS hardware FMEA/CIL, however IOA analyzed and assessed these items as EPD&C items. See the EPD&C portions of this report for the assessment results on these items.

On the current NASA FMEA/CIL, one FMEA or CIL sheet may include several components and/or failure modes. The criticality and screens assigned on the FMEA or CIL reflect only the worst case component failure mode. IOA accepted this practice (with reservation) since the components and failure modes are addressed, however IOA is concerned that this lumping of components and

failure modes on FMEAs and CILs reduces insight into the effects of individual OMS subsystem component failures and may lessen the attention given to critical failure modes. The components and failure modes lumped together on one FMEA or CIL could have different criticality and screen assignments if they were separated onto individual FMEAs and CILs, and better insight would be obtained. For example, the bipropellant valve assembly FMEAs (03-3-4001) include the engine control valve, pneumatic actuator, rack & pinion assembly, bipropellant valves, and bipropellant valve cavity pressure relief valve. IOA recommends that the engine control valve and pressure relief valve be addressed on individual FMEAs and assigned unique criticalities since they are not mechanically linked to the bipropellant valves, pneumatic actuator, and rack & pinion. This would provide better insight into the effects of the failures of these components and would ensure that they receive the appropriate amount of individual attention.

Another example of this concern is the TVC gimbal actuator output drive assembly FMEAs (03-3-6402) which include the acme screw, nut tube assembly, end bearings, attach hardware, drive shaft, drive shaft bearings, and primary and secondary drive gears. IOA again recommends that these components be separated onto individual FMEAs and assigned unique criticalities to provide better insight into the variety and severity of possible failure modes in the assembly. Lumping the failures of components on one FMEA lessens insight into which failures are more or less important and which deserve more or less attention.

Related to this concern are the issues raised by IOA (and agreed to by the SSM) that leakage of valve housings should be addressed on the FMEA/CIL. IOA recommended that a new FMEA and CIL be generated for each valve housing, however accepted the lumping of all valve housings onto existing helium, propellant, and GN2 line leakage FMEAs.

Some OMS subsystem failures do not exist as "failure modes" on current FMEAs and CILs. Instead, they are listed only as causes on FMEAs and CILs for other failure modes. IOA does not consider a failure mode to be adequately addressed only by its listing as a cause on a FMEA or CIL. For example, the "failed closed" and "failed open" failure modes for the bipropellant valve cavity pressure relief valve are addressed only as causes on 03-3-4001-6 (see section 4.2.3.A.3). All critical failures should be listed as failure modes on FMEAs and CILs to ensure that they receive the appropriate amount of attention.

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In several instances in the OMS hardware FMEA/CIL, a failure mode listed on a FMEA is also listed as a cause on another FMEA with a more severe criticality. IOA considers this to be an inconsistency. The criticality assigned to a failure mode should reflect the worst case ultimate effect of the failure. If a failure mode can cause another critical failure, the criticality assigned to the failure mode should reflect that fact. See 4.2.3.A.1 as an example.

4.4.B EPD&C Comments and Concerns

The IOA OMS EPD&C FMEA and CIL assessments were performed on the NASA/RI FMEA/CIL reevaluation information received by IOA as of 1/01/88. Any updates or changes in this information made by NASA/RI after this date are not reflected in this report. The IOA assessment of the OMS EPD&C CILs was performed against the post-CCB CIL package dated 12/08/87. This information was presented at OMS PRCB on 23 December 1987. The IOA assessment of the OMS EPD&C FMEAs (non-CILs) was performed against a criticality and screen summary package dated 5/6/87. Since updated FMEA (non-CIL) sheets were not generated by NASA/RI, only the criticalities and screens could be assessed.

IOA takes issue with the NASA interpretations of NSTS 22206, Section 2.1.s, page 2-4, the definition of redundancy. The NASAapplied definition of the redundancy string allowed the selection of specific failures which were required to cause known problems, e.g., failures required to cause continuous power to valves. IOA considers many NASA redundancy strings to include multiple unrelated failures.

IOA analyzed the function of the item or the item's circuit string and determined the impact of the failure. Per NSTS 22206 interpretation, the redundancy string was defined as any other item that is capable of performing the function of this item or string. Criticalities were then assigned based on this redundancy. In general, the NASA definition tended to be more conservative (assigned a more severe criticality on the FMEA). However, IOA was requested to follow NSTS 22206. The difference in interpretations accounts for the high number of issues cited.

Because of time constraints, IOA did not generate new analysis worksheets to match the diode groupings that NASA used.

In general, each item was considered to have two functions: to control a valve open or closed, and to prevent inadvertently opening or closing a valve. These two functions correspond to the two main failure modes, fail open and fail closed. Also, redundancy often depends on the failure mode. Two parallel items can be considered redundant to each other for the failed open failure mode, and two series items can be considered redundant for the failed closed failure mode.

The electrical components within valves (microswitches, diodes, etc.) are not specifically addressed on the current NASA FMEA/CIL. Due to time constraints, IOA also did not individually address these items. However, IOA recommends that the EPD&C components within a valve be addressed individually on FMEAs and CILs to provide better insight into the effects of their failures, and to ensure that critical failures receive the proper amount of attention. Failures of valve EPD&C components are not visible on the current valve hardware FMEAs.

5.0 REFERENCES

Reference documentation available from NASA, Rockwell, and MDAC was used in the analysis. The documentation used included the following:

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- 1. JSC 10588, Flight Procedures Handbook, OMS/RCS Operations, Preliminary, November 1980.
- 2. JSC 12770, 8C-OMS, Shuttle Flight Operations Manual, Preliminary, 6-6-80.
- 3. JSC 18958, OMS/RCS Systems Briefs Handbook, Basic, 10-1-84.
- 4. JSC 19950, OMS 2102, Orbiter Systems Training Manual, March 84.
- 5. NSTS 22206, Instructions for Preparation of FMEA and CIL, October 10, 1986.
- 6. Reliability Desk Instruction, No. 100-2G, Flight Hardware FMEA & CIL, 1-31-84.
- 7. OMS OMRSD, V43 File III, 6-13-86.
- 8. OMS FPR, Report M4001002, 7-22-86.
- 9. OMS Single Barrier Failures, MDAC-HOU TM 1.1.-TM-ES86009-43., 7-17-86.
- 10. Orbiter Actuation Subsystem Presentation Charts, J. Vernon.
- 11. JSC 11174, Rev C, DCN-5, Space Shuttle Subsystems Handbook, Vols. 1 & 2, Secs. 1-20, 9-13-85.
- 12. MB0160-007, Rev M, 3-11-80, Steel Tubing, Mat'l spec., RI.
- 13. MB0160-035, Rev G, 7-5-77, Steel Tubing, Mat'l spec., RI.
- 14. MC276-0017, Rev D, 6-23-84, Helium High Pressure Coupling, Proc. spec., RI.
- 15. MC276-0018, Rev B, 2-14-84, Hypergolic Service Coupling, Proc. spec., RI.
- 16. MC282-0082, Rev D, 3-17-82, Pressurant Storage Tank, Proc. spec., RI.
- 17. MC284-0421, Rev E, 5-3-82, Pressure Relief Valve, Proc. spec., RI.
- 18. MC284-0430, Rev E, 6-22-81, AC Motor Valve, Proc. spec., RI.
- 19. MC284-0480, Rev C, 5-3-82, Manual Operated Valve, Proc. spec., RI.

| | 20. | MC284-0481, Rev B, 6-23-84, Quad Check Valve, Proc. spec., RI |
|---|-------------|--|
| | 21. | MC363-0031, Rev C, 3-15-78, Electrical Heater, Detail Proc. spec., RI. |
| | 22. | MC621-0009, Rev E, 7-7-82, OMS Engine, Proc. spec., RI. |
| | 23. | MC621-0059, Rev E, 6-4-82, APS, Proc. spec., RI. |
| | 24. | ME271-0092, Rev D, 4-1-80 (?), Gimbal Joint, Spec. Control Dwg., RI. |
| | 25. | ME276-0032, Rev B, 7-20-79, Test Point Coupling, Spec. Control Dwg., RI. |
| - | 26. | ME449-0177, Rev F, 7-15-74 (?), Pressure Transducer, Low, Med., & High Range, Spec. Control Dwg., RI. |
| | 27. | MF0004-400, EEE Orbital Parts List |
| | 28. | AMS5562A, 7-15-80, Steel Tubing, Mat'l spec., SAE. |
| | 29. | 73A000014, Rev J, 1-13-83, APS Fluid Schematics, 4 sheets, MDAC. |
| | 30. | 73A620096, 2-3-77, Regulator Sensing Port Drawing, MDAC. |
| | 31. | 73A740000, Rev H, 9-13-82, OMS Tank Assembly Drawings, MDAC. |
| | 32. | 73A740066, Rev C, 3-15-85, Tank Acq. System Gallery Assembly Drawings, MDAC. |
| | 33. | 73B740001, Rev D, Communication Screen Assy., Source Dwg., MDAC. |
| | 34. | 73B740002, Rev D, Band Screen Assy., Source Dwg., MDAC. |
| | 35. | 73B740003, Rev C, Arresting Screen Assy., Source Dwg., MDAC. |
| | 36. | 73B740004, Rev C, Gallery Screen Assy., Source Dwg., MDAC. |
| | 37. | 73P550003, Rev B, 3-22-82, Alignment Bellows, Proc. spec., MDAC. |
| | 38. | 73P550013, Revs A,B,C,D, 3-9-82, Propellant Tank, Proc. spec., MDAC. |
| | 39 . | 73P550015, Rev B, 3-22-82, Gimbal Bellows, Proc. spec., MDAC. |
| | 40. | 73P620001, Rev B, 3-19-82, DC Solenoid Valve, High Pressure, Proc. spec., MDAC. |

- 41. 73P620002, Rev D, 10-20-82, Helium Pressure Regulator, Proc. spec., MDAC.
- 42. 73P620004, Rev A, 4-27-79, DC Solenoid Valve, Low Pressure, Proc. spec., MDAC.
- 43. 73P880001, Rev D, 9-9-83, Propellant Quantity Gaging Assy., Proc. spec., RI.

- 44. 73P880001-1001, CR # 12-880001-101D, 9-3-82, OMS Gaging Subsystem, MDAC.
- 45. VS70-430202, Rev E, 6-30-84, OMS Subsystem Control Schematic, Right Pod.
- 46. VS70-430209, Rev B, 8-17-82, OMS Subsystem Control Schematic, Right Pod.
- 47. VS70-430302, Rev D, 7-12-84, OMS Subsystem Control Schematic, Left Pod.
- 48. VS70-430309, Rev D, 6-29-84, OMS Subsystem Control Schematic, Left Pod.
- 49. VS70-430402, Rev A, 6-10-81, OMS Subsystem Control Schematic, OMS Kit.
- 50. VS70-430409, 8-8-81, OMS Subsystem Control Schematic, OMS Kit
- 51. VS70-431001, Rev E, 9-19-79, APS Schematic, (102 only).
- 52. VS70-431099, Rev D, 7-29-85, APS Schematic, RI.
- 53. VS70-943099, Rev A, 3-1-82, OMS/RCS Integrated System Schematics, 099, 103, 104, RI Level III.
- 54. VS70-943102, Rev C, 10-29-80, OMS/RCS Integrated System Schematics, 102, RI Level III.
- 55. V070-435011, Rev B, 7-15-84, Crossfeed Lines Installation, OMS Propellant, Installations drawings.
- 56. JSC 20923, STS Operational Flight Rules Rationale, PCN-1, 2-14-86.
- 57. 73A550001, Rev E, OMS Fuel Feed System Installation drawings
- 58. 73A550002, Rev G, OMS Oxidizer Feed System Installation drawings.
- 59. 73A800001, Rev E, Equipment Installation Pod DFI.
- 60. 73A801001, Rev C, Equipment Installation RCS Housing DFI.

- 61. 1181220, Rev A, 8-23-74(?), Injector, Thrust Chamber Detail, 5 sheets, Aerojet.
- 62. 1181700, 2-27-75, Series Valve (Biprop valve) Assembly Detail, 3 sheets, Aerojet.
- 63. 1181710, 2-24-75, Actuator Assembly, Bipropellant Valve, 2 sheets, Aerojet.
- 64. 1181900, Rev D, Date?, Nozzle Extension Detail, 4 sheets, Aerojet.
- 65. 1186895, Rev H, 7-23-83(?), Controller, Gimbal Actuator, Source Control Drawing, 1 sheet, Aerojet.
- 66. JSC 17952, Orbiter Crash and Rescue Information, March 1982.
- 67. 621-0009-2161, 1-5-82, As-Built Configuration Record, OMS Gimbal Actuator Parts List, AiResearch.
- 68. JSC 19413, Rev H, January 1986, Shuttle Flight Data and Inflight Anomaly List.
- 69. 73A550128, 11-2-79, Flange Assy Crossfeed Interface Detail Dwg., MDAC.
- 70. 73P760001, Rev B, 2-26-82, APS Procurement Spec for Electrical Heaters.
- 71. STS83-0010A, 6-30-85, Sec 4.10, pp4-169 through 4-182, Space Shuttle Operational Level C FSSR Document, GN&C, Part D, RM, RI.
- 72. JSC 08934, Rev D, 10-84, Vol. 1, pp 3.4.3.3-1 through -6, Shuttle Systems Performance and Constraints Data.
- 73. 73A760210, Rev E, Electrical Installation POD Operational drawing.
- 74. 73A760060, Rev A, Marker, Wire harnesses drawing.

APPENDIX A ACRONYMS

| Ac | - | Nozzle inlet plane area |
|-------|---|--|
| ac | - | Alternating Current |
| Ae | - | Nozzle exit plane area |
| AOA | - | Abort Once Around |
| At | - | Nozzle throat area |
| ARCS | - | Aft Reaction Control Subsystem |
| ASSY | - | Assembly |
| ATO | - | Abort to Orbit |
| ATT | - | Attitude |
| BFS | | Backup Flight System |
| CIL | - | Critical Items List |
| CL | - | Close (Closed) |
| CRIT | - | Criticality |
| CRT | - | Cathode Ray Tube |
| C&W | - | Caution and Warning System |
| D/C | - | Displays and Controls |
| DAP | _ | Digital Autopilot |
| dc | _ | direct current |
| DISP | _ | Display |
| DPS | - | Data Processing System |
| EPD&C | _ | Electrical Power Distribution and Control |
| EPDCS | _ | Electrical Power Distribution and Control System |
| F | - | Functional. Fahrenheit |
| FC | - | Flight Critical |
| FDA | _ | Fault Detection Annunciation |
| FM | _ | Failure Mode |
| FMEA | _ | Failure Mode and Effects Analysis |
| FRCS | - | Forward Reaction Control System |
| FSSR | _ | Flight Systems Software Requirements |
| ft | - | Feet |
| FU | | Fuel |
| G | _ | Gravity |
| GFE | _ | Government Furnished Equipment |
| GN2 | - | Gaseous Nitrogen |
| GNC | _ | Guidance Navigation and Control |
| GPC | - | General Purpose Computer |
| GSE | _ | Ground Support Equipment |
| He | _ | Helium |
| нw | - | Hardware |
| Hz | _ | Hertz (cycles per second) |
| TOA | _ | Independent Orbiter Assessment |
| Isol | _ | Tsolation |
| JSC | _ | Johnson Space Center |
| LPS | - | Launch Processing System |
| LRU | _ | Line Replaceable Unit |
| LVDT | _ | Linear Variable Differential Transformer |
| MCA | _ | Motor Control Assembly |
| MCC | _ | Mission Control Center (JSC) |
| MDAC | - | McDonnell Douglas Astronautics Company |
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| MDM | - | Multiplexer/Demultiplexer | |
|-----------|---|--|------|
| MECO | - | Main Engine Cutoff | |
| MM | - | Major Mode | |
| MMH | - | Monomethyl Hydrazine | |
| MNVR | - | Maneuver | |
| MOD | - | Mission Operations Directorate | |
| MSEC | - | millisecond | |
| N204 | - | Nitrogen Tetroxide | |
| NA | - | Not Applicable | |
| NASA | | National Aeronautics and Space Administration | |
| NSTS | - | National Space Transportation System | |
| NTO | - | Nitrogen Tetroxide | |
| 0.D. | - | Outside Diameter | |
| OI | - | Operational Instrumentation | |
| OMRSD | _ | Operational Maintenance Requirements and | |
| | | Specifications Document | |
| OME | | Orbital Maneuvering Engine | |
| OMS | _ | Orbital Maneuvering System | |
| OP | _ | Open | |
| OPS | _ | Operations | 1 |
| ox | _ | Oxidizer | |
| | _ | Oxidizer | |
| PASS | _ | Primary Avionics Software System | |
| DBT | _ | Push-Button Indicator | |
| PC | _ | Chamber Pressure | |
| PCT | _ | Potential Critical Item | |
| DCMMIT | _ | Pulse Code Modulator Master Unit | |
| DLS | _ | Primary Landing Site | |
| PDFCC | _ | Pressure — | |
| PRESS | _ | Pounds Der Square Inch | |
| psi | _ | Pounds Fer Square Inch Absolute | |
| psid | | Pounds Fer Square Inch Absorace | |
| psia | _ | Pounds Per Square Inch Differencial | |
| psig | | Pounds Per Square Inch Gage | 1111 |
| RUS | | Reaction control system | |
| RAC | | Rotacional nanu concroirer | |
| RI | _ | Rockwell International | • |
| RM DDC | - | Redundancy Management | 1 |
| | - | Remote Power Controller | |
| RTLS | - | Return to Launch Site | - |
| SCIM | | Standard Cubic Feet per Minute | i |
| SFOM | - | Soutche Filght Operations Manual | |
| SM | - | Systems Management | |
| SPEC | - | | |
| STS | - | Space Transportation System | |
| SSM | - | Subsystem Manager (NASA) | |
| SSSH | - | Space Shuttle Systems Handbook | |
| SW | - | | |
| TAL | | Transatiantic Abort Landing | |
| TCA | - | Inrust Chamber Assembly | |
| TD | - | Touch Down and the state of the | - |
| TK | - | Tank | |
| TPS | - | Thermal Protection System | |
| TVC | - | Thrust Vector Control | ; |
| V | - | Velocity, Volts | |
| VLV | - | Valve | |

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APPENDIX B

DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions

B.2 Project Level Ground Rules and AssumptionsB.3 OMS-Specific Ground Rules and Assumptions

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APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions

Definitions contained in <u>NSTS 22206, Instructions For Preparation</u> of <u>FMEA/CIL</u>, <u>10 October 1986</u>, were used with the following amplifications and additions.

INTACT ABORT DEFINITIONS:

<u>RTLS</u> - begins at transition to OPS 6 and ends at transition to OPS 9, post-flight

<u>TAL</u> - begins at declaration of the abort and ends at transition to OPS 9, post-flight

<u>AOA</u> - begins at declaration of the abort and ends at transition to OPS 9, post-flight

<u>ATO</u> - begins at declaration of the abort and ends at transition to OPS 9, post-flight

<u>CREDIBLE (CAUSE)</u> - an event that can be predicted or expected in anticipated operational environmental conditions. Excludes an event where multiple failures must first occur to result in environmental extremes

<u>CONTINGENCY CREW PROCEDURES</u> - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards .

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EARLY MISSION TERMINATION - termination of onorbit phase prior to planned end of mission

<u>EFFECTS/RATIONALE</u> - description of the case which generated the highest criticality

<u>HIGHEST CRITICALITY</u> - the highest functional criticality determined in the phase-by-phase analysis

<u>MAJOR MODE (MM)</u> - major sub-mode of software operational sequence (OPS)

<u>MC</u> - Memory Configuration of Primary Avionics Software System (PASS)

<u>MISSION</u> - assigned performance of a specific Orbiter flight with payload/objective accomplishments including orbit phasing and altitude (excludes secondary payloads such as GAS cans, middeck P/L, etc.) <u>MULTIPLE ORDER FAILURE</u> - describes the failure due to a single cause or event of all units which perform a necessary (critical) function

<u>OFF-NOMINAL CREW PROCEDURES</u> - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards

<u>OPS</u> - software operational sequence

<u>PRIMARY MISSION OBJECTIVES</u> - worst case primary mission objectives are equal to mission objectives

PHASE DEFINITIONS:

<u>PRELAUNCH PHASE</u> - begins at launch count-down Orbiter power-up and ends at moding to OPS Major Mode 102 (liftoff)

<u>LIFTOFF MISSION PHASE</u> - begins at SRB ignition (MM 102) and ends at transition out of OPS 1 (Synonymous with ASCENT)

ONORBIT PHASE - begins at transition to OPS 2 or OPS 8 and ends at transition out of OPS 2 or OPS 8

<u>DEORBIT PHASE</u> - begins at transition to OPS Major Mode 301 and ends at first main landing gear touchdown

<u>LANDING/SAFING PHASE</u> - begins at first main gear touchdown and ends with the completion of post-landing safing operations

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.2 IOA Project Level Ground Rules and Assumptions

The philosophy embodied in <u>NSTS 22206, Instructions for</u> <u>Preparation of FMEA/CIL, 10 October 1986</u>, was employed with the following amplifications and additions.

1. The operational flight software is an accurate implementation of the Flight System Software Requirements (FSSRs).

RATIONALE: Software verification is out-of-scope of this task.

2. After liftoff, any parameter which is monitored by system management (SM) or which drives any part of the Caution and Warning System (C&W) will support passage of Redundancy Screen B for its corresponding hardware item.

> RATIONALE: Analysis of on-board parameter availability and/or the actual monitoring by the crew is beyond the scope of this task.

3. Any data employed with flight software is assumed to be functional for the specific vehicle and specific mission being flown.

RATIONALE: Mission data verification is out-of-scope of this task.

4. All hardware (including firmware) is manufactured and assembled to the design specifications/drawings.

RATIONALE: Acceptance and verification testing is designed to detect and identify problems before the item is approved for use.

5. All Flight Data File crew procedures will be assumed performed as written, and will not include human error in their performance.

RATIONALE: Failures caused by human operational error are out-of-scope of this task.

- 6. All hardware analyses will, as a minimum, be performed at the level of analysis existent within NASA/Prime Contractor Orbiter FMEA/CILs, and will be permitted to go to greater hardware detail levels but not lesser.
 - RATIONALE: Comparison of IOA analysis results with other analyses requires that both analyses be performed to a comparable level of detail.
- 7. Verification that a telemetry parameter is actually monitored during AOS by ground-based personnel is not required.

RATIONALE: Analysis of mission-dependent telemetry availability and/or the actual monitoring of applicable data by ground-based personnel is beyond the scope of this task.

8. The determination of criticalities per phase is based on the worst case effect of a failure for the phase being analyzed. The failure can occur in the phase being analyzed or in any previous phase, whichever produces the worst case effects for the phase of interest.

RATIONALE: Assigning phase criticalities ensures a thorough and complete analysis.

9. Analysis of wire harnesses, cables, and electrical connectors to determine if FMEAs are warranted will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

10. Analysis of welds or brazed joints that cannot be inspected will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

11. Emergency system or hardware will include burst discs and will exclude the EMU Secondary Oxygen Pack (SOP), pressure relief valves and the landing gear pyrotechnics.

> RATIONALE: Clarify definition of emergency systems to ensure consistency throughout IOA project.

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.3 OMS Ground Rules and Assumptions

The IOA analysis and assessment was performed to the component or assembly level. The analysis and assessment considered the worst case effects of the hardware or functional failure on the subsystem, mission, and crew and vehicle safety.

- 1. Top level redundancy is considered in determining functional criticality. The OMS function is to provide delta-V for orbit insertion, on-orbit ops, and deorbit. From a top down system analysis approach, the OMS has redundancy via the left and right subsystems. In determining redundancy for hardware items downstream of the crossfeed line, items which perform the same function in each pod may be considered redundant to each other, depending on the failure mode.
- 2. No RCS backup deorbit capability exists in the event of loss of OMS deorbit capability. It cannot be ensured that enough OMS propellant will remain to complete an RCS deorbit burn since the RCS jets have a lower Isp. However, OMS through RCS can be used to achieve orbit insertion. An AOA abort can be accomplished without OMS engines.
- 3. Loss of an OME is, at a minimum, a loss of mission during the on-orbit phase. Loss of the first OME is possible loss of mission objectives (ref. flight rule 6-48), and loss of the next OME will lead to loss of deorbit capability (no RCS deorbit assumed) and loss of life/vehicle. An OMS engine which will be used only for critical burns is not considered lost.

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- 4. The OMS payload bay kit hardware is not addressed in this analysis.
- 5. Flight rules and Flight Systems Software Requirements (FSSR) are not used to downgrade criticalities, only to upgrade and provide better system understanding.
- 6. Analysis of component filters are covered in the analysis of the component. Filters which are not integral to other components are analyzed separately.
- 7. For the thermal control analysis it is assumed that, at the time of vehicle liftoff, all areas of the thermal environment are within redlines.
- 8. If applicable, the redundancy and criticalities assigned to an electrical component are tied to those assigned to mechanical parts affected by the failure of the electrical component.

- 9. Electrical components which enable and inhibit operation (e.g., allows a valve to be opened and closed) are not redundant to electrical components which control the operation (e.g., actually opens and closes the valve).
- 10. Instrumentation passage of screen B does not require the ability to discern between sensor or hardware failure, but on detection of the measurement being out of a predefined limit. The ability to differentiate between sensor and hardware failure is reflected in the criticality assignment.
- 11. Two OMS engines are required to ensure the successful completion of RTLS and TAL pre and post-MECO OMS dumps. Loss of one engine may result in the inability to complete a planned dump leading to violations of propellant tank landing constraints and/or orbiter mass properties constraints. For post-MECO OMS dumps, both engines must have successful purges between the pre and post-MECO dumps. Loss of TVC control of one engine will result in either loss of the affected engine and inability to complete the OMS dump, or loss of vehicle control using the affected engine. An OMS TVC failure does not affect the ability to perform an OMS dump before MECO.
- 12. The crew will manually shut down an OMS engine in response to an OMS FDA caused by the violation of engine operating limits before the effects become life/vehicle threatening (e.g., engine explosion). However, this action may not preclude damage to and loss of the engine. This assumption does not apply to failures which lead directly to catastrophic effects (e.g., engine structural failures).
- 13. IOA-OMS assumed the inability to re-open a propellant tank isolation valve on ascent is not a credible event. These valves are open prelaunch and are used to supply propellants for orbital insertion, orbital circularization, and RTLS/TAL aborts.
- 14. IOA-OMS assumed if a valve was closed for some reason (i.e. to isolate a leak) after ascent, the inability to re-open this valve was a credible failure and the reason to close was not in the redundancy string.
- 15. MDM discretes and the event indicators (talkbacks) provide the logic and visual status of the valve position. Resistors, diodes, and hybrid drivers are used in the circuitry that provide this data. IOA-OMS claims the failure of these items may lead to a false indication of the valve position. The worst effect of these indicators would be to falsely fail the valve closed which may affect on-orbit operations.
- 16. IOA-OMS did not analyze electrical components within the valve (microswitches, diodes, etc.) for this assessment report, unlike the IOA-RCS EPD&C report.

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APPENDIX C DETAILED ASSESSMENT

This section contains the IOA assessment worksheets generated during the assessment of this subsystem. The information on these worksheets facilitates the comparison of the NASA FMEA/CIL (Pre and Post 51-L) to the IOA detailed analysis worksheets. Each of these worksheets identifies the NASA FMEA being assessed, corresponding MDAC Analysis Worksheet ID, item, criticality, redundancy screens, and recommendations. For each failure mode, the highest assessed hardware and functional criticality is compared and discrepancies noted as "N" in the compare row under the column where the discrepancy occurred.

> LEGEND FOR IOA ASSESSMENT WORKSHEETS _____

Hardware Criticalities:

- = Loss of life or vehicle 1
- = Loss of mission or next failure of any redundant item 2 (like or unlike) could cause loss of life/vehicle
- = All others 3

Functional Criticalities:

- 1R = Redundant hardware items (like or unlike) all of which, if failed, could cause loss of life or vehicle
- = Redundant hardware items (like or unlike) all of which, 2R if failed, could cause loss of mission

Redundancy Screens A, B and C:

- = Passed Screen Ρ
- = Failed Screen F
- NA = Not Applicable

NASA Data :

Baseline = NASA FMEA/CIL

Baseline with Proposed Post 51-L Changes New -

CIL Item :

X = Included in CIL

Compare Row :

= Non compare for that column (deviation) N

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DURING ENTRY. IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE VIOLATIONS OF ORBITER MASS PROPERTIES CONSTRAINTS DURING ENTRY.

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NASA DATA: ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-102 BASELINE [1 03-3-1002-1 NEW [X] NASA FMEA #: SUBSYSTEM: OMS 102 MDAC ID: COUPLING, HELIUM FILL ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT A B C HDW/FUNC
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[X] [X] [] COMPARE [/] [N] [N] [] RECOMMENDATIONS: (If different from NASA) [2/1R] [F] [F] [P] [A] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [] **REMARKS:** NASA/RI ORIGINALLY PASSED A SCREEN. HOWEVER, DURING MEETING BETWEEN IOA AND SSM, IT WAS AGREED THAT THE A SCREEN SHOULD BE FAILED FOR ALL QD COUPLINGS BASED ON INABILITY TO VERIFY CONDITION OF CAP SEAL AFTER CAP INSTALLATION. IOA AGREES WITH NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE AND IS ADDRESSED ON RCS QD COUPLING FMEAS. IOA ALSO RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE VIOLATIONS OF ORBITER MASS PROPERTIES CONSTRAINTS DURING ENTRY.

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| ASSESSME ASSESSME NASA FME | NT D NT I A #: | ATE: D: | 1/01/2 OMS-1 03-3- | 88 05 1101– | -1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | |
|----------------------------------|----------------------|------------|--------------------------|-------------------|--------|---|--------|----------|--------------------|----------|----------|-----------|-----|--|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 105 LINES | AND | MECH | ANIC | AL FI | TTI | NGS-HEL | IUM | PR | ESSI | URE | |
| LEAD ANA | LYST | : | C.D. | PRUS | г | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | |
| | CRIT | ICAL | ITY | R | EDUND | ANCY | SCRE | ENS | | - (| CIL | м | | |
| | HD | W/FU | NC | A | | B | | I | C | - | | •• | | |
| NASA IOA | [1 [1 | /1 |]] | [[|]] | [[|]] | [[|]] | | X X |] | * | |
| COMPARE | [| / |] | Γ |] | [|] | [|] | | [|] | | |
| RECOMMEN | DATI | ons: | (If | dif | feren | t fr | om NA | SA) | | | | | | |
| | [| / |] | [|] | [| J. | [|] | (AD | [)/D |] ELE' | TE) | |
| * CIL RE REMARKS: NO DIFFE | TENI RENC | CION | RATION | ALE: | (If | appl | icabl | e) IN | ADEQUAI ADEQUAI | 'E 'E | [|]] | | |

IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE VIOLATIONS OF ORBITER ENTRY MASS PROPERTIES CONSTRAINTS.

REPORT DATE 2/26/88

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| ASSESSM ASSESSM NASA FM | ENT ENT EA | D2 I] #: | ATE: D: | 1/02 OMS- NONI | 1/88 -106 E | | | | ŀ | JASA BASE | DATA: LINE [NEW [|]] | | |
|-------------------------------|------------------|----------------|----------------|----------------------|-------------------|--------------|--------|--------------|------------|--------------|--------------------------|-----------------------|---------|---|
| SUBSYST MDAC ID ITEM: | EM: : | | | OMS 106 LINI | ES AND | MEC | HANIC | AL I | FITTIN | igs-H | ELIUM P | RES | SURE | |
| LEAD AN | ALY | ST | : | C.D. | . PRUS | т | | | | | | | | |
| ASSESSM | ENT | : | | | | | | | | | | | | |
| | CR | IT: F) | ICAI LIGH | LITY IT INC | R | EDUN | IDANCY | SCI | REENS | - | CI IT | L EM | | |
| | | יטח | ny ru | | л | • | | | | • | | | | |
| NASA IOA | [[| 1 | / /1 |]] | [[|] | [[|]] | [[|]] | ן נ | x] | * | |
| COMPARE | [| N | /N |] | [|] | [|] | [|] | ٢ | N] | | |
| RECOMME | NDA | TIC | ons: | (] | If dif | fere | ent fr | om 1 | NASA) | | | | | |
| | [| | / | ן | [|]. | [|] | [|] |] (ADD/ |] DELI | ETE) | |
| * CTT. PI | ज क | יידיא | TON | RATTO | ONALE: | (Tf | appl | icat | ole) | | | | | |
| | Li 1 10 | | | | | (11 | abbt | | INA INA | DEQU DEQU | ATE [ATE [|] | | |
| REMARKS | : SES | 01 | N AN | ALYS | IS SHE | ET S | HOULD | NOJ | INCI | UDE | "FILTER | 14 14 - 5 - 1 - | | |
| BLOCKAG | <i>۾</i> ٿع | N | <u>ስ</u> ም (| OVER | RESTR | TOTE | D FLO | W TN | JASE | GMEN | T OF LT | NE I | OUE TO | 2 |
| OBSTRUC | TIO | N (| OR I | DEFORM | MATION | (CF | IMPIN | G). | SUCH | I AN | OCCURRE | NCE | COULI | Ś |
| RESULT | IN | 1/ : | 1 EF | FECTS | 5, HOW | EVER | THE | CREI | DIBIĻI | TY O | F SUCH | AN | | |
| DOWNST | NCE | IS P | 5 QŬ דדיתיד | JESTI(| ONABLE COMPO | . А Nenit | NY CO | NTAN A DI | IINATI | ON W | OULD FL | OW 7 CH ਹ | ro A | |
| FAILURE | BE | A | DDRF | ESSED | ON TH | È FM | EA/CI | L, E | SUT DC | ES N | OT REGA | RD 7 | THIS | |

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REPORT DATE 2/26/88

RECOMMENDATION AS AN OPEN ISSUE.

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-107 03-3-10 | 03-2 | | NASA DA BASELI N | TA: NE [] EW [X] |
|--|-------------------------------|----------------------|-----------------------|------------------------|---------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 107 VALVE, | HELIUM I: | SOLATION | | |
| LEAD ANALYST: | C.D. PR | UST | | | |
| ASSESSMENT: | | | | | |
| CRITICAL FLIGH | ITY T | REDUNDA | NCY SCREI | ENS | CIL ITEM |
| HDW/FU | NC | A | В | С | |
| NASA [2 /1R IOA [2 /1R |] [] [| P] P] | [P] [P] | [P] [P] | [X]* [X] |
| COMPARE [/ |] [|] | [] | [] | [] |
| RECOMMENDATIONS: | (If d | ifferent | from NAS | SA) | |
| τ / | .] [|] | [] | []] | [] (ADD/DELETE) |
| * CIL RETENTION | RATIONAL | E: (If a | pplicable | e) | |
| | | | | ADEQUAT INADEQUAT | Έ[] Έ[] |
| REMARKS: NO DIFFERENCES F SHEET OMS-111. | OR THE F | AILS CLO | SED FAIL | URE MODE. | SEE ASSESSMENT |
| IOA RECOMMENDS A VIOLATION OF PRO | DDING A PELLANT | STATEMEN TANK LAN | T TO THE DING CON: | EFFECTS A | BOUT POSSIBLE |

REPORT DATE 2/26/88

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| ASSESSM ASSESSM NASA FM | ENT ENT EA # | DZ II : | ATE: D: | 1/ OM 03 | 01/8 S-10 -3-1 | 8 8 00 |)3- | -1 | | | | | | N2 I | ASA BASE | DATA LINE NEW | : [[| x |] | |
|-------------------------------|--------------------|---------------|---------------|----------------|----------------------|--------------|--------|--------|--------|--------|--------|-----|------------|-----------|-------------|---------------------|-------------|-------|----------|------------------|
| SUBSYST MDAC ID ITEM: | EM: : | | | 0M 10 VA | IS 98 LVE, | F | IEI | LIUM | IS | OL | ATI | :ON | | - | | | : | | | • • • • • • • |
| LEAD AN | ALYS | T: | : | c. | D. P | R | JSI | 2 | | | | | | | | | | | | |
| ASSESSM | ENT: | | | | | | | | | | | | | | | | - | | | |
| | CRI | T | CAL | [TY | | | RE | EDUN | DAN | СҮ | sc | REE | INS | ; | | | C] | L | , | |
| | Н | DV | V/FUN | IC NC | | | A | | | В | | | | С | | | 1.1 | L C L | 1 | |
| NASA IOA | [[| 3 3 | /1R /1R |]] | | [[| P P |]] | [[| F F |]] | | [[| P P |]] | | [[| x |]] | * |
| COMPARE | [| | / |] | | [| |] | [| |] | | נ | |] | | [| N |] | |
| RECOMME | NDAT | IC | ONS: | | (If | đi | lff | iere | nt | fro | сm | NAS | A) | | | · | | | | |
| | [| | / |] | | [| |] | [| |] | | [| |] | (AI |] DD/ | ⁄Dł |] ELE | TE) |
| * CIL R REMARKS | eten | T | ION P | RAT | IONA | LF | 5: | (If | ap | pl | ica | ble | 2) - IN | AI IAI | DEQU. | ATE ATE | [| |]] | |
| NASA/RI FATI, PE | ORI R IO | G] A | INALI ISSI | LY JE. | PASS | EI | | B SC | REE | N, | HO | WEV | ÉF | 2 | CHAN | GED I | 3 5 | SCF | REE | N TO |

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IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE PROP TANK OVERPRESSURIZATION AND RUPTURE WITH THE LOSS OF ALL REDUNDANCY (INCLUDING THE PRESSURE RELIEF ASSEMBLY).

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-109 03-3-1003-1 | NASA DA BASELI N | TA: NE [] EW [X] |
|---|---|-------------------------------------|---------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 109 VALVE, HELIUM | ISOLATION | |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL | TY REDUN | DANCY SCREENS | CIL |
| HDW/FUI | IC A | B C | 11EM |
| NASA [3 /1R IOA [3 /1R |] [P]] [P] | [F] [P] [F] [P] | [] * [X] |
| COMPARE [/ |] [] | []][] | [N] |
| RECOMMENDATIONS: | (If differe | nt from NASA) | |
| [/ |] [] | [][] | [] (ADD/DELETE) |
| * CIL RETENTION 1 | RATIONALE: (If | applicable) ADEQUAI INADEQUAI | 'E [] 'E [] |
| REMARKS: NASA/RI ORIGINAL FAIL PER IOA ISSU TOA RECOMMENDS AND | LY PASSED B SC UE. DDING A STATEM | REEN, HOWEVER CHANGE | D B SCREEN TO |

IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE PROP TANK OVERPRESSURIZATION AND RUPTURE WITH THE LOSS OF ALL REDUNDANCY (INCLUDING THE PRESSURE RELIEF ASSEMBLY).

REPORT DATE 2/26/88

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NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-110 ٦ NEW [X] NASA FMEA #: 03-3-1101-1 SUBSYSTEM: OMS MDAC ID: 110 VALVE, HELIUM ISOLATION ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT C ----HDW/FUNC Α В] [[NASA [1/1]]] [[X] *] L ŗ 1 /1 [X] [1 IOA]. COMPARE [] [ſ []]] **RECOMMENDATIONS:** (If different from NASA)] [(ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE ſ 1 INADEQUATE Γ 1 **REMARKS:** NASA/RI AGREED TO ADD THIS VALVE BODY TO THE ITEM LIST ON THIS FMEA, AND TO ADD CORRESPONDING RETENTION RATIONALE TO THE CIL SHEET, PER IOA ISSUE.

IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE VIOLATIONS OF ORBITER MASS PROPERTIES CONSTRAINTS.

REPORT DATE 2/26/88

| | ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-111 03-3-1003-2 | | | NASA DATA: BASELINE [] NEW [X] | | | | |
|--|--|---------------------------------------|------------|------------|---|-------------------|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | | OMS 111 VALVE, HELIUM ISOLATION | | | | | | | |
| LEAD ANALYST: | | C.D. PRUST | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| | CRITICALITY | | REDUNDANC | Y SCREENS | CIL TTEM | | | | |
| | HDW/FU | NC . | A B | | С | 2 | | | |
| | NASA [2 /1R IOA [2 /1R |] [] [| P][P][| P][F][| P] P] | [X] * [X] | | | |
| | COMPARE [/ |] [| J [| N] [|] | [] | | | |
| RECOMMENDATIONS: (If different from NASA) | | | | | | | | | |
| | [2 /1R |] [| P] [| F] [| F] (Al | [] DD/DELETE) | | | |
| * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEOUATE [] | | | | | | | | | |
| REMARKS: NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). HOWEVER, NASA/RI ADDED "RESTRICTED FLOW" TO THE FAILURE MODES ON 03-3-1003-2 (FAILS CLOSED). IOA RECOMMENDS THAT "RESTRICTED FLOW" BE PLACED ON A NEW FMEA SEPARATE FROM "FAILS CLOSED", AND THAT THE B AND C SCREENS BE FAILED. A FLOW RESTRICTION DURING DUAL-LEG OPERATION WOULD NOT | | | | | | | | | |
| | BE DETECTABLE (F | ATT. B SCR | EEN). | | | | | | |

BE DETECTABLE (FAIL B SCREEN). ALSO, ANY CONTAMINATION CAN AFFECT BOTH VALVES SIMULTANEOUSLY (FAIL C SCREEN).

REPORT DATE 2/26/88

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| ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #: | 1/01/88 1 OMS-112 NONE | | | NASA DAT BASELIN NE | TA: NE [] EW [] | [] · [] | |
|---|---|---------------------------------------|--------------------------------------|----------------------------------|------------------------------|-------------------------|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 112 VALVE, H | OMS 112 VALVE, HELIUM ISOLATION | | | | | |
| LEAD ANALYST: | C.D. PRU | ST | | | | | |
| ASSESSMENT: | | | | | . * | . . | |
| CRITICA FLIG HDW/FU | LITY : HT JNC : | REDUNDANCY | SCREENS | C | CIL ITEM | | |
| NASA [/ IOA [3 /3 |] [] [|] [] [|] [] [|]] | [] [] | * | |
| COMPARE [N /N |] [|] [|] [|] | [] | | |
| RECOMMENDATIONS | : (If di | fferent fi | com NASA) | | | | |
| [/ |] [|] [| ן נ |] (| [] ADD/DEL | ETE) | |
| * CIL RETENTION | RATIONALE | : (If app) | Licable) IN | ADEQUATE ADEQUATE | | . <u>.</u> | |
| REMARKS: NASA/RI DID NOT AGREES WITH NASA THE FMEA/CIL. N "FAILS TO OPEN" | COVER THIS A/RI THAT ' NORST CASE | S FAILURE THIS FAILU OF "DELAY | MODE (DE JRE MODE) (ED OPERA) | LAYED OF NEED NOT TION" IS | PERATION BE ADD COVERE |). IOA ED TO D BY | |
| ana ang ang ang ang ang ang ang ang ang | | | | ·· | | ÷ | |

REPORT DATE 2/26/88
| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-113 03-3-1205-1 | NASA DATA BASELINE NEW | : [x] | | | | | | | |
|--|---|--|-----------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 113 COUPLING-TEST P | ORT, HIGH PRESSURE H | ELIUM | | | | | | | |
| LEAD ANALYST: | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL | | | | | | | | | | |
| HDW/FU | NC A | B C | | | | | | | | |
| NASA [3 /1R IOA [3 /1R |] [F]] [P] | [F] [P] [P] [P] | [X]* [] | | | | | | | |
| COMPARE [/ |] [N] | נ ז) נאן | [N] | | | | | | | |
| RECOMMENDATIONS: | (If different | from NASA) | | | | | | | | |
| [3 /1R |] [F] | [F] [P] (A | [A] .DD/DELETE) | | | | | | | |
| * CIL RETENTION | RATIONALE: (If a | pplicable) | r) | | | | | | | |
| , | | INADEQUATE | | | | | | | | |
| REMARKS: IOA AND AGREES W VERIFY CONDITION AGREES WITH NASA | ITH FAILURE OF A OF CAP SEALS AF /RI FAILURE OF B | SCREEN BASED ON INA TER CAP INSTALLATION SCREEN. | BILITY TO IOA ALSO | | | | | | | |

IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-114 03-3-1205 | -3 | | ł | NASA D BASEL | ATA: INE [NEW [|] x] | · · · | | | |
|---|---------------------------------------|------------------------------|--------------------------|------------------------|-----------------|-------------------------|------------------------|-----------------------|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 114 COUPLING- | TEST PO | RT, HI | GH PI | RESSUR | E HEL | IUM | | | | |
| LEAD ANALYST: | C.D. PRUS | T | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | |
| HDW/FU | NC A | • | В | C | 3 | a to sa | T T T T | | | | |
| NASA [3 /3 IOA [3 /3 |] [] [|] [] [|]] | [[|]] | [[|] | * | | | |
| COMPARE [/ | J [|] [| .] | [|] | [|] | | | | |
| RECOMMENDATIONS: | (If dif | ferent | from N | ASA) | | | | | | | |
| [3 /3 |] [|] [|] | [|] |) (ADD |] / DELI | ETE) | | | |
| * CIL RETENTION | RATIONALE: | (If ap | plicab | le) I TNZ | ADEQUA | TE [TE [|] | | | | |
| REMARKS: IOA FAILURE MODE AND "RESTRICTED "RESTRICTED FLOW | S ON ANALY FLOW". IO " BE ADDED | SIS SHE A RECOM TO THE | ET SHO MENDS FAILU | ULD I THAT RE MO | INCLUD FAIL | E "FA S CLO N THI | ILS (SED" S FMI | CLOSED" AND EA. | | | |

THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD

REPORT DATE 2/26/88

COUPLING FMEAS.

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| ASSESSMENT ASSESSMENT NASA FMEA | ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-115 NASA FMEA #: 03-3-1205-2 | | | | | | | SA DATA ASELINE NEW | : [[X |]] | |
|---|--|-----------------------|----------------|--------|--------|--------|-----------------|---------------------------|---------------|--|-----|
| SUBSYSTEM: MDAC ID: ITEM: | : | OMS 115 COUPLII | NG-TE | ST PC | PRT, | HIGH | PRE | SSURE H | ELIU | M | |
| LEAD ANALY | | | | | | | | | | | |
| ASSESSMENT | r: · | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | |
| | HDW/FU | NC | A | | в | | С | | | [X] [X] LIUM CIL ITEM [] * [] [] [] [] | |
| NASA IOA | [3 /3 [3 /3 |]] | [] [] | | - - |]] | [[|] | [[|]] | * |
| COMPARE | [/ |] | [] | [| |] | [|] | [|] | |
| RECOMMENDA | ATIONS: | (If | diffe | erent | fro | m NAS | A) | | | | |
| | t Ż |] | [] | [| |] | [|] (A | |] ELE | TE) |
| * CIL RETH | ENTION I | RATIONA | LE: (| (If ag | pli | cable |) AD INAD | EQUATE EQUATE | [[|] | |
| REMARKS: IOA FAILUN OPEN" AND NO DIFFERN | RE MODE "RESTR ENCES. | S ON AN. ICTED F | ALYS] LOW". | IS SHI | CET : | SHOUL | D NO | T INCLU | DE " | FAI | LS |

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REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-116 03-3-1101-1 | J | NASA DATA: BASELINE [NEW [X |] | | | | | | |
|---|--|---|--|--------------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 116 LINES AND MI | OMS L16 LINES AND MECHANICAL FITTINGS-HELIUM | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | .D. PRUST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAL | ITY REDU | JNDANCY SCREENS | CIL | л | | | | | | |
| HDW/FU | NC A | B | C Andrew C | • | | | | | | |
| NASA [1 /1 IOA [2 /1R |] []] [P] | [] [[P] [] | P] [X |] *] | | | | | | |
| COMPARE [N /N |] [N] | [N] [] | N] [|] | | | | | | |
| RECOMMENDATIONS: | (If differ | rent from NASA) | | | | | | | | |
| ī / |] [] | [] · [|] [(ADD/DE |] ELETE) | | | | | | |
| * CIL RETENTION | RATIONALE: (] | [f applicable) IN | ADEQUÁTE [ADEQUATE [|] | | | | | | |
| REMARKS: IOA ORIGINALLY CO ISOL VLVS AND HE AGREES WITH NASA | ONSIDERED THE PRESS REGS 1 /RI REEVALUAT | <u>TWO HE LINE SI</u> TO BE REDUNDANT FION AND RATION | EGMENTS BETWEE TO EACH OTHEF ALE FOR A 1/1 | N THE HE R. IOA | | | | | | |

REPORT DATE 2/26/88

CRITICALITY.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-117 NONE | | | NASA DATA BASELINE NEW | : [] [] |
|--|---|---|--|--|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 117 LINES AN | ND MECHAN | ICAL FIT | TINGS-HELIU | M PRESSURE |
| LEAD ANALYST: | C.D. PR | UST | | | |
| ASSESSMENT: | | | | | |
| CRITICAL FLIGH HDW/FU | ITY T NC | REDUNDAN A | CY SCREEN B | ns C | CIL ITEM |
| NASA [/ IOA [2 /1R |] [] [|] [P] [|] F] | [] [P] | [] * [X] |
| COMPARE [N /N |] [| м] [| N] | [N] | [N] |
| RECOMMENDATIONS: | (If d | ifferent | from NAS | A) | |
| [/ |] [| <u>ן</u> נ |] | [] (A | [] DD/DELETE) |
| * CIL RETENTION | RATIONAL | E: (If ap | plicable |) ADEQUATE INADEQUATE | [] |
| REMARKS: IOA CAUSES ON AN BLOCKAGE". NASA/RI DO NOT C OBSTRUCTION OR D RESULT IN 2/1R P OCCURRENCE IS QU DOWNSTREAM FILTE FAILURE BE ADDRE RECOMMENDATION A | ALYSIS S OVER RES EFORMATI FP EFFEC ESTIONAB R OR COM SSED ON S AN OPE | HEET SHOU TRICTED F ON (CRIMP TS, HOWEV LE. ANY PONENT. THE FMEA/ N ISSUE. | LD NOT IN LOW IN A ING). SU ER THE CI CONTAMINA IOA RECON CIL, BUT | NCLUDE "FIL SEGMENT OF UCH AN OCCU REDIBILITY ATION WOULD MMENDS THAT DOES NOT R | TER LINE DUE TO RRENCE COULD OF SUCH AN FLOW TO SUCH A EGARD THIS |

REPORT DATE 2/26/88

NASA DATA: BASELINE [] NEW [X] ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-118 03-3-1004-1 NASA FMEA #: OMS SUBSYSTEM: MDAC ID: 118 REGULATOR ASSY, HELIUM PRESSURE ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C NASA [3/1R] [P] [F] [P] IOA [2/1R] [P] [F] [P] [X]* [X] COMPARE [N /] [] [] [] **RECOMMENDATIONS:** (If different from NASA) Γ [] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [1 INADEQUATE [1 REMARKS: IOA AGREES WITH NASA/RI RATIONALE FOR 3/1R CRITICALITY. SSM AGREED TO REMOVE STATEMENT IN EFFECTS WHICH DESCRIBES 2/1R CRITICALITY, PER IOA ISSUE.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-119 03-3-100 | 04-2 | | NASA DATA BASELINE NEW | : [] [X] | | | | |
|---|---------------------------------|---|-------------------------------------|------------------------------|----------------------|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 119 REGULATO | MS 19 EGULATOR ASSEMBLY, HELIUM PRESSUR | | | | | | | |
| LEAD ANALYST: | C.D. PR | UST | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICAL | ITY | REDUND | ANCY SCREI | ENS | CIL | | | | |
| HDW/FU | NC | A | В | С | 1154 | | | | |
| NASA [2 /1R IOA [2 /1R |] [] [| P] P] | [P] [F] | [F] [P] | [X]* [X] | | | | |
| COMPARE [/ |] [|] | [N] | [N] | [] | | | | |
| RECOMMENDATIONS: | (If d | ifferen | t from NAS | SA) | | | | | |
| [2 /1R |] [| P] | [F]. | [F] [`] (A | [] DD/DELETE) | | | | |
| * CIL RETENTION | RATIONAL | E: (If a | applicable | e) ADEQUATE INADEQUATE | [] | | | | |
| REMARKS: IOA RECOMMENDS T REGULATOR WOULD IOA ACCEPTS NASA | HAT THE NOT BE D /RI FAIL | B SCREE ETECTAB | N BE FAIL LE DURING C SCREEN. | ED. A FAILE DUAL-LEG OP | D CLOSED ERATION. | | | | |

IOA ACCEPTS NASA/RI FAILORE OF C CONLINE IOA ALSO RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE VIOLATION OF THE PROPELLANT TANK LANDING CONSTRAINT.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-120 03-3-100 | 04-2 | | NASA DATA BASELINE NEW | : [] [X] |
|--|-------------------------------------|-----------------------------------|-------------------------------|------------------------------|---------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 120 REGULATO | OR ASSEMB | LY, HELI | UM PRESSURE | - . |
| LEAD ANALYST: | C.D. PRO | JST | | | |
| ASSESSMENT: | | | | | i _l esti estis |
| CRITICAL FLIGH | ITY T | REDUNDAN | CY SCREE | NS | CIL ITEM |
| HDW/FU | NC | A | B | C | |
| NASA [2 /1R IOA [2 /1R |] [] [| P] [P] [| P] F] | [F] [P] | [X]* [X] |
| COMPARE [/ |] [|] [| N] | [N] | []] |
| RECOMMENDATIONS: | (If d | ifferent | from NAS | A) | |
| [2 /1R |] [| P] [| F] | [F] (A) | [] DD/DELETE) |
| * CIL RETENTION | RATIONAL | E: (If ap | plicable | | Г 1 |
| | | | | INADEQUATE | |
| REMARKS: IOA RECOMMENDS TI REGULATOR WOULD IOA ACCEPTS NASA | HAT THE I NOT BE DI /RI FAILU | B SCREEN ETECTABLE JRE OF C | BE FAILE DURING SCREEN. | D. A FAILE DUAL-LEG OP | D CLOSED ERATION. |

IOA ALSO RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE VIOLATION OF THE PROPELLANT TANK LANDING CONSTRAINT.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-121 03-3-1004-2 | NASA DAT BASELIN NE | A: E [] W [X] |
|---|--|--|------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 121 REGULATOR ASSEN | BLY, HELIUM PRESSUR | E |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL | CIL | | |
| HDW/FU | NC A | ВС | 1101 |
| NASA [2 /1R IOA [2 /1R |] [P]] [P] | [P] [F] [F] [P] | [X]* [X] |
| COMPARE [/ |] [] | [N] [N] | [] |
| RECOMMENDATIONS: | (If different | t from NASA) | |
| [2 /1R |] [P] | [F] [F] (. | [] ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (If a | applicable) ADEQUATE INADEQUATE | [] |
| REMARKS: IOA RECOMMENDS TH REGULATOR WOULD H IOA ACCEPTS NASA, | HAT THE B SCREEN NOT BE DETECTABI /RI FAILURE OF C | N BE FAILED. A FAIL LE DURING DUAL-LEG O C SCREEN. | ED CLOSED PERATION. |

IOA ALSO RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE VIOLATION OF THE PROPELLANT TANK LANDING CONSTRAINT.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-122 03-3-110 | 01-1 | NASA DATA BASELINE NEW | : [] [X] | | | | | | |
|--|--------------------------------|-------------------|-----------------------------------|-------------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 122 REGULATO | DR ASSEMBLY | , HELIUM PRESSURE | | | | | | | |
| LEAD ANALYST: | C.D. PRU | JST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAL FLIGH HDW/FU | ITY T NC | REDUNDANCY A B | SCREENS C | CIL ITEM | | | | | | |
| NASA [1 /1 IOA [2 /1R |] [] [|] [P] [P |] []] [P] | [X]* [X] | | | | | | |
| COMPARE [N /N |] [| N] [N |] [И] | [] | | | | | | |
| RECOMMENDATIONS: | (If di | ifferent fr | om NASA) | | | | | | | |
| [/ |] [|] [|] [] (A | [] DD/DELETE) | | | | | | |
| * CIL RETENTION | RATIONALI | E: (If appl | icable) ADEQUATE INADEQUATE | | | | | | | |
| REMARKS: NASA/RI AGREED TO ADD THIS REGULATOR BODY TO THE ITEM LIST ON THIS FMEA, AND TO ADD CORRESPONDING RETENTION RATIONALE TO THE CIL SHEET PER IOA ISSUE. IOA AGREES WITH NASA/RI REEVALUATION AND RATIONALE FOR A 1/1 CRITICALITY. IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE VIOLATIONS OF ORBITER ENTRY MASS PROPERTIES CONSTRAINTS. | | | | | | | | | | |

REPORT DATE 2/26/88

| ASSESSMEN ASSESSMEN NASA FMEA | ASSESSMENT DATE: 1/01/ ASSESSMENT ID: OMS-1 NASA FMEA #: 03-3- SUBSYSTEM: OMS | | | | | 1 | | | | | NA E | SA DATA BASELINE NEW | : [] | x |] | |
|-------------------------------------|--|------------|----------------------|--------|--------|--------|--------|---------|--------|----------|-----------|----------------------------|-------------|----------|-------------|---|
| SUBSYSTEM MDAC ID: ITEM: | [: | | OMS 123 COUPLI | ING | ;-1 | EST : | POI | RТ, | VAPO | DR | IS | OLATION | CI | IEC | K-OUT | |
| LEAD ANAL | YST | : | C.D. 1 | PRU | JSI | • | | | | | | | | | | |
| ASSESSMEN | (T: | | | | | | | | | | | | | | | |
| c | RITI | CAL | ĽΤΥ | | RE | DUND | ANC | CY | SCREE | ENS | 5 | | C) | L | , | |
| | F1 HDV | N/FUI | 1° 1° | | A | | | в | | | С | | ⊥. | LEP | 1 | |
| NASA IOA | [3 [3 | /1R /1R |]] | [[| F P |]] | [[| F NA |] | [[| P P |] | [[| x |] *] | |
| COMPARE | [| / |] | [| N |] | [| N |] | [| |] | [| N |] | |
| RECOMMEND | DATIC | ONS: | (If | di | Ĺff | eren | ti | fro | om NAS | SA) | • | | | | | |
| • | [3 | /1R |] | נ | F |] | ٢ | F |] | [| P |] (A |] DD, | A /DI |] CLETE) | |
| * CIL RET | ENT | ION I | RATION | ALI | Ξ: | (If | apı | pli | cable | ≥) IN | AI IAI | DEQUATE DEQUATE | [| |] | |
| IOA AGREE | s w | ITH I | FAILUR | EC | ΟF | A SC | REI | EN | BASEI | 0 0 | N | INABILI | TΥ | Т | VERI | F |

IOA AGREES WITH FAILURE OF A SCREEN BASED ON INABILITY TO VERIFY CONDITION OF CAP SEALS AFTER CAP INSTALLATION. IOA ALSO AGREES WITH NASA/RI FAILURE OF B SCREEN.

IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSES ASSES NASA | ssmen Ssmen Fme <i>i</i> | IT D. IT I X #: | ATE: D: | 1/01/8 OMS-12 03-3-1 | 88 24 1205- | •3 | | | NZ E | ASA DA' BASELII NI | TA: NE EW | [[x |]] | |
|------------------------|---|-----------------------|------------|----------------------------|--|--------|--------|--------|------------------|--------------------------|-----------------|-----------|----------|--------|
| SUBSY MDAC ITEM: | (STEN ID: : | 1: | | OMS 124 COUPLI | OMS 124 COUPLING-TEST PORT, VAPOR ISOLATIC | | | | | | | | CK- | OUT |
| LEAD | ANAI | LYST | : | C.D. H | C.D. PRUST | | | | | | | | | |
| ASSES | ASSESSMENT: | | | | | | | | | | | | | |
| | CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | | |
| | | HD | W/FUI | NC | A | | В | | С | | | | - | |
| NZ J | ASA IOA | [3 [3 | /3 /3 |]] | [[|] | [[|]] | [[|] | | [[|] | * |
| COMPA | ARE | [| / |] | [|] | [|] | נ |] | | [|] | |
| RECON | MENI | DATI | ons: | (If | diff | erent | t fr | om NAS | SA) | | | | | |
| | | [3 | /3 |] | ٢ |] | [| 3 | נ |] | (AD | [D/DE |] ELE | TE) |
| * CII | L REI | CENT | ION | RATION | LE: | (If a | appl | icable | e) Al INAI | DEQUAT | E E | [[|] | |
| REMAN IOA I AND | RKS: FAILU "REST | JRE FRIC | MODE | S ON AN FLOW". | IALYS | SIS SI | IEET | SHOUI | D IN | ICLUDE | "F | AILS | C C | LOSED" |
| IOA I | RECON | IMEN | DS TI | HAT "FA | AILS | CLOSI | ED" / | AND "F | RESTI | RICTED | FL | OW" | BE | ADDED |

TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT D. NT I A #: | ATE: D: | 1/01/2 OMS-12 03-3-2 | 88 25 1205 [,] | -2 | | | ł | IASA DA BASELI I | ATA: INE NEW | : [X |] | |
|--|-----------------------|------------|----------------------------|---|--------|--------|------|--------|------------------------|--------------------|----------|--------------|---|
| SUBSYSTE MDAC ID: ITEM: | м: | | OMS 125 COUPL | OMS 125 COUPLING-TEST PORT, VAPOR ISOLATION | | | | | | | | CK-OUI | [|
| LEAD ANALYST: C.D. PRUST | | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS | | | | | | | | | CII ITE | M | | | |
| | HD | W/FU | NC | Α | | В | 1 | Ċ | 2 | | | | |
| NASA IOA | [3 [3 | /3 /3 |]] | [[|]] | [[|] | [[|] | | [[|] *] | |
| COMPARE | [| / |] | [|] | Ē |] | [|] | | [|] | |
| RECOMMEN | DATI | ONS: | (If | dif | ferer | nt fr | om N | ASA) | , | | | | |
| | [| / |] | ٢ |] | [|] | [|] | (A) | |] DELETE) | |
| * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEOUATE] | | | | | | | | | | [[|]] | | |
| REMARKS: IOA FAILURE MODES ON ANALYSIS SHEET SHOULD NOT INCLUDE OPEN" AND "RESTRICTED FLOW". | | | | | | | | | DE " | FAILS | то | | |

NO DIFFERENCES.

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REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ENT D ENT I EA #: | ATE: D: | 1/0 0M 03- | 01/8 5-12 -3-1 | 8 6 .00 |)6- | -2 | | | | | NZ E | ASA DA BASELI N | TA: NE EW | [] |] K] | : - | |
|----------------------------------|-------------------------|------------|------------------|----------------------|---------------|--------|--------|--------|-----------|--------|------------|-----------|-----------------------|-----------------|------------|------------|------|---|
| SUBSYSTI MDAC ID: ITEM: | EM : : | | 0M: 12 VA: | S 6 LVE, | 7 | /AI | POR | ISOI | LAI | rion | 1-0X] | [D] | IZER | | | | | |
| LEAD ANA | ALYST | : | c.) | D. P | R | JSI | 2 | | | | | | | | | | | |
| ASSESSMI | ent: | | | | | | | | | | | | | | | | | |
| | CRIT | ICAL | ITY T | | | RE | EDUN | DANG | CY | SCF | REENS | 5 | | -T | CII ITI | L EM | | |
| | HD | W/FU | NC | | | A | | | В | | | C | | | | | | |
| NASA IOA | [2 [2 | /1R /1R |]] | | [[| P P |]] | [[| F P |]] | [[| P P |]] | | [] | K] K] | * | |
| COMPARE | [| 1 |] | | [| |] | [| N |] | [| |] | × . | [|] | | |
| RECOMMEN | NDATI | ONS: | | (If | d | lff | fere | nt i | fro | , m | IASA) | | | | | | | |
| | [| / |] | | [| |] | נ | |] | [| |] | (AD | [0D/1 | .] DEL | ETE) |) |
| * CIL RI | ETENT | ION | RAT | IONA | LI | E : | (If | apı | 91 | icat | ole) IN | AI JAI | DEQUAI DEQUAI | 'E 'E | [|]] | | |
| REMARKS | : | | | | | | | | | | | | | | - | - | | |

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IOA ACCEPTS NASA/RI FAILURE OF B SCREEN, BASED ON RESTRICTED FLOW FAILURE MODE. HOWEVER, IOA CONSIDERS THE FAILED OPEN FAILURE MODE TO BE READILY DETECTABLE DURING FLIGHT. SEE ASSESSMENT SHEET OMS-130. IOA RECOMMENDS ADDING STATEMENT TO THE EFFECTS ABOUT POSSIBLE VIOLATION OF PROPELLANT TANK LANDING CONSTRAINT.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT D. NT I A #: | ATE: D: | 1/0 OMS 03- | 1/88 -127 3-10 | 06 | -1 | | | | | NZ I | ASA I BASEI | DATA LINE NEW | : [] | x |]] | |
|----------------------------------|-----------------------|--------------|-------------------|----------------------|-----|--------|------|----------|--------|--------|---------|----------------|---------------------|-------------|-----------|----------|-----|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 127 VAL | VE, | VA | POR | ISC | DLA | TIO | N-OX | ID | IZER | | | | | |
| LEAD ANA | LYST | : | c.D | . PF | US | т | | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | | | | |
| | CRIT F | ICAL LIGH | ITY F | | R | EDUN | NDAI | ICA | SC | REEN | s | | | C] I] | CL CEN | 1 | |
| | HD | W/FUI | NC | | A | | | В | | | С | | | | | | |
| NASA IOA | [3 [3 | /3 /1R |] | [| P |]] | | [[F |]] | [[| P |]] | | [[| x |]] | * |
| COMPARE | [| /N |] | l | N |] | | [N |] | · [| N |] | | [| N |] | |
| RECOMMEN | DATI | ons: | (| If | lif | fere | ent | fr | om | NASA |) | | | | | | |
| | [3 | /1R |] | i | P |] | | [F |] | [| P |] | (A |] ,00. | A /DI |] ELF | TE) |
| * CIL RE | TENT | ION | RATI | ONAI | E: | (11 | faj | ppl | ica | ble) | | | | , | | - | |
| | | | | | | | | | | I | A NA | DEQU. DEQU | ATE | L [| |] | |
| REMARKS: IOA RECO | MMEN | DS T | HAT | THIS | S I | TEM | AN | | AIL | | MO | DE B | E UP | GRA | ADI | ED | TO |

IOA RECOMMENDS THAT THIS ITEM AND FAILURE MODE BE UPGRADED TO A 3/1R PFP AND PLACED ON THE CIL. WITH FAILED OPEN VAPOR ISOL VALVE AND SERIES OXID CHECK VALVE POPPETS, THE CONTAMINATION OF UPSTREAM COMPONENTS BY PROP OR PROP VAPORS COULD RESULT IN LOSS OF PROP TANK REPRESS CAPABILITY RESULTING IN INABILITY TO USE OR DEPLETE OMS PROP, AND OXIDIZER CROSSOVER TO THE FUEL SIDE CAUSING A POSSIBLE HYPERGOLIC REACTION IN THE LINES. FAILURE OF ONE LEG OF REDUNDANCY (CHECK VALVE POPPET) IS NOT DETECTABLE DURING FLIGHT (FAIL B SCREEN).

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-128 03-3-1006-1 | 1 | IASA DATA: BASELINE NEW | [] [X] |
|--|------------------------------------|------------------------------|-------------------------------|---------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 128 VALVE, VAPOR I | SOLATION-OXII | DIZER | |
| LEAD ANALYST: | C.D. PRUST | | | |
| ASSESSMENT: | | | | |
| CRITICAL FLIGH | ITY REDUND T | ANCY SCREENS | - | CIL ITEM |
| HDW/FU | NC A | в | - | |
| NASA [3 /3 IOA [3 /1R |] []] [P] | [] [[F] [] |] P] | [] * [X] |
| COMPARE [/N |] [N] | ·[N][1 | 1] | [И] |
| RECOMMENDATIONS: | (If differen | t from NASA) | | |
| [3 /1R |] [P] | [F] [] | ? <u>]</u> (Al | [A] DD/DELETE) |
| | | amplicable) | | |
| * CIL RETENTION | RATIONALE: (II | appricable) INI INI | ADEQUATE ADEQUATE | |
| REMARKS: IOA RECOMMENDS T 3/1R PFP AND PLA | HAT THIS ITEM A CED ON THE CIL. | ND FAILURE MO WITH INTERI | DDE BE UPO NALLY LEAP | RADED TO A |
| ISOL VALVE AND S | ERIES OXID CHEC | N VALVE PUPPI | SIS, INE C | ESHLT |

OF UPSTREAM COMPONENTS BY PROP OR PROP VAF IN LOSS OF PROP TANK REPRESS CAPABILITY RESULTING IN INABILITY TO USE OR DEPLETE OMS PROP, AND OXIDIZER CROSSOVER TO THE FUEL SIDE CAUSING A POSSIBLE HYPERGOLIC REACTION IN THE LINES. FAILURE OF ONE LEG OF REDUNDANCY (CHECK VALVE POPPET) IS NOT DETECTABLE DURING FLIGHT (FAIL B SCREEN).

REPORT DATE 2/26/88

| ASSESSMEI ASSESSMEI NASA FMEI | SSESSMENT DATE:1/01/88NASA DATA:SSESSMENT ID:OMS-129BASELINE []ASA FMEA #:03-3-1101-1NEW [X]UBSYSTEM:OMS | | | | | | | | | |
|-------------------------------------|--|----------------|---------------------|--------|----------------|--------|--------------|---------------------------|-----------------------|-----------|
| SUBSYSTEM MDAC ID: ITEM: | M: | | OMS 129 VALVE | :, VA | APOR I | ISOLA | rion | -OXIDIZER | | |
| LEAD ANA | LYSI | :: | C.D. | PRUS | ST | | | | | |
| ASSESSME | NT: | | | | | | | | | |
| | CRIJ | TCAL | JTY. | F | REDUNI | DANCY | SCR | EENS | CIL ITEM | |
| | н | W/FU | NC | P | ~~~~ | | | | | |
| NASA IOA | [] | L /1 L /1 |]] | [[|]] | [[|]] | [] | [X] [X] | * |
| COMPARE | [| / |] | [|] | [|] | [] | [] | |
| RECOMMEN | DATI | cons: | (11 | dif | fere | nt fr | om N | ASA) | | |
| | [| / |] | ٢ |] · | C |] | [] | [] (ADD/DELE | TE) |
| * CIL RE | TENT | TION | RATION | IALE | (If | appl | icab | le) | | |
| | | | | | | | | ADEQUAI INADEQUAI | | |
| REMARKS: NASA/RI FMEA, AN | AGRI D T(| EED I D ADD | O ADD | THIS | S VAL NDING | VE BO | DY T NTIO | O THE ITEM N RATIONALE | LIST ON T TO THE C | HIS IL |
| STREET, TOA RECO | PER MMEI | IOA NDS A | ISSUE. | A SI | TATEM | ENT T | о тн | E EFFECTS A | BOUT POSS | IBLE |

VIOLATIONS OF ORBITER ENTRY MASS PROPERTIES CONSTRAINTS.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | ENT I ENT I EA # | DATE: ID: : | 1/01/8 OMS-13 03-3-1 | 38 30 1006- | -2 | | | | NASA I BASEI | DATA: LINE NEW | : [X |]] |
|----------------------------------|------------------------|-------------------|----------------------------|-------------------|--------|------------|-------|-----------|-----------------|----------------------|-------------|-------------|
| SUBSYSTE MDAC ID: ITEM: | EM : | | OMS 130 VALVE, | VAI | POR I | SOLA | TION- | -0XI | DIZER | | | |
| LEAD ANA | LYS | F : | C.D. I | PRUSI | 2 | | | | | | | |
| ASSESSME | ENT: | | | | | | | | | | | |
| | CRI | FICALI FLIGHT | CTY C | RI | EDUND | ANCY | SCRI | EENS | 5 | | CIL ITEI | M |
| | HI | DW/FUI | 1C | A | | B | 5 | | C | | | |
| NASA IOA | [] | 2 /1R 2 /1R |]] | [P [P |]] | [F [F |] | [| P] P] | | [X [X |] * |
| COMPARE | [| / |] | [|] | [|] | [|] | | [|] |
| RECOMMEN | IDAT: | IONS: | (If | diff | eren | t fr | om NZ | ASA) | | | | |
| | [| / |] | [|] | [|] | [| -] | (AI | ן וס/סמ |] Elete) |
| * CIL RE | TENT | TION H | RATIONA | LE: | (If | appl | icabl | .e) IN | ADEQUA | ATE ATE | [[|] |
| REMARKS: NASA/RI | ORIC | GINAL | LY DID | NOT | COVE | R TH | IS FA | ILU | RE MOI | DE (F | REST | RICTED |

NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). HOWEVER, NASA/RI ADDED "RESTRICTED FLOW" TO THE FAILURE MODES ON 03-3-1006-2 (FAILS CLOSED), AND CHANGED THE B SCREEN TO "FAIL". IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE

VIOLATION OF THE PROPELLANT TANK LANDING CONSTRAINT.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT NT A (| D2 II #: | ATE: D: | I/O OMS NON | 01/88 5-131 NE | | | | ł | IASA BASE | DATA: LINE NEW | [[|]] | |
|----------------------------------|-----------------|----------------|------------|-------------------|----------------------|---------------|----------|-------------|------------------|----------------|----------------------|-----------|-----------|-----|
| SUBSYSTE MDAC ID: ITEM: | M: | | | 0M9 132 VAI | S L Lve, Vai | POR | ISOLA | FION | I-OXII | DIZER | L | | | |
| LEAD ANA | LYS | ST | : | с.1 |). PRUSI | | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | |
| | CR | IT: | | LITY | RI | DUI | NDANCY | SCF | REENS | | | CII | M | |
| | I | HDV | W/FU | ЛС | A | | В | | c | 3 | | *** | | |
| NASA IOA | [[| 3 | / /3 |]] | [[|]] | [[|]] | [[|]] | | [[|]] | * |
| COMPARE | [| N | /N |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | DA' | FI | ONS | : | (If diff | ere | ent fr | om N | IASA) | | | | | |
| | Γ | | / |] | [|] | [|] | נ |] | (AI | [)D/[|] DELE | TE) |
| * CIL RE | TEI | NT: | ION | RAT: | IONALE: | (11 | f appl | icat | ole) / IN/ | ADEQU ADEQU | IATE IATE | [[|]] | |
| REMARKS: | | | | 00171 | PD MUTC | 5 73 7 | י זמוז ד | WODE | י (הדי | AVET | | רידי גל | (NN) | |

NASA/RI DID NOT COVER THIS FAILURE MODE (DELAYED OPERATION). IOA AGREES WITH NASA/RI THAT THIS FAILURE MODE NEED NOT BE ADDED TO THE FMEA/CIL. WORST CASE OF "DELAYED OPERATION" IS COVERED BY "FAILS TO OPEN".

REPORT DATE 2/26/88

et: 5

| | ASSESSME ASSESSME NASA FME | NT I NT] A #: | DATE: | 1/01 OMS- 03-3 | L/88 -132 8-1007 | -2 | | | NASI BAS | A DATA: SELINE NEW | x |]] |
|---|----------------------------------|----------------------|----------------|----------------------|------------------------|------------|------------|------|------------------------|----------------------------|-------------|-------------|
| | SUBSYSTE MDAC ID: ITEM: | :M : | | OMS 132 VALV | 7E, QU | AD C | HECK | VALV | 'ES | | | |
| | LEAD ANA | LYSI | C: | C.D. | PRUS | т | | | | | | |
| | ASSESSME | NT: | | | | | | | | | | |
| | | CRIT I HI | TICAL FLIGH | ITY T NC | R | EDUN | DANCY | SCF | REENS | (] | CIL (TEN | 1 |
| | | | | | | | | • | (D] | | • • | - т |
| | NASA IOA | [2 | 2 /1R 2 /1R |] | | ,] ,] | [F [F |] | [P] [P] | | X |] * |
| • | COMPARE | [| 1 |] | [| ן | ſ |] | [] | i | |] |
| | RECOMMEN | [DAT] | CONS: | () | [f dif | fere | nt fro | om N | IASA) | | | |
| | | [| 1 |] | [|] | ľ |] | ເ ່າ | (ADI | D/DI |] Elete) |
| | * CIL RE | TENI | TION | RATIC | DNALE: | (If | appl | icak | ole) ADE(INADE(| QUATE QUATE | |]] |
| | NO DIFFE | RENC | CES. | nea di bir | | | · | | ele tur f | | | |

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-133 03-3-1007-1 | NAS. BA | A DATA: SELINE [] NEW [X] |
|---|---|---|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 133 VALVE, QUAD CHE | CK VALVES, FUE | L |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL | ITY REDUNDA | NCY SCREENS | CIL ITEM |
| HDW/FU | NC A | B C | |
| NASA [3 /3 IOA [2 /1R |] []] [P] | [] [] [F] [P] | [] * [X] |
| COMPARE [N /N |] [N] | | [N] |
| RECOMMENDATIONS: | (If different | from NASA) | - |
| [2 /1R |] [P] | [F] [P] | [A] (ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (If a | pplicable) ADE INADE | QUATE [] OUATE [] |
| REMARKS: IOA RECOMMENDS T 2/1R PFP AND PLA WITH FAILED OPEN UPSTREAM COMPONE IN LOSS OF PROP | HAT THIS ITEM AN CED ON THE CIL (FUEL CHECK VALV NTS BY PROP OR F TANK REPRESS CAF | D FAILURE MODE SEPARATE FROM E POPPETS, THE PROP VAPORS COU PABILITY RESULT | BE UPGRADED TO A THE OXIDIZER ASSY). CONTAMINATION OF LD RESULT ING IN INABILITY TO |

USE OR DEPLETE OMS PROP, AND FUEL CROSSOVER TO THE OXID SIDE CAUSING A POSSIBLE HYPERGOLIC REACTION IN THE LINES. FAILURE OF ONE POPPET IS NOT DETECTABLE DURING FLIGHT (FAIL B SCREEN).

REPORT DATE 2/26/88

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| ASSESSMENT DATE: | 1/01/88 | | NASA DATA: | |
|--|--|---|--|---|
| ASSESSMENT ID: NASA FMEA #: | OMS-134 03-3-1007-1 | | BASELINE | [] [X] |
| SUBSYSTEM: MDAC ID: ITEM: | OMS 134 VALVE, QUAD CHE | CK VALVES, | OXIDIZER | |
| LEAD ANALYST: | C.D. PRUST | | | |
| ASSESSMENT: | | | | · · · · · · · · · · · · · · · · · · · |
| CRITICAL FLIGH | ITY REDUNDA | NCY SCREEN | S | CIL ITEM |
| HDW/FUI | NC A | В | C | |
| NASA [3 /3 IOA [3 /1R |] []]]]]]]]]]]]]]]]]] | [] [[F] [|] P] | [] * [X] |
| COMPARE [/N |] [N] | [N][| N] | [N] |
| RECOMMENDATIONS: | (If different | from NASA |) | <u>.</u> |
| [3 /1R |]. [b] | [F] [| P] (AD | [A] D/DELETE) |
| * CIL RETENTION H | RATIONALE: (If a | pplicable) Il | ADEQUATE NADEQUATE | [] |
| REMARKS: IOA RECOMMENDS TH 3/1R PFP AND PLAC WITH FAILED OPEN THE CONTAMINATION PROP VAPORS COULD RESULTING IN INAL CROSSOVER TO THE IN THE LINES FAILURE OF ONE PO SCREEN). | HAT THIS ITEM AN CED ON THE CIL (OXID CHECK VALV N OF UPSTREAM CO D RESULT IN LOSS BILITY TO USE OR FUEL SIDE CAUSI OPPET IS NOT DET | D FAILURE I SEPARATE FI E POPPETS A MPONENTS BY OF PROP TA DEPLETE OI NG A POSSII ECTABLE DU | MODE BE UPG ROM THE FUE AND VAPOR I Y PROP OR ANK REPRESS MS PROP, AN BLE HYPERGO RING FLIGHT | RADED TO A L ASSY). SOL VALVE, CAPABILITY D OXID LIC REACTION (FAIL B |

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT DA NT II A #: | ATE: D: | 1/01/8 OMS-13 03-3-1 | 8 5 .101- | -1 | | | N | ASA DA BASELI N | NTA: INE IEW | [[| x |]] | |
|---|------------------------|---------------------|----------------------------|-----------------|--------------|----------------|----------------|----------------|-----------------------|--------------------|-----------|-----------|------------|-----------|
| SUBSYSTE MDAC ID: ITEM: | : M : | | OMS 135 VALVE, | QUA | AD CHI | ECK V | ALVES | 5 | | | | | | |
| LEAD ANA | LYST | : | C.D. F | RUSI | ſ | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | - | | | | | |
| | CRIT | ICAL | ITY | RI | EDUNDA | ANCY | SCREE | ens | | | CI TT | 'L 'EM | r | |
| | HD | W/FUI | NC | A | | В | | C | | | | | • | |
| NASA IOA | [1 [1 | /1 /1 |]] | [[|] | [[|] | [[|]] | | [[| X X |]] | * |
| COMPARE | [| / |] | C |] | [|] | [|] | | [| |] | |
| RECOMMEN | IDATI(| ÓNS: | (If | dif | feren | t fro | om NAS | SA) | | | | | | |
| | [| / |] | [|] | [|] | [|] | (AI |] /00 | 'DF |] :LE | TE) |
| * CIL RE | TENT | ION | RATION | ALE: | (If a | appl | icable | ≥) A INA | DEQUA | re re | [| |] | |
| REMARKS: NASA/RI FMEA, AN SHEET, N | AGRE | ED T ADD OA I | O ADD 7 CORRES | THIS SPONI | VALV DING | E BOI RETEI | DY TO NTION | THE RAI | ITEM | LIS E T(| ST C J | ON HE | I I E C | HIS IL |

IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE VIOLATIONS OF ORBITER ENTRY MASS PROPERTIES CONSTRAINTS, AND ABOUT POSSIBLE PROP OR PROP VAPOR LEAKAGE RESULTING IN POSSIBLE CORROSION, FIRE, EXPLOSION AND EXPOSURE OF EVA AND GROUND CREWS.

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| ASSESSME ASSESSME NASA FME | NT D NT I A #: | ATE: D: | 1/01/2 OMS-12 03-3-2 | 88 36 1007- | -3 | | | . 1 | NASA DA BASELI N | NE IEW | [[] | ן [א | |
|----------------------------------|----------------------|------------|----------------------------|-------------------|--------|--------|--------|-----------|------------------------|-----------|----------------|------------|-------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 136 VALVE | , QU2 | AD CH | IECK | VALVE | S | | | | | |
| LEAD ANA | lyst | : | C.D. | PRUSI | C | | | | | | | | |
| ASSESSME | NT: | | | | | | - | | | | | | |
| | CRIT | ICAL | ITY | RI | EDUNI | DANCY | SCRE | ENS | | | CI | L EM | |
| | HD | W/FU | NC | A | | В | | (| C i | | - - - - | | |
| NASA IOA | [1 [1 | /1 /1 |]] | [[|]] | [[|]] | [[|]] | | [] | X] X] | * |
| COMPARE | [| / |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | DATI | ons: | (If | difi | ferer | nt fr | om NA | SA) | | | | | |
| | ٢. | / |] | [|] | [|] | ĺ |] | (AI | [00/1 |] DEI | LETE) |
| * CIL RE | TENT | ION | RATION | ALE: | (If | appl | icabl | e) INZ | ADEQUAJ ADEQUAJ | 'E 'E | [[|] | |
| REMARKS : | | | | | | | | | - | | - | - | |

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NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (RESTRICTED FLOW OF SINGLE INLET FILTER). NASA/RI AGREED TO ADD THIS NEW FMEA (03-3-1007-3) TO COVER THIS 1/1 FAILURE, PER IOA ISSUE.

REPORT DATE 2/26/88

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s in Areas

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-137 03-3-1205-1 | NASA DATA: BASELINE NEW | [] [X] |
|---|---|--|---------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 137 COUPLING-TEST P | ORT, QUAD CHECK VALVE | C |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL | ITY REDUNDA | NCY SCREENS | CIL |
| HDW/FU | NC A | ВС | 1 I EM |
| NASA [3 /1R IOA [3 /1R |] [F]] [P] | [F] [P] [NA] [P] | [X]* [] |
| COMPARE [/ |] [N] | [א] [א] | [N] |
| RECOMMENDATIONS: | (If different | from NASA) | |
| [3 /1R |] [F] | [F] [P] (AI | [A] DD/DELETE) |
| * CIL RETENTION | RATIONALE: (If a | pplicable) ADEQUATE INADEOUATE | [] |
| REMARKS: IOA AGREES WITH CONDITION OF CAP WITH NASA/RI FAI | FAILURE OF A SCR SEALS AFTER CAF LURE OF B SCREEN | EEN BASED ON INABILIT O INSTALLATION. IOA A | TY TO VERIFY |

IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-138 03-3-1205 | -3 |] | [] | | | | | | | |
|--|---------------------------------|---|---------------|----------------------|-------------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 138 COUPLING- | MS 138 COUPLING-TEST PORT, QUAD CHECK VALVE | | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | .D. PRUST | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRITICAL | CIL ITEM | | | | | | | | | | |
| HDW/FUN | NC A | Ē | , | c | | | | | | | |
| NASA [3 /3 IOA [3 /3 |] [] [|] [] [|] [|] | [] * [] | | | | | | |
| COMPARE [/ |] [|] [|] [|] - | [] | | | | | | |
| RECOMMENDATIONS: | (If dif: | ferent fr | om NASA) | | | | | | | | |
| [3 /3 |] [|] [| ן נ נ |] (AI | [])D/DELETE) | | | | | | |
| * CIL RETENTION H | RATIONALE: | (If appl | icable) IN | ADEQUATE ADEQUATE | | | | | | | |
| REMARKS: IOA FAILURE MODES AND "RESTRICTED D | 5 ON ANALYS | SIS SHEET | SHOULD | INCLUDE "F | AILS CLOSED" | | | | | | |

IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | | | | |
|--|---|----------|--------------------|-------|------|--------|--------|--------|--------|-------|----------|-------------|----|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 139 COUP | LING- | TEST | PORT | , QU | AD CH | HECK V | VALVI | E | | |
| LEAD ANA | LYST | : | C.D. | PRUS | Т | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS | | | | | | | | | | | CI TT | L | |
| | HD | W/FU | NC | А | | E | 3 | 2 | | | | | |
| NASA IOA | [3 [3 | /3 /3 |]] | [|] | [[|]] | [[|]] | | [[|] *] | |
| COMPARE | [| / |] | [|] | [|] | Γ |] | | [|] | |
| RECOMMEN | DATI | ons: | (I | f dif | fere | nt fr | om N | ASA) | | | | | |
| | [| / |] | [|] | [|] | [|] | (Al |] DD/ |] Delet: | E) |
| * CIL RE | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEOUATE [] | | | | | | | | | | | | |
| REMARKS: IOA FAIL OPEN" AN NO DIFFE | REMARKS: IOA FAILURE MODES ON ANALYSIS SHEET SHOULD NOT INCLUDE "FAILS TO OPEN" AND "RESTRICTED FLOW". NO DIFFERENCES. | | | | | | | | | | | | |

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REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-140 NONE | | NASA DA Baseli N | ATA: INE [] IEW [] |
|--|---|---|--|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 140 LINES AND MECH | HANICAL FI | ITTINGS-HEI | JUM PRESSURE |
| LEAD ANALYST: | C.D. PRUST | | | |
| ASSESSMENT: | | | | |
| CRITICAL | ITY REDUNI | CIL | | |
| HDW/FUI | NC A | В | C | LIEM |
| NASA [/ IOA [3 /3 |] [] | [] [] | [] [] | []* |
| COMPARE [N /N |] [] | [] | [] | []] |
| RECOMMENDATIONS: | (If differen | nt from NA | ASA) | |
| [/ |] [] | [] | [] | [] (ADD/DELETE) |
| * CIL RETENTION 1 | RATIONALE: (If | applicabl | Le) ADEQUAT INADEQUAT | YE [] YE [] |
| REMARKS: IOA CAUSES ON AND BLOCKAGE". | ALYSIS SHEET SI | HOULD NOT | INCLUDE "F | ILTER |
| NASA/RI DO NOT CO OBSTRUCTION OR DI RESULT IN 3/3 EFI OCCURRENCE IS QUI DOWNSTREAM FILTEI FAILURE BE ADDRES | OVER RESTRICTED EFORMATION (CRI FECTS, HOWEVER ESTIONABLE. AN R OR COMPONENT SSED ON THE FMU | D FLOW IN IMPING). THE CREDI NY CONTAMI . IOA REC EA/CIL. BI | A SEGMENT SUCH AN OC IBILITY OF INATION WOU COMMENDS TH IT DOES NOT | OF LINE DUE TO CURRENCE COULD SUCH AN ULD FLOW TO LAT SUCH A REGARD THIS |

REPORT DATE 2/26/88

RECOMMENDATION AS AN OPEN ISSUE.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-141 03-3-1009-2 | NASA DATA BASELINI NEV | A: E [] N [X] |
|---|-----------------------------------|--|---------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 141 VALVE-PRESSU | RE RELIEF ASSEMBLY | |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL FLIGH HDW/FU | ITY REDU F NC A | INDANCY SCREENS B C | CIL ITEM |
| NASA [3 /1R IOA [1 /1 |] [F]] [] | [NA] [P] [][] | [X]* [X] |
| COMPARE [N /N |] [N] | [N] [N] | [] |
| RECOMMENDATIONS: | (If differ | cent from NASA) | |
| [/ |] [] | | [] ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (1 | If applicable) ADEQUATE INADEQUATE | |
| REMARKS: IOA NO LONGER CO AND CONCURS WITH NO DIFFERENCES. | NSIDERS RELIE NASA/RI CRII | EF VALVE TO BE AN EMERG FICALITY AND SCREEN ASS | ENCY SYSTEM, IGNMENTS. |

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-141A 03-3-1009-4 |] | NASA DATA: BASELINE NEW | [] [X] | | | | | | | | |
|---|--|------------------|-------------------------------|-------------------|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 141 VALVE-PRESSU | JRE RELIEF ASSEN | MBLY | | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | D. PRUST | | | | | | | | | | |
| ASSESSMENT: | ASSESSMENT: | | | | | | | | | | | |
| CRITICAL | ITY REDU | JNDANCY SCREENS | | CIL | | | | | | | | |
| HDW/FU | NC A | B | C | | | | | | | | | |
| NASA [3 /1R IOA [1 /1 |] [P]] [] | [NA] [[] [| P]] | [] * [X] | | | | | | | | |
| COMPARE [N /N |] [N] | [N] [] | N] | [N] | | | | | | | | |
| RECOMMENDATIONS: | (If differ | cent from NASA) | | | | | | | | | | |
| [/ |] [] | [][|] (AD | [] DD/DELETE) | | | | | | | | |
| * CIL RETENTION | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | |
| REMARKS: IOA NO LONGER CONSIDERS RELIEF VALVE TO BE AN EMERGENCY SYSTEM, AND CONCURS WITH NASA/RI CRITICALITY AND SCREEN ASSIGNMENTS. | | | | | | | | | | | | |

REPORT DATE 2/26/88

| ASSESSMEN ASSESSMEN NASA FMEA | SESSMENT DATE: 1/01/88 SESSMENT ID: OMS-142 SA FMEA #: 03-3-1009-3 | | | | | | | | NASA DATA: BASELINE [] NEW [X] | | | | | | | |
|---|--|------------|----------------------|--|--------|--------|--------|-----------------|---|--------|--------|-----------|----------|--------|----------|------|
| SUBSYSTEM MDAC ID: ITEM: | : | | OMS 142 VALVE- | MS 42 ALVE-PRESSURE RELIEF ASSEMBI | | | | | | | | BLY | | | | |
| LEAD ANAL | YST | : | C.D. F | D. PRUST | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS | | | | | | | | | | | C: | [L FEN | л | | | |
| | FLIGHT HDW/FUNC | | | | | | | В | | | С | | | | T | |
| NASA IOA | [2 [2 | /1R /1R |]] | [[| P P |]] | [[| F N <i>P</i> | 7]] | [[| P P |] | [[| X X |] | * |
| COMPARE | [| / |] | [| |] | [| N |] | [| |] | [| |] | |
| RECOMMEND | ATI | ons: | (If | di | ff | erent | t : | fro | om NAS | SA) |) | | | | | |
| | [| / |] | [| |] | [| |] | [| |] (A |] DD, | /DI |] SLF | ETE) |
| * CIL RET | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] | | | | | | | | | | | | | | | |
| REMARKS: IOA ACCEPTS NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS ADDING STATEMENTS TO EFFECTS ABOUT POSSIBLE LEAKAGE OF PROP OR PROP VAPORS RESULTING IN POSSIBLE CORROSION, | | | | | | | | | | | | | | | | |

FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-143 NASA FMEA #: 03-3-1009-3 | | | | | | | NASA DATA: BASELINE [] NEW [X] | | | | | | | | |
|--|----------------------|-------------------------|---------------------------|--|------------------|------------------------|---|---------------|-------------------------|-----------------------|------------------------------------|------------------|-----------------|-----------------|---------------------|
| SUBSYSTEM MDAC ID: ITEM: | : | | OMS 143 VALVE | MS 43 Alve-pressure relief Assem | | | | | | | BLY | | | | |
| LEAD ANAL | YST | | C.D. | PRU | JST | | | | | | | | | | |
| ASSESSMEN | T: | | | | | | | | | | | | | | |
| c | RIT | TY | | RE | DUNDA | ŃĊ | Y: | SCREE | ENS | | CI TT | L EM | r | | |
| | FLIGHT HDW/FUNC | | | | | | | в | | С | | TICN | | | |
| NASA IOA | [2 [2 | /1R /1R |] | [[| P P |] | [[| F NA |] | [P [P | .] |]] | X |] | * |
| COMPARE | [| / |] | [| |] | [| N |] | [|] | [| N |] | |
| RECOMMEND | ATIC | ONS: | (If | di | ff | erent | f | ro | m NAS | SA) | | | | | |
| | [| / |] | [| |] | [| |] | C . |] (AI |] /סכ | 'DE |] LE | TE) |
| * CIL RET | ENT | ION I | RATION | ALI | 2: | (If a | PF |)]i | cable | ≥) AI INAI | DEQUATE DEOUATE | ך ר | |] | |
| REMARKS: NASA/RI C INTERNAL THE FAILU | RIG LEAI JRE N | INALJ KAGE) MODES | LY DID). NA 5 ON 0 | NC SA/ 3-3 | OT /RI 3-1 | COVER ÀGRE 009-3 | T EC (| THI: T(BU) | S FA] O ADI RST I | LURI) "II)ISK | E MODE (I NTERNAL I PREMATUI | SUF LEA RE | NST KA RU | ' D GE PT | ISK "TO URE), |

PER IOA ISSUE. IOA AGREES WITH NASA/RI FAILURE OF B SCREEN. BURST DISK LEAK IS NOT DETECTABLE DURING FLIGHT.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-144 03-3-1009- | -5 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | |
|--|----------------------------------|--------------------|---|-------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 144 VALVE-PRES | SSURE RELIEF ASS | EMBLY | - | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | C | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRITICAL FLIGH | ITY RE T | EDUNDANCY SCREEN | S | CIL ITEM | | | | | | | |
| HDW/FU | NC A | В | С | | | | | | | | |
| NASA [2 /1R IOA [1 /1 |] [P] |] [NA] [] [] [| P]] | [X]* [X] | | | | | | | |
| COMPARE [N /N |] [N |] [N] [| N] | [] | | | | | | | |
| RECOMMENDATIONS: | (If diff | ferent from NASA | .) | | | | | | | | |
| ι. Ι |] [| נ ז נ |] (Al | [] DD/DELETE) | | | | | | | |
| * CIL RETENTION | RATIONALE: | (If applicable) | ADEQUATE | | | | | | | | |
| REMARKS: IOA NO LONGER CO | NSIDERS REI | LIEF VALVE TO BE | AN EMERGEN | ICY SYSTEM | | | | | | | |

IOA NO LONGER CONSIDERS RELIEF VALVE TO BE AN EMERGENCY SYSTEM, AND CONCURS WITH NASA/RI CRITICALITY AND SCREEN ASSIGNMENTS. NASA/RI ORIGINALLY PASSED B SCREEN, HOWEVER HAS RECLASSIFIED B SCREEN AS "NA" PER IOA ISSUE.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-145 03-3-100 | 9-1 | | | NA E | SA DATA: BASELINE NEW | [[X |]] | | | | |
|--|--|---------|--------|--------|-----------------|-----------------------------|------------|-------------|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 145 VALVE-PR | ESSURE | RELI | EF AS | SEME | BLY | | | | | | |
| LEAD ANALYST: | C.D. PRU | ST | | | ÷ | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICAL | ns | | CIL | r | | | | | | | | |
| HDW/FU | NC | A | В | | С | | | • | | | | |
| NASA [1 /1 IOA [1 /1 |] [] [|]] | [[|] | [[|]] | [X [X |] *] -: | | | | |
| COMPARE [/ |][|] | [|] | [|] | [|] | | | | |
| RECOMMENDATIONS: | (If di | fferen | t fro | om NAS | A) | | | | | | | |
| [/ |] [|] | [|] | [|] (AI | [DD/DE |] LETE) | | | | |
| * CIL RETENTION | RATIONALE | : (If a | appli | cable |) AC INAC | DEQUATE DEQUATE | [| | | | | |
| REMARKS: SSM REMOVED FAIL LEAK", PER IOA J FAILURE TO OCCUP | EMARKS: SM REMOVED FAILURE MODE STATEMENT WHICH DESCRIBE "DIAPHRAGM EAK", PER IOA ISSUE. A BURST DISK LEAK IS NOT REQUIRED FOR THIS VAILURE TO OCCUR. | | | | | | | | | | | |

IOA RECOMMENDS ADDING STATEMENTS TO EFFECTS REGARDING POSSIBLE LEAKAGE OF PROP OR PROP VAPORS RESULTING IN FIRE/EXPLOSION HAZARD AND EXPOSURE OF EVA AND GROUND CREWS TO PROP.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT DATE: NT ID: A #: | 1/01/88 OMS-145 03-3-11 | 5A .01-1 | | | N | ASA DATA BASELINE NEW | .: ; [; [X |]] | |
|--|--|--|--|-------------------------------|----------------------------------|--------------------------|--|-------------------------|------------------------|--|
| SUBSYSTE MDAC ID: ITEM: | :M : | OMS 145 VALVE-F | PRESSURE | E RELI | IEF AS | SSEM | BLY | | | |
| LEAD ANA | LYST: | C.D. PF | NUST | | | | | | | |
| ASSESSME | INT: | | | | | | | | | |
| | CRITICAL | LITY | REDUNI | DANCY | SCREI | ens | | CIL | м | |
| | HDW/FU | JNC | A | В | | С | | TIDU | | |
| NASA IOA | [1 /1 [1 /1 |] [] [|] | [[|] | [[|]] | [X [X |] *] | |
| COMPARE | [/ |] (|] | [|] | [|] | [|] | |
| RECOMMEN | IDATIONS: | : (If d | lifferer | nt fro | om NAS | SA) | | | | |
| | [/] | -] [|] | [· |] | C |]. (2 |] DD/D |] ELETE) | |
| * CIL RE | TENTION | RATIONAI | LE: (If | appl | icabl | e) A INA | DEQUATE DEQUATE | [[|]] | |
| REMARKS: NASA/RI FMEA, AN | AGREED 7 ID TO ADI | TO ADD TH | HIS VALV PONDING | /E BOI RETEI | DY TO NTION | THE RAT | ITEM LI IONALE 7 | IST O TH | N THIS E CIL | |
| IOA RECO VIOLATIC ABOUT PC EXPLOSIC | OMMENDS A ONS OF OF OSSIBLE A ON, AND A | ADDING A RBITER EN LEAKAGE (EXPOSURE | STATEMI NTRY MAS OF PROP OF EVA | ENT T SS PR RESU AND | O THE OPERT LTING GROUN | EFF IES IN D CR | ECTS ABO CONSTRAI CORROSIO EWS. | OUT P INTS, DN, F | OSSIBLE AND IRE, | |
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| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-146 NASA FMEA #: 03-3-1205-1 | | | | | | | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | |
|--|---------------------|--------------|---------------------|---|----------|----------|---|------------|----------|----------------|-----------|--------------------|------------|----------|-----------------|----|
| SUBSYSTI MDAC ID: ITEM: | EM: ; | | OMS 146 COUPL | IS 6 DUPLING-TEST PORT, PRESSURE RELIEF | | | | | | | | CF V | /AL | VE | | |
| LEAD ANALYST: C.D. PRUST | | | | | | | | | | | | | | | | |
| ASSESSMI | ENT : | | | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS | | | | | | | | | | C | CIL | | | | | |
| | r NC | | A | | | В | | | с | | | LTEM | | | | |
| NASA IOA | [3 | /1R /1R |]] | [[| F P |]] | [[| F NJ |] | [[| P P |] | | X X |] *] | |
| COMPARE | [| / |] | [| N |] | [| N | ן | נ | |] | | |] | |
| RECOMMEN | IDATI | ons: | (If | di | iff | fere | nt f | irc | om 1 | NASA) |) | | | | | |
| | [3 | /1R |] | [| F |] | נ | F |] | ľ | P | j | ADI | A D/D |] ELETE) | |
| * CIL RI | ETENT | ION I | RATION | ALI | :2 | (If | app | l i | lcai | ble) Il | AI | DEQUATI DEQUATI | C (C (| • |] | |
| REMARKS | : Ees W On of | ITH I CAP | FAILURI SEALS | E AI |)F TI | AS RC | CREE AP 1 | N NS | BA TA | SED (LLAT) | ON LON | INABII I. IOZ | LITY AI | T LSO | O VERI AGREE | FY |

WITH NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88
| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-147 03-3-1205- | -3 | | NASA DATA BASELINE NEW | : [x |]] |
|--|----------------------------------|------------|---------------|------------------------------|-------------|-------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 147 COUPLING-1 | TEST PORT | , PRESS | URE RELIEF | VALV | Έ |
| LEAD ANALYST: | C.D. PRUST | r | | | | |
| ASSESSMENT: | | | | | | |
| CRITICAL | ITY RI | EDUNDANCY | SCREEN | S | CIL TTEM | r |
| HDW/FU | NC A | E | 3 | С | ± + 141 | • |
| NASA [3 /3 IOA [3 /3 |] [|] [] [|] [] [|]] | [[|] *] |
| COMPARE [/ |] [|] [|] [|] | [|] |
| RECOMMENDATIONS: | (If dif: | ferent fi | com NASA | .) | | |
| [3 /3 |] [|] [|] [|] | [.DD/DE |] Elete) |
| * CIL RETENTION | RATIONALE: | (If app] | licable) I | ADEQUATE NADEQUATE | [[|] |
| REMARKS: IOA FAILURE MODE AND "RESTRICTED | S ON ANALY: FLOW". | SIS SHEET | SHOULD |) INCLUDE " | FAILS | BE ADDED |

IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-148 NASA FMEA #: 03-3-1205-2 | | | | | | | | | Ň | ASA I BASEI | ATA: LINE NEW | [|] X] | |
|--|-----------|------------|---------------|--------------------|---------------|-----------|--------|--------|------------------|----------------|---------------------|----------|--------------|--------|
| SUBSYST MDAC ID ITEM: | EM : | | <u>11</u> .1. | OMS 148 COUP | LING- | TEST | PORT | , PF | ESSUE | E REI | LIEF | VA | LVE | |
| LEAD AN | AL | ζST | : | C.D. | PRUS | T | | | | | | | | |
| ASSESSM | ENT | C: | | - | | | | | | | - | | · · · - : | |
| | CI | RIT: F: | ICAI LIGH | LITY IT | F | REDUN | DANCY | SCF | REENS | | | CI IT | L EM | |
| | | HD | W/FU | INC | A | 1 | E | 3 | C | | | | | |
| NASA IOA | . . | [3 [3 | /3 /3 |] | [[|]] | [[|]] | [|]] | | [[|] | * |
| COMPARE | | [| / |] | ٢ |] | [|] | [|] | | [|] | |
| RECOMME | NDZ | ATI | ons: | (I | f dif | fere | nt fr | rom N | IASA) | | | | | |
| | l | [| / |] | [|] | ľ |] | [|] | (AI |] /00 |] DELH | ETE) |
| * CIL R | ETI | ENT | ION | RATIO | NALE: | (If | appl | .icab | ole) A INA | DEQUA | TE | [[|]] | |
| REMARKS IOA FAI OPEN" A | LUI ND | RE I | MODE | S ON | ANALY FLOW | SIS ". | SHEET | SHO | NULD N | IOT IN | ICLUI | DE | "FA] | ILS TO |

NO DIFFERENCES.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-149 NONE | | NASA BASE | DATA: CLINE [] NEW [] |
|--|---|-------------------------------------|---|--|
| SUBSYSTEM: MDAC ID: ITEM: NTO | OMS 149 PROPELLANT | LINES AND | MECHANICAI | FITTINGS-MMH AND |
| LEAD ANALYST: | C.D. PRUST | | | |
| ASSESSMENT: | | | | |
| CRITICAL | ITY RED | UNDANCY S | CREENS | CIL ITEM |
| HDW/FU | NC A | В | С | 1 1 211 |
| NASA [/ IOA [1 /1 |] []] [] | [] [] | [] [] | [] * [X] · |
| COMPARE [N /N |] [] | [] | [] | [N] |
| RECOMMENDATIONS: | (If diffe | rent from | NASA) | |
| [/ |] [] | [] | [] | [] (ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (| If applica | able) ADEQU INADEQU | VATE [] VATE [] |
| REMARKS: IOA CAUSES ON AN BLOCKAGE". | ALYSIS SHEET | SHOULD NO | OT INCLUDE | "FILTER |
| NASA/RI DO NOT C OBSTRUCTION OR D RESULT IN 1/1 FF | OVER RESTRIC EFORMATION (FECTS HOWEY | TED FLOW CRIMPING) ER THE CRI | IN A SEGMEN . SUCH AN EDIBILITY C | T OF LINE DUE TO OCCURRENCE COULD OF SUCH AN |
| OCCURRENCE IS QU DOWNSTREAM FILTE | ESTIONABLE. | ANY CONT | AMINATION W | OULD FLOW TO THAT SUCH A |
| FAILURE BE ADDRE | SSED ON THE | FMEA/CIL, | BUT DOES N | IOT REGARD THIS |

REPORT DATE 2/26/88

RECOMMENDATION AS AN OPEN ISSUE.

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| ASSES ASSES NASA | ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-150 NASA FMEA #: 03-3-2001- SUBSYSTEM: OMS MDAC ID: 150 | | | | | | | | | | | | NA E | SA I ASE | DATA: LINE NEW | [[| x |] | | |
|---|---|---|---|---|--|--|---|---|---|---|---|--|--|--|--|--|-------------------------------------|--------------------------|--|---|
| SUBSY MDAC ITEM: | (STE ID: | M: | | | OMS 150 COUPLI | :NC | 3-1 | TEST | POI | RT, | | PROPE | LLA | NT 1 | PRESS | UF | ٤E | CH | IECK | |
| LEAD | ANA | LYS | ST | | C.D. 1 | PRI | ງຮາ | ſ | | | | | | | | | | | | |
| ASSES | SSME | NT | : | | | | | | | | | | | | | | | | | |
| | ł | CR | IT | [CAL] | LTY | | RI | EDUN | DANG | CY | S | CREEN | 5 | | | C] | L | , | | |
| | | F | F1 HDV | N/FUN | I' NC | | A | | 4 | В | | | С | | | ΤJ | . EN | | | |
| NZ J | ASA [OA | [[| 2 2 | /1R /1R |] | ן נ | F P |] | [[| F NA | 7]] | [[| P P |]] | | [[| X X |]] | * | |
| COMP | ARE | [| | / |] | [| N |] | [| N |] | [| |] | | [| |] | | |
| RECON | IMEN | DA' | FI | ons: | (If | d: | if | fere | nt 1 | fro | m | NASA |) | | | | | | | |
| | | [| 2 | /1R |] | [| F |] | [| F |] | [| P |] | (AD | [D/ | A 'DE |] LE | TE) | |
| * CII REMAI NASA, HOWEY 506) IOA 2 VERII AGREI IOA 1 AS A AND 2 IOA 2 OF OI | L RE RKS: /RI VER, HAV AGRE FY C ES W RECO FAI IS A ALSO RBIT | TEI DII TI ES ONI ITI MMI LUI DDI RI ER | NT D HE BEI W DI H I ENI RE RE ECC EI | ION I REF EN AI ITH I FION NASA, DS TI MODI SSED OMMEI NTRY | APPEAR DES NU DED TO NASA/RJ OF CAH /RI FAJ HAT "PO E ON TH ON RCS NDS TH MASS I | T(T(TM) (1) () (1) () () () () ()) () ()) ()) ()) (| E: DO DO SEI DO TH DO PI | (If COVE RS F -3-2 LUR AL A S OF F FA FMEA COU HE E SRTI | app R TH OR 7 001- E OI FTEI B S ILS FFEG ES 0 | HIS THI -1, F A CSCR OP THI NG CTS CON | .C. S. S. XA XA S. F. S. S. | able) II COUPL COUP PER IC SCREEL P INS' EN. N (DUI IS A MEAS. INCLUI TRAIN' | AI NAI ING LIN CA N I TAI RIN CI DE TS | PEQUA DEQUA SOR IG (1 ISSI DASE JLED IG F EDI POS: AND | ATE ATE IGINA MD405 UE. D ON . IC LIGHT BLE F SIBLE PROP |]] A]]]]]]]]]]]]]]]]] | LY. 40 NAE AI LU VIC |]] SC RE RE | 505, LITY TO ADDED MODE ATIONS | J |
| LAND: IN CO GROUI | ING ONTA ND C | WE: MII REV | igi Na' Ws | HT CO FION, • | , FIRE, | LN'. | rs , EXI | , AN PLOS | ION | , A | (N) | D EXP | SSI | VRE (| AKAGE OF EV | 'A | AN | D | | |

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-151 03-3-20 | 01-3 | | | N)] | ASA DATA BASELINE NEW | : [x |] | | | | |
|--|--|---------|--------|-------|---------|-----------------------------|-----------|--------------|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 151 COUPLIN | G-TEST | PORT | , pro | PELL | ANT PRES | SURE | CHECK | | | | |
| LEAD ANALYST: | C.D. PR | UST | | | | | | | | | | |
| ASSESSMENT: | ASSESSMENT: | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | |
| FLIGHT ITEM HDW/FUNC A B C | | | | | | | | | | | | |
| NASA [3 /3 IOA [3 /3 |] [] [|] | [[|] | [[|] | [[|] *] | | | | |
| COMPARE [/ |] [|] | [|] | [|] | [|] | | | | |
| RECOMMENDATIONS: | (If d | ifferen | t fr | om NA | SA) | | | | | | | |
| [3 /3 |] [|] | Γ |] | [|] (A |] DD/D |] DELETE) | | | | |
| * CIL RETENTION | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | |
| REMARKS: IOA FAILURE MODES ON ANALYSIS SHEET SHOULD INCLUDE "FAILS CLOSED" AND "RESTRICTED FLOW". NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. HOWEVER. THE REF DES NUMBERS FOR THIS COUPLING (MD405, 406, 505, | | | | | | | | | | | | |

506) HAVE BEEN ADDED TO 03-3-2001-3, PER IOA ISSUE. IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-152 03-3-2001- | -2 | | NASA DATA BASELINE NEW | : [] 7 [X] |
|---|--|---|---------------------------|--|-----------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 152 COUPLING-1 | TEST PORT | , PROP | ELLANT PRES | SURE CHECK |
| LEAD ANALYST: | C.D. PRUST | Г | | | |
| ASSESSMENT: | | | | | . · · · · · · · · · · |
| CRITICAL FLIGH HDW/FU | ITY RI F | EDUNDANCY B | SCREE | NS | CIL ITEM |
| nDw/r0 | AC A | J | | C | |
| NASA [3 /3 IOA [3 /3 |] [] [|] [] [|] | [] [] | [] * [] |
| COMPARE [/ |] [|] [|] | [] | [] |
| RECOMMENDATIONS: | (If dif | ferent fr | om NAS. | A) | |
| . [/ |] [| ן [|] | [] (A | [] DD/DELETE) |
| * CIL RETENTION | RATIONALE: | (If appl | icable |) ADEQUATE INADEQUATE | [] [] |
| REMARKS: IOA FAILURE MODE | S ON ANALYS | SIS SHEET | SHOUL | D NOT INCLU | DE "FAILS TO |
| OPEN" AND "RESTR NASA/RI DID NOT HOWEVER, THE REF 506) HAVE BEEN A | ICTED FLOW APPEAR TO (DES NUMBER DDED TO 03- | ". COVER THI RS FOR TH -3-2001-2 | S COUP IS COU , PER | LING ORIGIN PLING (MD40 IOA ISSUE. | ALLY. 5, 406, 505, |

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT NT A # | | ATE:): | 1/0 OM: NOI | 01/8: S-15: NE | B 3 | | | | 1 | IASA BASE | DATA: LINE NEW | [[|]] | |
|----------------------------------|-----------------|--------------|------------|-------------------|----------------------|--------|--------|--------|--------|------------|----------------|----------------------|------------|-----------|------|
| SUBSYSTE MDAC ID: ITEM: | М: | | | 0M 15 VA | S 3 LVE-(| GROU | JND, | MANU | JAL I | SOLAI | TION | | | | |
| LEAD ANA | LYS | 5 T : | : | c.] | D. P | RUSI | נ | | | | | | | | |
| ASSESSME | NT : | : | | | | | | | | | | | | | |
| | CRI | T] | CAL | ITY | | RI | EDUNE | DANCY | SCR | EENS | | | CII TTE | M | |
| | ł | IDV | I/FU | NC | | A | | F | 3 | C | 3 | | *** | | |
| NASA IOA | [[| 1 | / /1 |]] | • | [[|]] | [[|]] | [[|]] | | [[X |] | * |
| COMPARE | [| N | /N |] | | [|] | [|] | C |] | | [N | [] | |
| RECOMMEN | 'DA'I | PIC | ONS: | | (If | dif | ferer | nt fi | com N | ASA) | | | | | |
| | [| | 1. |] | | [|] | [|] | [· |] | (AI | [)D/D |] DELE | ETE) |
| * CIL RE | TEI | T I | CON | RAT | IONA | LE: | (If | appl | licab | le) INZ | ADEQU ADEQU | ATE ATE | [[|] | |
| REMARKS: | | - N(| י יידע | OVE | ਨ ਪਾਸ | TS | FATTJ | | ODE | (FAT) | LS TO | REMA | TN | OPF | EN). |

NASA/RI DO NOT COVER THIS FAILURE MODE (FAILS TO REMAIN OPEN). IOA NOW CONSIDERS THE CREDIBILITY OF THIS FAILURE MODE TO BE QUESTIONABLE. IOA DOES NOT REGARD THE ABSENCE OF THIS FAILURE MODE IN THE FMEA/CIL TO BE AN OPEN ISSUE, BUT DOES RECOMMEND THAT THIS FAILURE MODE BE ADDRESSED.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT E NT I A #: | DATE: | 1/01, OMS-: 03-3 | /88 154 -1008 | -1 | | | 1 | IASA BASE | DATA: LINE NEW | : [[X |] | • |
|----------------------------------|----------------------|----------|------------------------|---------------------|--------|--------|--------|-----------------|--------------|----------------------|---------------|------------|----|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 154 VALV | E-GRO | UND, | MANU | AL I | SOLA | rion | | | | |
| LEAD ANA | lysi | : | C.D. | PRUS | r | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | |
| | CRII | ICAL | ITY | R | EDUN | DANCY | SCR | EENS | | | CIL | м | |
| | HE | W/FU | NC | A | | E | 5 | C | 3 | | | ** | |
| NASA IOA | [3 [3 | /3 /3 |]] | [[|]] | [[|]] | [[|] | | [[|] *] | |
| COMPARE | [| / |] | ſ |] | [|] | [|] | | [|] | |
| RECOMMEN | DATI | ons: | (1 | f dif | fere | nt fr | om N | ASA) | | | | | |
| | C | / |] | ſ |] | [|] | [|] | (AI | [DD/D |] ELETE | ;) |
| * CIL RE | TENI | NOI | RATIO | NALE: | (If | appl | icab | le) / TNZ | ADEQU. | ATE ATE | [|] | |
| REMARKS: | DFNC | ידי | | | | | | | | | L | L | |

NO DIFFERENCES.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT NT A # | DATE: ID: : | 1/01 OMS- 03-3 | /88 155 -1101 | -1 | | | NZ H | ASA DAT BASELIN NE | A: E [W [X |] |
|---|-------------------------|-------------------------------------|-------------------------|-------------------------|-------------|---------------|--------------|------------------------------|-----------------------------|----------------------------|-----------------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 155 VALV | E-GRO | UND, | MANU | AL I | ISOLATI | LON | | |
| LEAD ANA | LYS | T: | C.D. | PRUS | т | | | | | | |
| ASSESSME | NT: | | | | | | | | | | |
| | CRI | TICAL | JTY | R | EDUN | DANCY | SCI | REENS | | CIL ITEM | |
| | H | IDW/FU | INC | А | • | В | | С | | | |
| NASA IOA | [[| 1 /1 1 /1 |]] | [[|]] | [[|] | [[|]] | [X [X |] *] |
| COMPARE | [| / |] | [|] | [|] | C |] | ۵ |] |
| RECOMMEN | DAI | lons: | (1 | f dif | fere | nt fr | om 1 | NASA) | | | |
| | [| / |] | C |] | [|] | [|] (| [ADD/DE |] LETE) |
| * CIL RE | TEN | TION | RATIC | NALE: | (If | appl | ical | ble) AI INAI | DEQUATE DEQUATE | [[|] |
| REMARKS: NASA/RI FMEA, AN SHEET, P IOA RECO | AGF D I ER MME | REED I TO ADE IOA I ENDS A | CO ADE CORR SSUE. |) THIS ESPON A ST | VAL DING | VE BO RETE | UY T UTIO | TO THE ON RATI HE EFFI | ITEM L IONALE ECTS AB | IST ON TO THE OUT PO | THIS CIL SSIBLE |
| VTOLATTO | NG | OF OF | BITER | ENTR | V MA | SS PR | OPEI | RTTES (| CONSTRA | INTS. | AND |

ABOUT PROP LEAKAGE RESULTING IN POSSIBLE CORROSION, FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-156 03-3-2001-1 | NASA DAT BASELIN NE | A: E [] W [X] |
|--|---|---|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 156 COUPLING-TANK VENT | | |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | Ξ |
| CRITICAL FLIGH HDW/FU | ITY REDUNDANCY F NC A H | SCREENS C | CIL ITEM |
| NASA [2 /1R IOA [2 /1R |] [F] [H] [P] [H | F] [P] NA] [P] | [X]* [X] |
| COMPARE [/ |] [N] [M | 4] [] | [] |
| RECOMMENDATIONS: | (If different fi | com NASA) | |
| [2 /1R |] [F] [I | ?] [P] | [A] ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (If app) | Licable) ADEQUATE INADEQUATE | |
| REMARKS: NASA/RI ORIGINAL BETWEEN IOA AND FAILED FOR ALL Q CONDITION OF CAP IOA AGREES WITH IOA RECOMMENDS T AS A FAILURE MOD AND IS ADDRESSED IOA ALSO RECOMMEN VIOLATIONS OF PRO MASS PROPERTIES RESULTING IN POSS EVA AND GROUND C | LY PASSED A SCREEN. SSM, IT WAS AGREED D COUPLINGS BASED O SEAL AFTER CAP INS NASA/RI FAILURE OF HAT "POPPET FAILS O E ON THIS FMEA. TH ON RCS QD COUPLINO NDS ADDING STATEMEN OPELLANT TANK LANDI CONSTRAINTS DURING SIBLE CORROSION, FI REWS. | HOWEVER, DURING THAT THE A SCREED ON INABILITY TO VI STALLATION. B SCREEN. OPEN (DURING FLIGH HIS IS A CREDIBLE G FMEAS. WIS TO EFFECTS ABO ING CONSTRAINTS AN ENTRY, AND ABOUT IRE, EXPLOSION, AN | G MEETING N SHOULD BE ERIFY HT)" BE ADDED FAILURE MODE DUT POSSIBLE ND ORBITER PROP LEAKAGE ND EXPOSURE OF |

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| ASSESSME ASSESSME NASA FME | NT D NT I A #: | ATE: D: | 1/01/ OMS-1 03-3- | ′88 .57 •2001 | 3 | | | N | ASA D BASEI | ATA: INE NEW | [[x |]] | |
|----------------------------------|----------------------|-------------|-------------------------|---------------------|--------|--------|--------|------------------|----------------|--------------------|-----------|-------------|----|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 157 COUPI | LING- | TANK | VENT | | | | | | | |
| LEAD ANA | LYST | : | C.D. | PRUS | T | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | |
| | CRIT | ICAL | ITY | F | EDUN | DANCY | SCF | REENS | | | CIL | M | |
| | r HC | W/FU | NC | A | 7 | В | | С | • | | | | |
| NASA IOA | [3 [3 | /3 |]] | [[|]] | [[|]] | [[|]] | | [[|] *] | |
| COMPARE | [| / |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | DATI | ONS: | (11 | E dif | fere | nt fr | om N | IASA) | | | | | |
| | -[3 | /3 |] | [|] | [|] | [|] | (AI | [DD/D |] ELETE) | |
| * CIL RE | TENI | NOI | RATION | VALE: | : (If | appl | icak | ole) A INA | DEQUA | TE TE | [[|]] | |
| REMARKS: IOA FAII AND "RES | URE TRIC | MODE TED | S ON A | ANALY | ISIS | SHEET | SHO | OULD I | NCLUE |)E "] | FAIL | S CLOSEI |)" |

IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ent i ent j ea #: | DATE: [D: ; | 1/01/ OMS-1 03-3- | ′88 .58 -2001 | L-2 | | | 1 | IASA I BASEI | DATA LINE NEW | ••]] |] x] | |
|----------------------------------|-------------------------|-------------------|-------------------------|---------------------|--------|--------|--------|------------------|-----------------|---------------------|--------------|----------|--------|
| SUBSYSTI MDAC ID: ITEM: | E M : ; | | OMS 158 COUPI | JING- | -TANK | VENT | 2 | - | | | | | |
| LEAD ANA | LYSI | :: | C.D. | PRUS | ST | | | | | | | | · |
| ASSESSMI | ENT: | | | | | | | | | | | 54 - X | |
| | CRIT | TCAL | ITY | I | REDUN | DANCY | SCR | EENS | | | CI | L FM | |
| | H | W/FU | NC | 1 | A | E | 3 | C | 2 | | + 1 | 1.51-1 | |
| NASA IOA | [3 | 3 /3 3 /3 |] | ([|]] | [[|]] | [[|]] | | [[|] | * |
| COMPARE | ٢ | 1 |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | IDATI | CONS: | (If | aif | fere | nt fr | om N | IASA) | | | | | |
| | [| 1 |] | [|] | [|] | [|] | (AI |] /0C | .] | TE) |
| * CIL RI | ETENJ | NOI | RATION | IALE : | (If | appl | .icab | ole) 7 INZ | DEQUA DEQUA | TE TE | [[|]] | · |
| TOA FATI | JIRE | MODE | S ON A | NALY | SIS | SHEET | SHO | ULD N | IOT IN | ICLUI | DE | "FAI | LLS TO |
| OPEN" AI | ND "F | ESTR | ICTED | FLOW | 7". | | | · | · | | | | |

NO DIFFERENCES.

REPORT DATE 2/26/88

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| ASSESSMENT ASSESSMENT NASA FMEA | T DATE: T ID: #: | DATE: 1/01/88 NASA DATA: ID: OMS-159 BASELINE [] : NONE NEW [] | | | | | | |] | |
|--|---|--|---|---------|------|--------|---------|------------|-------------|--|
| SUBSYSTEM: MDAC ID: ITEM: NTO | : | OMS 159 PROPELI | MS 59 ROPELLANT LINES AND MECHANICAL FITTINGS-MMH | | | | | | | |
| LEAD ANALYST: C.D. PRUST | | | | | | | | | | |
| ASSESSMENT | ASSESSMENT: | | | | | | | | | |
| CI | RITICAL | ITY | REDU | NDANCY | SCR | EENS | | CIL | A | |
| | HDW/FU | NC | A | В | | C | ! | T T T T | 1 | |
| NASA IOA | [/ [1 /1 |) () (|] | [[|] | [[|]] | [[X |] *] | |
| COMPARE | [N /N |] [|] | ľ |] | [|] | [N |] | |
| RECOMMEND | ATIONS: | (If d | liffer | ent fro | om N | ASA) | | | | |
| | t / | ן י |] | [|] | [|] (A | [נס/סם |] ELETE) | |
| * CIL RET | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEOUATE [] - | | | | | | | | | |
| REMARKS: IOA CAUSE BLOCKAGE" | REMARKS: IOA CAUSES ON ANALYSIS SHEET SHOULD NOT INCLUDE "FILTER BLOCKAGE". | | | | | | | | | |

NASA/RI DO NOT COVER RESTRICTED FLOW IN A SEGMENT OF LINE DUE TO OBSTRUCTION OR DEFORMATION (CRIMPING). SUCH AN OCCURRENCE COULD RESULT IN 1/1 EFFECTS, HOWEVER THE CREDIBILITY OF SUCH AN OCCURRENCE IS QUESTIONABLE. ANY CONTAMINATION WOULD FLOW TO DOWNSTREAM FILTER OR COMPONENT. IOA RECOMMENDS THAT SUCH A FAILURE BE ADDRESSED ON THE FMEA/CIL, BUT DOES NOT REGARD THIS RECOMMENDATION AS AN OPEN ISSUE.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT DA NT II A #: | ATE: D: | 1/01/8 0MS-10 03-3-2 | 1/88 NA -160 B 3-2601-1 | | | | | ASA DATA BASELINE NEW | [[X |] |
|--|------------------------|-------------------------|-------------------------------|-------------------------------|----------------------------|-----------------------|-------------------------|------------------|-----------------------------|--------------|-------------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 160 GIMBAI | L BEI | LLOWS | | | ÷ | | | |
| LEAD ANA | lyst | : | C.D. 1 | PRUST | r | | | | | | |
| ASSESSME | NT: | | | | | | | | | ÷ . | |
| | CRIT | ICAL | ITY | RI | EDUNDA | NCY | SCREE | ENS | | CIL | ĸ |
| | HD | W/FUI | NC | A | | В | | С | | | • |
| NASA IOA | [1 [1 | /1 /1 |] | [[|] | [[|] | [[|] | [X [X |] * |
| COMPARE | [| / |] | [|] | [|] | [|] | [|] |
| RECOMMEN | DATI | ons: | (If | dif | ferent | : fro | om NAS | SA) | | | |
| | [| 1 |] | [|] | נ |] | נ |] (A |] 10/00 |] ELETE) |
| * CIL RE | TENT | ION I | RATION | ALE: | (If a | npp1: | icable | e) AI INAI | DEQUATE DEQUATE | [[|] |
| REMARKS: NASA/RI CAUSES O THE CIL | AGRE N TH SHEE | ed To Is Fi T Sho | D ADD ' MEA, PI DULD AI | FAI ER IC | LED CI DA ISS SS THI | JOSEI UE. IS NI | D ACMV THE EW CAU | RET RETI | LIEF DEV ENTION R | ICE" ATIO | TO THE NALE ON |

IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS. IOA ALSO RECOMMENDS THAT "BINDING/JAMMING OF LINE BELLOWS" BE ADDED AS A CAUSE ON THIS FMEA.

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REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT NT A | DZ II #: | ATE: D: | 1/0 OMS NON | 1/8 -16 E | 8 | | | |] | NASA BASI | DATA: ELINE NEW | [[| |]] | |
|----------------------------------|---------------|----------------|------------|-------------------|-----------------|--------|--------|--------|--------|----------|--------------|-----------------------|----------|---------|----------|------|
| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 161 GIM | IBAL | , BEI | LLOWS | 3 | _ | | | | | | | |
| LEAD ANA | LYS | ST | : | c.c |). F | RUST | C | | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | | | |
| | CR | [T] | | ITY | | RI | EDUNI | DANCY | SCRE | ENS | | | CI TT | L FW | ſ | |
| | I | HDV | N/FU | INC | | A | | В | | | с | | | | • | |
| NASA IOA | [[| 1 | / /1 |]] | | [[|]] | [[|]] | [[|] | | [[| x |]] | * |
| COMPARE | [| N | /N |] | | [|] | [|] | [|] | | [| N |] | |
| RECOMMEN | DA' | FI | ONS: | (| lf | dif | ferei | nt fr | om NA | SA) | | | | | | |
| | [| | / |] | | נ |] | .[|] | [|] | (AI | [>D/ | DE |] ELE | ETE) |
| * CIL RE | TE | T' | ION | RATI | ONA | LE: | (If | appl | icabl | e) TN | ADEQU | JATE JATE | [| |] | |
| REMARKS: | | | | | | | | | | | | | L | | J | |

NASA/RI DO NOT COVER THIS FAILURE MODE (NO BELLOWS ANGULAR DEFLECTION). IOA RECOMMENDS THAT THIS FAILURE MODE BE INCLUDED AS A CAUSE ON LINE AND BELLOWS RUPTURE FMEAS.

REPORT DATE 2/26/88

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| ASSES ASSES NASA | SMEN SMEN FMEA | T T # | DA IC : | ATE:): | 1/01/3 OMS-1 NONE | 88 62 | | | | N | IASA BASE | DATA: LINE NEW | [[|]] |
|------------------------|----------------------|-------------|---------------|---------------|-------------------------|----------|-------|--------|--------|----------------|----------------|----------------------|-------------|-------------|
| SUBSY MDAC ITEM: | STEM ID: | : | | | OMS 162 GIMBA | L BEI | LOWS | | | | | | | |
| LEAD | ANAL | YS | т: | | C.D. | PRUSI | 1 | | | | | | | |
| ASSES | SMEN | т: | | | | | | | | | | | | |
| | с | RI | TI FI | CALI LIGHT | TTY F | RE | DUND | NCY | SCREE | ns | | | CIL ITEN | 1 |
| | | H | DW | /FUN | iC | A | | В | | C | 2 | | | |
| NA I | SA OA | [[| 1 | / /1 |]] | [[|] | [[|]] | [[|] | | [x |] *] |
| COMPA | RE | [| N | /N |] | [|] | [|] | [|] | | [N |] |
| RECOM | MEND | AT | ΊC | ons: | (If | diff | erent | : fro | om NAS | A) | | | | |
| | | [| | / |] | . [|] | [|] | [|] | (AI | [DD/DH |] ELETE) |
| * CIL | RET | 'EN | TI | ION I | RATION | ALE: | (If a | appli | icable | e) A INA | ADEQU ADEQU | ATE ATE | [[|]] |

REMARKS: NASA/RI DO NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). IOA NOW CONSIDERS THE CREDIBILITY OF RESTRICTED FLOW IN A BELLOWS TO BE QUESTIONABLE. IOA DOES NOT REGARD THE ABSENCE OF THIS FAILURE MODE IN THE FMEA/CIL TO BE AN OPEN ISSUE, BUT DOES RECOMMEND THAT IT BE ADDRESSED.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-163 03-3-2002-1 | NASA DATA BASELINE NEW | : [] [X] |
|--|-----------------------------------|--------------------------------|-------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 163 PROPELLANT TANK | | |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL | JITY REDUNDANCY SC | REENS | CIL |
| HDW/FU | INC A B | C | 1154 |
| NASA [1 /1 IOA [1 /1 |] [] []] [] [] | [] [] | [X]* [X] |
| COMPARE [/ |] [] [] | [] | [] |
| RECOMMENDATIONS: | (If different from | NASA) | |
| [/ |] [] [] | [] (A | [] DD/DELETE) |
| * CIL RETENTION REMARKS: NO DIFFERENCES. | RATIONALE: (If applica | ble) ADEQUATE INADEQUATE | [] [] |

REPORT DATE 2/26/88

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NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [] NEW [X] ASSESSMENT ID: OMS-164 NASA FMEA #: 03-3-2002-2 SUBSYSTEM: OMS 164 MDAC ID: PROPELLANT TANK ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT В С HDW/FUNC Α [F] [P] [X]* [2 /1R] NASA [P] IOA $\begin{bmatrix} 1/1 \end{bmatrix}$ Ĩ ſ [X] 1 ſ 1 1 COMPARE [N /N] [N] [N] [N] [] RECOMMENDATIONS: (If different from NASA) [] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEOUATE ſ 1 INADEQUATE [1 **REMARKS:**

IOA DID NOT CONSIDER INDIVIDUAL TANK SEAL FAILURES. IOA AGREES WITH NASA/RI REEVALUATION AND RATIONALE FOR 2/1R PFP ASSIGNMENT. IOA RECOMMENDS ADDING STATEMENTS TO THE EFFECTS ABOUT POSSIBLE CORROSION, FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS DUE TO PROP LEAKAGE.

REPORT DATE 2/26/88

C-68

| ASSESSMENT DA ASSESSMENT ID NASA FMEA #: | E: 1/01/88 OMS-165 03-3-20 | : 1/01/88 NASA DATA: OMS-165 BASELINE [] 03-3-2009-1 NEW [X] | | | | | |
|--|---|---|-----------------|-----------------------|---------------------|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 165 COUPLIN | G-PROP TAN | IK, HORIZO | NTAL DRAIN | 1 PORT | | |
| LEAD ANALYST: | C.D. PR | UST | | | | | |
| ASSESSMENT: | | | | | | | |
| CRITI FL | CALITY IGHT | REDUNDANC | CY SCREENS | | CIL ITEM | | |
| HDW | FUNC | А | В | C | | | |
| NASA [2 IOA [2 | /1R] [/1R] [| F] [P] [| F] [NA] [| P] P] | [X] * [X] | | |
| COMPARE [| ′] [| N] [| N] [|] | [] | | |
| RECOMMENDATIO | RECOMMENDATIONS: (If different from NASA) | | | | | | |
| [2 | '1R] [| F] [| F] [| P] (AI | [A] DD/DELETE) | | |
| * CIL RETENTI | ON RATIONAL | E: (If app | plicable) IN | ADEQUATE IADEQUATE | | | |
| INADEQUATE [] REMARKS: NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD479, 480, 579, 580) HAVE BEEN ADDED TO 03-3-2009-1, PER IOA ISSUE. IOA AGREES WITH NASA/RI FAILURE OF A SCREEN BASED ON INABILITY TO VERIFY CONDITION OF CAP SEAL AFTER CAP INSTALLATION. IOA ALSO AGREES WITH NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS. IOA ALSO RECOMMENDS THAT A STATEMENT BE ADDED TO THE EFFECTS ABOUT POSSIBLE CORROSION, FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS DUE TO PROP LEAKAGE. | | | | | | | |

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | ENT DATE: ENT ID: EA #: | 1/01/88 OMS-166 03-3-2009 |)-3 | NASA DATA: BASELINE [] NEW [X] | | | | | |
|----------------------------------|-------------------------------------|--|----------------------------------|---|-------------------------|----------------------------|----------------|------------|--------------|
| SUBSYSTE MDAC ID: ITEM: | E M : | OMS 166 COUPLING- | PROP TA | NK, НО | RIZON | TAL DRA | IN PC | RT | |
| LEAD ANA | LYST: | C.D. PRUS | ST | | | | | | |
| ASSESSME | ENT: | | | | | | | | |
| | CRITICAL: FLIGH | ITY F F | REDUNDAN | CY SCR | EENS | | CII ITE | EM | |
| | HDW/FUI | NC I | A | В | C | | | | |
| NASA IOA | [3 /3 [3 /3 |] [] [|] [] [|] | [[|]] | [[|] *] | : |
| COMPARE | [/ | J [| ן ב |] | [|] | [|] | |
| RECOMMEN | DATIONS: | (If dif | ferent | from N | ASA) | | | | |
| | [3/3 |] [|] [|] | Ľ |) (|] ADD/I |] DELEI | ĽE) |
| * CIL RE | ETENTION 1 | RATIONALE | (If ap | plicab | le) A INA | DEQUATE DEQUATE | [[|]] | |
| REMARKS: IOA FAII AND "RES | LURE MODE: STRICTED | S ON ANALY FLOW". | SIS SHE | et sho | ULD I | | "FAII | LS CI | .OSED" |
| NASA/RI HOWEVER, 580) HAV | DID NOT A THE REF ZE BEEN A | DES NUMBI DED TO 03 | COVER T ERS FOR 3-3-2009 | THIS CO -3, PE | OUPLI R IOA | NG (MD4 ISSUE. | 79, 4 | 80, | 579, |
| IOA RECO TO THE H MODES AN | OMMENDS T FAILURE M ND ARE AD | HAT "FAILS ODES ON TH DRESSED ON | 5 CLOSED HIS FMEA N RCS QD | " AND . THE COUPI | "RESI SE AR ING F | RICTED E CREDI MEAS. | FLOW" BLE F | BE BILU | ADDED IRE |

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| ASSESSMENT DATE:1/01/88NASA DATA:ASSESSMENT ID:OMS-167BASELINE []NASA FMEA #:03-3-2009-2NEW [X] | | | | | |]] | | |
|---|--------------------------|--|--------|--------|---------|-------------|-------------|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 167 COUPLING-1 | S 7 DUPLING-PROP TANK, HORIZONTAL DRAIN PORT | | | | | | |
| LEAD ANALYST: C.D. PRUST | | | | | | | | |
| ASSESSMENT: | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL | | | | | | | | |
| HDW/FU | NC A | E | 3 | С | | | 1 | |
| NASA [3 /3 IOA [3 /3 |] [] [|] [] [|]] | [[|] | [[|] *] | |
| COMPARE [/ |] [|] [|] | [|] | [|] | |
| RECOMMENDATIONS: | (If dif: | ferent fr | om NAS | SA) | | | | |
| [/ |] [|] [|] | [|] (A |] ID/DD. |] ELETE) | |
| * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEOUATE [] | | | | | | | | |
| REMARKS: IOA FAILURE MODES ON ANALYSIS SHEET SHOULD NOT INCLUDE "FAILS TO OPEN" AND "RESTRICTED FLOW". NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. | | | | | | | | |

HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD479, 480, 579, 580) HAVE BEEN ADDED TO 03-3-2009-2.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | NASA DATA: BASELINE [] NEW [X] | | | | | | |
|--|---|------------------------------|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 168 COUPLING-TANK ACQ. SYSTEM | TRAP FILL/VENT PORT | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | |
| ASSESSMENT: | | | | | | | |
| CRITICALI FLIGHI HDW/FIN | TY REDUNDANCY SCREENS | CIL ITEM | | | | | |
| | | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [F] [F] [] [P] [NA] [| P] []* P] [X] | | | | | |
| COMPARE [/ |] [N] [N] [|] [N] | | | | | |
| RECOMMENDATIONS: (If different from NASA) | | | | | | | |
| [2 /1R |] [F]] [F,] [| P] [A] (ADD/DELETE) | | | | | |
| * CIL RETENTION F | ATIONALE: (If applicable) | ADEQUATE [] ADEQUATE [] | | | | | |
| REMARKS: NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. ACT HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD426, 427, 526, 527) HAVE BEEN ADDED TO 03-3-2001-1, PER IOA ISSUE. IOA AGREES WITH NASA/RI FAILURE OF A SCREEN BASED ON INABILITY TO VERIFY CONDITION OF CAP SEAL AFTER CAP INSTALLED. IOA ALSO AGREES WITH NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS. IOA ALSO RECOMMENDS THAT THE EFFECTS INCLUDE POSSIBLE VIOLATIONS OF ORBITER ENTRY MASS PROPERTIES CONSTRAINTS AND PROP TANK LANDING WEIGHT CONSTRAINTS, AND POSSIBLE PROP LEAKAGE RESULTING IN CONTAMINATION, FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND | | | | | | | |

REPORT DATE 2/26/88

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| ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #: | : 1/01/88 OMS-169 03-3-20 | /01/88 NASA DATA: MS-169 BASELINE [] 03-3-2001-3 NEW [X] | | | | | |]] |
|---|---|--|--------|--------|--------|----------|-----------------------|-------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 169 COUPLIN | G-TANK | ACQ. | SYSTE | M TR | AP FILL | VENT | PORT |
| LEAD ANALYST: | C.D. PR | UST | | | | | | |
| ASSESSMENT: | | | | | | | | |
| CRITICA | LITY | REDUND | ANCY | SCREE | INS | | CIL | л |
| HDW/H | UNC | A | В | | С | | T T D 1 | • |
| NASA [3 /3 IOA [3 /3 |] [|]] | [[|] | [[|] | [|] *] |
| COMPARE [/ |] [| 1 | [|] | [|] | [|] |
| RECOMMENDATIONS | : (If d | lifferen | t fro | om NAS | SA) | | | |
| [3/3 |] [|] | Γ |] | [| j (Al |] נס/סס |] ELETE) |
| * CIL RETENTION | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | |
| REMARKS: IOA FAILURE MOI | REMÀRKS: IOA FAILURE MODES ON ANALYSIS SHEET SHOULD INCLUDE "FAILS CLOSED" | | | | | | | |

AND "RESTRICTED FLOW". NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD426, 427, 526, 527) HAVE BEEN ADDED TO 03-3-2001-3, PER IOA ISSUE. IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-170 NASA FMEA #: 03-3-2001-2 | | | | | NASA DAT BASELIN NE | A: E [W [X |] | |
|--|-----------------------|------------------------|--------------------------|--------|---------------------------|-----------------------|-------------|------------|
| SUBSYSTEM MDAC ID: ITEM: | M: | OMS 170 COUPLING | G-TANK | ACQ. | SYSTEM | unte I TRAP FIL | L/VENT | PORT |
| LEAD ANAL | LYST: | C.D. PR | JST | | | ų · · | | |
| ASSESSME | NT: | | | | | | | |
| , (| CRITICAL | ITY P | REDUNI | DANCY | SCREEN | IS | CIL ITEM | |
| | HDW/FUI | NC | A | В | | C | 11154 | |
| NASA IOA | [3 /3 [3 /3 |] [] [|] | [[|] [|] | [[|] *] |
| COMPARE | [/ |] [| ٦. ا | [|] (|] | C |] |
| RECOMMENI | DATIONS: | (If di | ifferer | nt fro | om NASZ | X) | | |
| | [/ | Ĵ [|] | [| <u>ן</u> ו |] (| [ADD/DE |] LETE) |
| * CIL RE | TENTION 1 | RATIONALI | 2: (If | appli | icable) I | ADEQUATE NADEQUATE | |] |
| REMARKS: IOA FAILU OPEN" ANU NASA/RT U | JRE MODES D "RESTR | 5 ON ANAI ICTED FLO | LYSIS S DW". COVER | HEET | SHOULI COUPI | NOT INCL | UDE "F | AILS TO |

HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD426, 427, 526, 527) HAVE BEEN ADDED TO 03-3-2001-2, PER IOA ISSUE.

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REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | : 1/01/88 OMS-171 03-3-2001-1 | NASA DATA: BASELINE NEW | [] [X] | | | | |
|--|-------------------------------------|-------------------------------|--------------------|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 171 COUPLING-TANK A | ACQ. SYSTEM FILL/VENT | PORT | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | |
| ASSESSMENT: | | | | | | | |
| CRITICAL | LITY REDUNDA | ANCY SCREENS | CIL | | | | |
| HDW/FU | JNC A | ВС | 1154 | | | | |
| NASA [2 /1] IOA [2 /1] | R] [F] R] [P] | [F] [P] [NA] [P] | [] * [X] | | | | |
| COMPARE [/ |] [И] | [N] [] | [N] | | | | |
| RECOMMENDATIONS: (If different from NASA) | | | | | | | |
| [2 /1] | R] [F] | [F] [P] ['] (AC | [A] D/DELETE) | | | | |
| * CIL RETENTION | RATIONALE: (If a | applicable) | | | | | |
| | | ADEQUATE INADEQUATE | | | | | |
| REMARKS: NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD421, 422, 521, 522) HAVE BEEN ADDED TO 03-3-2001-1, PER IOA ISSUE. IOA AGREES WITH NASA/RI FAILURE OF A SCREEN BASED ON INABILITY TO VERIFY CONDITION OF CAP SEAL AFTER CAP INSTALLED. IOA ALSO AGREES WITH NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS. IOA ALSO RECOMMENDS THAT THE EFFECTS INCLUDE POSSIBLE VIOLATIONS OF ORBITER ENTRY MASS PROPERTIES CONSTRAINTS AND PROP TANK LANDING WEIGHT CONSTRAINTS, AND POSSIBLE PROP LEAKAGE RESULTING IN CONTAMINATION, FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND | | | | | | | |

REPORT DATE 2/26/88

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| | ASSESSME ASSESSME NASA FME | ent Ent Ea | DA IC #: | ATE: | 1/01/88 OMS-172 03-3-2001-3 | | | | | | NASA DATA: BASELINE [NEW [X | | |] | . . | |
|---|---|------------------|------------------|-------------|-----------------------------------|-----------------------|----------------|--------------------|--------------|---------------|-------------------------------------|------------|--------------|----------|------------|----|
| | SUBSYSTE MDAC ID: ITEM: | : M | | | OMS 172 COUI | PLING- | TANK | ACQ. | SYS | TEM | FILL/V | ENT | POR | | <u>*</u> | |
| | LEAD ANA | LY | ST: | | C.D | . PRUS | т | | | | | | | | | |
| | ASSESSME | INT | : | | | | | | | | | | 2 | | . T. | |
| | | CR | ITI FI HDW | CAL LIGH | ITY T NC | R | EDUN | DANCY | SCF | REENS | C | | CII ITE | M | | |
| | | | 110 | / 10 | - | - | - | | - | r | - , | | ~ | , | ъ | |
| | NASA IOA | l [| 3 | /3 |] | L [|] | [|] | [|] | | L [|] | • | |
| | COMPARE | [| | / |] | [|] | [|] | ٢ |] | | [|] | | |
| | RECOMMEN | IDA | TIC | ons: | (: | If dif | fere | nt fro | om N | IASA) | | | | | | |
| | | [| 3 | /3 |] | [|] | [|]. | ſ |] | (AI | [)D/D |] ELE | TE) | |
| | * CIL RE | TE | NTI | ON | RATI | ONALE: | (If | appl | icat | ole) | : | | | | | |
| | | | | | | | | | | IN | ADEQUA ADEQUA | ATE ATE | [[|] | | |
| - | REMARKS: IOA FAII AND "RES | LUR STR | E N ICI | iode Ted | S ON FLOW | ANALY | SIS | SHEET | SHC | ULD | INCLUE | DE "I | FAIL | s c | LOSE | D" |
| | NASA/RI HOWEVER, | DI T | DN HE | IOT REF | APPE DES | AR TO <u>NUMBE</u> | COVE RS F | R THIS | s co Is c | OUPLI | NG ORI ING (M | ID42 | λιιν L, 4 | · 22, | 521 | , |
| | 522) HAV | /E | BEE | EN A | DDED HAT | TO 03 | -3-2 CLO | 001-3 SED" / | , PÉ AND | R IO RES | A ISSU TRICTE | D FI | LOW" | BE | ADD | ED |
| | TO THE H | FAI ID | LUF | E M | ODES DRES | ON TH | IS F RCS | MEA. | THE | ESE A LING | RE CRE FMEAS. | DIBI | LE F | 'AIL | URE | |
| | | | | | | · | | | | | , - <u></u> | • | | | | |
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| | 1. The second | | 27 | <u></u> | | 나는 그는 문제에서 | . . | .* .* <u>*</u> *** | | | | | | | - 1 M - 4 | |

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT D NT I A #: | ATE: D: | 1/01/88 NASA DATA OMS-173 BASELINE 03-3-2001-2 NEV | | | | | | | DATA LINE NEW | : [] |] X] | |
|----------------------------------|--|--------------|--|--------------|--------|--------|--------|--------|-------|---------------------|-------------|-------------|------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 173 COUPI | JING- | TANK | ACQ. | SYS | STEM | FILL/ | VENT | PO | RT | |
| LEAD ANA | LYST | : | C.D. | PRUS | Т | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| | CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | |
| FLIGHT HDW/FUNC A B C | | | | | | | | | | | | 111 | |
| NASA IOA | [3 [3 | /3 /3 |]] | [[|]] | [[|]] | [[|] | | ((|] *] | |
| COMPARE | Γ | / |] | ٢ |] | [|] | נ |] | | [|] | |
| RECOMMEN | DATI | ons: | (If | dif | fere | nt fro | 1 mc | NASA) | | | | | |
| | [| / |] | [|] | [|] | [|] | (A) |] DD/ |] DELETH | 2) |
| * CIL RE | CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | | |
| REMARKS: IOA FAII OPEN" AN | URE | MODE ESTR | S ON A | NALY FLOW | SIS | SHEET | SHO | OULD | NOT I | NCLU | DE | "FAILS | 5 то |

NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD421, 422, 521, 522) HAVE BEEN ADDED TO 03-3-2001-2, PER IOA ISSUE.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT DATE: NT ID: A #: | 1/01/88 OMS-174 03-3-20 | 01-1 | | NASA DATA BASELINE NEW | : | | | |
|---|--|---|---|--|--|--|--|--|--|
| SUBSYSTE MDAC ID: ITEM: | M: | OMS 174 COUPLIN | G-PROPEI | LANT, TANI | K TEST PORT | | | | |
| LEAD ANA | LYST: | C.D. PR | UST | | | | | | |
| ASSESSME | NT: | | | | | | | | |
| (| CRITICAL | LTY P | REDUNDA | CIL | | | | | |
| | HDW/FUN | 4C | A | В | С | ITEM | | | |
| NASA IOA | [2 /1R [2 /1R |] [| F] P] | [F] [NA] | P] P] | [] * [X] | | | |
| COMPARE | [/ |] [| N] | [N] | :] | [N] | | | |
| RECOMMENI | DATIONS: | (If d | ifferent | from NASP | A) | | | | |
| • | [2 /1R |] [| F] | [F] (| [P] (Al | [A] DD/DELETE) | | | |
| * CIL RE1 | FENTION F | RATIONALI | E: (If a | pplicable)] | ADEQUATE NADEQUATE | [] | | | |
| REMARKS: NASA/RI I HOWEVER, 517) HAVI IOA AGREI VERIFY CO AGREES WI IOA RECOM AS A FAII AND IS AI IOA ALSO OF ORBITH LANDING W IN CONTAM CREWS. | DID NOT A THE REF E BEEN AD ES WITH N DNDITION TH NASA/ MENDS TH LURE MODE DRESSED RECOMMEN ER ENTRY VEIGHT CO MINATION, | APPEAR TO DES NUME DED TO O IASA/RI H OF CAP S TRI FAILU IAT "POPH ON THIS ON RCS O IDS THAT MASS PRO ONSTRAINT FIRE, H | COVER BERS FOR 03-3-200 FAILURE SEAL AFT JRE OF B PET FAIL S FMEA. QD COUPL THE EFF DPERTIES TS, AND EXPLOSIO | THIS COUPI THIS COUP 1-1, PER 1 OF A SCREE ER CAP INS SCREEN. S OPEN (DU THIS IS A ING FMEAS. ECTS INCLU CONSTRAIN POSSIBLE F N, AND EXF | LING ORIGINA PLING (MD416 OA ISSUE. IN BASED ON TALLED. IC RING FLIGHT CREDIBLE H DE POSSIBLE TS AND PROF PROP LEAKAGE OSURE OF EV | ALLY. 5, 417, 516, INABILITY TO DA ALSO F)" BE ADDED FAILURE MODE E VIOLATIONS F TANK E RESULTING VA AND GROUND | | | |

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-175 03-3-200 | 1/01/88 NASA DATA: 0MS-175 BASELINE [] 03-3-2001-3 NEW [X] | | | | | | | | |
|--|-----------------------------------|--|----------------|----------------|-----------------|-----------|------------------------|-----------|--------|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 175 COUPLING | -PROP | ELLAN | ИТ, Т. | ANK I | EST PORT | | | | |
| LEAD ANALYST: | C.D. PRU | ST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAI FLIGH | LITY IT | REDUN | DANC | SCR | EENS | | CII ITE | M | | |
| HDW/FU | JNC | A | E | 3 | C | 2 | | | | |
| NASA [3 /3 IOA [3 /3 |] [] [|] | [[|]] | [[|]] | [[|]] | * | |
| COMPARE [/ |] [|] | [|] | [|] | [|] | | |
| RECOMMENDATIONS | (If di | ffere | nt fi | com N | ASA) | | | | | |
| [3 /3 |] [|] | [|] | [|] (A | [DD/D |] DELE | TE) | |
| * CIL RETENTION | RATIONALE | :: (If | appl | Licab | le) J INJ | DEQUATE | [, [|]] | | |
| REMARKS: IOA FAILURE MODI AND "RESTRICTED NASA/RI DID NOT | ES ON ANAI FLOW". APPEAR TO | LYSIS COVE | SHEET R THI | r sho Is co | UPLIN | INCLUDE " | FAII Ally | s c | LOSED" | |
| HOWEVER, THE REL | DES NUME | BERS F | OR TH | HISC | OUPLI | NG (MD41 | 6, 4 | 17, | 516, | |

517) HAVE BEEN ADDED TO 03-3-2001-3, PER IOA ISSUE. IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSMENT D ASSESSMENT D NASA FMEA #: | DATE: | 1/01/ OMS-1 03-3- | 88 76 2001 | -2 | | N | ASA DATA BASELINE NEW | : [x |] | | |
|--|---|------------------------------------|--------------------|-----------------------|--------------|--------|-----------------------------|----------------------------------|----------------------|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | | OMS 176 COUPL | ING- | PROPE | LLAN | T, TAN | IK TI | EST PORT | | na (a fuera) - C La la marco de como en | |
| LEAD ANALYST | : | C.D. | PRUS | т | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRIT | ICAL | ITY | R | EDUND | ANCY | SCREE | INS | | CIL | M | |
| HE | W/FU | NC | A | | В | | C | | | •• | |
| NASA [3 IOA [3 | /3 |]] | [[|] 1 | [[|]] | [[|]] | ן נ |] * | |
| COMPARE [| / |] | [|] | [|] | [|] | Γ |] | |
| RECOMMENDATI | ONS: | (If | dif | ferent | t fro | om NAS | SA) | | | | |
| Ē | / | 3 | [|] | [|] | [|] (A |] DD/D |] ELETE) | |
| * CIL RETENT | NON | RATION | ALE: | (If a | appl: | icable | e) Al INAI | DEQUATE DEQUATE | с с |] | |
| REMARKS: IOA FAILURE OPEN" AND "F NASA/RI DID | MODE ESTR NOT | S ON A ICTED APPEAR DES M | NALY FLOW TO | SIS SI ". COVER | HEET THIS | SHOUI | D N | OT INCLU G ORIGIN NG (MD41 | DE " ALLY 6. 4 | FAILS TO | |
| 517) HAVE BE | WEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD418, 417, 518, 17) HAVE BEEN ADDED TO 03-3-2001-2, PER IOA ISSUE. | | | | | | | | | | |

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-177 03-3-3202- | -1 | | NASA DATA BASELINE NEW | : [] [X] |
|--|----------------------------------|------------|---------------|------------------------------|-------------------|
| SUBSYSTEM: MDAC ID: ITEM: | oms 177 Gaging Pro | OBE, FORW | ARD COME | PARTMENT | |
| LEAD ANALYST: | | | | | |
| ASSESSMENT: | | | | | |
| CRITICAI | JITY R | EDUNDANCY | SCREENS | 5 | CIL ITEM |
| HDW/FU | INC A | В | | С | |
| NASA [3 /3 IOA [3 /3 |] [] [|] [] [|] [] [|]] | [] * [] |
| COMPARE [/ |] [|] [|] [|] | [] |
| RECOMMENDATIONS: | (If dif: | ferent fr | om NASA) | I | |
| [/ |] [|] [|] [|] (A | [] DD/DELETE) |
| * CIL RETENTION | RATIONALE: | (If appl | icable) IN | ADEQUATE VADEQUATE | [] [] |
| REMARKS: NO DIFFERENCES. | IOA ANALY | ZED FORWA | RD AND A | AFT PROBES | SEPARATELY |

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ENT I ENT 1 EA # : | DATE: | 1/01/ OMS-1 03-3- | -1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | |
|----------------------------------|---------------------------------|--------------|-------------------------|--------|---|--------|--------|-----------------|----------------|------------|-----------|--------------|
| SUBSYSTE MDAC ID: ITEM: | em : : | | OMS 178 GAGIN | ig pr | OBE, | FORW | ARD | COMP | ARTME | NT | ** | |
| LEAD ANA | ALYSI | :: | C.D. | PRUS | Т | | | | | | | |
| ASSESSME | ENT: | | | | | | | | | • | | |
| | CRIT | TICAL | ITY | R | EDUN | DANCY | SCR | EENS | | | CIL | M |
| | HI | W/FU | NC | A | | В | i i | C | 2 | - | · · · · | • |
| NASA IOA | [3 | 3 /3 3 /3 |] | [[|]] | [[|]] | [[|] | | [[|] *] |
| COMPARE | Γ | / |] | [|] | [|] | [|] | | [|] |
| RECOMMEN | NDATI | IONS: | (If | dif | fere | nt fr | om N | ASA) | | | | |
| | [| / |] | נ |] | [|] | [|] | (AI | [DD/D |] DELETE) |
| * CIL RE | ETENI | TION | RATION | ALE: | (If | appl | icab | le) / IN/ | ADEQU ADEQU | ATE ATE | |]] |
| REMARKS: NO DIFFI | : ERENC | CES. | IOA A | NALY | ZED | FORWA | RD A | ND AI | T PR | OBES | SEF | ARATELY. |

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT NT A # | DATE: ID: : | 1/01/88 OMS-179 NONE | | | | | | ASA BASE | DATA: LINE NEW | [[|]] | |
|----------------------------------|-----------------|-------------------|----------------------------|--------|--------|--------|--------|----------------|-------------|----------------------|---------------|-----------|-----|
| SUBSYSTE MDAC ID: ITEM: | м: | | OMS 179 GAGINO | G PRO |)BE, F | ORWA | ARD CC | MPA | RTME | NT | | | |
| LEAD ANA | LYS | т: | C.D. 1 | PRUST | 2 | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | |
| | CRI | TICAL | ITY | RI | DUNDA | NCY | SCREE | INS | | | CIL | л | |
| | Н | DW/FU | NC | A | | В | | C | 1 | | | • | |
| NASA IOA | [[| / 3 /3 |]] | [[|] | [[|]] | [[|]] | | [[|] | * |
| COMPARE | Γ | N /N |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | DAT | IONS: | (If | difi | ferent | : fro | om NAS | SA) | | | | | |
| | [| / |] | [|] | [|] | [|] | (AI | [[] [] |] ELE' | TE) |
| * CIL RE | TEN | TION | RATION | ALE: | (If a | appli | icable | e) A INA | DEQU | ATE ATE | [|]] | |
| REMARKS: NASA/RI | DO | NOT C | OVER TI | HIS | FAILUE | RE MO | DDE. | THI | S FA | ILURE | e moi | DE, | |

NASA/RI DO NOT COVER THIS FAILURE MODE. THIS FAILURE MODE, "ERRATIC OPERATION", IS CONSIDERED BY IOA TO BE ADEQUATELY COVERED UNDER THE NASA/RI FMEA WITH FAILURE MODE "ERRONEOUS INDICATION, LOSS OF OUTPUT" (03-3-3202-1). THE EFFECTS OF THESE TWO FAILURE MODES ARE THE SAME. IOA ANALYZED FORWARD AND AFT PROBES SEPARATELY.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT DA NT II A #: | ATE: D: | 1/01/3 OMS-13 NONE | | | NASA DATA: BASELINE [] NEW [] | | | | | |
|---|-------------------------|-----------------------|-----------------------------|------------------------|-------------------------|---------------------------------------|--------------------------|------------------|------------------------------|-----------------------------|---------------------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 180 GAGINO | G PRO | DBE, I | FORW | ARD C | | RTMENT | , FUEL | |
| LEAD ANA | LYST: | : | C.D. 1 | PRUSI | 2 | | | | | | |
| ASSESSME | NT: | | | | | | | | | | |
| | CRITI FI | CAL | ITY r | RE | DUND | ANCY | SCREI | ens | | CIL ITEN | প |
| | HDW | V/FUI | NC | A | | В | | C | | | • |
| NASA IO A | [[3 | / /3 |]] | ((|] | [[|] | [[|]] | [[|] *] |
| COMPARE | [_ท | /N |] | [|] | [|] | [` |] | [|] |
| RECOMMEN | DATIC | ONS: | (If | diff | erent | t fro | om NAS | 5A) | | | |
| | [| / |] | [|] | [|] | [|] | [(ADD/DI |] ELETE) |
| * CIL RE | TENTI | ION I | RATION | ALE: | (If a | appl | icable | ≥) Al TNAI | DEQUATI | E (P (|] |
| REMARKS: NASA/RI RECOMMEN PROBE "E | DO NO DS AL RRONE | OT CO DINC LOUS | OVER TH 5 THIS INDICA | HIS F FAII ATION | AILUI URE N I FMI | RE MO MODE EA (O | DDE (0 AS A 03-3-3 | CAUS 202 | S FRACT SE ON T -1). A | URE). THE FOR A SEPAR | IOA RWARD RATE FMEA |

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IS NOT REQUIRED. FAILURE HISTORY OF PROBE INCLUDES THIS FAILURE. IOA ANALYZED FORWARD AND AFT PROBES SEPARATELY.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT I NT] A #: | DATE: LD: ; | 1/01/ OMS-1 03-3- | 88 81 3202: | -1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | |
|----------------------------------|----------------------|-------------------|-------------------------|-------------------|-------|---|--------|-----------------|------------------|----------|------------|-------------|--|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 181 GAGIN | g pr(| OBE, | FORW | ARD C | OMPAI | RTMEN | r | | | |
| LEAD ANA | LYS | r: | C.D. | PRUS | Г | | | | - | | | | |
| ASSESSME | NT: | | | | | | | | | | | | |
| | CRI | FICAL | ITY | R | EDUNI | DANCY | SCRE | ENS | | | CIL | м | |
| | H | DW/FU | NC | A | | ВС | | | | | ÷ | - | |
| NASA IOA | [] | 3 /3 3 /3 |]] | [[|] | [[|]] | [[|] | | [[|] *] | |
| COMPARE | [| 1 |] | [- |] | [|] | [|] | | [|] | |
| RECOMMEN | DAT | IONS: | (If | dif | ferer | nt fr | om NA | SA) | | | | | |
| | [| 1 |] | . |] | נ |] | [|] | (Al | ן וס/סכ |] ELETE) | |
| * CIL RE | TEN' | TION | RATION | ALE: | (If | appl | icabl | e) Al INA | DEQUA' DEQUA' | TE TE | [[|]] | |
| REMARKS: | REN | CES. | NASA/ | RI L | ISTS | "PRO | P INT | ERNA | L LEA | KAG | E" A: | 5 CAUSE | |

ON "ERRONEOUS INDICATION, LOSS OF OUTPUT" FMEA. IOA ANALYZED FORWARD AND AFT PROBES SEPARATELY.

REPORT DATE 2/26/88

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| ASSESSMENT DA ASSESSMENT II NASA FMEA #: | TE: 1/01/8): OMS-18 03-3-3 | 8 2 202-1 | | NASA D. BASEL | NASA DATA: BASELINE [] NEW [X] | | | | | | | |
|---|---|-----------------|--------|------------------|---|---|-------------|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 182 GAGING | PROBE, | AFT C | COMPAR | rment | | | | | | | |
| LEAD ANALYST: | C.D. P | RUST | | | | | | | | | | |
| ASSESSMENT: | | | | | | 5 E | | | | | | |
| CRITI | CALITY | REDUN | DANCY | SCREE | NS | CIL | r | | | | | |
| HDW | /FUNC | A | В | | C | + | • | | | | | |
| NASA [3 IOA [3 | /3] /3] | [] [] | [[|]] | [] [] | [[|] *] | | | | | |
| COMPARE [| /] | [] | [|] | []] | Γ |] | | | | | |
| RECOMMENDATIO | NS: (If | differe | nt fro | om NASZ | A) | | | | | | | |
| ſ | / 1 | [] | [|] | [] | [(ADD/DE |] :LETE) | | | | | |
| * CIL RETENTI | ON RATIONA | LE: (If | appli | cable; |) ADEQUA | TE (TE (|] | | | | | |
| REMARKS: NO DIFFERENCE REGARDING THE AFTER LOSS OF | MARKS: DIFFERENCES. IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS GARDING THE INABILITY TO DETECT FAILURE OF COMMUNICATION SCREEN TER LOSS OF OUTPUT FROM AFT PROBE. IOA ANALYZED FORWARD AND | | | | | | | | | | | |

AFT PROBES SEPARATELY.
| ASSESSME ASSESSME NASA FME | NT I NT I A #: | DATE: | 1/01/ OMS-1 03-3- | /01/88 NASA DATA: MS-182A BASELINE [] 3-3-3202-4 NEW [X] | | | | | | | | | |
|----------------------------------|--|--------------|-------------------------|--|--------|--------|--------|--------|--------|-----|-------------|--------------|--|
| SUBSYSTE MDAC ID: ITEM: | М: | | OMS 182 GAGIN | G PF | OBE, | AFT | COMP | ARTMI | ENT | - | | | |
| LEAD ANA | LYSI | : | C.D. | PRUS | ST | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | |
| | CRIJ | TICAL | ITY | F | REDUN | DANCY | C SCR | EENS | | | CII TTTE | 'M | |
| | HI | W/FU | NC | I | ł | I | 3 | C | 2 | | | | |
| NASA IOA | [3 | 3 /3 3 /3 |]] | [[|]] | [[|]] | ((|]] | | [[|] *] | |
| COMPARE | [| / |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | DATI | IONS: | (If | di: | ffere | nt fi | com N | IASA) | | | | | |
| | [| / |] | [|] | [|] | [|] | (A) | [DD/I |] DELETE) | |
| * CIL RE | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | | |
| REMARKS: NO DIFFE | EMARKS: O DIFFERENCES. IOA ANALYZED FORWARD AND AFT PROBES SEPARATELY. | | | | | | | | | | | | |

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT D NT I A #: | ATE: D: | 1/01/ OMS-1 03-3- | 88 83 3202- | -3 | | | N | ASA BASE | DATA: LINE NEW | [[X |] |
|----------------------------------|----------------------|------------|-------------------------|-------------------|----------|--------|--------|--------------------|--------------|----------------------|-----------|-------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 183 GAGIN | G PR | OBE, | AFT | COMI | PARTME | NT | | | . |
| LEAD ANA | LYST | : | C.D. | PRUS | r | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | |
| | CRIT | ICAL | ITY | R | EDUNE | DANCY | SCI | REENS | | | CIL | M |
| | HD | W/FU | NC NC | A | | B | | c | | | 110 | 11 |
| NASA IOA | [3 [3 | /3 /3 |] | [|] | [[|]] | [|]] | | [[|] *] |
| COMPARE | [| / |] | [|] | [|] | [|] | | [|] |
| RECOMMEN | DATI | ons: | (If | dif | ferer | nt fr | om 1 | NASA) | | | | |
| | [| 1 | <u>ַ</u> | [| <u>ן</u> | [|] | [|] | (AI |] ס/סכ |] ELETE) |
| * CIL RE | TENT | ION | RATION | ALE: | (If | appl | icak | ole) - A INA | DEQU DEQU | ATE ATE | [[|] |
| NO DIFFE | RENC | ES. | IOA A | NALY | ZED F | ORWA | RD A | AND AF | T PR | OBES | SEP | ARATELY. |

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT D NT I A #: | ATE: D: | 1/01 OMS- 03-3 | /01/88 NASA DATA: MS-183A BASELINE [] /3-3-3202-1 NEW [X] | | | | | | | | |
|----------------------------------|-----------------------------|------------|----------------------|--|--------|--------|--------|-----------------|--------------|------------|------------|-------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 183 GAGI | NG PRO | OBE, | AFT | COMP | ARTME | :NT | | | |
| LEAD ANA | LYST | : | C.D. | PRUS | r | | | | | | - | |
| ASSESSME | NT: | | | | | | | | | | | |
| | CRIT | ICAL | ITY T | R | EDUN | IDANCY | SCR | EENS | | | CIL ITE | M |
| | HD | W/FU | NC | А | | E | 5 | C | 2 | | | |
| NASA IOA | [3 [3 | /3 /3 |]] | [|]] | [[|]] | [[|]] | | [[|] *] |
| COMPARE | ٢ | / |] | ſ |] | [|] | [|] | | [|] |
| RECOMMEN | DATI | ONS: | () | f dif | fere | ent fr | om N | ASA) | | | | |
| | [| / |] | ľ |] | [|] | Γ |]. | (A) | [DD/D |] ELETE) |
| * CIL RE | TENI | ION | RATIC | ONALE: | (I1 | f appl | icab. | le) / IN/ | DEQU DEQU | ATE ATE | [[|] |
| REMARKS: NO DIFFE | RENC | ES. | IOA | RECOM | MENI | S ADE | ITIO | N OF | FOLLA | OWING | G IN | FORMAT |

NO DIFFERENCES. IOA RECOMMENDS ADDITION OF FOLLOWING INFORMATION TO EFFECTS: FALSE INDICATION OF COMMUNICATION SCREEN FAILURE (LESS THAN FULL AFT COMPARTMENT READING WITH PROP REMAINING IN FORWARD COMPARTMENT) MAY RESULT IN PERFORMANCE OF SETTLING BURNS PRIOR TO OMS BURNS AND LOSS OF ONORBIT INTERCONNECT. IOA ANALYZED FORWARD AND AFT PROBES SEPARATELY.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ENT ENT EA (| D/ II #: | ATE: D: | 1/01/8 OMS-18 NONE | 38 34 | | | | ł | IASA I BASEI | DATA: LINE NEW | [[|] | |
|----------------------------------|--------------------|----------------|------------|--------------------------|----------|-------|--------|--------|----------------|-----------------|----------------------|---------------|----------|-----|
| SUBSYSTI MDAC ID: ITEM: | em : : | | | OMS 184 GAGING | ; PRC | BE, A | FT (| COMPAR | YTME | ENT | | | | |
| LEAD AND | LYS | ST | : | C.D. 1 | PRUSI | 2 | | | | | | | | |
| ASSESSMI | ENT | : | | | | | | | | | | | | |
| | CRI | IT] | | (TY | RE | DUNDA | NCY | SCREE | INS | | | CIL | ſ | |
| | F | HDV | V/FUI | 1C | A | | В | | Ċ | | m | T T DL | 1 | |
| NASA IOA | [[| 3 | / /3 |]] | [[|] | [[|] | [[|]] | | [[|]] | * |
| COMPARE | ۵ | N | /N |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | NDA: | FIC | ONS: | (If | diff | erent | fre | om NAS | SA) | | | | | |
| | [| | 1. |] | [|] | [|] | [|] . | (AE | [DD/DE |] ELE | TE) |
| * CIL RI | etei | NT) | ION I | RATION | ALE: | (If a | ppl: | icable | e) 7 IN7 | DEQUA DEQUA | ATE ATE | [[|] | |

REMARKS:

NASA/RI DO NOT COVER THIS FAILURE MODE. THIS FAILURE MODE, "ERRATIC OPERATION", IS CONSIDERED BY IOA TO BE ADEQUATELY COVERED BY THE NASA/RI FMEA WITH THE FAILURE MODE "ERRONEOUS INDICATION, LOSS OF OUTPUT" (03-3-3202-1). THE EFFECTS OF THESE TWO FAILURE MODES ARE THE SAME. IOA RECOMMENDS ADDING STATEMENT TO EFFECTS REGARDING THE INABILITY TO DETECT A FAILURE OF THE COMMUNICATION SCREEN AFTER LOSS OF OUTPUT FROM AFT PROBE. IOA ANALYZED FORWARD AND AFT PROBES SEPARATELY.

REPORT DATE 2/26/88

| ASSESSMENT ASSESSMENT NASA FMEA | T DAT T ID: #: | E: 1/01 OMS- NONE | /88 185 | | | | N | ASA DATA BASELINE NEW | .: : [/ [|]] |
|--|-------------------------|----------------------------|------------------------|-----------------------|----------|-----------------------|------------------------|-----------------------------------|-------------------------|----------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | ; | OMS 185 GAGI | NG PF | OBE, | AFT | COMP | ARTME | NT, FUEI | J | |
| LEAD ANALY | (ST: | C.D. | PRUS | T | | | | | | |
| ASSESSMENT | :: | | | | | | | | | |
| CF | | ALITY | F | REDUN | DANCY | SCR | REENS | | CII | י ז אר י |
| | HDW/ | FUNC | A | 1 | E | 3 | C | : | | 111 |
| NASA (IOA (| [/ [3 / |] 3] | [[|]] | [[|]] | [[|]] | [[|] *] |
| COMPARE (| ע א / | N] | C |] | C |] | [|] | [|] |
| RECOMMENDA | ATION | 's: (I | f dif | fere | nt fi | com N | IASA) | | | |
| [| [/ |] | [|] | [|] | [|] | |] DELETE) |
| * CIL RETH | ENTIO | N RATIO | NALE: | (If | app] | licab | ole) A INA | DEQUATE | [[|] |
| REMARKS: NASA/RI DO RECOMMENDS "ERRONEOUS | D NOT 5 ADD 5 IND | COVER COVER CING THI | THIS S FAI " FMI | FAIL LURE EA (0 | URE MODE | 10DE E AS 8202- | (GLAS A CAU ·1). | S FRACTU JSE ON TH A SEPARA | JRE). HE AH ATE H | IOA TT PROBE TMEA IS |

NOT REQUIRED. FAILURE HISTORY OF PROBE INCLUDES THIS FAILURE MODE. IOA ANALYZED FORWARD AND AFT PROBES SEPARATELY.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: | 1/01/88 | | NASA DATA: | | | | | | |
|--|-----------------------------------|------------------------------------|----------------------|-----------------------------|------------------------------------|--|--|--|--|
| ASSESSMENT ID: NASA FMEA #: | OMS-186 03-3-320 | 02-1 | | BASELINE NEW | [] [X] | | | | |
| SUBSYSTEM: MDAC ID: ITEM: | OMS 186 GAGING | PROBE, AF | T COMPAR | TMENT | | | | | |
| LEAD ANALYST: | C.D. PR | JST | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICAL | ITY | REDUNDAN | CY SCREE | NS | CIL | | | | |
| HDW/FU | NC | A | В | | | | | | |
| NASA [3 /3 IOA [3 /3 |] [] [|] [] [|]] | | [] * [] | | | | |
| COMPARE [/ |] [|] [|] | [] | [] | | | | |
| RECOMMENDATIONS: | (If d | ifferent | from NAS | A) | | | | | |
| [/ |] [|] [|] | [] (Al | [] DD/DELETE) | | | | |
| * CIL RETENTION | RATIONALI | E: (If ap | plicable |) ADEQUATE INADEQUATE | u∰teur <u>A</u> leys [] [] | | | | |
| REMARKS: NO DIFFERENCES. "ERRONEOUS INDIC FORWARD AND AFT | NASA/RI ATION, LA PROBES SI | LIST "PR DSS OF OU EPARATELY | OP INTER TPUT" FM | NAL LEAKAGE' EA. IOA ANA | " AS CAUSE ON ALYZED | | | | |

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REPORT DATE 2/26/88

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Second Contraction

| ASSESSME ASSESSME NASA FME | NT DATE: NT ID: A #: | 1/01/ OMS-1 03-3- | 1/01/88 NASA DAT OMS-187 BASELIN 03-3-3284-1 NN | | | | | | | |] | |
|----------------------------------|----------------------------|-------------------------|---|--------|--------|-------|--------------|------------------|-----|-----------|------------|-----|
| SUBSYSTE MDAC ID: ITEM: | M: | OMS 187 TOTAL | IZER | | | | | | | | | |
| LEAD ANA | LYST: | C.D. | PRUS | r | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | |
| | CRITICAL | LITY | R | EDUNI | DANCY | SCRI | EENS | | | CII | י זארי | |
| | HDW/FU | JNC | A | | В | | c | 2 | | | 1.1 | |
| NASA IOA | [3 /3 [3 /3 |]] | [[|]] | [[|] | [[|]] | | [[|] ' [| k |
| COMPARE | [/ |] | C |] | [|] | [|] | | [|] | |
| RECOMMEN | DATIONS | : (If | dif | fere | nt fr | om Nž | ASA) | | | • | | |
| | [/ |] | [|] | Ľ |] | [|] | (A) |] DD/D |] DELET | ΓE) |
| * CIL RE | TENTION | RATION | ALE: | (If | appl | icab: | le) | DEQUA | ΓE | [|] | |
| REMARKS: NO DIFFE | RENCES. | IOA R | ECOM | MEND | S ADD | ING S | INZ STATI | ADEQUA EMENTS | TO | l EFF | J TECTS | 5 |

ADDRESSING LOSS OF LOW PROP QUANTITY WARNING AND INABILITY TO DETECT COMMUNICATION SCREEN FAILURE.

REPORT DATE 2/26/88

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| ASSESSMENT DA ASSESSMENT II NASA FMEA #: | ATE: 1/01/3 D: OMS-13 NONE | 88 88 | | | NA E | SA DATA BASELINE NEW | : [[|] |
|--|---|---|--|---|-----------------------------------|--|---|-------------------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 188 TOTAL | IZER | | | | | | |
| LEAD ANALYST | : C.D. | PRUST | | | | | | |
| ASSESSMENT: | | | | | | | | |
| CRIT | ICALITY | REI | UNDANCY | SCREE | NS | | CIL | r |
| HD | W/FUNC | A | В | | С | | T T T T | • |
| NASA [IOA [3 | /] /3] | | |]] | [|] | [[|] *] |
| COMPARE [N | /N] | [] |] [| 3 | [|] | C |] |
| RECOMMENDATI | ONS: (If | diffe | erent fr | om NAS | A) | | | |
| C | 71 | t 3 |] [|] | [|] | [DD/DI |] ELETE) |
| * CIL RETENT | ION RATION | ALE: | (If appl | icable |) | | F | - |
| | | | | | AL INAC | DEQUATE | l [|] |
| REMARKS: NASA/RI DO N "ERRONEOUS I COVERED BY T OPERATION" (EFFECTS WHIC | OT COVER T NDICATION" HE NASA/RI 03-3-3284- H ADDRESS | HIS FA , <u>IS (</u> FMEA 1).] FALSE | VILURE M CONSIDER WITH TH COA RECO INDICAT | ODE. ED BY E FAIL MMENDS IONS O | THIS IOA URE ADE F PF | FAILURI TO BE A MODE "E DING STA ROP LOW (| e moi Dequa RRATI FEMEN QUANI | DE, ATELY C NTS TO CITY |

REPORT DATE 2/26/88

WARNING AND COMMUNICATION SCREEN FAILURE.

| ASSESSMI ASSESSMI NASA FMI | ENT ENT EA | D2 II #: | ATE: D: | 1/01/ OMS-1 03-3- | 88 89 3284- | -1 | | · | ł | IASA BASE | DATA: LINE NEW | [[| X |] | |
|----------------------------------|------------------|----------------|------------|-------------------------|-------------------|--------|--------|--------|--------|--------------|----------------------|----------|----------|----------|------|
| SUBSYST MDAC ID ITEM: | EM : : | | | OMS 189 TOTAL | IZER | | | | | | | | | | |
| LEAD AN | ALY | ST | : | C.D. | PRUST | ſ | | | | | | | | | |
| ASSESSM | ENT | : | | | | | | | | | | | | | |
| | CR | IT: | ICAL | ITY | RI | EDUND | ANCY | SCREE | NS | | | C] | L ידי | x | |
| | 1 | HD | W/FU | NC | A | | в | | C | 2 | | 11 | . 1. 1 | 1 | |
| NASA IOA | [[| 3 3 | /3 /3 |]] | [[|]] | [[|] | [[|]] | | ((| |]] | * |
| COMPARE | · [| | / |] | [|] | [|] · | [|] | | [| |] | |
| RECOMME | NDA | TI | ons: | (If | dif | feren | t fr | om NAS | A) | | | | | | |
| | [| | / |] | [|] | [|] | [|] | (AI | [)D/ | DI |] ELF | ETE) |
| * CIL R | ete: | NT | ION | RATION | ALE: | (If | appl | icable | e) | ADEQU | JATE | [| |] | |

REMARKS:

INADEQUATE []

NO DIFFERENCES. IOA RECOMMENDS ADDING STATEMENTS TO EFFECTS ADDRESSING LOSS OF LOW PROP QUANTITY WARNING AND INABILITY TO DETECT COMMUNICATION SCREEN FAILURE.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-190 03-3-2006 | NASA DATA BASELINE NEW | [] [X] | | | | | | |
|--|---------------------------------|------------------------------------|--------------|--------------|-----------------------|-------------------|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 190 COMMUNICA | DMS L90 COMMUNICATION SCREEN | | | | | | | |
| LEAD ANALYST: | C.D. PRUS | T | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICAL | ITY R | EDUND | ANCY | SCREEN | S | CIL | | | |
| HDW/FU | NC A | | с | | | | | | |
| NASA [1 /1 IOA [2 /2 |] [] [|]] | [[|] [] [|]] | [X]* [X] | | | |
| COMPARE [N /N |] [|] | [|] [|] | [] | | | |
| RECOMMENDATIONS: | (If dif | feren | t fro | om NASA |) | | | | |
| [/ |] [|] | [|] [|] (AI | [] DD/DELETE) | | | |
| * CIL RETENTION REMARKS: | RATIONALE: | (If ; | appli | icable) I | ADEQUATE NADEQUATE | []] | | | |
| IOA WILL NOT DIS | PUTE NASA/ | RI 1/3 | 1 CRI | IT ASSI | GNMENT. | | | | |

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| ASSESSMENT ASSESSMENT NASA FMEA | DA IC #: | ATE:): | 1/01/8 OMS-19 03-3-2 | 1/01/88 NA DMS-191 H 03-3-2006-3 | | | | | | | | ASA DA BASELI N | TA NE EW | : [] | x |] | |
|---------------------------------------|----------------|------------|----------------------------|--|------|--------|--------|----|--------|----------|-----------|-----------------------|----------------|-------------|-----------|----------|-----|
| SUBSYSTEM: MDAC ID: ITEM: | | · | OMS 191 COMMUN | 110 | CAJ | NOI S | SCR | EE | N | | | | | | | | |
| LEAD ANALY | ST: | | C.D. I | PRU | JSI | 2 | | | | | | | | | | | |
| ASSESSMENT | : | | | | | | | | | | | · | | | | | |
| CR | ITI FI | CAL | LTY F | | RI | EDUNDA | ANC | Y | SCRE | ENS | 5 | | | CI II | IL IEN | 1 | |
| | HDW | /FUI | NC | | A | | | В | | | С | | | | | | |
| NASA [IOA [| 1 3 | /1 /2R |] | [[| Р |]] | [[| F |]] | [[| P |] | | [[| X X |]] | * |
| COMPARE [| N | /N |] | [| N |] | [| N |] | [| N |]. | | [| |] | |
| RECOMMENDA | TIC | ons: | (If | dj | if | feren | t f | r | om NA | SA |) | | | | | | |
| [| | / |] | ۵ | |] | נ | |] | [| |] | (A) |] DD/ | DI |] ELE | TE) |
| * CIL RETE | NTJ | ION 3 | RATION | ALF | E: | (If | app | 11 | cabl | e) Il | IA IAV | DEQUAI DEQUAI | 'E 'E | [[| |] | |
| REMARKS: | OT | יצדת | DUTE N | ASZ | A /1 | ат 17 | 1 0 | R | T AS | SI | GNI | MENT. | H | OWI | EVI | ER. | IC |

IOA WILL NOT DISPUTE NASA/RI 1/1 CRIT ASSIGNMENT. HOWEVER, IOA RECOMMENDS THAT THE 3/2R EFFECTS OF A LESS SEVERE SCREEN FAILURE (WHICH ONLY ALLOWS SOME HELIUM TO PASS INTO THE AFT COMPARTMENT) ALSO BE INCLUDED ON THIS FMEA. IOA CONSIDERS THIS DEGREE OF FAILURE TO BE MORE CREDIBLE THAN A TOTAL (1/1) SCREEN FAILURE.

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-192 BASELINE [1 NEW [X] 03-3-2005-1 NASA FMEA #: OMS SUBSYSTEM: 192 MDAC ID: GALLERY LEGS ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С HDW/FUNC В Α [P] [P] IASA [3 /2R] IOA [3 /2R] [P] [P] [F] [F] [X] [X] NASA COMPARE [/] [] [] [] [] RECOMMENDATIONS: (If different from NASA)] [(ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [٦ INADEQUATE [] **REMARKS:**

NO DIFFERENCES. IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS REGARDING POSSIBLE LOSS OF ONE OMS ENGINE OR RCS THRUSTERS AS A RESULT OF THE LOSS OF ALL REDUNDANCY. ENGINE AND TANK ASSEMBLY IN OTHER POD NOT CONSIDERED BY IOA TO BE REDUNDANT.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-193 03-3-2004 | | NASA DATA BASELINE NEW | X: Z [] Z [X] | | | | | |
|--|---------------------------------|-------------------------------|------------------------------|------------------------------|--------------------|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 193 COLLECTOR | AS 93 DLLECTOR MANIFOLD | | | | | | | |
| LEAD ANALYST: | C.D. PRUS | r | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICAL FLIGH | ITY RI T NC A | EDUNDA | ANCY SCRE | ENS | CIL ITEM | | | | |
| 1104/10 | | _ | | | | | | | |
| NASA [2 /2 IOA [3 /2R |] [] [P |] | [] [F] | [] [P] | [X]* [X] | | | | |
| COMPARE [N /N |] [N |] | [N] | [N] | [] | | | | |
| RECOMMENDATIONS: | (If dif: | ferent | t from NA | SA) | | | | | |
| · [/ |] [|] | []. | [] | [] ADD/DELETE) | | | | |
| * CIL RETENTION | RATIONALE: | (If a | applicabl | e) ADEQUATE INADEQUATE | | | | | |
| IOA AGREES WITH | NASA/RI RE | EVALUA | ATION AND | RATIONALE P | FOR 2/2 | | | | |

IOA AGREES WITH NASA/RI REEVALUATION AND RATIONALE FOR 2/2 CRITICALITY. STRUCTURAL FAILURE OF DEVICE MAY ALLOW HELIUM TO BYPASS GALLERY LEGS.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-194 03-3-2101-1 | | NASA DATA: BASELINE NEW | [] [X] | | | | | | |
|--|---|---|-------------------------------|----------------------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: NTO | OMS 194 PROPELLANT LIN | AS 94 ROPELLANT LINES AND MECHANICAL FITT | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | | |
| ASSESSMENT: | | | | Same and a second | | | | | | |
| CRITICAL FLIGH HDW/FU | ITY REDUND. F NC A | ANCY SCREE B | NS C | CIL ITEM | | | | | | |
| NASA [1 /1 IOA [1 /1 |] []] [] | [] [] | [] [] | [X] * [X] | | | | | | |
| COMPARE [/ |] [] | [] | [] | [] | | | | | | |
| RECOMMENDATIONS: | (If differen | t from NAS | A) | | | | | | | |
| [/ |] [] | []] | [] (AE | [] DD/DELETE) | | | | | | |
| * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | |
| REMARKS: NASA/RI ADDED "F. THIS FMEA, PER IC SHEET SHOULD ADD | AILED CLOSED AC DA ISSUE. THE RESS THIS NEW C | MV RELIEF RETENTION AUSE. | DEVICE" TO I RATIONALE ON | THE CAUSES ON THE CIL | | | | | | |
| IOA RECOMMENDS AN FIRE, EXPLOSION, | DDING A STATEME AND EXPOSURE O | NT TO THE F EVA AND | EFFECTS ABOU GROUND CREWS | JT POSSIBLE 5. IOA ALSO | | | | | | |

RECOMMENDS THAT "BINDING/JAMMING OF LINE BELLOWS" BE ADDED AS A CAUSE ON THIS FMEA.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT DA NT IA A #: | ATE: D: | 1/01/ OMS-1 03-3- | 88 94A 2102 | -1 | | NASA DATA: BASELINE [] NEW [X] | | | | | | | |
|---|---|------------|-------------------------|-------------------|------|-------|---|-------|------|--------|------------|-----------|-------|-----|
| SUBSYSTE MDAC ID: ITEM: NTO | M: | | oms 194 PROPE | LLAN | T LI | NES A | ND M | ECHAN | ICAL | FIT | TIN | gs-M | IMH 2 | AND |
| LEAD ANA | LYST | : | C.D. | PRUS | т | | | | | | | | | |
| ASSESSME | ASSESSMENT: | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS C | | | | | | | | | | | CI TT | L EM | | |
| | HD | W/FU | NC | CABC | | | | | | | | | | |
| NASA IOA | [1 [1 | /1 /1 |]] | | | | | | | [[| X] X] | * | | |
| COMPARE | [| / |] | ľ |] | [|] | [|] | | [|] | | |
| RECOMMEN | DATI | ons: | (If | dif | fere | nt fi | com N | ASA) | | | | | | |
| | C | / |] | [|] | ſ |] | [|] | (A |] DD/ |] DELE | ETE) | • |
| * CIL RE | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | | | |
| REMARKS: NASA/RI THIS FME SHEET SH | REMARKS: NASA/RI ADDED "FAILED CLOSED ACMV RELIEF DEVICE" TO THE CAUSES ON THIS FMEA, PER IOA ISSUE. THE RETENTION RATIONALE ON THE CIL SHEET SHOULD ADDRESS THIS NEW CAUSE. | | | | | | | | | | | | | |

IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ent ent ea # | | ATE:): | 1/01/88 NASA DATA OMS-195 BASELINI 03-3-2601-1 NEX | | | | | | | DATA: LINE NEW | [| X |]] | |
|--|-----------------------------|----------------|-----------------------------|--|----------------------|--------------------|--------------------------------|-------------------------|-------------------------|---------------------------|----------------------|-----------|-----------------|----------------------|----------------|
| SUBSYSTI MDAC ID: ITEM: | EM : : | | | OMS 195 GIMBA | L BE | LLOW | S | | - | | | | | 1913 | |
| LEAD ANA | ALYS | ST: | ; | C.D. | PRUS | T | | | | | | | | | |
| ASSESSMI | ENT: | | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS FLIGHT | | | | | | | | | | | CIL ITEM | | | | |
| | H | IDV | /FU | NC | A | L | E | 3 | (| | · · · · | | | | |
| NASA IOA | [נ | 1 1 | /1 /1 |] | [[|] | [[|]] | [[|]] | | [] | X X |] *] | |
| COMPARE | [| | / |] | [|] | [|] | [|] | | [| |] | |
| RECOMMEN | IDAI | IC | ONS: | (If | aif | fere | nt fi | com N. | ASA) | | | | | | |
| | [| | / |] | [|] | [|] | [|] | (AI | [DD/1 | DE |] LETE |) |
| * CIL RE | eten | T | ION I | RATION | IALE: | (If | appl | licab | le) INZ | ADEQUI ADEQUI | ATE ATE | [| |]] | |
| REMARKS NASA/RI THIS FMI SHEET SH | ADE EA, IOUI | DEI PI D |) "F ER I ADD | AILED OA ISS RESS I | CLOS UE. THIS | ED A THE NEW | CMV F RETE CAUSE | RELIE ENTIO | F DEY N RAY | VICE" FIONA | TO I LE ON | HE T | C. HE | AUSE CIL | S ON |
| IOA RECO FIRE, EX RECOMMEN CAUSE ON | OMME (PLC NDS N TH | NI SJ TH | OS A ION, HAT 5 FM | DDING AND E "BINDI EA. | A SI XPOS NG/J | URE AMMI | <u>ent</u> 1 of ev Ng of | TO TH 7 AAN 7 LIN | E EF) D GR(E BE) | FECTS OUND (LLOWS) | ABOU CREWS "BE | AD | PO: IC DE | SSIB DA A D AS | LE LSO A |

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT DATE: NT ID: A # : | 1/01/8 OMS-19 NONE | 8 | | | |] | NASA DAT BASELIN NE | 'A: E W | [[|] | | |
|----------------------------------|------------------------------------|--------------------------|----------------------------|--------|--------|--------|----------|---------------------------|---------------|----------|----------|----------|----|
| SUBSYSTE MDAC ID: ITEM: | M: | OMS 196 GIMBAI | OMS 96 IMBAL BELLOWS | | | | | | | | | | |
| LEAD ANALYST: C.D. PRUST | | | | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | |
| | CRITICAL | ITY | RI | DUND | ANCY | SCREE | ENS | | | | L FM | | |
| | HDW/FU | NC | A | | В | | 1 | C | | ± ± . | GM | | |
| NASA IOA | [/ [1 /1 |]] | [[|]] | [[|]] | [[|]] | | [[: |] x] | * | |
| COMPARE | [N /N |] | [|] | [|] | [|] | | [] | N] | I | |
| RECOMMEN | DATIONS: | (If | diff | erent | t fro | om NAS | SA) | | | | | | |
| | [/ |] | [|] | [|]. | [|] (| AD | [D/ |] DEI | Let! | E) |
| * CIL RE | TENTION | RATION | LE: | (If a | appl | icable | €) IN | ADEQUATE ADEQUATE | 2 | [[|] |] | |
| REMARKS: NASA/RT | DO NOT C | OVER TH | IIS I | TAILU | RE MO | DDE (1 | 10 | BELLOWS | AN | GU | LAF | ર | |

DEFLECTION). IOA RECOMMENDS THAT THIS FAILURE MODE (NO BELLOWS ANGULAR AS A CAUSE ON LINE AND BELLOWS RUPTURE FMEAS.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT NT A # | D2 II : | ATE: D: | 1/0 0M9 NO1 | 01/88 5-197 NE | | | | NZ I | asa Base | DATA ELINE NEW | [[|]] | ~ |
|----------------------------------|-----------------|---------------|--------------|-------------------|----------------------|--------|---------|------------------|--------------------|--------------|----------------------|---------------|--------------|------|
| SUBSYSTE MDAC ID: ITEM: | M: | | | 0M9 197 GIN | 5 7 IBAL | BELLO | ows | | <u>-</u> | - 4 - | | | ·* ·* , | |
| LEAD ANA | LYS | ST | : | c.1 | D. PR | UST | | | | | ~ | | | |
| ASSESSME | NT : | | | | | | | | | | | | | |
| | CRI | T] דו | ICAL | ITY | | REDU | JNDANCY | SC | REENS | | | CII | L EM | |
| | H | ID | N/FU | NC | | A | В | | С | | | *** | J * * | |
| NASA IO A | [[| 1 | / /1 |]] | [[|]] | [[|]] | [[|] | | [] | x] | * |
| COMPARE | נ | N | /N |] | [|] | [|] | [|] | | [] | N] | |
| RECOMMEN | DAJ | T | ONS: | | (If d | iffer | cent fr | om | NASA) | | | | | • |
| | Ľ | | / |] | . [|] | . [|] | ſ |] | (AI | []]/I |] DELH | ETE) |
| * CIL RE | TEN | 1 T: | ION | RAT: | IONAL | E: (] | (f appl | ica | ble) Al INAI | DEQU | JATE JATE | [|] | |
| REMARKS: | | ata anti-atti | 1 ANG. 10 10 | | • 1967 | | | NA TOTAL SUBJECT | | | | • • | - - | |

NASA/RI DO NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). IOA NOW CONSIDERS THE CREDIBILITY OF RESTRICTED FLOW IN A BELLOWS TO BE QUESTIONABLE. IOA DOES NOT REGARD THE ABSENCE OF THIS FAILURE MODE IN THE FMEA/CIL TO BE AN OPEN ISSUE, BUT DOES RECOMMEND THAT IT BE ADDRESSED.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT D NT I A #: | DATE: | 1/01/8 OMS-19 03-3-2 | L/01/88 NASA I DMS-198 BASEI D3-3-2007-2 | | | | | | | ASA DA BASELI 1 | ATA: INE NEW | : [[| x |] | | | |
|----------------------------------|----------------------|---------------|----------------------------|--|----------|---------------|----------|------------|---------|--------------|-----------------------|--------------------|------------------|------------|-----------|----------|------------|----------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 198 VALVE- | MS 98 ALVE-PROPELLANT TANK ISOLATION | | | | | | | | | | | | | | |
| LEAD ANA | LYST | : | C.D. H | PRU | SJ | 2 | | | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | | | | | |
| | CRII F | ICAL | ITY F | 1 | RE | DUND | A | IC. | Z | SCRE | EEN | s | | | CI IT | L EM | ſ | |
| | HC | W/FU | NC | | A | | |] | 3 | | | С | | | | | | |
| NASA IOA | [2 [2 | /1R /1R |]] | [| P P |]] | | | F |]] | [[| P P |] | | [| X X |] | * |
| COMPARE | [| / |] | [| |] | (|] | 1 |] | [| |] | | [| |] | |
| RECOMMEN | DATI | ONS: | (If | di | f1 | eren | t | f | rc | om NZ | ASA |) | | | | | | |
| | [| / |] | [| |] | I | [| |] | (| |] | (Al |] DD/ | DE |] :LE | TE) |
| * CIL RE | TENI | NON | RATION | ALE | : | (If | aŗ | op: | Li | [cab] | le) I | A NA | DEQUA' DEQUA' | re Fe | [| |]] | |
| REMARKS: IOA CONS DURING F | IDEF | RSA IT (P. | FAILED ASS B S | CL/ SCR | OS EI | SED V EN). | 'A] H | LV] IOI | E WE | TO I EVER | BE IO | RE. A | ADILY | DE: NOT | FEC DI | TA SF | NBI PUI | .E 'E |

NASA/RI B SCREEN FAILURE (WHICH IS BASED ON RESTRICTED FLOW FAILURE MODE). SEE ASSESSMENT SHEET OMS-203. IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE VIOLATION OF THE PROP TANK LANDING WEIGHT CONSTRAINT.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-199 03-3-2007-1 | 1 | NASA DATA: BASELINE NEW | [] [X] |
|--|-----------------------------------|-----------------|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 199 VALVE-PROPI | ELLANT TANK IS | OLATION | |
| LEAD ANALYST: | C.D. PRUST | | | |
| ASSESSMENT: | | | - | |
| CRITICAL | ETY RE | DUNDANCY SCREE | NS | CIL ITEM |
| HDW/FU | NC A | В | C | |
| NASA [2 /1R IOA [3 /3 |] [P] [|] [NA]] [] | [P] [] | [X]* [] |
| COMPARE [N /N |] [N |] [N] | [N] | [N] |
| RECOMMENDATIONS: | (If diffe | erent from NAS | A) | |
| [/ |] [|] [] | [] (AD | [] DD/DELETE) |
| * CIL RETENTION 1 | RATIONALE: | (If applicable |) ADEQUATE INADEQUATE | [] |
| REMARKS: IOA AGREES WITH I PNP ASSIGNMENT. | NASA/RI REEV | VALUATION AND | RATIONALE RE | GARDING 2/1R |
| | | | an a | an a |

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REPORT DATE 2/26/88

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C-106

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-200 NONE | | | NASA DATA: BASELINE NEW | [] [] |
|--|----------------------------|--------|--------------|-------------------------------|-------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 200 VALVE-PRO | PELLAN | IT TANK IS | OLATION | |
| LEAD ANALYST: | C.D. PRUS | т | | | |
| ASSESSMENT: | | | | | |
| CRITICAL FLIGH | T R | EDUNDA | NCY SCREE | NS | CIL ITEM |
| HDW/FU | NC A | | В | С | |
| NASA [/ IOA [2 /1R |] [] [P |] | [] [P] | [] [P] | [] * [X] |
| COMPARE [N /N |] [N |] | [N] | [И] | [N] |
| RECOMMENDATIONS: | (If dif | ferent | from NAS | A) | |
| · [/ |] [|] | [] | [] (AI | [] DD/DELETE) |
| * CIL RETENTION | RATIONALE: | (If a | applicable |) ADEQUATE INADEQUATE | |
| REMARKS: | | | | | |

NASA/RI DO NOT COVER THIS FAILURE MODE (FAILS MID-TRAVEL, PARTIALLY OPEN/CLOSED). IOA RECOMMENDS THAT THESE FAILURE MODES BE ADDED TO 03-3-2007-2, HOWEVER FMEA/CIL IS ADEQUATE WITHOUT THESE ADDITIONS. THE EFFECTS OF THESE FAILURE MODES ARE COVERED 03-3-2007-2.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT I NT J A #: | DATE: [D: | 1/01/2 OMS-2 03-3-2 | 88 01 200 | 7-1 | | | ASA DATA BASELINE NEW | ATA: [NE [] JEW [X] | | | | |
|----------------------------------|----------------------|---------------|---------------------------|-----------------|------------|-----------------|----------|-----------------------------|------------------------------|-------------------|--|--|--|
| SUBSYSTE MDAC ID: ITEM: | м: | | OMS 201 VALVE | -PR | OPE | LLANT | TANK | ISOLA | FION | | | | |
| LEAD ANA | LYSI | C : | c.p. 3 | PRU | ST | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | |
| | CRIJ | TICAL | ITY | | REL | UNDAN | CY SCR | EENS | | CIL | | | |
| | HI | W/FUI | NC | | A | | В | С | | 1120 | | | |
| NASA IOA | [2 | 2 /1R 3 /3 |]] | [[| P]] | . [[| NA]] | [P [|]] | [X] * [] | | | |
| COMPARE | [] | 1 /N |] | [| и] | [| ן א | [N |] | [N] | | | |
| RECOMMEN | DATI | cons: | (If | di | ffe | erent : | from N | ASA) | | | | | |
| | [| / |] | [|] | [|] | C |] (A) | [] DD/DELETE) | | | |
| * CIL RE | TENI | TION 1 | RATION | ALE | : (| If app | plicab | le) Al INAI | DEQUATE DEQUATE | [] [] | | | |
| REMARKS: IOA AGRE ASSIGNME | ES V NT H | VITH I | NASA/R | I R L L | eev Ear | ALUAT AGE FA | ION AN | D RAT | IONALE FO | OR 2/1R PNP | | | |

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| ASSESSMI ASSESSMI NASA FMI | ENT ENT EA | D2 II #: | ATE: D: | 1/0 OM: 03- | 01/88 5-202 -3-210 | 88 NASA DATA: 02 BASELINE [] 101-1 NEW [X] | | | | | | | | | |
|----------------------------------|------------------|------------------|----------------------|-------------------|--------------------------|---|-------------|--------|------------------|----------------|-------------|----------|-----------|----------|------|
| SUBSYSTE MDAC ID: ITEM: | EM : | | | 0M 202 VA | 5 2 LVE-PR(| OPELI | LANT T | ANK | ISOLA | TION | | | | | |
| LEAD ANA | ALY: | ST | : | с. | D. PRU | ST | | | | | | | | | |
| ASSESSMI | ENT | : | | | · | | | | | | | | | | |
| | CR | IT: FI HDV | ICAL LIGH W/FU | ITY T NC | | REDUN A | IDANCY B | SCI | REENS C | | | C] I] | IL IEN | 4 | |
| NASA IOA | [[| 1 1 | /1 /1 |]] | [[|]] | [[|]] | [[|]] | | [[| x x |]] | * |
| COMPARE | נ | | / |] | ſ |] | Γ |] | [|] | | [| |] | |
| RECOMMEN | NDA' | TIC | ONS: | | (If di | ffere | ent fr | om 1 | NASA) | | | | | | |
| | [| | / |] | [|] | [|] | [|] | (A) |] DD/ | ۲DJ |] ELF | ETE) |
| * CIL R | ETE | NT | ION | RAT | IONALE | : (If | f appl | ical | ole) A INA | DEQU. DEQU. | ATE ATE | [| |] | |

REMARKS: NASA/RI AGREED TO ADD THIS VALVE BODY TO THE ITEM LIST ON THIS FMEA, AND TO ADD CORRESPONDING RETENTION RATIONALE TO THE CIL SHEET, PER IOA ISSUE. NASA/RI ALSO ADDED "FAILED CLOSED ACMV RELIEF DEVICE" TO THE CAUSES ON THIS FMEA, PER IOA ISSUE. IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | ENT D ENT I EA #: | DATE: | 1/01, OMS-1 03-3 | /88 202 A -2007 | 7-3 | NASA DATA: BASELINE [] -3 NEW [X] | | | | | | | |
|--|-------------------------|---------------|------------------------|------------------------------|----------------|--|--------------|--------------------|----------------|--------------|--------------|--------------|-------------|
| SUBSYSTE MDAC ID: ITEM: | EM: | | OMS 202 AC V | ALVE | | | | | | | | | |
| LEAD ANA | LYST | !: | C.D. | PRUS | ST | | | - | | | | | |
| ASSESSME | INT: | | | | | | | | | | - | | - . |
| | CRIT | ICAL | ITY | 1 | REDUN | DANCY | SCF | REENS | | | CI | L FM | |
| | HD | W/FU | NC | 1 | A | В | | С | - · · · ÷ | | | C.141 | |
| NASA IOA | [1 [1 | /1 /1 |]] | [[|]] | [[|]] | [[|]] | | []] | x] x] | * |
| COMPARE | [| 1 |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | IDATI | ons: | (1 | f di | ffere | nt fr | om N | IASA) | | | | | . . |
| | [| / |] | ľ |] | [|] | C |] | (A) |] 1/DD |] DELE | TE) |
| * CIL RE | TENT | NOI | RATIO | NALE | : (If | appl | icab | ole) - A INA | DEQU. DEQU | ATE ATE | [[|] | |
| REMARKS: IOA RECO AS A CAU ADDITION | MMEN JSE O | IDS T N TH | HAT " IS FM | FAILI EA, I | ED CL HOWEV | osed Er fm | ACMV EA 1 | 7 RELI S ADE | ef di Quat: | EVIC E WI | e" i Thoi | BE A JT T | DDED HIS |

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IOA ALSO RECOMMENDS ADDING A STATEMENT TO THE EFFECTS REGARDING POSSIBLE EXPOSURE OF EVA AND GROUND CREWS TO PROPELLANT.

REPORT DATE 2/26/88 C-110

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-203 03-3-20 | L/01/88 NASA DATA: DMS-203 BASELINE [D3-3-2007-2 NEW [X | | | | | | |
|--|-------------------------------|---|-------------------|----------------------------|-------------------|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 203 VALVE-P | ROPELLAN | T TANK ISOI | LATION | | | | |
| LEAD ANALYST: | C.D. PR | UST | | | | | | |
| ASSESSMENT: | | · | | | | | | |
| CRITICAI FLIGH HDW/FI | LTY T | REDUNDA | NCY SCREENS | s C | CIL ITEM | | | |
| | | А | D | 0 | | | | |
| NASA [2 /11 IOA [2 /11 | [] [| P] P] | [F] [[F] [| P] P] | [X]* [X] | | | |
| COMPARE [/ |] [|] . | [] [|] | [] | | | |
| RECOMMENDATIONS | (If d | ifferent | : from NASA |) | | | | |
| [/ |] [|] | [][|] (A) | [] DD/DELETE) | | | |
| * CIL RETENTION | RATIONAL | E: (If a | npplicable) II | ADEQUATE NADEQUATE | [] [] | | | |
| REMARKS: NASA/RI ORIGINAI FLOW). NASA/RI | LY DID N AGREED T | OT COVER O ADD "F | THIS FAIL | JRE MODE (1 FLOW" TO TH | RESTRICTED | | | |

MODES ON 03-3-2007-2 (FAILS CLOSED), PER IOA ISSUE. NASA/RI ALSO CHANGED THE B SCREEN ON 03-3-2007-2 TO "FAIL" FOR RESTRICTED FLOW, PER IOA ISSUE. IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE

VIOLATION OF THE PROP TANK LANDING WEIGHT CONSTRAINT.

REPORT DATE 2/26/88

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| ASSESSMEN ASSESSMEN NASA FMEZ | NT DZ NT II A #: | ATE:): | 1/01/8 OMS-20 NONE | 38)4 | | | | | | | NZ I | ASA D BASEL | ATA: INE NEW | [[|] | , |
|-------------------------------------|------------------------|------------|--------------------------|------------|-----|--------|--------|-------------|-------------|----------|-----------|----------------|--------------------|-----------|----------|-------|
| SUBSYSTEN MDAC ID: ITEM: | 1: | | OMS 204 VALVE- | ·PF | 101 | PELLA | NT | TZ | NK I | soi | LAJ | TION | | | | |
| LEAD ANAL | LYST: | ł | C.D. F | C.D. PRUST | | | | | | | | | | | | |
| ASSESSMEN | IT: | | | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS | | | | | | | | | CIL ITEM | | | | | | | |
| | HDW | I/FUI | 10 | | A | | | B | | | С | | | | _ | |
| NASA IOA | [[3 | / /2R |]] | [[| P |]] | [[| P |]] | [[| P |]] | | [[|]] | * |
| COMPARE | [N] | /N |]. | [| N |] | נ | N |] | [| N |] | | (|] | |
| RECOMMENI | DATIC | ons: | (If | di | .f1 | ferent | t 1 | rc | om NA | SA) |) | | | | | |
| | [| / |] | [| |] | [| |] | [| |] | (AD | [D/DE |] :LE | TE) |
| * CIL RET | [ENT] | ION P | RATIONA | LF | : | (If a | apţ |)]j | cabl | e) Il | AI NAI | DEQUA DEQUA | TE TE | [|] | |
| REMARKS: | 71.3 5 | נדתדי | ים ייאדס | | רגי | THE | Δ | ; 2 | 3/3 | _ | vz | ALVES | ARE | OPF | 'N | DURTN |

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IOA NOW CLASSIFIES THIS FAILURE AS A 3/3. VALVES ARE OPEN DURING ALL PHASES OF FLIGHT. VALVES ARE VERIFIED OPEN BEFORE BURN ATTEMPTED. IOA 3/2R BASED ON VALVE IN GPC POSITION IS INCORRECT. NASA/RI DO NOT COVER THIS FAILURE MODE (DELAYED OPERATION). THIS FAILURE MODE NEED NOT BE ADDED TO THE FMEA/CIL. THE WORST CASE EFFECTS OF "DELAYED OPERATION" ARE COVERED BY "FAILS CLOSED" (03-3-2007-2).

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT NT A i | DZ II #: | ATE: D: | 1/ 0M NO | 01/8 5-20 NE | 8 5 | | | | | | | NZ I | ASA BASE | DATA: LINE NEW | [[| |] | |
|----------------------------------|-----------------|----------------|--------------|----------------|--------------------|--------|-----|--------|-----|----|-------------------|------------|-----------|--------------|----------------------|-----------------|---------------|----------|-------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | | 0M 20 VA | S 5 LVE- | PI | ROF | ELL | ANI | T | ÀN | K ISO | LA: | TION | | | | | |
| LEAD ANA | LYS | ST | : | c. | C.D. PRUST | | | | | | | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | | | | | | |
| | CR | IT F | ICAL LIGH | ITY F | | | RE | EDUNI | DAN | CY | S | CREEN | 5 | | | C] I] | L L LEN | 1 | |
| |] | HDI | V/FUI | NC | | | A | | | B | • | | С | | | | | | |
| NASA IOA | [[| 2 | / /1R |]] | | [[| P |]] | [| F |] | [| P |]] | | [[| x |]] | * |
| COMPARE | [| N | /N |] | | [| N |] | (| N |] | [| N |] | | [| N |] | |
| RECOMMEN | DA' | FI (| ONS: | | (If | d: | iff | ere | nt | fr | on | NASA |) | | | | | | |
| | [| | / |] | | [| |] | [| |] | [| |] | (AI | [)D/ | /DI |] Ele | ETE) |
| * CIL RE | TE | NT | ION | RAT | IONA | 'L] | Ξ: | (If | aŗ | pl | ic | able) I | A NA | DEQU DEQU | ATE ATE | [| |] | |
| REMARKS: NASA/RI | DO | N | OT C | OVE | R TH | | 5 I | | URI | | וס <u>ו</u> גי | E (IN | TE: FV | RNAL | RELI | - נבו גיד | F N A T I | - VAI | LVE RE N |

NASA/RI DO NOT COVER THIS FAILURE MODE (INTERNAL RELIEF VALVE FAILS TO RELIEVE) ON A SEPARATE FMEA. HOWEVER, THIS FAILURE MODE IS LISTED AS A CAUSE ON PROP LINE AND GIMBAL BELLOWS EXTERNAL LEAKAGE FMEAS. IOA RECOMMENDS THAT THIS FAILURE BE ADDRESSED AS A FAILURE MODE ON A SEPARATE FMEA TO ENSURE THAT IT GETS THE PROPER AMOUNT OF ATTENTION, BUT DOES NOT REGARD THIS RECOMMENDATION TO BE AN OPEN ISSUE.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-206 NONE | ľ | NASA DATA: BASELINE [] NEW [] | | | | | | |
|---|--------------------------------|-----------------------|---------------------------------------|------------------|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: NTO | OMS 206 PROPELLANT LINES | AND MECHAN | IICAL FITT | 'INGS-MMH AND | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICAL FLIGH HDW/FU | ITY REDUNDANG F NC A | CY SCREENS B C | | CIL ITEM | | | | | |
| NASA [/ IOA [2 /1R |] [] [] [P] [|] [F] [F |] | [] * [X] | | | | | |
| COMPARE [N /N |] [И][| N] [N | r] | [N] | | | | | |
| RECOMMENDATIONS: | (If different f | from NASA) | | | | | | | |
| [/ |] [] [|] [|] (AD | [] D/DELETE) | | | | | |
| * CIL RETENTION H | RATIONALE: (If app | plicable) A INA | DEQUATE | [] | | | | | |
| REMARKS: IOA CAUSES ON AND | ALYSIS SHEET SHOUL | LD NOT INCL | UDE "FILT | ER: A. LAR | | | | | |
| BLOCKAGE". NASA/RI DO NOT COVER RESTRICTED FLOW IN A SEGMENT OF LINE DUE TO OBSTRUCTION OR DEFORMATION (CRIMPING). SUCH AN OCCURRENCE COULD RESULT IN 2/18 FEFECTS HOWEVER THE CREDIBILITY OF SUCH AN | | | | | | | | | |
| OCCURRENCE IS QUESTIONABLE. ANY CONTAMINATION WOULD FLOW TO DOWNSTREAM FILTER OR COMPONENT. IOA RECOMMENDS THAT SUCH A FAILURE BE ADDRESSED ON THE FMEA/CIL, BUT DOES NOT REGARD THIS RECOMMENDATION AS AN OPEN ISSUE. | | | | | | | | | |

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-207 03-3-2009-1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | |
|---|-----------------------------------|---|--|--|--|--|--|--|--|
| SUBSYSTEM:OMSMDAC ID:207ITEM:COUPLING - PROPELLANT LOW-POINT DRAIN | | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICAL FLIGH | ITY REDUNDANCY SCREEN T | IS CIL ITEM | | | | | | | |
| HDW/FU | NC A B | С | | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [F] [F] [] [P] [NA] (| P] [X]* P] [X] | | | | | | | |
| COMPARE [/ |] [И] [И] (| .] [] | | | | | | | |
| RECOMMENDATIONS: | (If different from NASA | ¥) | | | | | | | |
| [2 /1R |] [F] [F] [| P] [A] (ADD/DELETE) | | | | | | | |
| * CIL RETENTION | RATIONALE: (If applicable) | ADEQUATE [] INADEQUATE [] | | | | | | | |
| INADEQUATE [] REMARKS: NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD469, 470, 569, 570) HAVE BEEN ADDED TO 03-3-2009-1, PER IOA ISSUE. IOA AGREES WITH NASA/RI FAILURE OF A SCREEN BASED ON INABILITY TO VERIFY CONDITION OF CAP SEAL AFTER CAP INSTALLATION. IOA ALSO AGREES WITH NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE | | | | | | | | | |

AND IS ADDRESSED ON RCS QD COUPLING FMEAS. IOA ALSO RECOMMENDS THAT A STATEMENT BE ADDED TO THE EFFECTS ABOUT POSSIBLE CORROSION, FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS DUE TO PROP LEAKAGE.

REPORT DATE 2/26/88

| ASSESSMI ASSESSMI NASA FMI | | | 1 | NASA D BASEI | DATA: LINE NEW | : [} |] [K] | . · · · · · · · · · · · · · · · · · · · | | | | | |
|----------------------------------|------------|----------------|---------------------|-----------------|----------------------|----------|------------|---|------------------|----------|------------|-----------|--------|
| SUBSYSTI MDAC ID: ITEM: | EM: : | | OMS 208 COUPI | LING | - PF | OPELI | ANT | LOW-1 | POINT | DRAI | EN | | |
| LEAD ANA | ALYST | : | C.D. | PRUS | ST | | | | · | | | | |
| ASSESSMI | ent : | | | | | | | | | | | | - |
| | CRIT | ICALI LIGHI | ETY F | F | REDUÑ | IDANCY | SCF | REENS | | | CII ITE |] IM | |
| | HD | W/FUI | NC | P | ł | E | 3 | C | 2 | | | | |
| NASA IOA | [3 [3 | /3 /3 |]] | [[|]] | [[|]] | [[|]] | | [[|] | * |
| COMPARE | [| / |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | NDATI | ons: | (If | dif | fere | ent fr | om N | IASA) | | | | | |
| | [3 | /3 |] | [|] | [|] | [|] | (AI | [)D/[|] DELE | FE) |
| * CIL RI | ETENT | ION P | RATION | IALE: | (If | appl | icab | ole) 7 INZ | ADEQUA ADEQUA | TE TE | [[|]] | |
| REMARKS | | MODES | S ON A | NALY | sis | SHEET | SHO | ULD] | INCLUD | E "F | AII | s ci | LOSED" |

AND "RESTRICTED FLOW". NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD469, 470, 569, 570) HAVE BEEN ADDED TO 03-3-2009-3, PER IOA ISSUE. IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

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| ASSESSMENT ASSESSMENT NASA FMEA | DATE: ID: #: | ·2 | | | NZ H | ASA DA' BASELI N | TA: NE EW | [} |] x] | | | |
|---------------------------------------|---|----------------------|--------|--------|---------|------------------------|-----------------|--------|----------|-----------|-----------|-----|
| SUBSYSTEM: MDAC ID: ITEM: | : | OMS 209 COUPLI | NG - | PROF | ELLA | NT LO | W-PC | DINT D | RAI | N | | |
| LEAD ANALY | (ST: | C.D. P | RUSI | • | | | | | | | | |
| ASSESSMENT | C: | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL | | | | | | | | | | | | |
| | HDW/FUN | iC | A | | В | | С | | | | 71.1 | |
| NASA [IOA [| 3 /3 3 /3 |]] | [[|]] | [[|]] | [[|] | | [[|] | * |
| COMPARE [| [/ |] | [|] | נ |] | [|] | | [|] | |
| RECOMMENDA | ATIONS: | (If | diff | erent | : fro | om NAS | SA) | | | | | |
| (| [/ |] | [|] | [|] | [|] | (AC | [0D/I |] DELE | TE) |
| * CIL RETH | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | |
| REMARKS: IOA FAILUF OPEN" AND | REMARKS: IOA FAILURE MODES ON ANALYSIS SHEET SHOULD NOT INCLUDE "FAILS OPEN" AND "RESTRICTED FLOW". | | | | | | | | | | | |
| NASA/RI DI | NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. | | | | | | | | | | | |

HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD469, 470, 569, 570) HAVE BEEN ADDED TO 03-3-2009-2.

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REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-210 03-3-2009-1 | NASA DATA BASELINE NEW | : [] [[] [X] | | | | | | |
|--|-----------------------------------|------------------------------|--------------------------------|---------------------|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 210 COUPLING-OMS/RC | S PROPELLA | NT FILL POP | RT | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICALI | TY REDUNDA | NCY SCREEN | S | CIL | | | | | |
| HDW/FUN | IC A | В | C | 11 CM | | | | | |
| NASA [2 /1R IOA [2 /1R |] [F]] [P] | [F] [[NA] [| P] P] | [X]* [X] | | | | | |
| COMPARE [/ |] [И] | ן א ן |] | [] | | | | | |
| RECOMMENDATIONS: | (If different | from NASA | .) | | | | | | |
| [2 /1R |] [F] | [F] [| P] (AI | [A] DD/DELETE) | | | | | |
| * CIL RETENTION F | RATIONALE: (If a | pplicable) I | ADEQUATE NADEQUATE | [] | | | | | |
| ADEQUATE [] INADEQUATE [] INADEQUATE [] REMARKS: VASA/RI ORIGINALLY PASSED A SCREEN. HOWEVER, DURING MEETING BETWEEN IOA AND SSM, IT WAS AGREED THAT THE A SCREEN SHOULD BE FAILED FOR ALL QD COUPLINGS BASED ON INABILITY TO VERIFY CONDITION OF CAP SEAL AFTER CAP INSTALLATION. IOA AGREES WITH NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS. IOA ALSO RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE CORROSION, FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREW DUE TO PROP LEAKAGE. | | | | | | | | | |

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| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-211 NASA FMEA #: 03-3-2009-3 | | | | | | | NASA DATA: BASELINE [] NEW [X] | | | | | | |
|---|--|----------|---------------------|--|------|--------|---|--------|--------|-------------|-------------|---|--|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 211 COUPL | MS 11 COUPLING-OMS/RCS PROPELLANT FILL POR | | | | | | | | | |
| LEAD ANA | LYST | : | C.D. | C.D. PRUST | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL | | | | | | | | | | | | | |
| | HD | W/FU | NC | А | | E | B C | | | | ¥*¥ | | |
| NASA IOA | [3 [3 | /3 /3 |] | [[|] | [[|]] | [[|]] | ([|] *] | | |
| COMPARE | [| / |] | [|] | [|] | [|] | [|] | | |
| RECOMMEN | DATI | ons: | (If | dif | fere | nt fi | com N | ASA) | | | | | |
| | [__ 3 | /3 |] | [|] | [|] | [|] |] (ADD/1 |] DELETE |) | |
| * CIL RE | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | | |
| REMARKS: IOA FAILURE MODES ON ANALYSIS SHEET SHOULD INCLUDE "FAILS CLOSED" AND "RESTRICTED FLOW". | | | | | | | | | | | | | |

IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

| ASSESSMI ASSESSMI NASA FMI | DATE: ID: : | 1/01/8 OMS-21 03-3-2 | -2 | | NASA DATA: BASELINE [] NEW [X] | | | | | | | | |
|--|---|----------------------------|---------------------|---|---|--------|--------|----------|----------|-----------|------------|----|--|
| SUBSYSTI MDAC ID: ITEM: | EM : : | | OMS 212 COUPL | OMS 212 COUPLING-OMS/RCS PROPELLANT FILL PORT | | | | | | | | | |
| LEAD ANA | ALYS | T: | C.D. 1 | C.D. PRUST | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS | | | | | | | | | | CIL | | | |
| | н | DW/FU | NC | A | | В | | С | | 111 | 11.1 | | |
| NASA IOA | [[| 3 /3 3 /3 |]] | [[|] | [[|] | [[|] | [[|] *] | | |
| COMPARE | [| 1 |] | [|] | [|] | [|] | [|] | | |
| RECOMMEN | IDAT | IONS: | (If | dif | ferent | : fro | om NAS | SA) | | | | | |
| - | [| 1 |] | [|] | [|] | נ |] (A) | [DD/D |] ELET: | E) | |
| * CIL RI | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEOUATE [] | | | | | | | | | | | | |
| REMARKS: IOA FAII OPEN" AN NO DIFFI | REMARKS: TOA FAILURE MODES ON ANALYSIS SHEET SHOULD NOT INCLUDE "FAILS TO OPEN" AND "RESTRICTED FLOW". NO DIFFERENCES. | | | | | | | | | | | | |

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REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-213 03-3-2009-1 | NASA DATA: BASELINE NEW | [] [X] | | | | | | | |
|---|-----------------------------------|--|---------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 213 COUPLING - PROPE |)MS 213 COUPLING - PROPELLANT GROUND-PURGE | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAI FLIGH | ITY REDUNDAN | CY SCREENS | CIL ITEM | | | | | | | |
| HDW/FU | NC A | B C | | | | | | | | |
| NASA [2 /1F IOA [2 /1F | [F] [F] [] [P] [| F] [P] NA] [P] | [X]* [X] | | | | | | | |
| COMPARE [/ |] [и] [| N] [] | [] | | | | | | | |
| RECOMMENDATIONS: | (If different : | from NASA) | | | | | | | | |
| [2 /1F | t] [F] [| F] [P] (AD | [A] DD/DELETE) | | | | | | | |
| * CIL RETENTION | RATIONALE: (If ap) | plicable) ADEQUATE INADEQUATE | [] | | | | | | | |
| REMARKS: NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD461, 462, 561, 562) HAVE BEEN ADDED TO 03-3-2009-1, PER IOA ISSUE. IOA AGREES WITH NASA/RI FAILURE OF A SCREEN BASED ON INABILITY TO VERIFY CONDITION OF CAP SEAL AFTER CAP INSTALLATION. IOA ALSO AGREES WITH NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS. IOA ALSO RECOMMENDS THAT A STATEMENT BE ADDED TO THE EFFECTS ABOUT POSSIBLE CORROSION, FIRE, EXPLOSION, AND EXPOSURE OF EVA | | | | | | | | | | |

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-214 03-3-2009-3 | } | NASA DATA BASELINE NEW | : [] [X] |
|--|---|---|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 214 COUPLING - | PROPELLANT G | ROUND-PURGE | |
| LEAD ANALYST: | C.D. PRUST | | | |
| ASSESSMENT: | | | | the second second |
| CRITICAL FLIGH HDW/FU | ITY REI T NC A | UNDANCY SCRE B | ENS Cueve reference | CIL ITEM |
| NASA [3 /3 IOA [3 /3 | | [] | [] [] | []* |
| COMPARE [/ |] [] | []] | [] | [] |
| RECOMMENDATIONS: | (If diffe | erent from NA | SA) | |
| [3 /3 |] [] | []] | [] (A | [] .DD/DELETE) |
| * CIL RETENTION | RATIONALE: (| If applicabl | e) ADEQUATE INADEQUATE | [] |
| REMARKS: IOA FAILURE MODE AND "RESTRICTED NASA/RI DID NOT HOWEVER, THE REF | S ON ANALYSI FLOW". APPEAR TO CO DES NUMBERS | S SHEET SHOU OVER THIS COU S FOR THIS COU | LD INCLUDE " PLING ORIGIN UPLING (MD46 | FAILS CLOSED" ALLY. 1, 462, 561, |
| 562) HAVE BEEN A IOA RECOMMENDS T TO THE FAILURE M | DDED TO 03-3 HAT "FAILS C ODES ON THIS | -2009-3, PER LOSED" AND " FMEA. THES | IOA ISSUE. RESTRICTED F E ARE CREDIE | 'LOW" BE ADDED LE FAILURE |

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MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

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REPORT DATE 2/26/88
| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-215 03-3-2009- | 8 NASA DATA: 5 BASELINE [] 2009-2 NEW [X] | | | | | | | | | | |
|--|--|--|------------|----------|-----------|-------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 215 COUPLING - | - PROPELL | ANT GROUI | ND-PURGE | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | r | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICAL FLIGH | CIL ITEI | м | | | | | | | | | | |
| HDW/FU | NC A | A B C | | | | | | | | | | |
| NASA [3 /3 IOA [3 /3 |] [] [|] [] [|] [] [|]] | [[|] *] | | | | | | |
| COMPARE [/ |] [|] [|] [|] | [|] | | | | | | |
| RECOMMENDATIONS: | (If diff | ferent fro | om NASA) | | | | | | | | | |
| [/ |] [|] [|] [|] (A | [DD/D |] ELETE) | | | | | | |
| * CIL RETENTION | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEOUATE [] | | | | | | | | | | | |
| REMARKS: IOA FAILURE MODE OPEN" AND "RESTR | INADEQUATE [] REMARKS: IOA FAILURE MODES ON ANALYSIS SHEET SHOULD NOT INCLUDE "FAILS TO OPEN" AND "RESTRICTED FLOW". | | | | | | | | | | | |

HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD461, 462, 561, 562) HAVE BEEN ADDED TO 03-3-2009-2.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT I NT J A #: | DATE: | 1/01 OMS- 03-3 | /88 216 -200: | 10-1 | | Ň | IASA BASI | DATA LINE NEW | : [[X |] | |
|----------------------------------|----------------------------|----------------|----------------------|---------------------|--------|---------|--------|-----------------|---------------------|----------------|------------|--------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 216 CROS | SFEEI | D GIM | IBAL JO | TMIC | , <u> </u> | | | | |
| LEAD ANA | LYSI | : | C.D. | PRUS | ST | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | |
| | CRITICALITY REDUNDANCY SCH | | | | | | | | | | CII | J |
| | H | FLIGH DW/FU | T NC | 1 | A | В | | c | : | | TIF | M |
| NASA IOA | [] [] | /1 /1 |] | [[|]] | [[|]] | [[|]] | | [X [X | [] * [] |
| COMPARE | [| 1 |] | C |] | [|] | [|] | | Ľ | :] |
| RECOMMEN | DATI | ons: | (I | fdi | ffere | nt fro | om N | ASA) | | | | |
| | [| 1 | Ì] | [|] | [|] | [| J | (A) | |] DELETE) |
| * CIL RE | TENI | TION | RATIO | NALE | : (If | appl: | icab | le) A INA | DEQU | JATE JATE | [[|]] |
| REMARKS: NASA/RI THIS FME | | ED "F | AILED | CLOS | SED A | CMV RI | ELIE | FDEV | ICE" | ' T Ọ ' | ГНE | CAUSES |
| IOA RECO | MMEN | IDS A | DDING | A ST | FATEM | ENT TO |) TH | E EFF | ECTS | ABO | UT P | OSSIBLE |

FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS. IOA ALSO RECOMMENDS THAT "BINDING/JAMMING OF LINE BELLOWS" BE ADDED AS A CAUSE ON THIS FMEA.

REPORT DATE 2/26/88

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| SUBSYSTE MDAC ID: ITEM: | :M: | | | 0M9 217 CR0 | 3 7 DSSFEED | GIM | IBAL JO | DIN' | r | | | | |
| LEAD ANA | LYS | ST | : | c.1 | D. PRUSI | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | |
| | CR | IT: | ICAL | ITY | RE | DUN | IDANCY | SC | REENS | | | CIL ITE | M |
| | 1 | HD | W/FU | NC | A | | В | | C | 2 | | | |
| NASA IOA | . [[| 1 | / /1 |] | [[|]] | [[|]] | [_ [|]] | | [[x |] *] |
| COMPARE | [| N | /N |] | [|] | [|] | [|] | | [N |] |
| RECOMMEN | IDA' | TI(| ons: | | (If diff | ere | ent fro | om 1 | NASA) | | | | |
| | [| | / |] | [|] | [|] | [|] | (AI | [0/D |] ELETE) |
| * CIL RE | TE | NT | ION | RAT | CONALE: | (If | f appli | lcal | ble) / IN/ | ADEQU ADEQU | ATE ATE | [[|] |
| REMARKS: | | N | OT C | OVFI | י פיאיי א | ΤΤΔ | JIRE MO | ODE | (NO F | SELLO | WS AN | GUT | AR |

NASA/RI DO NOT COVER THIS FAILURE MODE (NO BELLOWS ANGULAR DEFLECTION). IOA RECOMMENDS ADDING THIS FAILURE MODE AS A CAUSE ON CROSSFEED LINE AND BELLOWS RUPTURE FMEAS.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ENT ENT EA | D2 I1 #: | ATE: D: | 1/01 OMS- NONH | L/88 -218 E | | | | ľ | IASA BASE | DATA: LINE NEW | [| |]] | - |
|----------------------------------|------------------|-----------------|----------------------|----------------------|-------------------|--------|-------------|--------|------------------|----------------|----------------------|-------------|-----------|----------|------|
| SUBSYSTI MDAC ID: ITEM: | EM: : | | | OMS 218 CROS | SFEED | GIN | ABAL JO | DIN | r | | | | | | |
| LEAD ANA | ALY | ST | : | C.D. | PRUS | г | | | | | | | | | |
| ASSESSMI | ent | : | | | | | | | | | | | | | |
| | CR | IT: FI HD | ICAL LIGH W/FU | ITY T NC | RI A | EDUN | NDANCY B | SC | REENS | 2 | | C] I] | (L Pem | ſ | |
| NASA IOA | [[| 1 | / /1 |]] | [|]] | [. [|]] | [[|]] | | [[| x |]] | * |
| COMPARE | [| N | /N |] | [|] | ſ |] | [|] | | ן | N |] | |
| RECOMMEN | NDA' | TIC | ONS: | (] | f dif: | fere | ent fro | om 1 | NASA) | | | | | | |
| | [| | / |] | [|] | [|] | [|] | (AD |] D/ | /DF |] ELF | ETE) |
| * CIL RI | ETE | NT | ION | RATIO | ONALE: | (11 | f appl: | ical | ble) / IN/ | ADEQU ADEQU | IATE IATE | [[r | |] | |

REMARKS:

NASA/RI DO NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). IOA NOW CONSIDERS THE CREDIBILITY OF RESTRICTED FLOW IN A BELLOWS TO BE QUESTIONABLE. IOA DOES NOT REGARD THE ABSENCE OF THIS FAILURE MODE IN THE FMEA/CIL TO BE AN OPEN ISSUE, BUT DOES RECOMMEND THAT IT BE ADDRESSED.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT D NT I A #: | ATE: D: | 1/01/8 OMS-22 03-3-2 | 01/88 NASA DATA: S-219 BASELINE [] -3-20011-1 NEW [X] | | | | | | | | | |
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| SUBSYSTE MDAC ID: ITEM: | :M : | | OMS 219 FLEXII | BLE I | LINE A | SSEN | IBLY | | | | | | |
| LEAD ANA | LYST | • | C.D. 1 | PRUSI | C | | | | | | | | |
| ASSESSME | ent: | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS | | | | | | | | | | | L FM | | |
| | HD | W/FU | NC | A | | В | | с | | *** | 214 | | |
| NASA IOA | [1 [1 | /1 /1 |]] | [[|]] | [[|] | [[|]] | []] | K] K] | * | |
| COMPARE | [| / |] | [|] | [|] | [|] | [|] | | |
| RECOMMEN | IDATI | ONS: | (If | dif | ferent | : fro | om NAS | SA) | | | | | |
| | [| / |] | [|] | [|] | [|] (A |] .DD/1 |] DELE | TE) | |
| * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | | | |
| REMARKS: NASA/RI THIS FME | ADDE EA, F | D "F. PER I | AILED (OA ISSI | CLOSI | ed aci | IV RI | ELIEF | DEV | ICE" TO | THE | CAU | SES | |

IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS.

ON

REPORT DATE 2/26/88

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| SUBSYST MDAC ID ITEM: | EM : : | | | OMS 220 FLEXII | BLE I | LINE | Assen | MBLY | | | | |
| LEAD AND | ALYS | ST | : | C.D. 1 | RUSI | C | | | | | | |
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| | CR | IT: | ICAL | ITY | RI | EDUND | ANCY | SCREE | ENS | | CII | L RM |
| | 1 | HD | N/FU | NC | A | | В | | С | | | _m |
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| COMPARE | נ | N | /N |] | [|] | [|] | [|] | [] | v] |
| RECOMME | NDA | FI (| ONS: | (If | diff | feren | t fro | om NAS | SA) | | | |
| | נ | | / |] | [|] | [| 1 | [|] | [ADD/1 |] DELETE) |
| * CIL R | ETEI | NT: | ION | RATION | ALE: | (If | appl | icable | ≥) A INA | DEQUATE DEQUATE | [|]] |
| REMARKS NASA/RI | DO STDI | N(FR | OT CO | OVER TH | IIS I | TAILU | RE MO | DDE (I | REST | RICTED I | LOW | IOA |

NASA/RI DO NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). TOA NOW CONSIDERS THE CREDIBILITY OF RESTRICTED FLOW IN A BELLOWS TO BE QUESTIONABLE. IOA DOES NOT REGARD THE ABSENCE OF THIS FAILURE MODE IN THE FMEA/CIL TO BE AN OPEN ISSUE, BUT DOES RECOMMEND THAT IT BE ADDRESSED.

REPORT DATE 2/26/88

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| LEAD AND | ALY | ST | : | C.D. | PRI | JSI | ? | | | | | | | | | | |
| ASSESSMI | ENT | : | | | | | | | | | | | | | | | |
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| NASA | ſ | | | ı | Г | | 1 | 1 | | 1 | Γ | |] | | [|] | * |
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| COMPARE | [| N | /N |] | [| N |] | ł | N |] | [| N |] | | [] | N] | |
| RECOMME | NDA | TIC | ONS: | (1: | f di | Ĺfſ | iere | nt | fr | om 1 | NASA) |) | | | | | |
| | [| | / |], | נ | |] | 1 | - |] | [| |] | (A |] /DD |] DEI | LETE) |
| * CIL R | ETE | NT | ION | RATIO | NALI | Ξ: | (If | aj | ppl | ical | ole) Il | IA IAN | DEQU DEQU | JATE JATE | [[|] | |
| REMARKS | : Ses E" | 0 | N AN | ALYSI | 5 SI | HEI | et s | но | JLD | NOT | r ing | ĊĹŬ | JDE | "FII | TER | | |
| NASA/RI | | N | OT C | OVER | RES | rr] | [CTE | DI | FLO | W II | NAS | 5EC | SMEN | NT OF | ' LI | NE | DUE |

NASA/RI DO NOT COVER RESTRICTED FLOW IN A SEGMENT OF LINE DUE TO OBSTRUCTION OR DEFORMATION (CRIMPING). SUCH AN OCCURRENCE COULD RESULT IN 3/2R EFFECTS, HOWEVER THE CREDIBILITY OF SUCH AN OCCURRENCE IS QUESTIONABLE. ANY CONTAMINATION WOULD FLOW TO DOWNSTREAM FILTER OR COMPONENT. IOA RECOMMENDS THAT SUCH A FAILURE BE ADDRESSED ON THE FMEA/CIL, BUT DOES NOT REGARD THIS RECOMMENDATION AS AN OPEN ISSUE.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | ENT ENT EA | DATE: 1/01/88 ID: OMS-222 #: NONE | | | | | | | . 1 | NASA D BASEL | ATA: INE NEW | [|]] | |
|---|-------------------|---|----------------------|----------------------|------------------------|----------------------|----------------------|--------------|--------------------|--------------------|--------------------|------------|-------------|-----------------|
| SUBSYSTE MDAC ID: ITEM: FITTINGS | EM : 5 | | | OMS 222 CROS | SFEED | PRC | PELLA | NT I | LINES | AND M | ECHA | NIC | CAL | 72 |
| LEAD ANA | LYS | ST: | : | C.D. | PRUS | T | | | | | | | | |
| ASSESSME | ENT | : | | | | | | | | | | | | |
| | CRI | ET: FI HDV | ICAL LIGH W/FU | ITY T NC | F | EDUN | IDANCY E | SCF | REENS | | | CII ITH | SM SM | |
| NASA IOA | [[| 1 | //1 |]] | [[|]] | [[|]] | ן נ |] | | [] | []] | * |
| COMPARE | ٦ | N | /N |] | [|] | [|] | [|] | | [] | 1] | |
| RECOMMEN | IDAT | CI C | SNS: | (] | f dif | fere | ent fr | rom N | IASA) | | | | | |
| | [· | | / |] | C |] | C |] | [|] | (AD | [0D/I |] DEL | ETE) |
| * CIL RE | eten | NT: | ION | RATIC | NALE: | (If | appl | icab | ole) - A INA | ADEQUA | re re | [[|] | |
| REMARKS: IOA CAUS BLOCKAGE | SES | 01 | N AN | ALYSI | S SHE | ET S | HOULE | гои (| INCI | LUDE " | FILT | ER | | |
| NASA/RI OBSTRUCI | DO TION | N N (| OT C OR D | OVER EFORM | RESTR ATION | ICTE | D FLC | W IN (G). | I A SE | EGMENT I AN O | OF CCUR | LIN REN | IE ICE | DUE TO COULD |
| RESULT I | IN 1 ICE | 1/1 IS | 1 EF S QU | FECTS ESTIC | S, <u>HOW</u> NABLE | EVER A | THE NY CO | CREE | IBILI IINATI | TY OF | SUC JLD | H A FLC | N W | ГО |
| DOWNSTRE FAILURE RECOMMEN | EAM BE IDAT | F Al FIC | ILTE DDRE ON A | R OR SSED S AN | COMPC ON TH OPEN | NENT E FM ISSU | '. IC EA/CI E. | A RE | SUT DO | ENDS TI DES NO' | HAT F RĒ | GAF | ED I | A THIS |

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-223 03-3-2008- | -2 | | NASA DATA BASELINE NEW | : [[X |] |
|--|----------------------------------|---------------------|--------------|------------------------------|---------------|------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 223 VALVE-CROS | SSFEED | | | | |
| LEAD ANALYST: | C.D. PRUST | C | | | | |
| ASSESSMENT: | | | | | | |
| CRITICAL FLIGH | ITY RI T NC A | EDUNDANCY | SCREENS | S C | CIL ITEM | |
| NACA (2 /1P | ים ה | י ב ו ר פ | 1 (| ר ק ו ק | ſ |] * |
| IOA [3 /2R |] [P |] [P | j | P j | Ĺ | j |
| COMPARE [/N |] [|] [|] [|] | [|] |
| RECOMMENDATIONS: | (If dif: | ferent fro | om NASA) |) | | |
| . [/ |] [|] [|] [|] | [DD/DE |] LETE) |
| * CIL RETENTION | RATIONALE: | (If appl: | icable) I | ADEQUATE NADEQUATE | [|] |
| REMARKS: | | | | | • | - |

IOA ACCEPTS NASA/RI REEVALUATION AND RATIONALE REGARDING 3/1R CRITICALITY. NASA/RI DELETED THE 1/1 ABORT CRITICALITY BASED ON S/W CHANGES WHICH WILL HAVE BOTH XFEED VALVE SWITCHES IN THE GPC POSITION FOR LAUNCH BEGINNING WITH STS-26.

REPORT DATE 2/26/88

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| ASSESSME | NT D | ATE: D: | 1/01/0 OMS-2 | 88 24 | | | NAS | SA DATA ASELINE | .: : Г | | · <u>-</u> | | |
|--|------------|------------|---------------------|----------|------------|------|----------|--------------------|-------------|------------------|------------|-------------|-----|
| NASA FME | A #: | | 03-3-3 | 2008 | 8-1 | | | | | NEW | ינֿא | ij | |
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 224 VALVE | -CRC | SSFE | ED | | | | | | | |
| LEAD ANA | LYST | : | C.D. 1 | PRUS | ST | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS FLIGHT | | | | | | | | | | CIL ITE | M | | |
| | HD | W/FUI | NC | P | 1 | | B | | С | | | | |
| NASA IOA | [3 [3 | /2R /3 |]] | [I [|)] | [| P]] | [[| P |] | [|] *] | |
| COMPARE | [| /N |] | [] | 1] | []] | N] | [| N |] | [|] | |
| RECOMMEN | DATI | ons: | (If | dif | fere | nt f | rom | NASA | Ĵ | | | | |
| | [| 1 | Ĵ | [|] | [|] | [| |] (A |] DD/D |] ELETE) | |
| * CIL RE | TENT | ION | RATION | ALE: | (If | app | lic | able) I | ADI NADI | EQUATE EQUATE | [[|] | |
| REMARKS: IOA AGRE | ES W | ITH I | NASA/R | I RE | EVAL | UATI | ON | AND R | ATIC | ONALE R | EGAR | DING 3 | /2R |

CRITICALITY.

REPORT DATE 2/26/88

HRANSLOW, AND CONTRACT

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-225 NONE | | | | | | NASA BASI | DATA: ELINE NEW | [[|] |
|--|----------------------------|-----|-------|----------|--------|----------|--------------|-----------------------|------------|-------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 225 VALVE-C | ROS | SFEED |) | | | | | | |
| LEAD ANALYST: | C.D. PR | UST | I | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAL | ITY | RE | DUNDA | NCY | SCREE | INS | | | CIL | л |
| HDW/FU | NC | A | | В | | | С | | | • |
| NASA [/ IOA [3 /2R |] [| Р |] . | [[P |] | [[|] P] | | [[|] *] |
| COMPARE [N /N |] [| N |] | [N |] | [| N] | | [|] |
| RECOMMENDATIONS: | (If d | iff | erent | : fro | om NAS | SA) | | | | |
| t / |] [| |] | [|] | [|] | (Aľ | [DD/DI |] ELETE) |
| * CIL RETENTION | RATIONAL | E: | (If a | appli | cable | ≥) IN | ADEQI | UATE UATE | [[|]] |
| REMARKS: | - | | | | | | | | - | |

NASA/RI DID NOT COVER THIS FAILURE MODE (FAILS MIDTRAVEL). IOA RECOMMENDS THAT THIS FAILURE MODE BE ADDED TO 03-3-2008-2, HOWEVER FMEA/CIL IS ADEQUATE WITHOUT THIS ADDITION. THE EFFECTS OF THIS FAILURE MODE ARE COVERED ON 03-3-2008-2.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-226 03-3-200 | 08-1 | | NASA DATA BASELINE NEW | : [] [X] |
|--|--------------------------------|----------|--------------|------------------------------|-------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 226 VALVE-CH | Rossfeei |) | | |
| LEAD ANALYST: | C.D. PRU | JST | | | |
| ASSESSMENT: | | | | | |
| CRITICAL FLIGH | ITY T | REDUNDA | ANCY SCRE | ENS | CIL ITEM |
| HDW/FU | NC | A | В | Ç | |
| NASA [3 /2R IOA [3 /3 |] [| P]] | [P] [] | [P] [] | [].* |
| COMPARE [/N | J [| N] | [N] | [N] | [] |
| RECOMMENDATIONS: | (If di | lfferent | : from NA | SA) | |
| [/ |][|] | [] | [[']] (A | [] DD/DELETE) |
| * CIL RETENTION | RATIONALI | E: (If a | applicabl | e) ADEQUATE INADEQUATE | [] |
| REMARKS: | NACA /DT T | | | | mv. |
| ASSIGNMENT. HOW | EVER, IOA | MAINTA | INS CONC | ERN REGARDIN | G |

DETECTABILITY OF INTERNAL LEAKAGE DURING FLIGHT. IOA ACCEPTS SSM POSITION THAT A LEAKAGE LARGE ENOUGH TO CAUSE ANY PROBLEMS WOULD BE DETECTABLE. LEAKAGES TOO SMALL TO DETECT ARE OF NO CONSEQUENCE.

C-134

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-227 03-3-2101-1 | | NASA DATA BASELINE NEW | : [x] [x] |
|--|-----------------------------------|------------------|------------------------------|---------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 227 VALVE-CROSSFE | ED | | |
| LEAD ANALYST: | C.D. PRUST | | | |
| ASSESSMENT: | | | | |
| CRITICAL FLIGH HDW/FU | ITY REDUN F NC A | IDANCY SCRE B | ENS C | CIL ITEM |
| NASA [1 /1 IOA [1 /1 |] []] [] | [] | [] | [X]* [X] |
| COMPARE [/ |] [] | [] | [] | []] |
| RECOMMENDATIONS: | (If differe | ent from NA | SA) | |
| [/ |] [] | []] | [] (A | [] DD/DELETE) |
| * CIL RETENTION D | RATIONALE: (II | f applicabl | e) ADEQUATE INADEQUATE | [] |

NASA/RI AGREED TO ADD THIS VALVE BODY TO THE ITEM LIST ON THIS FMEA, AND TO ADD CORRESPONDING RETENTION RATIONALE TO THE CIL SHEET, PER IOA ISSUE. NASA/RI ALSO ADDED "FAILED CLOSED ACMV RELIEF DEVICE" TO THE CAUSES ON THIS FMEA, PER IOA ISSUE. IOA RECOMMENDS ADDING STATEMENTS TO THE EFFECTS ABOUT POSSIBLE FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS.

REPORT DATE 2/26/88

ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [] NEW [X] ASSESSMENT ID: OMS-227A NASA FMEA #: 03-3-2008-3 SUBSYSTEM: OMS MDAC ID: 227 AC VALVE ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С. HDW/FUNC Α В NASA [1 /1] [[X] *] []]]] l Ī 1 Γ IOA [1/1][X]]] COMPARE [/] [Г 1 Γ 1 1 [1 **RECOMMENDATIONS:** (If different from NASA) [] [1 (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [1 **REMARKS:** IOA RECOMMENDS THAT "FAILED CLOSED ACMV RELIEF DEVICE" BE ADDED

AS A CAUSE ON THIS FMEA, HOWEVER FMEA IS ADEQUATE WITHOUT THIS = ADDITION. IOA ALSO RECOMMENDS ADDING A STATEMENT TO THE EFFECTS REGARDING POSSIBLE EXPOSURE OF EVA AND GROUND CREWS TO PROPELLANT.

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-228 NEW [X] NASA FMEA #: 03-3-2008-2 SUBSYSTEM: OMS MDAC ID: 228 VALVE-CROSSFEED ITEM: C.D. PRUST LEAD ANALYST: ASSESSMENT: CIL REDUNDANCY SCREENS CRITICALITY ITEM FLIGHT В C HDW/FUNC Α [P] [P] [P] [3 /1R] NASA l [P] [X] [P] [F] [3/2R]IOA COMPARE [/N] RECOMMENDATIONS: (If different from NASA) /]· [] [] [] [(ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE I] INADEQUATE [1 **REMARKS:** NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). NASA/RI AGREED TO ADD "RESTRICTED FLOW" TO THE FAILURE"

FLOW). NASA/RI AGREED TO ADD "RESTRICTED FLOW" TO THE FAILURE MODES ON 03-3-2008-2 (FAILS CLOSED), PER IOA ISSUE. IOA AGREES WITH NASA/RI RATIONALE FOR 3/1R PPP CRIT ASSIGNMENT. IOA B SCREEN FAILURE WAS BASED ON THE USE OF BOTH XFEED VALVES FOR OMS XFEED OPS. HOWEVER, OMS XFEED IS A CONTINGENCY OPERATION. OMS/RCS INTERCONNECT NOMINALLY USES ONLY ONE OMS XFEED VALVE.

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-229 1 NEW [NASA FMEA #: NONE 1 SUBSYSTEM: OMS MDAC ID: 229 ITEM: VALVE-CROSSFEED LEAD ANALYST: C.D. PRUST ASSESSMENT: REDUNDANCY SCREENS CRITICALITY CIL FLIGHT ITEM В С HDW/FUNC Α NASA [] [] [] [P] [P] [P] 1 E IOA $\begin{bmatrix} 3/2R \end{bmatrix}$] COMPARE [N/N] [N] [N] [N]ſ 1 RECOMMENDATIONS: (If different from NASA) [(ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [1 **REMARKS:** NASA/RI DID NOT COVER THIS FAILURE MODE (DELAYED OPERATION). THIS FAILURE MODE NEED NOT BE ADDED TO THE FMEA/CIL. WORST CASE EFFECTS OF "DELAYED OPERATION" ARE COVERED BY THE "FAILS CLOSED" FMEA (03-3-2008-2).

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REPORT DATE 2/26/88

C-138

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-230 NONE | NASA BASI | DATA: ELINE [] NEW [] |
|--|--|---|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 230 VALVE-CROSSFE | ED | |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL | ITY REDUN | DANCY SCREENS | CIL ITEM |
| HDW/FU | NC A | B C | |
| NASA [/ IOA [3 /1R |] []] [P] | [] [] [F] [P] | [] * [X] |
| COMPARE [N /N |] [N] | [N] [N] | [N] |
| RECOMMENDATIONS: | (If differe | ent from NASA) | |
| [/ | ן נ | []]]]] | [] (ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (If | applicable) ADEQ INADEQ | UATE [] UATE [] |
| REMARKS: NASA/RI DO NOT C FAILS TO RELIEVE IS LISTED AS A C EXTERNAL LEAKAGE IOA RECOMMENDS T ON A SEPARATE FM ATTENTION, BUT D ISSUE. | OVER THIS FAII) ON A SEPARAT AUSE ON CROSSE FMEAS. HAT THIS FAILU EA TO ENSURE T OES NOT REGARI | LURE MODE (INTERNA TE FMEA. HOWEVER, TEED PROP LINE AND URE BE ADDRESSED A THAT IT GETS THE P O THIS RECOMMENDAT | L RELIEF VALVE THIS FAILURE MODE GIMBAL BELLOWS S A FAILURE MODE ROPER AMOUNT OF ION TO BE AN OPEN |

REPORT DATE 2/26/88

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| ASSES ASSES NASA | SME SME FME | ENT ENT EA | D I #: | ATE: D: | 1/01 OMS- 03-3 | 1/01/88 1 DMS-231 03-3-2001-1 | | | | | NA E | ASA DATA BASELINE NEW | : [] | X |] | | | | |
|---|--|---------------------------------------|------------------------------|---|--|---|--------------------------------------|---|---|---|--|---|---------------------|---|--------------------------------|--------------------------------|------------------------------------|--|---|
| SUBSY MDAC ITEM: | STE ID: | EM: | | | OMS 231 COUH | PLIN | G | – F | IIGH- | PO | נאז | BLEF | D | | | | · | | |
| LEAD | ANA | LY | ST | : | c.D. | PR | US | т | | | | | | | | | | | |
| ASSES | SME | ENT | : | | | | | | | | | | | | | | | | |
| | | CR | ΙŢ | ICAL | ITY | | R | EDU | INDAN | CY | sc | REENS | 5 | | C | [L | | | |
| | | | F HD | LIGH W/FU | T NC | | A | | | в | | | С | | Τ. | LEV | 1 | | |
| NA I | SA OA | [[| 2 2 | /1R /1R |]] | [[| F P |]] | [[| F N2 |] A] | [[| P P |] | [[| X X |]] | * | |
| сомра | RE | [| • | / |] | [| N |] | [| N |] | [| |] | [| |] | | |
| RECOM | MEN | IDA | TI | ons: | [] | f d | if | fer | rent | fro | om | NASA) | | | | | | | |
| | | נ | 2 | /1R |] | [| F |] | [| F |] | [| Ρ |] (AI |] ,00 | A ⁄DI |] ELE | TE) | |
| * CIL | RE | CTE: | NT | ION | RATIC | NAL | с: | (1 | fap | pl: | ica | ble) IN | AC IAC | EQUATE EQUATE | - [| |] | n - mana si | |
| REMAR NASA/ HOWEV BEEN IOA A VERIF AGREE | KS: RI ER, ADI GRE Y C | DI T DED CES CON | D HE T W DI H | NOT REF O 03 ITH TION NASA | APPEA DES -3-20 NASA/ OF C /RI F | R T NUM 001- 'RI 'AP 'AIL | O BE 1, FA SE UR | COV RS PE ILU AL E C | VER TI FOR ' IR IO IRE OI AFTEI OF B | HIS THI A I F Z R C SCH | S C IS ISS A S CAF REE | COUPLI COUPI UE. CREEN INST | NG IN E | G (MD667 ASED ON LED. IC | II DA | LY. 66 JAE AI | 58) 311 .SO | HAVE |) |
| IOA R AS A AND I IOA A OF OR LANDI IN CO CREWS | FAI SA LSC BIT NG NTA | MM LU DD R ER WE MI | EN RE EC IG | DS T MOD SSED OMME NTRY HT C TION | HAT " E ON NDS 1 MASS ONSTF , FIF | POP THI CS THAT S PR AIN E, | PE S QD T OP IS EX | T F FME CC HE ERI , A PLC | AILS A. DUPLIN EFFE ND PO SION | OI THI NG CTS CON DSS , 1 | PEN IS FM IS IS IB AND | (DUR IS A EAS. NCLUD RAINT LE PR EXPO | CR CR S OP | G FLIGHT EDIBLE H POSSIBLE AND PROH LEAKAGH RE OF EV | TAJ FAJ E V E P 7A | ILU VIC TAN RES AN | SE JRE DLA IK UL ID | ADDED MODE TIONS TING GROUNE | > |

응용할 수 있는 것 수밖에 많은 것 수밖에 많

ASSESSMENT DATE: 1/01/88 NASA DATA: ASSESSMENT ID: BASELINE [OMS-232 NEW [X] 03-3-2001-3 NASA FMEA #: SUBSYSTEM: OMS 232 MDAC ID: COUPLING - HIGH-POINT BLEED ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С В HDW/FUNC Α]] * NASA [3 /3 [[[[]] L IOA [3 /3 [] 1 Γ 1 1 [] [1 ſ 1 COMPARE] RECOMMENDATIONS: (If different from NASA)] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE E INADEQUATE [] **REMARKS:** IOA FAILURE MODES ON ANALYSIS SHEET SHOULD INCLUDE "FAILS CLOSED" AND "RESTRICTED FLOW". NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD667, 668) HAVE

BEEN ADDED TO 03-3-2001-3, PER IOA ISSUE. IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSM ASSESSM NASA FN | ient Ient Iea | D2 I1 #: | ATE D: | : 1/01 OMS- 03-3 | L/01/88 DMS-233 D3-3-2001-2 | | | | | | DATA LINE NEW | :]] |) x] | |
|-------------------------------|---------------------|----------------|--------------------|--------------------------|-----------------------------------|---------------------|-----------------------------|----------------------|-------------------------|--------------|---------------------|-------------|------------|-------|
| SUBSYST MDAC II ITEM: | CEM: | | | OMS 233 COUE | PLING | – ні | [GH-PO] | INT | BLEED | | | | | |
| LEAD AN | IALY | ST | : | C.D. | PRUS | ST | | | | | | | | |
| ASSESS | 1ENT | : | | | | | | | | | | | | |
| | CR | IT: FI | | LITY | F | EDUN | DANCY | SCI | REENS | | | CI TT | L EM | |
| |] | HD | W/FU | UNC | A | 7 | B | | C | | | | | |
| NASA IOA | A [A [| 3 3 | /3 /3 |]] | [[|]] | [[|]] | [[|]] | | [[| ; [] | * |
| COMPARE | 5 (| | / |] | נ |] | [|] | [|] | | [|] | |
| RECOMME | ENDA | FI (| ONS | : (1 | f dif | fere | ent fro | om 1 | NASA) | | | | | |
| | [| | / |] | [|] | Ĺ |] | [|] | (Al |] /00 |] DELEI | ſE) |
| * CIL F | RETE | N T I | ION | RATIC | NALE: | (If | appli | lcal | ole) A INA | DEQU DEQU | ATE ATE | [[|]] . | |
| IOA FAI OPEN" A | | E I "RI | MODI ESTI | ES ON RICTED | ANALY | SIS | SHEET | SHO | OULD N | OT I | | DE | "FAII | LS TO |
| NASA/RI HOWEVEF BEEN AI | DI R, TI | DI HE T(| NOT REI D 0: | APPEA F DES 3-3-20 | NUMBE | COVE RS F PEF | OR THIS FOR THI IOA I | s co Is o Issu | DUPLIN COUPLI JE. | g or Ng (| IGINA MD667 | ALI 7, | ¥. 668) | HAVE |
| | | | | 1 | | | | | | | | | | |

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-234 03-3-2009-1 | NASA DATA: BASELINE [] NEW [X] | | | | | | |
|--|--------------------------------------|---|---|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 234 COUPLING-CROSSFE | ED DRAIN | | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | |
| ASSESSMENT: | | | | | | | | |
| CRITICA FLIGH | LITY REDUNDANG | CY SCREENS CIL ITEM | | | | | | |
| nDw/r0 | | | | | | | | |
| NASA [2 /1] IOA [2 /1] | <pre> ¿] [F] [¿] [P] [</pre> | F] [P] [X]* NA] [P] [X] | | | | | | |
| COMPARE [/ |] [N]] | N][][] | | | | | | |
| RECOMMENDATIONS | (If different | from NASA) | | | | | | |
| [2 /1] | ٤] [F] [| F] [P] [A] (ADD/DELETE) | | | | | | |
| * CIL RETENTION | RATIONALE: (If ap) | plicable) ADEQUATE [] INADEQUATE [] | - | | | | | |
| INADEQUATE [] REMARKS: NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD673, 674, 679, 686) HAVE BEEN ADDED TO 03-3-2009-1, PER IOA ISSUE. IOA AGREES WITH NASA/RI FAILURE OF A SCREEN BASED ON INABILITY TO VERIFY CONDITION OF CAP SEAL AFTER CAP INSTALLATION. IOA ALSO AGREES WITH NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS. IOA ALSO RECOMMENDS THAT A STATEMENT BE ADDED TO THE EFFECTS ABOUT POSSIBLE CORROSION, FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS DUE TO PROP LEAKAGE. | | | | | | | | |

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 NASA DATA: OMS-235 BASELINE [] 03-3-2009-3 NEW [X] | | | | | | | |
|--|--|---|---|--------------------------------|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 235 COUPLING-CROS | SSFEED DRA | IN | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | |
| ASSESSMENT: | | | | | | | | |
| CRITICAL FLIGH | ITY REDUN T | NDANCY SCR | EENS | CIL ITEM | | | | |
| HDW/FU | NC A | B | | . : | | | | |
| NASA [3 /3 IOA [3 /3 |] [] | - [] [] | [] [] | [] * [] [*] | | | | |
| COMPARE [/ |] [] | [] | [] | [] | | | | |
| RECOMMENDATIONS: | (If differe | ent from N | ASA) | | | | | |
| [3 /3 |] [] | [] | [] | [] (ADD/DELETE) | | | | |
| * CIL RETENTION | RATIONALE: (II | f applicab | le) ADEQUAT INADEQUAT | E [] E [] | | | | |
| REMARKS: IOA FAILURE MODE AND "RESTRICTED | S ON ANALYSIS FLOW". | SHEET SHOW | ULD INCLUDE | "FAILS CLOSED" | | | | |
| NASA/RI DID NOT HOWEVER, THE REF 686) HAVE BEEN A | APPEAR TO COVI DES NUMBERS I DDED TO 03-3-2 | ER THIS COU FOR THIS CO 2009-3, PE | UPLING ORIG DUPLING (MD R IOA ISSUE | INALLY. 673, 674, 679, | | | | |
| IOA RECOMMENDS T TO THE FAILURE M MODES AND ARE AD | HAT "FAILS CLO ODES ON THIS F DRESSED ON RCS | SED" AND SED" AND SED" AND SED THESE SED COUPLE | "RESTRICTED SE ARE CRED ING FMEAS. | FLOW" BE ADDED IBLE FAILURE | | | | |

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-236 03-3-2009 | | NASA DATA: BASELINE [] ' NEW [X] | | | | | | |
|---|---------------------------------|--|---|-----------|----------|------------|-------------|----|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 236 COUPLING- | OMS 236 COUPLING-CROSSFEED DRAIN | | | | | | | |
| LEAD ANALYST: | C.D. PRUS | D. PRUST | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICAL | CII | L FM | | | | | | | |
| HDW/FU | NC A | ł | | | 5171 | | | | |
| NASA [3 /3 IOA [3 /3 |] [] [|] [].[|]] | [[|] | [[|] *] | | |
| COMPARE [/ |] [|] [|] | [|]. | [|] | | |
| RECOMMENDATIONS: | (If dif | ferent | from NA | ASA) | | | | | |
| [/ |] [|] [|] | [|] (A |] I \dd |] DELETE |) | |
| * CIL RETENTION | RATIONALE: | : (If ap | plicab | le) AI | DEQUATE | [|] | | |
| DENADUC. | | | | INAI | DEQUATE | Č | j | | |
| IOA FAILURE MODE OPEN" AND "RESTR | S ON ANALY | (SIS SHE | ET SHOU | ULD NO | OT INCLU | DE ' | "FAILS | то | |
| NASA/RI DID NOT APPEAR TO COVER THIS COUPLING ORIGINALLY. | | | | | | | | | |

HOWEVER, THE REF DES NUMBERS FOR THIS COUPLING (MD673, 674, 679, 686) HAVE BEEN ADDED TO 03-3-2009-2.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-237 NONE | | NASA D BASEL | ATA: INE [] NEW [] | | | | |
|---|----------------------------|------------------|----------------------------|----------------------------|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: NTO | OMS 237 PROPELLANT | LINES AND | MECHANICAL | FITTINGS-MMH AND | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | |
| ASSESSMENT: | | | | | | | | |
| CRITICAI FLIGH HDW/FU | ITY RE T NC A | DUNDANCY SC B | REENS C | CIL ITEM | | | | |
| NASA [/ IOA [3 /3 |].[] [|] [] | [] [] | []* [] | | | | |
| COMPARE [N /N |] [|] [] | []] | [] | | | | |
| RECOMMENDATIONS: | (If diff | erent from | NASA) | | | | | |
| [/ |] [|] [] | []] | [] (ADD/DELETE) | | | | |
| * CIL RETENTION | RATIONALE: | (If applica | ble) ADEQUA INADEQUA | TE [] TE [] | | | | |
| IOA CAUSES ON AN | ALYSIS SHEE | T SHOULD NO | T INCLUDE " | FILTER | | | | |
| NASA/RI DO NOT COVER RESTRICTED FLOW IN A SEGMENT OF LINE DUE TO OBSTRUCTION OR DEFORMATION (CRIMPING). SUCH AN OCCURRENCE COULD RESULT IN 3/3 EFFECTS, HOWEVER THE CREDIBILITY OF SUCH AN OCCURRENCE IS QUESTIONABLE. ANY CONTAMINATION WOULD FLOW TO DOWNSTREAM FILTER OR COMPONENT. IOA RECOMMENDS THAT SUCH A FAILURE BE ADDRESSED ON THE FMEA/CIL, BUT DOES NOT REGARD THIS RECOMMENDATION AS AN OPEN ISSUE. | | | | | | | | |

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-238 NONE | /01/88 NASA DATA: MS-238 BASELINE [] DNE NEW [] | | | | | | | |
|---|---|---|-------------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: NTO | OMS 238 PROPELLANT LINE | MS 38 ROPELLANT LINES AND MECHANICAL FITT | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICAL | ITY REDUNDA | NCY SCREENS | CIL | | | | | | |
| HDW/FU | NC A | B C | ± ± ±=11 | | | | | | |
| NASA [/ IOA [2 /1R |] []] [P] | [] [] [F] [P] | [] * [X] | | | | | | |
| COMPARE [N /N |] [N] | [N] [N] | [N] | | | | | | |
| RECOMMENDATIONS: | (If different | from NASA) | | | | | | | |
| [/ |] [] | [][](AC | [] DD/DELETE) | | | | | | |
| * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | |
| REMARKS: IOA CAUSES ON AN | REMARKS: IOA CAUSES ON ANALYSIS SHEET SHOULD NOT INCLUDE "FILTER | | | | | | | | |
| BLOCKAGE". NASA/RI DO NOT COVER RESTRICTED FLOW IN A SEGMENT OF LINE DUE TO OBSTRUCTION OR DEFORMATION (CRIMPING). SUCH AN OCCURRENCE COULD RESULT IN 2/1R EFFECTS. HOWEVER THE CREDIBILITY OF SUCH AN | | | | | | | | | |

RESULT IN 2/1R EFFECTS, HOWEVER THE CREDIBILITY OF SUCH AN OCCURRENCE IS QUESTIONABLE. ANY CONTAMINATION WOULD FLOW TO DOWNSTREAM FILTER OR COMPONENT. IOA RECOMMENDS THAT SUCH A FAILURE BE ADDRESSED ON THE FMEA/CIL, BUT DOES NOT REGARD THIS RECOMMENDATION AS AN OPEN ISSUE.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | ENT D ENT I EA #: | ATE: D: | 1/01/ OMS-2 03-3- | /88 239 -2601 | -1 | | NASA DATA: BASELINE [] NEW [X] | | | | | | |
|----------------------------------|-------------------------|--------------|-------------------------|---------------------|--------|--------|---|----------|----------------|----------|------------|------------|-------------|
| SUBSYSTE MDAC ID: ITEM: | EM : | | OMS 239 GIMBA | AL BE | LLOW | S | | | | | | | |
| LEAD ANA | LYST | : | C.D. | PRUS | т | | | | | | | | |
| ASSESSME | ENT: | | | | | | | | | | | | |
| | CRIT F | ICAL LIGH | ITY T | R | EDUN | DANCY | SCI | RÉENS | | | CII ITE | M | |
| | HD | W/FU | NC | A | | В | | C | | | | | |
| NASA IOA | [1 [1 | /1 /1 |]] | [[|]] | [[|] | [[|] | | [X [X | [] [] | * |
| COMPARE | [| / |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | IDATI | ons: | (I: | f dif | fere | nt fro | om 1 | NASA) | | | | | |
| | ľ | / |] | [· |] | [|] | [|] | (AI | [DD/D |] ELE | TE) |
| * CIL RE | TENT | ION | RATIO | NALE: | (If | appl | ical | ble) | | | | | |
| | | | | | | | | A INA | DEQUA DEQUA | TÉ TÉ | [[|] | |
| REMARKS: NASA/RI | AGRE | ED T | O ADD | "FAI | | CLOSE | D A | CMV RE | LIEF | DEVI | CE" | TO NAT. | THE E ON |

CAUSES ON THIS FMEA, PER IOA ISSUE. THE RETENTION RATIONALE ON THE CIL SHEET SHOULD ADDRESS THIS NEW CAUSE. IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS. IOA ALSO RECOMMENDS THAT "BINDING/JAMMING OF LINE BELLOWS" BE ADDED AS A CAUSE ON THIS FMEA.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT NT A ‡ | D/ II #: | ATE: D: | 1/01/ OMS-2 NONE | ′88 240 | | | | : | NASA DATA BASELINI NEV | ¥: 5 [√ [| |]] | |
|----------------------------------|--|----------------|--------------|------------------------|------------------------------|--------|--------|--------|-----------|------------------------------|------------------|-----------|----------|-----|
| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 240 GIMBA |)MS 240 FIMBAL BELLOWS | | | | | | | | | |
| LEAD ANA | LYS | 5 T : | : | C.D. | .D. PRUST | | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | |
| | CRI | TT FI | ICAL LIGH | ITY T | R | EDUNI | DANCY | SCR | EENS | | C] I] | IL TEN | 4 | |
| | ł | łDł | N/FU | NC | A | | E | 5 | 1 | с | | | - | |
| NASA IOA | [[| 1 | / /1 |]] | [[|]] | [[|]] | [[|]] | [[| x |]] | * |
| COMPARE | (| N | /N |] | ſ |] | Γ |] | [|] | [| N |] | |
| RECOMMEN | DAI | CI (| ons: | (If | dif | ferer | nt fr | om N | ASA) | | | | | |
| - | [| | / |] | [|] | [|] | [|] |] ADD/ | DI |] SLE | TE) |
| * CIL RE | TEN | VT: | ION | RATION | IALE: | (If | appl | icab | le) IN | ADEQUATE ADEQUATE | [[| |]] | |
| REMARKS: NASA/RI | REMARKS: NASA/RI DO NOT COVER THIS FAILURE MODE (NO BELLOWS ANGULAR | | | | | | | | | | | | | |

NASA/RI DO NOT COVER THIS FAILURE MODE (NO BELLOWS ANGULAR DEFLECTION). IOA RECOMMENDS ADDING THIS FAILURE MODE AS A CAUSE ON LINE AND BELLOWS RUPTURE FMEAS.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-241 NONE | | NASA DATA: BASELINE NEW | |
|--|-----------------------------|--------------------|-------------------------------|------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 241 GIMBAL BELLON | 1S | | |
| LEAD ANALYST: | C.D. PRUST | | | |
| ASSESSMENT: | | | | |
| CRITICAL FLIGH HDW/FU | ITY REDUI I IC A | IDANCY SCREEN B | s c | CIL ITEM |
| NASA [/ IOA [2 /1R |] []] [P] | [] [[F] [|] P] | [] * [X] |
| COMPARE [N /N |] [N] | [И] | N] | [N] |
| RECOMMENDATIONS: | (If differe | ent from NASA |) | |
| [/ |] [] | [][|] (AI | [] DD/DELETE |
| * CIL RETENTION 1 | RATIONALE: (I | f applicable) | ADEOUATE | r 1 |

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REMARKS:

NASA/RI DO NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). IOA NOW CONSIDERS THE CREDIBILITY OF RESTRICTED FLOW IN A BELLOWS TO BE QUESTIONABLE. IOA DOES NOT REGARD THE ABSENCE OF THIS FAILURE MODE IN THE FMEA/CIL TO BE AN OPEN ISSUE, BUT DOES RECOMMEND THAT IT BE ADDRESSED.

REPORT DATE 2/26/88

| ASSESSMI ASSESSMI NASA FMI | ENT D ENT I EA #: | ATE: D: | 1/01/8 OMS-24 03-3-2 | 38 12 2601– | -1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | |
|---|-------------------------|------------|----------------------------|-------------------|--------|---|----------|------------|--------------------|------------|--------------|--|--|--|
| SUBSYSTI MDAC ID: ITEM: | em : : | | OMS 242 GIMBAI | L BEI | LLOWS | | | | | | | | | |
| LEAD AND | : | | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCRE | | | | | | | | | | CIL | M | | | |
| | HD | W/FU | NC | A | | В | | С | | 111 | 11 | | | |
| NASA IOA | [1 [1 | /1 /1 |]] | [[|] | [[|] | [[|]] | [X [X |]* | | | |
| COMPARE | [| / |]. | [|] | [|] | [|] | [|] | | | |
| RECOMME | NDATI | ONS: | (If | dif | ferent | : fro | om NAS | SA) | | | | | | |
| | [| / |] | [| Ĵ | [| <u>ַ</u> | [|] (A | [DD/D |] PELETE) | | | |
| * CIL R | ETENI | NOI | RATION | ALE: | (If a | appl | icable | ≥) | | _ | _ | | | |
| | | | | | | | | AI INAI | DEQUATE DEQUATE | [[|] | | | |
| REMARKS: NASA/RI AGREED TO ADD "FAILED CLOSED ACMV RELIEF DEVICE" TO THE CAUSES ON THIS FMEA, PER IOA ISSUE. THE RETENTION RATIONALE ON THE CIL SHEET SHOULD ADDRESS THIS NEW CAUSE. | | | | | | | | | | | | | | |

IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS. IOA ALSO RECOMMENDS THAT "BINDING/JAMMING OF LINE BELLOWS" BE ADDED AS A CAUSE ON THIS FMEA.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ENT I ENT I EA # : | DATE: | 1/01/8 OMS-24 NONE | 38 43 | | | N. | ASA DATA BASELINE NEW | : . [[|]] | |
|---|---------------------------------|-----------------|--------------------------|----------|--------|--------|-------------|-----------------------------|--------------------|-----------|-------------|
| SUBSYSTI MDAC ID: ITEM: | em: : | | OMS 243 GIMBAI | L BE | LLOWS | | | | | | |
| LEAD AND | ALYSI | 2: | C.D. 1 | PRUS | т | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| | CRIT | ICAL | ITY | R | EDUNDA | ANCY | SCRE | ens | | CIL | м |
| | н | W/FU | NC | A | | В | | С | | ± ± ₩. | • |
| NASA IOA | [[] | / 1 /1 |] | [[|]] | ן נ |]] | [[|]] | [[x |] *] |
| COMPARE | ĹN | N /N |] | [|] | [|] | [|] | [N |] |
| RECOMMEN | ITADN | ons: | (If | dif | ferent | t fro | om NAS | 5A) | | | |
| | [| / |] | [|] | [|] | [|] (AI |] מ/סכ |] ELETE) |
| * CIL RI | ETENJ | TION | RATION | ALE: | (If a | appl: | icablo | e) A INA | DEQUATE DEQUATE | [[|] |
| REMARKS: NASA/RI DO NOT COVER THIS FAILURE MODE (NO BELLOWS ANGULAR DEFLECTION). IOA RECOMMENDS ADDING THIS FAILURE MODE AS A CAUSE ON LINE AND BELLOWS RUPTURE FMEAS. | | | | | | | | | | | |
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REPORT DATE 2/26/88

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| | ASSESSM ASSESSM NASA FM | ATE: D: | 1/01/88 OMS-244 NONE | | | | | | |] | NASA DATA: BASELINE [NEW [| | | | | | |
|---------------|--|------------|----------------------------|----------|-------|------------|-----|--------|--------|-------------|-----------------------------------|------------|----------------|--------------|-----------|-----------|-----|
| | SUBSYSTEM: OMS MDAC ID: 244 ITEM: GIMBAL BELLC | | | | | | | | S | - | | | | | | | |
| LEAD ANALYST: | | | | | C.D. | C.D. PRUST | | | | | | | | | | | |
| | ASSESSM | ENT | : | | | | | | | | | | | | | | |
| | | CR | IT: | ICAL | ITY | | RI | EDUN | DAN | CY | SCR | EENS | | | CII | M | |
| | | | HD | W/FU | NC | | A | | | В | | | С | | ± ± ± | | |
| | NASA IOA | [| 2 | / /1R |] | [[| P |]] | [[| F |]] | [[|] P] | | [[X |] | * |
| | COMPARE | [| N | /N |] | [| N |] | [| N |] | [| N] | | [N | [] | |
| | RECOMME | NDA | TI | ons: | (1 | fd | if: | fere | nt | fro | om N | iasa) | | | - · • | | |
| | | [| | / |] | [| |] . | [| |] | [|] | (AI | [)D/[|] DELE | TE) |
| | * CIL R | ETE | NT | ION | RATIO | NAL | Е: | (If | ap | pl : | lcab | ole) IN | ADEQI ADEQI | UATE UATE | [[|] | |
| | REMARKS | : | | | | | | | | | | | | _ | • | - | |

NASA/RI DO NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). IOA NOW CONSIDERS THE CREDIBILITY OF RESTRICTED FLOW IN A BELLOWS TO BE QUESTIONABLE. IOA DOES NOT REGARD THE ABSENCE OF THIS FAILURE MODE IN THE FMEA/CIL TO BE AN OPEN ISSUE, BUT DOES RECOMMEND THAT IT BE ADDRESSED.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT DATE: NT ID: A #: | 1/01/8 OMS-24 03-3-2 | 38 15 2602-1 | | NASA BASE | DATA: LINE [NEW [|] X] | | | | |
|----------------------------------|-----------------------------|----------------------------|--------------------|----------------|---------------------------|--------------------------|---------------|--|--|--|--|
| SUBSYSTE MDAC ID: ITEM: | M: | oms 245 Alignn | ient be | LLOWS | | | | | | | |
| LEAD ANA | LYST: | C.D. 1 | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | |
| | CRITICAI FLIGH HDW/FU | LITY IT INC | REDU A | INDANCY S B | CREENS | C | CIL ITEM | | | | |
| NASA IOA | [1 /1 [1 /1 |]] | [NA] [] | [NA] [] | [NA] [] | [[| X] * X] | | | | |
| COMPARE | [/ |] | [N] | [N] | [N] | ٢ |] | | | | |
| RECOMMEN | DATIONS: | (If | differ | ent from | NASA) | | | | | | |
| | [/ | J. | [] | []] | [] | [(ADD, |] /DELETE) | | | | |
| * CIL RE | TENTION | RATION | ALE: (I | f applic | able) ADEQU INADEQU | ATE [ATE [|] | | | | |
| REMARKS | | | | | | | | | | | |

NASA/RI AGREED TO ADD "FAILED CLOSED ACMV RELIEF DEVICE" TO THE CAUSES ON THIS FMEA, PER IOA ISSUE. THE RETENTION RATIONALE ON THE CIL SHEET SHOULD ADDRESS THIS NEW CAUSE. IOA RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS. IOA ALSO RECOMMENDS THAT "BINDING/JAMMING OF LINE BELLOWS" BE ADDED AS A CAUSE ON THIS FMEA. i i

REDUNDANCY SCREENS SHOULD BE BLANK PER NSTS 22206.

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| | ASSESSME ASSESSME NASA FME | ENT ENT EA # | | ATE: D: | 1/0 OMS NON | 1/88 -246 E | | | | 1 | |]] | | | | | |
|---------------|----------------------------------|--------------------|-------------|--------------|-------------------|---------------------------------|--------|---------|--------|--------|--------|--------|----------|-----------|----------|------|--|
| | SUBSYSTI MDAC ID: ITEM: | E M : : | | | OMS 246 ALI | OMS 246 ALIGNMENT BELLOWS | | | | | | | | | | | |
| LEAD ANALYST: | | | | | c.D | C.D. PRUST | | | | | | | | | | | |
| | ASSESSMI | ENT : | 1 | | | | | | | | | | | | | | |
| | | CRI | T T | ICAI LIGH | LITY IT | RE | DUN | IDANCY | SCI | REENS | | | C] I] | IL Fen | 1 | | |
| | | H | IDV | V/FU | JNC | Α | | В | (| C | | | | | | | |
| | NASA IOA | [[| 1 | / /1 |]] | [[|]] | [[|]] | [[|]] | | [[| х |]] | * | |
| | COMPARE | [| N | /N |] | ſ |] | [|] | [|] | | [| N |] | | |
| | RECOMMEN | IDAJ | FIC | ONS : | : (| If diff | ere | ent fro | om 1 | NASA) | | | | | | | |
| | | [| | / |] | [|] | [|] | [|] | (Al |] ,00 | /DI |] ELI | ETE) | |
| | * CIL RI | ETEN | 1 T] | ION | RATI | ONALE: | (If | appl: | lcal | ole) | | UATE | Į | |] | | |
| | REMARKS | : | | | | | | | | TN | RDEQ | UATE | ι | | 1 | | |

NASA/RI DO NOT COVER THIS FAILURE MODE (NO BELLOWS ANGULAR DEFLECTION). IOA RECOMMENDS ADDING THIS FAILURE MODE AS A CAUSE ON LINE AND BELLOWS RUPTURE FMEAS.

REPORT DATE 2/26/88

| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-247 NASA FMEA #: NONE | | | | | | | | | | | | N2] | ASA BASE | DATA: LINE NEW | [נ | 1 5 |]] | |
|---|-----------|-----------|----------------|---------------------|------|---------|-----|-------|-----------|-----|--------|---------|-------------|----------------------|----------|-----------|----------|----------|
| SUBSYST MDAC ID ITEM: | EM : : | | | oms 247 Align | IMEI | NT | BE | LLOW: | 5 | | | | | | | | | |
| LEAD AN | ALY | ST | : | C.D. | PRI | ารา | ſ | | | | | | | | | | | |
| ASSESSM | ENT | : | | | | | | | | | | | | | | | | |
| | CR | IT: FI | ICALI LIGHI | CTY F IC | | RI A | EDU | NDAN(| CY B | sc | CREENS | s c | | | C] I] | il Pen | 1 | |
| NACA | | | , | 1 | r | | | r | - | ٦ | r | | 1 | | г | | 1 | * |
| IOA | L [| 2 | /1R |] | [| P |] | ĺ | F |] | נ | Ρ |] | | [| Х |] | |
| COMPARE | [| N | /N |] | (| N |] | [| N |] | [| N |] | | [| N |] | |
| RECOMME | NDA' | FI | ONS: | (1 | E d | ifi | fer | ent : | fro | m | NASA) | | | | | | | |
| | [| | / |] | [| |] | [| |] | ַ | |] | (AC | [)D/ | ′DI |] ELF | ETE) |
| * CIL R | ETE | NT: | ION I | RATIO | IALI | Ē: | (1 | f app | 91 | ica | ble) | 65 | | | _ | | | <u>.</u> |

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REMARKS:

NASA/RI DO NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). IOA NOW CONSIDERS THE CREDIBILITY OF RESTRICTED FLOW IN A BELLOWS TO BE QUESTIONABLE. IOA DOES NOT REGARD THE ABSENCE OF THIS FAILURE MODE IN THE FMEA/CIL TO BE AN OPEN ISSUE, BUT DOES RECOMMEND THAT IT BE ADDRESSED.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-248 03-3-4002-2 | NA: Bi | SA DATA: ASELINE [] NEW [X] | | | | | | | | | |
|--|---|--|--------------------------------------|--|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 248 ENGINE INLET F | MS 248 INGINE INLET FILTER AND ORIFICE | | | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICAL | ITY REDUND. | ANCY SCREENS | CIL ITEM | | | | | | | | | |
| HDW/FU | NC A | ВС | | | | | | | | | | |
| NASA [3 /3 IOA [2 /1R |] []]. [P] | [] [[F] [P |] [] *] [X] | | | | | | | | | |
| COMPARE [N /N |] [N] | [N] [N | [И] | | | | | | | | | |
| RECOMMENDATIONS: | (If differen | t from NASA) | | | | | | | | | | |
| [1 /1 |] [] | [][|] [A] (ADD/DELETE) | | | | | | | | | |
| * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEOUATE [] | | | | | | | | | | | | |
| REMARKS: IOA NOW CLASSIFI A CATASTROPHIC E | REMARKS: IOA NOW CLASSIFIES THIS FAILURE MODE AS A 1/1 SINCE IT CAN CAUSE A CATASTROPHIC ENGINE FAILURE. CONTAMINATION OF ENGINE INJECTOR | | | | | | | | | | | |

A CATASTROPHIC ENGINE FAILURE. CONTAMINATION OF ENGINE INJECTOR ORIFICES OR COOLING CHANNELS COULD RESULT IN COMBUSTION CHAMBER BURN-THROUGH. IOA RECOMMENDS THAT THIS FAILURE MODE BE UPGRADED TO A 1/1 AND PLACED ON THE CIL.

REPORT DATE 2/26/88

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| ASSESSM ASSESSM NASA FM | IENT IENT IEA | D# II #: | ATE: D: | 1/01/88 OMS-249 03-3-4002-1 | | | | | | | | NASA DATA: BASELINE [] NEW [X] | | | | | | |
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| SUBSYST MDAC II ITEM: | : 1 | NL | ET F | 'IL' | TEF | R AI | 1D OR | IF | ICE | | | | | | | | | |
| LEAD ANALYST: C.D. PRUST | | | | | | | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | | | | | |
| | ITY I IC | | RE A | DUNE | AN | NCY SCREENS B | | | s C | | | CIL ITEM | | | | | | |
| NASI IOI | A [A [| 2 . 2 | /1R /1R |] | [[| P P |] | [[| P F |] | [[| P P |] | | [X [X |]] | * | |
| COMPARI | 5 [| | / |] | [| |]_ | [| N |] | [| |] | | [|] | , | |
| RECOMM | ENDA | TIC | ons: | (If | dj | ff | eren | it | fro | om 1 | NASA) | | | | | | | |
| | [| | / |] | [| |] | [| |] | [| |] | (AE | [)D/D |] ELE' | TE) | |
| * CIL H | RETE: | NTI | ION I | RATIONA | LF | 2: | (If | ap | pli | lcal | ole) IN | | EQUAT EQUAT | E E | [[|]] | | |
| IOA AGI | REES | W | CTH 1 | NASA/RI | F | TAS | IONA | LE | FC | DR I | PASSA | GE | OF B | SC | REE | N . | | |

REPORT DATE 2/26/88

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| SUBSYSTI MDAC ID: ITEM: | EM : ; | | OMS 250 BELLC |)WS-T | VC G | IMBAL | | | | | | |
| LEAD AND | LYS | r: | C.D. | PRUS | т | | | | | | | |
| ASSESSMI | en t : | | | | | | | • | | | | |
| | CRI | TICAL | ITY | R | EDUN | DANCY | SCI | REENS | | CII | J M | |
| | H | DW/FU | NC | А | | В | | C | | *** | 11.1 | |
| NASA IOA | [| 1 /1 1 /1 |]] | [[|]] | [[|]] | [[|]] | K] K] | [] * [] | |
| COMPARE | [| 1 |] | ٦ ۲ |] | [|] | נ |] | [|] | |
| RECOMMEN | NDAT | IONS: | (1: | f dif | fere | nt fr | om 1 | NASA) | | | | |
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| * CIL R | eten | TION | RATIO | NALE: | (If | appl | ical | ole) A INA | DEQUATI DEQUATI | E (E (|]] | |
| IOA REC | : OMME CAUS | NDS I ES ON | THAT " | FAILE FMEA | D CL | OSED H COR | ACM | V RELI | EF DEV: G RETEI | ICE" P | BE ADDI | ED |

TO THE CAUSES ON THIS FMEA WITH CORRESPONDING RETENTION RATIONALE. IOA ALSO RECOMMENDS ADDING STATEMENTS TO THE EFFECTS ABOUT

POSSIBLE EXPOSURE OF EVA AND GROUND CREWS TO PROPELLANT.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-251 NONE | | | | NA E | SA DATA: BASELINE NEW | [[|] |
|--|---|--|-----------------------------|--------------------------------|-----------------------------|--|------------------------|--------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 251 BELLOWS- | -TVC GIM | IBAL | | | | | |
| LEAD ANALYST: | C.D. PRU | JST | | | | | | |
| ASSESSMENT: | | | | | | | | |
| CRITICAL | ITY | REDUNDA | NCY | SCREE | NS | | CIL | x |
| HDW/FU | NC | A | В | | С | | <u> </u> | 1 |
| NASA [/ IOA [1 /1 |] [] [|]] | [[|] | [[|] | [[x |] *] |
| COMPARE [N /N |] [|] | [|] | [|] | [N |] |
| RECOMMENDATIONS: | (If di | fferent | fro | m NAS | A) | | | |
| [/ |] [|] | [|] | [|] | [DD/DI |] ELETE) |
| * CIL RETENTION D | RATIONALI | S: (If a | ppli | cable |) AI INAI | EQUATE | [[|] |
| REMARKS: NASA/RI DO NOT CO DEFLECTION) ON A FAILURE MODE AS A LEAKAGE FMEAS. | OVER THIS SEPARATI A CAUSE (A SEPARAT | S FAILUR E FMEA. ON ALL F TE FMEA | E MO IOA PROP IS N | DE (N RECO LINE OT RE | O BE MMEN AND QUIF | LLOWS AN IDS ADDIN BELLOWS RED. | IGULA IG TH EXTH | AR HIS ERNAL |

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THE PROPOSED IOA CAUSE IS ALREADY ADDRESSED ON FMEA WHICH LISTS "EXCESS GIMBALLING TORQUE" AS A CAUSE. A 03-3-4601-1,

REPORT DATE 2/26/88 C-160

| ASSESSME ASSESSME NASA FME | NT NT A | D2 II #: | ATE: D: | 1/ OM NO | 01/8 S-25 NE | 8 | | | | | | | | N2] | ASA BASI | DATA: ELINE NEW | : [[| |]] | |
|----------------------------------|---------------|----------------|----------------|----------------|--------------------|--------|-----|--------|-----|--------|-------------|------|------------|-----------|-------------|-----------------------|-------------|-----------|----------|------|
| SUBSYSTE MDAC ID: ITEM: | M: | | | ОМ 25 ВЕ | S 2 LLOW | ıs- | -TV | 7C | GIM | BA | L | | | | | | | | | |
| LEAD ANA | LYS | ST | : | с. | D. F | R | JSI | 2 | | | | | | | | | | • | | |
| ASSESSME | NT | : | | | | | | | | | | | | | | | | | | |
| (| CR: | IT: Fl | ICALI LIGHI | CTY C | | | RI | EDU | NDA | NC | Y | SC | REENS | ; | | | CI I | IL Fen | M | |
| | 1 | HD | W/FUI | NC | | | A | | | | B | | | С | | | | | | |
| NASA IOA | [[| 2 | / /1R |]] | | [[| P |]] | | [[| F |] | [[| P |]] | | [[| x |] | * |
| COMPARE | [| N | /N |] | | [| N |] | | [ׂ | N |] | [| N |] | | [| N |] | |
| RECOMMEN | DA' | FI (| ons: | | (If | d: | ifi | fer | ent | f | ird | om I | NASA) | _ | | | | | | |
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| * CIL RE | TE1 | NT: | ION I | RAT | IONA | L | Ξ: | (1 | fa | PF |)]j | lca | ble) IN | AI IAI | DEQU | JATE JATE | [[| |]] | |
| NASA/RI | DO | N | OT CO | DVE | R TH | IIS | 5 I | AI | LUR | Ē | MC | DE | (RES | TI | RICI | TED FI | 201 | A). | | IOA |

NASA/RI DO NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). IOA NOW CONSIDERS THE CREDIBILITY OF RESTRICTED FLOW IN A BELLOWS TO BE QUESTIONABLE. IOA DOES NOT REGARD THE ABSENCE OF THIS FAILURE MODE IN THE FMEA/CIL TO BE AN OPEN ISSUE, BUT DOES RECOMMEND THAT IT BE ADDRESSED.

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| ASSESSMENT DATE: 1/01/88 NASA DATA: ASSESSMENT ID: OMS-253 BASELINE [] NASA FMEA #: 03-3-4507-1 NEW [X] | | | | | | | | | | | |
|--|--|-------------------------------|-----------------------------------|--------------------------|----------------------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 253 COUPLING | - HIGH-P | OINT BLEI | ED TEST POF | ξ Τ | | | | | | |
| LEAD ANALYST: | C.D. PRUS | т | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C | | | | | | | | | | | |
| nDw/r0 | NC A | | | C | | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [F]] [P |] [] [| F] [NA] [| P] P] | [X] * [X] | | | | | | |
| COMPARE [/ |] [N |] [| N] [|] | []] | | | | | | |
| RECOMMENDATIONS: | (If dif | ferent f | rom NASA) | I | | | | | | | |
| [2 /1R |] [F | ן נ | F] [| P] (AE | [A] DD/DELETE) | | | | | | |
| * CIL RETENTION | RATIONALE: | (If app | licable) IN | ADEQUATE IADEQUATE | [] | | | | | | |
| REMARKS: IOA AGREES WITH VERIFY CONDITION | NASA/RI FA OF CAP SE | ILURE OF AL AFTER | A SCREEN CAP INST | N BASED ON TALLATION. | INABILITY TO IOA ALSO | | | | | | |
| IOA RECOMMENDS T AS A FAILURE MOD AND IS ADDRESSED | HAT "POPPE" E ON THIS TO ON RCS QD | T FAILS FMEA. T COUPLIN | OPEN (DUP HIS IS A G FMEAS. | ING FLIGHT CREDIBLE F |)" BE ADDED AILURE MODE | | | | | | |
| POSSIBLE FIRE, E DUE TO PROP LEAK | NDS ADDING XPLOSION, A AGE. | A STATE AND EXPO | SURE OF I | EVA AND GRO | OUND CREWS | | | | | | |

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-254 03-3-450 | 01/88 NASA DATA: S-254 BASELINE [] -3-4507-3 NEW [X] | | | | | | | | | | |
|---|----------------------------------|---|--------|---------------|----------|--------|-------|------------------|-----------|-------|--------|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 254 COUPLING | - HIG | H-PO | INT B | LEEL |) TEST | r poi | RT | | | | |
| LEAD ANALYST: | C.D. PRUS | ST | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICAL FLIGH | ITY 1 T | REDUNE | ANCY | SCRE | ENS | | | CIL ITE | M | | | |
| HDW/FU | NC | A | В | | C | 2 | | | | | | |
| NASA [3 /3 IOA [3 /3 |] [] [|]] | [[|]] | [[|] | | [[|]] | * | | |
| COMPARE [/ |] [|] | [|] | [|] | | [|] | | | |
| RECOMMENDATIONS: | (If di | fferen | nt fr | om NA | SA) | | | | | | | |
| [3 /3 |] [|] | [|]. | [|] | (Al | ן מ/סכ |] ELE | TE) | | |
| * CIL RETENTION | RATIONALE | : (If | appl | icabl | .e) 7 | | ATE | [| ļ | | | |
| REMARKS: IOA FAILURE MODE AND "RESTRICTED IOA RECOMMENDS T | S ON ANAL FLOW". HAT "FAIL | YSIS S S CLOS | SHEET | SHOU AND " | ILD] | INCLU | DE "I | L FAIL LOW | S C BE | LOSED | " D | |
| TO THE FAILURE M | ODES ON T | HIS FM | IEA. | THES | E AI | RE CRI | EDIB | LE F. | AIL | URE | | |

MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT D NT I A #: | D: | 1/01/ OMS-2 03-3- | 88 55 4507 | -2 | | | N | ASA DA BASEL | ATA: INE [NEW [] |] x] | |
|--|----------------------|---------------------|-------------------------|------------------|-------------|--------|----------|-----------------|------------------|--------------------------|-----------|---------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 255 COUPL | ING | - HIG | H-PC | INT F | 3LEED | TEST | PORT | | |
| LEAD ANA | LYST | : | C.D. | PRUS | T | | | | | | | |
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| | CRIT | ICAL | ITY | F | EDUNE | ANCY | SCRE | EENS | | CI | L FM | |
| | HD | W/FU | NC | A | L . | E | i | C | 2 | · - | LJ1'1 | |
| NASA IOA | [3 [3 | /3 /3 |]] | [|]] | [[|]] | [[|] | [[|] | * |
| COMPARE | [| / |] | [|] | [|] | [|] | [|] | |
| RECOMMEN | DATI | ONS: | (If | dif | feren | t fr | om NZ | ASA) | | | | |
| | [| / |] | [|] | . [|] | [|] | [. (ADD/) |] DELE | TE) |
| * CIL RE | TENT | ION | RATION | ALE: | (If | appl | icabl | Le) A INA | DEQUA' DEQUA' | TE (TE (|] | |
| REMARKS: IOA FAII OPEN" AN NO DIFFE | URE ID "R RENC | MODE ESTR ES. | S ON A ICTED | NALY FLOW | SIS S ". | HEET | SHOU | JLD N | OT IN | CLUDE | "FAI | L <u>s</u> to |

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REPORT DATE 2/26/88 C-164

and the second
| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-256 03-3-4001- | -2 | NZ E | ASA DATA: BASELINE NEW | [] [X] | | | | | | | |
|---|----------------------------------|----------------|----------------|------------------------------|------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 256 VALVE - BI | PROPELLAN | IT VALVE | | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | 2 | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICAL | ITY RE | EDUNDANCY | SCREENS | | CIL | | | | | | | |
| HDW/FUI | NC A | В | с | | | | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [P] [P |] [P] [P |] [P] [P |] | [X]* [X] | | | | | | | |
| COMPARE [/ |] [|] [|] [|] | [] | | | | | | | |
| RECOMMENDATIONS: | (If diff | ferent fro | om NASA) | | | | | | | | | |
| [/ |] [|] [|] [|] (AD | [] D/DELETE) | | | | | | | |
| * CIL RETENTION | RATIONALE: | (If appli | icable) | | | | | | | | | |
| | | | AI INAI | DEQUATE DEQUATE | [] | | | | | | | |
| INADEQUATE [] INADEQUATE [] REMARKS: IOA FAILURE MODES ON ANALYSIS SHEET SHOULD NOT INCLUDE "RESTRICTED FLOW". THE EFFECTS OF "RESTRICTED FLOW" ARE COVERED BY THE ENGINE INLET FILTER (03-3-4002-1), AND THE BIPROP VLV ASSY (03-3-4001-3). NO DIFFERENCES. IOA DECOMMENDE THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS | | | | | | | | | | | | |

IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

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| | н | DW/ | FU | 1C | | | A | | | В | | | С | | | 1.1 | LEP | L | |
| NASA IOA | [| 2 / 2 / | '1R '1R |]] | | [[| P P |] | [[| P P |]] | | P P |]] | | [[| X X |] | * |
| COMPARE | [| / | , |] | | [| |] | [| |] | | |] | | [| |] | |
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| * CIL R | ETEN | TIC | ON I | RATI | EONA | LE | : | (If | apj | p1 : | icat | ole) | A | DEQU | JATE JATE | [[| ÷ |] | |
| REMARKS | : | 010 | | TO | | | | END | יוחה י | | n m. | | מזזי | ~ | | • | 1 1/1 | | TENITO |
| NO DIFF INCLUDE PROVIDE | DON BET | TEF | IIS R IN | FMI | EA É GHT | SE IN | SE | PARA D THE | ATEI E Fi | D C AII | LURE | IE S IN IS I | IDI POS | VIDU | JAL FN LE IN | IEZ TH | AS IE | TO | ENIS |
| IOA REC POSSIBL | OMME E EX | NDS POS | S AI SURI | IIDC 10 E | NG A F EV | A A | sta An | TEME | ENT ROUI | TC ND | O TH CRE | ie i Ews | EFF: TO | ECTS PRC | S ABOU | TT NT | TH S. | E | |

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT NT A # | DATE: ID: : | 1/01/8 OMS-25 03-3-4 | 88 58 100 |)1- | -3 | | | | | N <i>F</i> | ASA DATA BASELINE NEW | : [[| x |]] | |
|---|---|-------------------|----------------------------|-----------------|--------|--------|--------|-------------|------------|--------|------------|-----------------------------|-------------|-----------|----------|------|
| SUBSYSTE MDAC ID: ITEM: | м: | | OMS 258 VALVE | - | ві | [PROP | ELI | LAN | IAV TV | LVI | Ξ | | | | | |
| LEAD ANA | LYS | т: | C.D. 1 | PRU | JSI | ſ | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY FLIGHT | | | | | | | | | | ENS | 5 | | C) I | [L Fen | 1 | |
| | н | DW/FU | NC | | Α | | | В | | | C | | | | | |
| NASA IOA | [[| 2 /1R 2 /1R |]] | [[| P P |]] | [[| F P |] | [[| P P |]] | [[| X X |]] | * |
| COMPARE | [| 1 |] | [| |] | [| N |] | [| |] | [| |] | |
| RECOMMEN | DAT | IONS: | (If | đ | iff | feren | t : | fro | om NAS | SA) |) | | | | | |
| | [| / |] | [| |] · | [| | <u>ַ</u> ז | [| |] (A |] ,DD, | /DF |] ELH | ETE) |
| * CIL RE | TEN | TION | RATION | 11 | 3: | (If | apj | pl : | icable | 2) | | | - | | , | |
| | | | | | | | | | | II | IA IA | DEQUATE | L [| |] | |
| REMARKS: NASA/RI TRAVEL) FAILURE TOA ACCE | INADEQUATE [] AMARKS: IASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (FAILS MID- TRAVEL) FOR THE BIPROPELLANT VALVE. NASA/RI NOW COVERS THIS FAILURE MODE ON 03-3-4001-3. IOA ACCEPTS NASA/RI FAILURE OF B SCREEN | | | | | | | | | | | | | | | |

IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

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REPORT DATE 2/26/88

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| ASSESSM ASSESSM NASA FM | ENT ENT EA | D/ I) #: | ATE: D: | 1/ OM 03 | 01/8 S-25 -3-4 | 38 59 400 |)1- | •6 | | | | | N2 E | ASA DAT BASELIN NE | IA: IE IW | [[X |] | | |
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| SUBSYST MDAC ID ITEM: | EM: : | | | 0M 25 VA | S 9 LVE | - | BI | PROP | EL | LAI | NT VA | LVI | E | | | | | | |
| LEAD AN | ALY | ST | : | с. | D. 1 | PRU | JST | • | | | | | | | | | | | |
| ASSESSM | ENT | : | | | | | | | | | | | | | | | | | |
| | CR | IT | ICAL | ITY | | | RE | DUND | AN | CY | SCRE | ENS | 3 | | (| CIL | M | | |
| | 1 | F. HDI | W/FU | NC NC | | | A | | | B | | | с | | | T.T.E | м | | |
| NASA IOA | [| 2 2 | /1R /1R |] | | [[| P P |]] | [[| F F |]] | ((| P P |] | | [X [X |] | * | |
| COMPARE | נ | | / |] | | [| |] | [| |] | [| |] | | [|] | | |
| RECOMME | NDA' | FI (| ONS: | | (If | di | ff | eren | t : | fro | om NA | SA) |) | | | | | | |
| | [| | / |] | | [| |]. | [| |] | [| |] | AD | [D/D |] ELF | ETE) | |
| * CIL R | ETE) | NT: | ION | RAT | IONZ | ALE | 5: | (If | apj | 91 : | lcabl | e) Il | AI JAI | DEQUATE DEQUATE | | [|]] | | |
| REMARKS | : | | | | | | | | | | | | | | | | | | |
| NASA/RI | OR HOW | IG FV | INAL | LY | PASS | SEL |) E געיי | SCR | EEI R | (/ | <u>יסR</u> " עדדעי | IN' T | CEF | RNAL LE | CAK. | AGE FR | TO | TAIL | URE |
| TSSUE. | LE | AK | AGE | PAS | T UI | PSI | IRE | CAM B. | AL | L I | ALVE | IS | ξτ | JNDETEC | TA | BLE | | - | |
| IOA REC | OMM | EN | DS A | DDI | NG Z | 4 5 | STA | TEME | NT | T |) THE | EI | FFE | ECTS AE | BOU | ΓР | oss | SIBL | E |
| EXPOSUR | EO | F] | EVA | AND | GRO | ĬŪC | ĪD | CREW | S ' | ľŌ | PROP | ELI | A | NTS. | 957.5 1940 | | | 17.6 | |
| IOA REC | OMM | EN | DS T | HAT | THE | E S | SUE | BASSE | MB1 | LY | COMP | ONI | SNI | CS INCI | UD | ED | ON | THI | S |

IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-260 03-3-2101 | -1 | | NASA BAS | DATA ELINE NEW | : [[X |]] |
|--|---------------------------------|--------|------------|-----------------------|----------------------|---------------|-------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 260 VALVE - B | IPROPE | LLANT VA | LVE | | | |
| LEAD ANALYST: | C.D. PRUS | Т | | | | | |
| ASSESSMENT: | | | | | | | |
| CRITICAL | LITY R | EDUNDA | NCY SCRE | ENS | | CIL | м |
| HDW/FU | JNC A | | В | С | | ± ± ± | •• |
| NASA [1 /1 IOA [1 /1 |] [] [|]] | [] [] | [] [] | | [X [X |] *] |
| COMPARE [/ |] [|] | [] | [] | | [|] |
| RECOMMENDATIONS | : (If dif | ferent | from NA | SA) | | | |
| [/ |] [|] | []] | [] | (A | [DD/D |] ELETE) |
| * CIL RETENTION | RATIONALE: | (If a | pplicabl | .e) ADEQ INADEO | UATE UATE | [r |] |
| REMARKS : | | | | | | • | 4 |

NASA/RI AGREED TO ADD THIS VALVE BODY TO THE ITEM LIST ON THIS FMEA, AND TO ADD CORRESPONDING RETENTION RATIONALE TO THE CIL SHEET, PER IOA ISSUE. NASA/RI ALSO ADDED "FAILED CLOSED ACMV RELIEF DEVICE" TO THE CAUSES ON THIS FMEA, PER IOA ISSUE. IOA RECOMMENDS ADDING STATEMENTS TO THE EFFECTS ABOUT POSSIBLE FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS.

REPORT DATE 2/26/88

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NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-261 NEW [X] 03-3-4001-3 NASA FMEA #: OMS SUBSYSTEM: 261 MDAC ID: VALVE - BIPROPELLANT VALVE ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: CIL REDUNDANCY SCREENS CRITICALITY ITEM FLIGHT В C HDW/FUNC Α [P] [P] [F] [P] [P] NASA [2 /1R] IOA [2 /1R] [P] [X] [N] [] · COMPARE [] Γ] ſ /] RECOMMENDATIONS: (If different from NASA) ſ (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [1 INADEQUATE [] **REMARKS:** NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (DELAYED OPERATION). NASA/RI NOW COVERS THIS FAILURE MODE ON 03-3-4001-3.

IOA ACCEPTS NASA/RI FAILURE OF B SCREEN. THIS FAILURE MODE IS LISTED AS A CAUSE ON 1/1 FMEAS (03-3-4004-1 AND 03-3-4004-2), HOWEVER THE SSM STATES THAT THIS FAILURE MODE IS NOT A CAUSE FOR THE 1/1 EFFECTS ON THESE FMEAS. IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS

FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-262 NONE | | | NASA DATA: BASELINE NEW | [] [X] |
|--|----------------------------|-----------|----------------|-------------------------------|---------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 262 VALVE - E | SIPROP CA | VITY PRE | SSURE RELIN | SF |
| LEAD ANALYST: | C.D. PRUS | ST | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY R | EDUNDANC | Y SCREEN | S | CIL |
| HDW/FU | NC A | L | В | С | |
| NASA [/ IOA [2 /1R |] [F | ,] [|] [F] [|] P] | [X]* [X] |
| COMPARE [N /N |] [N | ī] [| и] [| N] | [] |
| RECOMMENDATIONS: | (If dif | ferent f | rom NASA |) | |
| . [1/1 |] [|] [| ן נ |] (Al | [A] DD/DELETE) |
| * CIL RETENTION | RATIONALE: | (If app | olicable) T | ADEQUATE | |
| REMARKS: IOA NOW CLASSIFI CLOSED) AS A 1/1 | ES THIS IT SINCE IT | TEM AND I | TAILURE M | ODE (RELIE) STRUCTURAL | F VALVE FAILS |

CLOSED) AS A 1/1 SINCE IT COULD RESULT IN STRUCTURAL FAILURE OF THE BIPROP VALVE HOUSING AND LEAKAGE OF PROPELLANTS. THIS ITEM AND FAILURE MODE ARE CURRENTLY ONLY ADDRESSED AS A CAUSE ON 03-3-4001-6. IOA RECOMMENDS A NEW 1/1 FMEA FOR THIS ITEM AND FAILURE MODE TO ENSURE THAT THEY RECEIVE ADEQUATE ATTENTION.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ent Ent Ea | Di Il #: | ATE: D: | 1/01/ OMS-2 NONE | /88 263 | 88 NASA DATA: 63 BASELINE [] NEW [X] | | | | | | | | | | |
|----------------------------------|------------------|----------------|------------|------------------------|------------|---|--------|--------|------------------|------------------|----------|------------|---------|------|--|--|
| SUBSYST MDAC ID ITEM: | EM : : | | | OMS 263 VALVI | 2 - | BIPROF | P CAV | ITY | PRESS | URE RI | ELIE | F | | | | |
| LEAD AN | ALY | ST | : | C.D. | PRU | ST | | | | | | | | | | |
| ASSESSMI | ENT | : | | | | | | | | | | | | | | |
| | CR | IT: | ICAL | ITY T | | REDUNI | DANCY | SCI | REENS | | (| CIL ITE | , M | | | |
| |] | HD | W/FUI | NC | | A | В | | С | | • | | | | | |
| NASA IOA | [[| 3 | / /3 |]] | [[|]] | [[|]] | [[|] | | [X [|] | * | | |
| COMPARE | [| N | /N |] | [|] | [|] | [|] | | [N |] | | | |
| RECOMME | NDA | TI | ONS: | (11 | E di | fferer | nt fr | om 1 | IASA) | | | | | | | |
| | [| 2 | /1R |]. | [| P] | [F |] | [P |] | (ADI | [A 5/D |] EL | ETE) | | |
| * CIL R | ETE | NT | ION | RATIO | IALE | : (If | appl | ical | ole) A INA | DEQUA' DEQUA' | re re | [[|] | | | |

REMARKS: IOA NOW CLASSIFIES THIS ITEM AND FAILURE MODE (RELIEF VALVE FAILS OPEN) AS A 2/1R PFP. IOA DID NOT CONSIDER DOWNSTREAM BIPROP VALVE TO BE REDUNDANT TO RELIEF VALVE IN ORIGINAL ANALYSIS. THIS ITEM AND FAILURE MODE ARE CURRENTLY ADDRESSED ONLY AS A CAUSE ON 03-3-4001-6. IOA RECOMMENDS A NEW 2/1R PFP FMEA FOR THIS ITEM AND FAILURE MODE TO ENSURE THAT THEY RECEIVE ADEQUATE ATTENTION. ī

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-264 03-3-4003 | 1-6 | 1 | VASA DATA: BASELINE NEW | [] [X] | | | | | | | |
|---|---------------------------------|-------------|----------------------|-------------------------------|-------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 264 VALVE - 1 | BIPROP CA | VITY PRESS | SURE RELII | EF | | | | | | | |
| LEAD ANALYST: | C.D. PRUS | ST | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICAL | | REDUNDANC | Y SCREENS | | CIL | | | | | | | |
| HDW/FU | NC 2 | A | В | 2 | | | | | | | | |
| NASA [2 /1R IOA [3 /3 |] [] | P] [] [| F] []] [| P]] | [X]* [] | | | | | | | |
| COMPARE [N /N |] [] | N] [| и] [и | 4] | [N] | | | | | | | |
| RECOMMENDATIONS: | (If di | fferent f | rom NASA) | | | | | | | | | |
| [/ |] [|] [|] [|] (AI | [] DD/DELETE) | | | | | | | |
| * CIL RETENTION | RATIONALE | : (If app | licable) / IN/ | ADEQUATE ADEQUATE | | | | | | | | |
| INADEQUATE [] REMARKS: NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (INTERNAL LEAKAGE). HOWEVER, NASA/RI NOW COVERS THIS FAILURE MODE ON 03-3- 4001-6, BOTH AS A FAILURE MODE AND A CAUSE. | | | | | | | | | | | | |

IOA AGREES WITH NASA/RI RATIONALE FOR 2/1R PFP ASSIGNMENT. IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

REPORT DATE 2/26/88

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| ASSESSM ASSESSM NASA FM | ent Ent Ea | ' Di ' II #: | ATE: D: | 1/01/ OMS-2 NONE | 88 65 | | | | Ņ | IASA I BASEI | DATA: LINE NEW | : [[|]] | - |
|-------------------------------|------------------|--------------------|------------|------------------------|----------|---------|--------|----------|------------------|-----------------|----------------------|----------------|----------|-----|
| SUBSYST MDAC ID ITEM: | EM: : | | | OMS 265 VALVE | - | BIPROP | CAV | ITY | PRESS | SURE F | RELIH | EF | | |
| LEAD AN | ALY | ST | : | C.D. | PRU | JST | | | | | | | | |
| ASSESSM | ENI | !: | | | | | | | | | | | | |
| | CF | | ICAL | ITY | | REDUND | ANCY | SC | REENS | | | CIL | Mr | |
| FLIGHT HDW/FUNC A B C | | | | | | | | | | | | | • | |
| NASA IOA | (| 1 | / /1 |] | [[|]] | [[|]] | [[|]] | | [X [X |] | * |
| COMPARE | (| N | /N |] | [|] | [|] | [|] | | [|] | |
| RECOMME | NDA | TI(| ONS: | (If | di | fferen | t fr | om 1 | NASA) | | | | | |
| | [| 1 | /1 |] | [|] | [|] | [|] | (AI | [A DD/D |] ELE | TE) |
| * CIL R | ETF | INT | ION | RATION | ALE | E: (If | appl | ical | ble) A INA | DEQUA | ATE ATE | n 17 [[|] | |
| REMARKS | : | | | | | | | | | · | · | | | |
| NASA/RI | DC | | OT C | OVER S | TRU | ICTURAL | FAI | LUR T | E, RUE | TURE, | OR | EXT | CRN. | |
| THAT TH | | | LVE | VALVE HOUSIN | G F | SE ADDE | DTO | THI | E OTHE | ER VAI | LVE H | IOUS | ING | S |
| COVERED | ON | 10 | 3-3- | 2101-1 | ัพว | TH COR | RESP | OND | ING RE | TENTI | ION F | ITAS | ONA | LE. |

| ASSESSME ASSESSME NASA FME | SSESSMENT DATE: 1/01/88 NASA DATA: SSESSMENT ID: OMS-266 BASELINE [] NASA FMEA #: NONE NEW [] | | | | | | | | | | | | | |
|----------------------------------|---|-------------|---------|-------------------|--------|---------|---------|--------|------------|----------------|------------|-----------|---------------------------------|-----|
| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 266 VAL | VE – B | IPRC | OP CAV | 'ITY | PRES | SURE | RELI | EF | | |
| LEAD ANA | LYS | ST | | C.D | . PRUS | Т. | | | | | | | | |
| ASSESSME | NT : | : | | | | | | | | | | | | |
| | CRI | TT: | | ITY | R | EDUN | IDANCY | sc | REENS | | | CII | L M | |
| | F | HD | W/FU | NC | А | | E | 3 | | С | | *** | *1 [*] 1 | |
| NASA IOA | [[| 3 | / /3 |]] | [[|] | [[|]] | [[|] | | [[|] * | * |
| COMPARE | [| N | /N |] | Γ |] | Ţ |] | [|] | | [|] | |
| RECOMMEN | DAI | FI (| SNS: | (| If dif | fere | ent fr | on 1 | NASA) | | | | | |
| | [| | / |] | [|] | [|] | C |] | (A | [DD/I |] DELE: | ΓE) |
| * CIL RE | TEI | NT: | ION | RATI | ONALE: | (If | f appl | ica | ble) IN | ADEQU ADEQU | ATE ATE | [[|]] | |
| REMARKS: | | NT | ~ ~ | ATED | MUTC | E A T T | יוזסד א | | | סאיידיפ | አጥ | TOW | ויזיי כדי | нал |

NASA/RI DO NOT COVER THIS FAILURE MODE (OPERATES AT LOWER THAN NORMAL PSID). THE PROPOSED IOA FAILURE MODE IS ADEQUATELY COVERED BY THE "FAILS OPEN" FAILURE MODE. SEE ASSESSMENT SHEET OMS-263.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-267 03-3-4507-1 | | NASA DATA BASELINE NEW | : [] [X] | | | | | | | |
|--|-----------------------------------|------------------|------------------------------|-------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 267 COUPLING - BIPI | ROP VALVE D | RAIN/PURGE | TEST PORT | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRITICAL | CIL | | | | | | | | | | |
| HDW/FU | | | | | | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [F]] [P] | [F] [[NA] [| P] P] | [X]* [X] | | | | | | | |
| COMPARE [/ |] [N] | [и] [|] | [] | | | | | | | |
| RECOMMENDATIONS: | (If different | t from NASA | r) | | | | | | | | |
| [2 /1R |] [F] | [F] [| P] (AI | [A] DD/DELETE) | | | | | | | |
| * CIL RETENTION | RATIONALE: (If a | applicable) I | ADEQUATE NADEQUATE | [] | | | | | | | |
| INADEQUATE [] REMARKS: IOA AGREES WITH NASA/RI FAILURE OF A SCREEN BASED ON INABILITY TO VERIFY CONDITION OF CAP SEAL AFTER CAP INSTALLATION. IOA ALSO AGREES WITH NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT "POPPET FAILS OPEN (DURING FLIGHT)" BE ADDED AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS. IOA ALSO RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT | | | | | | | | | | | |
| POSSIBLE FIRE, E | XPLOSION, AND EX | XPOSURE OF | EVA AND GRO | OUND CREWS | | | | | | | |

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DUE TO PROP LEAKAGE.

| ASSESSMEN' ASSESSMEN' NASA FMEA | T DATE: T ID: #: | 1/01/88 OMS-268 03-3-45 | 07-3 | | | NA: Bi | SA DATA: ASELINE NEW | : [[X |]] | | | | |
|---------------------------------------|--|-------------------------------|---------|--------|--------|-----------|----------------------------|---------------|-------------|--|--|--|--|
| SUBSYSTEM MDAC ID: ITEM: | : | OMS 268 COUPLIN | G - BIP | ROP V | VALVE | DRAI | N/PURGE | TESI | PORT | | | | |
| LEAD ANAL | YST: | C.D. PR | UST | | | | | | | | | | |
| ASSESSMEN | т: | | | | | | | | | | | | |
| C | CIL | ſ | | | | | | | | | | | |
| | HDW/FUN | С | | | • | | | | | | | | |
| NASA IOA | [3 /3 [3 /3 |] [] [|] | [[|]] | [[|]] | [[|] *] | | | | |
| COMPARE | [/ |] [|] | [|] | [|] | [|] | | | | |
| RECOMMEND | ATIONS: | (If d | ifferen | t fro | om NAS | SA) | | | | | | | |
| | [3/3 |] · [|] | [|] | [. |] (Al | |] ELETE) | | | | |
| * CIL RET | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | | |
| IOA FAILU AND "REST | RE MODES | 5 ON ANA FLOW". | LYSIS S | HEET | SHOUI | LD IN | CLUDE " | FAILS | CLOSED" | | | | |

IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | ENT E ENT I EA #: | DATE: | 1/01/ OMS-2 03-3- | ′88 69 •4507 | -2 | | | | NASA DATA BASELINE NEW | .: : [/ [| x] | | |
|--|---|-------|-------------------------|--------------------|--------|--------|--------|-----------|------------------------------|------------------|---------------|------------|--|
| SUBSYSTE MDAC ID: ITEM: | EM : | | OMS 269 COUPI | LING | - BIP | ROP | VALVE | e dr | AIN/PURGE | : TE | ST POR | [] | |
| LEAD ANA | LYSI | : | C.D. | PRUS | T | | | | | | | | |
| ASSESSME | ENT: | | | | | | | | | | | | |
| | CRIT | ICAL | ITY T | R | RÉDÜND | ANCY | SCRE | EENS | 1 | CI TT | L EM | | |
| | н | W/FUI | NC | A | • | E | 3 | | с | | | | |
| NASA IOA | [3 [3 | /3 |]] | [[|]] | [[|]] | [[|]] | [[|] *] | | |
| COMPARE | [| 1 |] | [|] | [|] | (|] | [|] | | |
| RECOMMEN | IDATI | ONS: | (If | dif | feren | t fr | om NA | ASA) | | | | | |
| | [| 1 |] | [|] | [| j | [| .] (A |] /DD/ |] 'DELETE) |) | |
| * CIL RE | TENT | TON | RATION | IALE: | (If | appl | icabl | le) IN | ADEQUATE ADEQUATE | [[|] | | |
| REMARKS: IOA FAII OPEN" AN NO DIFFE | EMARKS: OA FAILURE MODES ON ANALYSIS SHEET SHOULD NOT INCLUDE "FAILS TO PEN" AND "RESTRICTED FLOW". O DIFFERENCES. | | | | | | | | | | | | |
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REPORT DATE 2/26/88

| ASSESSMENT DATE:1/01/88NASA DATA:ASSESSMENT ID:OMS-270BASELINE []NASA FMEA #:03-3-4003-1NEW [X] | | | | | | | | | | | | |
|---|---------------------|----------------------|--------------|------|---------------|--------------|-----------------|------------------|--------------|------------|------------|------|
| SUBSYSTE MDAC ID: ITEM: | M: | oms 270 ome at | LIGN | MENT | BELLA | ows | | | | | | |
| LEAD ANA | LYST: | C.D. | PRUS | т | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | |
| | CRITICAL | LITY | R | EDUN | DANCY | SCR | EENS | | | CII TTT | S M | |
| | HDW/FU | INC | А | | В | | C | 2 | | | | |
| NASA IO A | [1 /1 [1 /1 |]] | | | | | | | | | (] (] | * |
| COMPARE | [/ |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | DATIONS: | (If | dif | fere | nt fr | om N | ASA) | | | | | |
| | [/ |] | ۵ |] | C |] | [| Ĵ | (A) |] DD/I |] SELI | ETE) |
| * CIL RE | TENTION | RATION | ALE: | (If | appl | icab | le) / IN/ | ADEQUA ADEQUA | ATE ATE | [|]] | |
| REMARKS: IOA RECO "BINDING | MMENDS 1 JAMMING | THAT "F. G OF LI | AILE NE B | D CL | OSED WS" B | ACMV E AD | RELI DED A | LEF DI AS CAU | EVIC JSES | E" / ON | AND TH | IS |
| IOA ALSO | RECOMME | ENDS AD | DING | STA | TEMEN | TS T | O THI | E EFFI | ECTS | ABC FV2 | | חא |

POSSIBLE CORROSION, FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS DUE TO PROPELLANT LEAKAGE.

REPORT DATE 2/26/88

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| ASSESSMENT DAT ASSESSMENT ID: NASA FMEA #: SUBSYSTEM: | E: 1/01/88 OMS-271 NONE OMS | 3 L | | | NA E | ASA DATA: BASELINE NEW | [[|]] | | | | |
|---|--------------------------------------|---------------|--------|--------|------------------|------------------------------|------------|-------------|--|--|--|--|
| MDAC ID: ITEM: | 271 OME ALI | GNMENT | BELLO | ows | | | | | | | | |
| LEAD ANALYST: | C.D. PF | RUST | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITIC | CIL | r | | | | | | | | | | |
| | FUNC | À | В | | С | 19 | | L | | | | |
| NASA [/ IOA [3 / |] [3] [|] | [[|]] | [[|]] | [[|] *] | | | | |
| COMPARE [N / | ן א | :) | [|] | [|] | [|] | | | | |
| RECOMMENDATION | s: (If d | lifferen | t fro | om NAS | A) | | | | | | | |
| [/ |) (| :] | [|]. | [|] | [DD/DE |] :LETE) | | | | |
| * CIL RETENTIC | N RATIONAI | LE: (If | appl: | icable | e) Al INAL | EQUATE EQUATE | [[|] | | | | |
| REMARKS: NASA/RI DO NOT COVER THIS FAILURE MODE (NO BELLOWS ANGULAR DEFLECTION). IOA RECOMMENDS ADDING THIS FAILURE MODE AS A CAUSE ON LINE AND BELLOWS RUPTURE FMEAS. | | | | | | | | | | | | |

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REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-272 NONE | | | NASA DATA BASELINE NEW | : [[|]] |
|--|----------------------------|--------|------------|------------------------------|-------------|-------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 272 OME ALIG | NMENT | BELLOWS | | | |
| LEAD ANALYST: | C.D. PRU | ST | | | | |
| ASSESSMENT: | | | | | | |
| CRITICAL FLIGH | ITY T NC | REDUND | ANCY SCREI | ENS | CIL ITEN | 4 |
| | | л , | | | r | л т |
| IOA [2/1R |] [| P] | [F] | [P] | [X |] * |
| COMPARE [N /N |] [| ן א | [N] | [N] | [N |] |
| RECOMMENDATIONS: | (If di | fferen | t from NAS | SA) | | |
| [/ |] [|] | [] | [] (A) | [DD/DI |] ELETE) |
| * CIL RETENTION | RATIONALE | :: (If | applicable | e) ADEQUATE INADEOUATE | [r |] |
| REMARKS: | | | | | L | L |

NASA/RI DO NOT COVER THIS FAILURE MODE (RESTRICTED FLOW). IOA NOW CONSIDERS THE CREDIBILITY OF RESTRICTED FLOW IN A BELLOWS TO BE QUESTIONABLE. IOA DOES NOT REGARD THE ABSENCE OF THIS FAILURE MODE IN THE FMEA/CIL TO BE AN OPEN ISSUE, BUT DOES RECOMMEND THAT IT BE ADDRESSED.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ASSESSMENT DATE: 1/01/ ASSESSMENT ID: OMS-2 NASA FMEA #: 03-3- | | | | | | | | | -1 | | | | | | | NZ H | ASA BAS | ELI N | TA: NE IEW | [[| x |] | | |
|--|--|-------------|----------|-----------|----------------|----------------|------------|---------------|--------|------------|------------|-----------|-------------|------------|----------|------------|------------|------------|-------------|------------------|------------|------------|------------|-----------|------------------|
| SUBSYSTI MDAC ID: ITEM: | EM: | | | | ОМ 27 СО | IS 3 OUF | PLI | NC | ; - | - E | SIPF | 201 | ? 7 | 7AL | VE | DI | RAI | [N | POF | ۲۲ | | | | | |
| LEAD ANA | ALY: | ST | : | | c. | D. | F | R | JST | C | | | | | | | | | | | | | | | |
| ASSESSME | ENT | : | | | | | | | | | | | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS FLIGHT | | | | | | | | | | | C] | IL PEN | л | | | | | | | | | | | | |
| | FLIGHT HDW/FUNC | | | | | | | | A | | | | В | | | | с | | | | - | . 1.1 | 1 | | |
| NASA IOA | [[| 2 2 | /1 /1 | lR lR |]] | | | [[| F P |]] | | [[| F N2 | 1] | | [[| P P |]] | | | [[| x x |]] | * | |
| COMPARE | [| | / | |] | | | [| N |] | | ۵ | N |] | | [| |] | | | [| |] | | |
| RECOMMEN | NDA' | FI (| оиз | 5: | | (1 | f | di | lfi | fer | rent | : 1 | fro | m | NAS | SA | | | | | | | | | |
| - | [| 2 | /1 | lR |] | | | [| F |] | | [| F |] | | [| P |] | | (AI |] DD/ | A 'DI |] ELF | TE) | ł |
| * CIL RI | TE | NT: | IOI | N F | 2AT | 'IC | ONA | L | 3: | (1 | f a | ıpı | 91 3 | Lca | ble | e) Il | ÌA IAI | DEQ | UAI QUAI | 'E 'E | [[| |] | | |
| REMARKS: IOA AGRI VERIFY (| EES | | | H N ON | IAS OF | A/ | 'RI CAF | E E T.T | | | IRE AFT | OI EE | | A S CAF | | eei Ns: | n e Pai | BAS | ED | ON N. | II I | IAE [07 | SII A A | LSC | <u>с</u> т() |
| IOA RECO | | ENI RE | DS MC | TH | |)N | PC TH | PI | 2E2 | r F FME | AII A. | ່ເຮັ | OI CHJ | PEN [S | (I IS | | RIN CI | IG RED | FLI DIBI | GHI LE H | ")' "A] | 'E LU | 3E JRF | ADI MC |)ED)DE |
| AND IS A | ADD | RES | SSI | ED | ON | I F | RCS | Şζ | 2D | CC | UPI | II | ١G | FM | EAS | 5. | | | | | _ | | | _ | |

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IOA ALSO RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS DUE TO PROP LEAKAGE.

| ASSESSME ASSESSME NASA FME | NT DA NT ID A #: | TE: | 1/01/8 OMS-27 03-3-4 | 38 74 1507 • | -3 | | | N | IASA DAT BASELIN NE | 'A: 'E [W [X |]] | | | | |
|----------------------------------|--|--------------|----------------------------|--------------------|--------|--------|--------|--------|---------------------------|----------------------|----------|--------|--|--|--|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 274 COUPLI | ING · | - BIP | ROP | VALVE | DRA | AIN PORT | • | | | | | |
| LEAD ANA | LYST: | | C.D. 1 | PRUS | Г | | | | | | | | | | |
| ASSESSME | ASSESSMENT: | | | | | | | | | | | | | | |
| | CIL | M | | | | | | | | | | | | | |
| | HDW | I/FUI | NC | A | | В | 6 | C | 3 | 110 | | | | | |
| NASA IOA | [3 [3 | /3 /3 |] | [[|]] | [[|]] | [[|]] | [[|]] | * | | | |
| COMPARE | [| / |] | [|] | [|] | [|] | Γ |] | | | | |
| RECOMMEN | DATIC | ons: | (If | dif | feren | t fr | om NA | SA) | | | | | | | |
| | [3 | /3 |] | [|] | C |] | C |] | [ADD/D |] ELE | TE) | | | |
| * CIL RE | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | | | | |
| REMARKS: IOA FAII AND "RES | URE N STRICI | IODE. TED | S ON AN | NALY | sis s | HEEI | SHOU | JLD] | INCLUDE | "FAIL | IS C | LOSED" | | | |

IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-275 03-3-4507 | -2 | | NASA DAT BASELIN NI | TA: NE [SW [X |] |
|---|---------------------------------|----------------|--------------|------------------------------|-----------------------|-----------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 275 COUPLING · | - BIPROF | VALVE | DRAIN PORT | 6 | |
| LEAD ANALYST: | C.D. PRUS | r | | | | |
| ASSESSMENT: | | | | | | - |
| CRITICAL | ITY RI | EDUNDANC | Y SCREE | ENS | CIL | i M |
| HDW/FU | NC A | | В | C APPEN | 114 | 171 |
| NASA [3 /3 IOA [3 /3 |] [] [|] [|]] | [] [] | [[|] *] |
| COMPARE [/ |] [|] [|] | [] | [|] |
| RECOMMENDATIONS: | (If dif: | ferent f | rom NAS | SA) | | |
| _ [/ |] [|] [|] | [] | [(ADD/D |] ELETE) |
| * CIL RETENTION | RATIONALE: | (If app | licable | 2) ADEQUATI INADEQUATI | E (E (|]] |
| REMARKS: IOA FAILURE MODE OPEN" AND "RESTR NO DIFFERENCES. | S ON ANALYS | SIS SHEE '. | t shoui | LD NOT INCI | UDE " | FAILS TO |

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-276 NONE | NASA BASE | DATA: LINE [] NEW [] |
|--|--|---|---|
| SUBSYSTEM: MDAC ID: ITEM: NTO | OMS 276 PROPELLANT LIN | ES AND MECHANICAL | J FITTINGS-MMH AND |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL FLIGH HDW/FU | ITY REDUND T NC A | DANCY SCREENS B C | CIL ITEM |
| NASA [/ IOA [2 /1R |] [P] | [] [] [F] [P] | [] * [X] |
| COMPARE [N /N |] [N] | [N] [N] | [N] |
| RECOMMENDATIONS: | (If differer | t from NASA) | |
| [/ |] [] | [][] | [] (ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (If | applicable) ADEQU INADEQU | JATE [] JATE [] |
| REMARKS: IOA CAUSES ON AN BLOCKAGE". | ALYSIS SHEET SH | IOULD NOT INCLUDE | "FILTER |
| NASA/RI DO NOT C OBSTRUCTION OR D RESULT IN 2/1R E OCCURRENCE IS QU DOWNSTREAM FILTE | OVER RESTRICTED EFORMATION (CRI FFECTS, HOWEVER ESTIONABLE. AN R OR COMPONENT. | D FLOW IN A SEGMEN MPING). SUCH AN THE CREDIBILITY Y CONTAMINATION V IOA RECOMMENDS | IT OF LINE DUE TO OCCURRENCE COULD OF SUCH AN WOULD FLOW TO THAT SUCH A |
| FAILURE BE ADDRE | SSED ON THE FME | LA/CIL, BUT DUES I | NOT REGARD THIS |

REPORT DATE 2/26/88

RECOMMENDATION AS AN OPEN ISSUE.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-277 03-3-450 | 07-1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | |
|--|---|--|---|---|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 277 COUPLING | -oms engi | INE TRICK | LE PURGE PC | PRT | | | | | |
| LEAD ANALYST: | C.D. PRU | IST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAL | CTY P | REDUNDANC | CY SCREEN | S | CIL | | | | | |
| HDW/FUN | 4C | A | В | C | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [] [| F][P][| F] [NA] [| P] P] | [X] * [X] | | | | | |
| COMPARE [/ |] [| N][| N]. (|] | [] | | | | | |
| RECOMMENDATIONS: | (If di | fferent f | rom NASA | .) | | | | | | |
| [2 /1R |] [| F] [| F] [| P] (AD | [A] D/DELETE) | | | | | |
| * CIL RETENTION H | RATIONALE | : (If app | olicable) I | ADEQUATE NADEQUATE | [] | | | | | |
| REMARKS: IOA AGREES WITH N VERIFY CONDITION AGREES WITH NASA IOA RECOMMENDS TH | NASA/RI F OF CAP S /RI FAILU NAT "POPF | AILURE OF EAL AFTER RE OF B S PET FAILS | A SCREE CAP INS SCREEN. OPEN (DU | N BASED ON TALLATION. RING FLIGHT | INABILITY TO IOA ALSO) " BE ADDED | | | | | |

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AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS. IOA ALSO RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT POSSIBLE FIRE, EXPLOSION, AND EXPOSURE OF EVA AND GROUND CREWS DUE TO PROP LEAKAGE.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT DATE: NT ID: A #: | 1/01/88 OMS-278 03-3-45 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | |
|---|----------------------------|-------------------------------|---|--------|--------|-----------|-----------------|--------------|----------|----------|--------|--|
| SUBSYSTE MDAC ID: ITEM: | M: | OMS 278 COUPLIN | ig-oms | ENGIN | ie tr | ICKL | E PUR | GE PO | ORT | | | |
| LEAD ANA | LYST: | C.D. PF | RUST | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | |
| | HDW/FU | JNC | A | В | | | с | T T T | ** | | | |
| NASA IOA | [3 /3 [3 /3 |] [|] | [[|]] | [[|] | | [[|] | * | |
| COMPARE | [/ |] |] | [|] | [|] | | [|] | | |
| RECOMMEN | DATIONS | : (If d | liffere | ent fr | om N | ASA) | | | | | | |
| | [3/3 |] |] | [|] | [|] | (Al | [0/0 |] ELE | TE) | |
| * CIL RE | TENTION | RATIONAI | LE: (If | f appl | icab | le) IN | ADEQU. ADEQU | ATE ATE | [|] | | |
| REMARKS: IOA FAIL AND "RES | URE MODI | ES ON AND FLOW". | ALYSIS | SHEET | s sho | ULD | INCLU | DE "1 | FAIL | S C | LOSED" | |
| IOA RECO | MMENDS | THAT "FA | ILS CLO | SED" | AND | "RES | TRICT | ED F | LOW" | BE | ADDED | |

TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

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| ASSESSM ASSESSM NASA FM | ENT ENT EA | D/ I) #: | ATE: D: | 1/01 OMS- 03-3 | /88 279 -4507 | 7-2 | NASA DATA: BASELINE [] NEW [X] | | | | | | | |
|-------------------------------|------------------|----------------|------------|----------------------|--|--------|---|--------|-----------------|------------------|------------|----------|---------------------------|----|
| SUBSYST MDAC ID ITEM: | EM: : | | | OMS 279 COUP | OMS 279 COUPLING-OMS ENGINE TRICKLE PURGE PO | | | | | | | | | |
| LEAD AN | ALY | ST | : | C.D. | PRUS | ST | | | | | | | | |
| ASSESSM | ENT | : | | | | | | | | | | | | |
| | CR | IT | | ITY | I | REDUN | IDANCY | SCR | EENS | | | CI | L FM | |
| | | HD | W/FU | NC | 1 | ł | E | 3 | C | 2 | | ± ± 1 | | |
| NASA IOA | [| 3 3 | /3 /3 |]] | ([|]] | [[|]] | [[|]] | | [[|] *] | |
| COMPARE | [| | / |] | [| נ | [|] | [|] | | [|] | |
| RECOMME | NDA | TI | ons: | (I | f dif | fere | ent fr | om N | ASA) | | | | | |
| | [| | / |] | [|] | [|] | [|] | (AD | [D/1 |] DELETE) |) |
| * CIL R | ETE | NT | ION | RATIO | NALE: | (If | appl | icab. | le) / IN/ | ADEQU. ADEQU. | ATE ATE | [[|] | |
| REMARKS IOA FAI | : LUR | El | MODE | S ON | ANAL | ISIS | SHEET | з вно | ULD N | IOT I | NCLUD | E .' | 'FAILS | то |
| OPEN" A | ND | "R | ESTR | ICTED | FLOV | 7". | | | | | • • | | ya a m akar sa | |

NO DIFFERENCES.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-280 03-3-4004- | 1 | NA E | SA DATA: ASELINE NEW | [[X |]] |
|--|----------------------------------|----------------|----------------------|----------------------------|-------------|------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 280 PLATELET I | NJECTOR AS | SEMBLY | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | |
| ASSESSMENT: | | | | | | |
| CRITICAL | LITY RE | DUNDANCY S | CREENS | | CIL ITEM | |
| HDW/FU | JNC A | В | С | | | |
| NASA [1 /1 IOA [1 /1 |] [] [|] []] [] | |]] | [X [X |] *] |
| COMPARE [/ |] [|] [] |] [|] | [|] |
| RECOMMENDATIONS | : (If diff | erent from | n NASA) | | | |
| [/ |] [|] [] | 1 [|] (AD | [D/DE |] LETE) |
| * CIL RETENTION REMARKS: NO DIFFERENCES. | RATIONALE: | (If applic | cable) AI INAI | DEQUATE DEQUATE | [|] |

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT D NT I A #: | DATE: D: | 1/01/2 OMS-22 03-3-4 | 88 81 4004– | -1 | | | ł | NASA DA' BASELII NI | FA: NE EW | [[| x |]] | |
|----------------------------------|----------------------|-------------|----------------------------|-------------------|-------|--------|--------|----------------|---------------------------|-----------------|---------|----------|----------|-----|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 281 PLATE | LET I | INJEC | TOR | ASSEMI | 3LY | nt (1) | | | | | |
| LEAD ANA | lyst | : | C.D. | PRUS | r | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | |
| | CRIT | ICAL | ITY | RI | EDUND | ANCY | SCREE | ENS | | | CI | L 'EM | r | |
| | нD | W/FU | NC | A | | В | | C | 3 732 | | ± ± | | | |
| NASA IOA | [1 [1 | /1 |]] | [[|] | [[|]] |] [|] | | [[| x |]] | * |
| COMPARE | [| / |] | [|] | [|] | [|] | | [| N |] | 117 |
| RECOMMEN | DATI | ons: | (If | dif | feren | t fr | om NAS | SA) | | | | | | |
| | [| / |] | [|] | [|] | [|] | (AD | [D/ | DE |] :LE | TE) |
| * CIL RE | TENT | TON | RATION | ALE: | (If | appl | icable | ≥) A INA | ADEQUATI ADEQUATI | E | [[| |] | |

NO DIFFERENCES.

REPORT DATE 2/26/88

| ASSESSMEN ASSESSMEN NASA FMEA | T DAT: T ID: . #: | E: 1/01 OMS- 03-3 | /88 282 -4004-2 | | NASA DA BASELI I | ATA: INE [] NEW [X] |
|-------------------------------------|-------------------------|-------------------------|-----------------------|-------------|---------------------------|------------------------------|
| SUBSYSTEM MDAC ID: ITEM: | [: | OMS 282 PLAT | ELET INJ | ECTOR ASSEN | IBLY | |
| LEAD ANAI | LYST: | C.D. | PRUST | | | |
| ASSESSMEN | IT: | | | | | |
| c | RITIC FLI | ALITY GHT | REDU | NDANCY SCRI | EENS | CIL ITEM |
| | HDW/ | FUNC | A | В | C | |
| NASA IOA | [1 / [2 / | 1] 1R] | [] [P] | [] [F] | [] [P] | [X]* [X] |
| COMPARE | [N/ | N] | [N] | [א] | [N] | [] |
| RECOMMENI | DATION | s: (I | f differ | ent from NA | ASA) | |
| | [/ |] | [] | [] | []] | [] (ADD/DELETE) |
| * CIL RET | TENTIO | N RATIC | NALE: (I | f applicab | Le) ADEQUA INADEQUA | TE [] TE [] |
| REMARKS: | 1/1 CR | TTICALI | TY IS CO | RRECT. FA | ILURE COUL | D LEAD TO ENG |

NASA/RI 1/1 CRITICALITY IS CORRECT. FAILURE COULD LEAD TO ENGINE BURN-THROUGH. NASA/RI CHANGED "BLOCKAGE OF ENGINE INLET FILTER" TO "STRUCTURAL FAILURE OF ENGINE INLET FILTER" AS A CAUSE, PER IOA ISSUE.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-283 03-3-4005 | | | N | ASA DAT BASELIN NE | A: E [W [X |] | | |
|--|---------------------------------|-----------------|---------------|--------------|--------------------------|--------------------|---------------|------------|----------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 283 COMBUSTIO | n chai | MBER | | | | | | |
| LEAD ANALYST: | C.D. PRUS | т | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICAL | LITY R | EDUND | ANCY | SCREI | ENS | | CII | i 'Nr | |
| HDW/FU | INC A | | В | | с | | | 111 | |
| NASA [1 /1 IOA [1 /1 |] [] [|] | [[|] | ן נ |] | [X [X | [] [] | * |
| COMPARE [/ |] [| 3 | [|] | Γ |] | [|] | |
| RECOMMENDATIONS: | (If dif | ferent | t fro | om NAS | SA) | | | | |
| [/ |] [|] | [|] | [|] |] ADD/D |] ELE | TE) |
| * CIL RETENTION | RATIONALE: | (If a | appli | icable | e) Al INAI | DEQUATE DEQUATE | [[|]] | |
| NO DIFFERENCES. INCLUDE "BIPROP | IOA RECOM VALVE IMPR | MENDS OPER 1 | THAT TIMIN | THE IG OR | CAU: FAII | SES ON T | THIS TRAVE | FME L". | A |

REPORT DATE 2/26/88

| ASSESSMEI ASSESSMEI NASA FMEI | NT DAT NT ID: A #: | ГЕ: : | 1/01/ OMS-2 03-3- | L/01/88 NASA DATA: DMS-284 BASELINE D3-3-4005-2 NEW | | | | | | | |]] |
|-------------------------------------|--------------------------|----------|-------------------------|---|---------------|---------------|--------|--------------|--------------------|--------------|--------------|-------------|
| SUBSYSTE MDAC ID: ITEM: | М: | | OMS 284 COMBU | STIO | N CHA | MBER | | | | | | |
| LEAD ANA | LYST: | | C.D. | PRUS | т | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | - | |
| | CRITIC | | ITY | R | EDUNI | DANCY | SCRE | ENS | | | CIL TTEN | л |
| | HDW/ | /FUI | NC | A | | B | \$ | | с | | <u> </u> | • |
| NASA IOA | [1 / [1 / | /1 /1 |]] | [[|]] | [[|]] | [[|] | | [[X |] * |
| COMPARE | [/ | / |] | [|] | [|] | C |] | | [N |] |
| RECOMMEN | DATIO | NS: | (If | dif | ferer | nt fr | om NA | SA) | | | | |
| | [/ | / |] | [| .] | [|] | [|] | (AD | [D/DI |] Elete) |
| * CIL RE | TENTI | ON I | RATION | IALE: | (If | appl | icabl. | .e) IN | ADEQUA] ADEQUA] | CE CE | [[|]] |
| REMARKS: NO DIFFE INCLUDE | RENCE: "BIPRO | S. OP | IOA F VALVE | ECOM | MENDS OPER | 5 THA TIMI | AT THE | E CA R FA | USES ON ILS MII | 1 TH D-TR | IS I AVEI | FMEA |

REPORT DATE 2/26/88

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| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-285 NASA FMEA #: 03-3-4006-1 | | | | | | | | |] | NASA DAT BASELII NI | ra: Ne Ew | [|] x] | I |
|--|--------|------------|----------|----------------------|--------|--------|--------|--------|----------------|---------------------------|-----------------|----------|------------|------|
| SUBSYSTI MDAC ID ITEM: | EM: | | | oms 285 Nozzle | E EXT | TENSI | лс | | | | | | | |
| LEAD AND | ALYS | ST: | | C.D. 1 | PRUSI | | | | | | | | | |
| ASSESSMI | ENT: | | | | | | | | | | | | | |
| | CRI | TIC | ALI | TY | RE | DUND | ANCY | SCREI | ENS | | | | L FM | |
| | H | IDW/ | FUN | с | A | | В | В | | C | | | 21.1 | |
| NASA IOA | [[| 1 / 1 / | /1 /1 |] | [[|]] | [[|]] | [[|]] | | []] | K] K] | * |
| COMPARE | [| / | |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | IDAI | ION | IS: | (If | diff | erent | t fro | om NAS | SA) | | | | | |
| | [| / | , | j | [|] | [|] | [|] | (AD | [D/1 |] DEI | ETE) |
| * CIL RI | ETEN | ITIC | N R | ATIONA | LE: | (If a | appli | icable | ≥) / IN/ | ADEQUATI ADEQUATI | Ē | [[|] | |
| REMARKS | : | | | | | | | | | - | | • | | |

NO DIFFERENCES.

REPORT DATE 2/26/88

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| ASSESSMEN ASSESSMEN NASA FMEN | NT DA NT II A #: | ATE: D: | 1/01/8 OMS-28 03-3-4 | 88 85A 4005- | -1 | | | | NASA DATA BASELINE NEW | : [] | x] | | | |
|-------------------------------------|------------------------|------------|----------------------------|--------------------|--------|--------|--------|----------|------------------------------|--------------|--------------|--|--|--|
| SUBSYSTEN MDAC ID: ITEM: | 4: | | OMS 285 NOZZLI | E EXI | rensio | N | | | | | | | | |
| LEAD ANA | LYST | : | C.D. | PRUST | Г | | | | | • | | | | |
| ASSESSMEN | ASSESSMENT: | | | | | | | | | | | | | |
| (| | CI IT | L Em | | | | | | | | | | | |
| | HD | W/FU | NC | A | | В | | | С | | | | | |
| NASA IOA | [1 [1 | /1 /1 |] | [[|] | [[|]] | [[|] | [[| X] * X] | | | |
| COMPARE | [| / |] | ۵ |] | [|] | [|] | [|] | | | |
| RECOMMEN | DATI | ons: | (If | dif | ferent | t fr | om NAS | 5A) | | | | | | |
| | [| / |] | Ĺ | [|] | [|] (A |] DD/ |] DELETE) | | | | |
| * CIL RE | FENT | ION | RATION. | ALE: | (If a | appl | icable | e) IN | ADEQUATE (ADEQUATE |]] _ |]] | | | |
| NO DIFFE | RENC | ES. | | | | | | | | | | | | |

IOA ANALYZED COMBUSTION CHAMBER-TO-NOZZLE EXTENSION FLANGE LEAKAGE AS A NOZZLE FAILURE. NASA/RI ANALYZED IT AS A COMBUSTION CHAMBER FAILURE.

REPORT DATE 2/26/88

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| ASSESSMENT ASSESSMENT NASA FMEA # | DATE: ID: : | 1/01/8 OMS-28 03-3-4 | 8 6 006- | | | | NASA DAT BASELIN NE | CA: NE EW | [[X |]] | | |
|---|-------------------|----------------------------|----------------|-------|----------|--------|---------------------------|----------------------|----------|------------|----------|--------|
| SUBSYSTEM: MDAC ID: ITEM: | | OMS 286 NOZZLE | EXI | ENSIC | N | | | | | | | |
| LEAD ANALYS | T: | C.D. P | RUSI | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRI | TICALI FLIGHT | ITY IC | RE A | DUNDA | NCY B | SCREI | ENS | с | 5 I | CIL ITE | M | |
| NASA [IOA [| 1 /1 2 /1R |] | [[P |] | [[P |]] | [|] P] | | [X [X |]] | * |
| COMPARE [| N /N |] | (N |] | [N |] | [| N] | | [|] | |
| RECOMMENDAT | IONS: | (If | diff | erent | fro | om NAS | SA) | | | | | |
| . Γ | 1 |] | [|] | נ |] | [|] | (AC | [D/D] |] ELE | TE) |
| * CIL RETEN | TION F | RATIONA | LE: | (If a | appl: | icable | ≥) IN. | ADEQUATE ADEQUATE | C C | [[|]] | na bat |

IOA AGREES WITH NASA/RI CRITICALITY.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-287 03-3-4502-1 | N | ASA DATA: BASELINE NEW | [] [X] | | | | | | | | | |
|--|---|-------------------------|------------------------------|--------------------|--|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 287 COUPLING-GN2 TA | NK FILL/VENT | | | | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | | | | | |
| ASSESSMENT: | · | | | | | | | | | | | | |
| CRITICAL | ITY REDUNDA | NCY SCREENS | | CIL TTEM | | | | | | | | | |
| HDW/FU | | | | | | | | | | | | | |
| NASA [3 /1R IOA [3 /1R |] [F]] [P] | [F] [I [P] [I |)) | [X]* [] | | | | | | | | | |
| COMPARE [/ |] [N] | [N] [|] | [N] | | | | | | | | | |
| RECOMMENDATIONS: | (If different | t from NASA) | | | | | | | | | | | |
| [3 /1R |] [F] | [F] [I | ?] (AD | [A] D/DELETE) | | | | | | | | | |
| * CIL RETENTION | RATIONALE: (If a | applicable) / IN/ | ADEQUATE ADEQUATE | [] | | | | | | | | | |
| REMARKS: NASA/RI ORIGINAL BETWEEN IOA AND FAILED FOR ALL Q CONDITION OF CAP IOA AGREES WITH IOA RECOMMENDS T | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS: NASA/RI ORIGINALLY PASSED A SCREEN. HOWEVER, DURING MEETING BETWEEN IOA AND SSM, IT WAS AGREED THAT THE A SCREEN SHOULD BE FAILED FOR ALL QD COUPLINGS BASED ON INABILITY TO VERIFY CONDITION OF CAP SEALS AFTER CAP INSTALLATION. IOA AGREES WITH NASA/RI FAILURE OF B SCREEN. NAME ADDED | | | | | | | | | | | | |

AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE AND IS ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSM ASSESSM NASA FM | ENT ENT EA | ! D. ! I #: | ATE: D: | 1/0 OMS 03- | 1/88 -288 3-4502 | 2-3 | | | N | IASA BASE | DATA LINE NEW | : [[} |] (] | |
|---|------------------|-------------------|----------------------|-----------------------|---------------------------|-------------------------|--------------------------|--------------------|---------------------------|----------------------|---------------------|---------------|---------------|-------------|
| SUBSYST MDAC ID ITEM: | EM: | | | 0MS 288 COU | PLING- | -GN2 | TANK | FILI | L/VENI | 1 | | | | |
| LEAD AN | ALY | ST | : | c.D | . PRUS | ST | | | | | | | | |
| ASSESSM | ENI | : | | | | | | | | | | | - | |
| | CR | IT | ICAL | JITY | F | REDUN | DANCY | SCI | REENS | | | CII | זארי | |
| | | HD | W/FU | INC | P | L | В | | c | | | T T T | 21.1 | |
| NASA IOA | . [. [| 3 3 | /3 /3 |]] | [[|]] | [[|]] | [[|]] | | [[|] *] | |
| COMPARE | ; C | | / |] | [|] | [|] | [|] | | [|] | |
| RECOMME | NDA | TI | ons: | (| If dif | fere | ent fr | om 1 | NASA) | | - | | | |
| | [| 3 | /3 |] | ſ |] | [|] | [|] | (A) |] DD/I |] DELEI | 'E) |
| * CIL R | ETE | 'NT | ION | RATI | ONALE: | (If | appl. | ical | ole) A INA | DEQU. | ATE ATE | [[|]] | |
| REMARKS IOA FAI AND "RE | LUR | E IC | MODE TED | S ON FLOW | ANALY | SIS | SHEET | SHO | OULD I | NCLU | DE " | FAII | S CI | ØSED" |
| IOA REC TO THE MODES A | OMM FAI ND | EN LU AR | DS T RE M E AC | THAT IODES DRES | "FAILS ON TH SED ON | S CLO IIS H I RCS | SED" MEA. G QD C | AND THI DUPI | "REST ESE AF LING F | RICT E CR MEAS | ED F EDIB | LOW" LE F | ' BE 'AILU | ADDED RE |
| s ar the second second second second second second second second second second second second second second second | - | | 7 B. L | | | · · · · · | • 1 - 1 1 - 1 | | | | · · · · | • | | |

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REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-289 03-3-4502 | -2 | | NASA DATA BASELINE NEW | : [[X |]] | | | | | | | | | |
|--|---------------------------------|-----------------|-------------------------------|------------------------------|---------------|-------------|--|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 289 COUPLING-(| GN2 TANK | FILL/VEN | T | | | | | | | | | | | |
| LEAD ANALYST: | C.D. PRUS | т | | | | | | | | | | | | | |
| ASSESSMENT: | ASSESSMENT: | | | | | | | | | | | | | | |
| CRITICAL | CIL | м | | | | | | | | | | | | | |
| HDW/FU | NC A | В | | С | ± ± ±. | | | | | | | | | | |
| NASA [3 /3 IOA [3 /3 |] [] [|] [] [| B C] [] []] [] [] | | [[|] *] | | | | | | | | | |
| COMPARE [/ |] [|] [|] [|] | Γ |] | | | | | | | | | |
| RECOMMENDATIONS: | (If dif | ferent fr | om NASA) | | | | | | | | | | | | |
| [/ |] [|] [|] [|] (A | [מ/סמי |] ELETE) | | | | | | | | | |
| * CIL RETENTION | RATIONALE: | (If appl | icable) IN | ADEQUATE IADEQUATE | [[|]] | | | | | | | | | |
| REMARKS: IOA FAILURE MODE OPEN" AND "RESTR | S ON ANALY ICTED FLOW | SIS SHEET ". | SHOULD | NOT INCLU | JDE " | FAILS TO | | | | | | | | | |

NO DIFFERENCES.

REPORT DATE 2/26/88

| ASSESSMENT DAT ASSESSMENT ID: NASA FMEA #: | TE: 1/01/88 OMS-290 03-3-451 | 10-1 | NA: B | SA DATA: ASELINE [] NEW [X] | |
|--|------------------------------------|--------------------------------------|--------------|--------------------------------------|---------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 290 GN2 PRES | SURE LINES | AND MECHA | NICAL FITTING | S |
| LEAD ANALYST: | C.D. PRU | JST | | | |
| ASSESSMENT: | | | | | |
| CRITIC | CALITY | REDUNDANCY | SCREENS | CIL ITEM | |
| HDW/ | FUNC | A B | C | | |
| NASA [2 / IOA [3 / | /1R] [/1R] [| P][P] P][F |) [P] [P | [X]] [X] | * |
| COMPARE [N / | '] [|] [N | .] [|] [] | |
| RECOMMENDATION | IS: (If di | fferent fr | om NASA) | | |
| [/ | ′][|] [|] [|] [] (ADD/DEL | ETE) |
| * CIL RETENTIO | ON RATIONALE | : (If appl | icable) | | |
| | | | INAD | EQUATE [] | |
| REMARKS: IOA ACCEPTS NA INDIVIDUAL LIN | ASA/RI 2/1R NE SEGMENTS | PPP, 1/1 A SEPARATELY CN2 LINE | BORT ASSIG | MENT. IOA A | NALYZED |
| LEAKAGE OF THI | IS SEGMENT I | O BE A $3/1$ | R PFP. | | - |

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| ASSESSME ASSESSME NASA FME | NT NT A | D2 II #: | ATE: D: | 1/01 OMS- NONE | L/88 -291 E | | | |] | NASA D BASEL | ATA INE NEW | : [] |]] | |
|----------------------------------|---------------|----------------|------------|----------------------|-------------------|-------|---------|--------|------------|------------------|-------------------|-------------|------------|-----|
| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 291 GN2 | PRESS | SURE | LINES | ANC | MEC | HANICA | LF | ITTI | NGS | |
| LEAD ANA | LYS | 5T | : | C.D. | . PRUS | ST | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | |
| | CR | IT: | ICAL | ITY | SCF | REENS | | | CII | , M | | | | |
| | I | F. HDI | W/FU | NC | 1 | A | В | | | С | | 111 | 17.1 | |
| NASA IOA | [[| 3 | / /3 |]] | [[|] | [[|]] | [[|]] | | [[|] *] | t |
| COMPARE | [| N | /N |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | IDA' | FI (| ONS: | (: | If di | ffer | ent fro | om N | iasa) | | | | | |
| | [| | / |] | Γ |] | [|] | Γ |] | (A) | [DD/I |] DELEJ | ſE) |
| * CIL RE | TE | NT | ION | RATI | ONALE | : (I | f appl. | icak | ole) IN | ADEQUA ADEQUA | ATE ATE | [[|] | |
| REMARKS: IOA CAUS BLOCKAGE | SES | 0 | N AN | ALYS | IS SH | EET | SHOULD | LON | T INC | LUDE " | FIL | TER | | |

NASA/RI DO NOT COVER RESTRICTED FLOW IN A SEGMENT OF LINE DUE TO OBSTRUCTION OR DEFORMATION (CRIMPING). SUCH AN OCCURRENCE COULD RESULT IN 3/3 EFFECTS, HOWEVER THE CREDIBILITY OF SUCH AN OCCURRENCE IS QUESTIONABLE. ANY CONTAMINATION WOULD FLOW TO DOWNSTREAM FILTER OR COMPONENT. IOA RECOMMENDS THAT SUCH A FAILURE BE ADDRESSED ON THE FMEA/CIL, BUT DOES NOT REGARD THIS RECOMMENDATION AS AN OPEN ISSUE.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ENT ENT EA | D. I #: | ATE: D: | 1/02 OMS- 03-2 | 1/88 -292 3-4511 | L-2 | | | Ň | IASA BASE | DATA LINE NEW | : |] (] | |
|---|-----------------------------|----------------------|----------------------------|------------------------|--------------------------|-------------------|------------------------|---------------------|------------------|--------------|---------------------|--------------|-----------|------|
| SUBSYSTI MDAC ID: ITEM: | EM : : | | | OMS 292 VALV | VE-GŅ2 | 2 TAN | IK FIL | L/VE | NT | | | | | |
| LEAD ANZ | ALY | ST | : | C.D. | . PRUS | ST | | | | | | | | |
| ASSESSME | ENT | : | | | | | | | | | | | | |
| CRITICAL FLIGH HDW/FU | | | | LITY IT INC | 1 2 | REDUN | IDANCY B | SCF | EENS | 2 | ъ - | CII ITE | EM . | |
| NASA IOA | ([| 3 3 | /3 /3 |]] | [[|]] | [[|]] | ([|]] | | [[|]] | * |
| COMPARE | [| | 1 |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | NDA! | TI(| ons: | () | If dif | fere | ent fr | om N | IASA) | | | | | |
| | [| | / |] | [|] | Γ |] | [|] | (A | [DD/I |] DELE | TE) |
| * CIL RH | ETE | NT | ION | RATIC | ONALE: | (If | appl | icab | ole) A INA | DEQUA | ATE ÁTE | |]] | |
| REMARKS: NO DIFFI FAILURE TO GROUN ADDRESSI | EREI MOI ND (ED I | NC DE OP BY | ES. S AS ERAT ASS | SIGNI IONS ESSMI | ed by Only. Ent sf | IOA "F IEET | ON AS AILS OMS-2 | SESS OPEN 94. | MENT "DUR | SHEE Sing | r om Flig | S-29 HT 1 | 2 A S | PPLY |

REPORT DATE 2/26/88

بالمريحين مرابع

| ASSESSMEI ASSESSMEI NASA FMEI | NT DATE: NT ID: A #: | 1/01/88 OMS-293 03-3-45 | 10-: | 1 | | | N) | ASA DATA BASELINE NEW | : [x |]] |
|-------------------------------------|----------------------------|-------------------------------|--------|--------|------------|--------|----------------|-----------------------------|-------------|-------------|
| SUBSYSTE MDAC ID: ITEM: | M: | OMS 293 VALVE-G | N2 [| TANK | FILI | L/VENT | C | | | - |
| LEAD ANA | LYST: | C.D. PR | UST | | | | | | | |
| ASSESSME | NT: | | | | | | | | | |
| (| CRITICAL | ITY | RE | DUNDA | NCY | SCREI | ens | | CIL ITEN | 4 |
| | HDW/FU | NC | | | - | | | | | |
| NASA IOA | [2 /1R [3 /1R |] [| P P |]] | [P [P |] | [P [P |]] | [X [|] *] |
| COMPARE | [N / |] [| |] | [|] | [|] | [N |] |
| RECOMMEN | DATIONS: | (If d | iff | erent | fro | om NAS | SA) | | | |
| | [/ |] [| • |] | [|] | [|] |] וס/סס |] ELETE) |
| * CIL RE | TENTION | RATIONAL | E: | (If a | appli | icable | e) A INA | DEQUATE DEQUATE | [|] |
| REMARKS: | | /DT 2/10 | סס ס | ר ס | ז בר/ | 30RT 3 | ASST | GNMENT. | - | - |

IOA ACCEPTS NASA/RI 2/1R PPP, 1/1 ABORT ASSIGNMENT. NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (STRUCTURAL FAILURE, RUPTURE, EXTERNAL LEAKAGE) BUT AGREED TO ADD THIS VALVE BODY TO THE ITEM LIST ON THIS FMEA, AND TO ADD CORRESPONDING RETENTION RATIONALE TO THE CIL SHEET, PER IOA ISSUE.

REPORT DATE 2/26/88

| ASSESSMENT I ASSESSMENT I NASA FMEA #: | DATE: [D: | 1/01/8 OMS-29 03-3-4 | 8 4 511 | -1 | | | | N | IASA DA' BASELII NI | TA: NE EW | [[X |] | | |
|--|--------------------------------------|-------------------------------------|--------------------------|-------------------------------------|------------------|-------------|-------------------------|------------------|---------------------------|-------------------|----------------------|-----------------|----------------------|---------------|
| SUBSYSTEM: MDAC ID: ITEM: | | OMS 294 VALVE- | GN2 | TANK | FJ | LI | L/VENI | 2 | • | | | | | |
| LEAD ANALYST | :: | C.D. P | RUS | г | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | |
| CRIT | TCALI | TY | RI | EDUND | ANC | CY | SCREE | INS | | | CIL | i M | | |
| н | W/FUN | rc | A | | | В | | C | | 181 | - - - | | | |
| NASA [3] IOA [3] | /1R /1R |]] | [P [P |] | [[| F P |] | [F [F |)] | - | [X [|] | * | |
| COMPARE [| / |] | [|] | נ | N |] | [|] | | [] |] | | |
| RECOMMENDATI | IONS: | (If | dif | ferent | : 1 | irc | om NAS | A) | | | | | | |
| ſ | / | j | [|] | [| |] | [|] | (AI | [0D/D |] ELI | ETE) | |
| * CIL RETENT | TION R | ATIONA | LE: | (If a | pp |)]j | cable | e) A INA | DEQUATI | E | [r |] | | |
| REMARKS: IOA AGREES W IOA RECOMMEN EFFECTS BE F FILL/VENT CO | VITH N IDS TH REVISE OUPLIN | ASA/RI AT THE D. IO G SEAL | FA REI A CO ANI | ILURE DUNDAN DNSIDE D CAP, | OF ICY ERS | | SCRE TRING THE ST | EN. LI RIN | STED UN G TO IN | NDE NCI OTH | R T UDE IER | HÉ ON ENC | "E" ILY T SINE | - FHE • |
| THERE ARE NO |) ADDI | TIONAL | REI | DUNDAN | IT | VA | LVES | OR | COUPLIN | NGS | | | | |

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT DATE: NT ID: A #: | 1/01/8 OMS-29 03-3-4 | 8 5 501- | -1 | | | ł | IASA I BASEI | DATA: LINE NEW | ; [[X |]] |
|----------------------------------|----------------------------|----------------------------|----------------|----------|---------|--------|-----------|------------------|----------------------|---------------|-------------|
| SUBSYSTE MDAC ID: ITEM: | M: | OMS 295 TANK-G | N2 S | STORA | GE | | | | | | |
| LEAD ANA | LYST: | C.D. F | RUSI | C | | | | | | | |
| ASSESSME | NT: | | | | _ | | | | | | |
| | CRITICAL FLIGH | ITY T | RI | EDUNE | ANCY | SCRE | ENS | | | CIL ITE | M |
| | HDW/FU | NC | A | | В | | C | 2 | | | |
| NASA IOA | [1 /1 [1 /1 |]] | [[|] | -[[|]] | [[|]] | | [X [X |] *] |
| COMPARE | [/ |] | [|] | [|] | [|] | | [|] |
| RECOMMEN | DATIONS: | (If | dif | feren | nt fr | om NA | SA) | | | | |
| | [/ |] | C |] | ĺ |]. | [|] | (Al | [ס/סכ |] ELETE) |
| * CIL RE | TENTION | RATIONA | LE: | (If | appl | icabl | e) INZ | ADEQUI ADEQUI | ATE ATE | [|]] |
| REMARKS: NO DIFFE | RENCES. | | TO 1 | א קום | DOGG | קזמד | FFF | а ст а Ба | чточ | CHO. | |

IOA CONSIDERS SHRAPNEL TO BE A POSSIBLE EFFECT WHICH SHOULD BE ADDRESSED PER NSTS 22206.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-296 NASA FMEA #: 03-3-4501-1 | | | | | | | | | | | | | | NZ 1 | ASA BASE | DATA: ELINE NEW | : [] | x |]] | |
|----------------------------------|--|-------------|-----------|----------------|------------------|--------|-----|--------|------|---------|------------|---------|-----|----------|-----------|--------------|-----------------------|-------------|----------|----------|------|
| SUBSYSTE MDAC ID: ITEM: | E M : ; | | | ОМ 29 ТА | IS 96 NK-0 | SN2 | 2 5 | STO | RAGI | E | | | | | . 77- | | | | | | |
| LEAD ANA | ALY: | ST | : | c. | D. E | PRI | JSI | C | | | | | | | | | | | | | |
| ASSESSME | ENT | : | | | | | | | | | | | | | | | | | | | |
| | CRITICALITY FLIGHT HDW/FUNC | | | | | • | RI | EDUI | NDAI | 10 | Y | sc | REE | NS | 5 | | | | L TEM | 1 | |
| | H | HDV | N/FUI | NC | | | A | | | | в | | | | С | | | | | - | |
| NASA IOA | [[| 1 3 | /1 /1R |]] | | [[| P |]] | | | P |]] | | [[| Ρ |]] | | [[| х |] | * |
| COMPARE | [| N | /N |] | | [| N |] | ł | • | N |] | | [| N |] | | [| N |] | |
| RECOMMEN | IDAT | FI C | ONS: | | (If | d | iff | fer | ent | f | rc | m | NAS | A) | | | | | | | |
| | [| | / |] | | [| |] | . | • | |] | | [| |] | (AI | [)D/ | DE |] :LE | TE) |
| * CIL RE | ETEI | 1 T] | ION I | rai | IONA | LI | 3: | (I: | f ar | p | 1 i | .ca | ble |) IN | AI IAI | DEQU DEQU | VATE VATE | [| |] | - |
| REMARKS: IOA ACCE | EPTS | 5 1 72(| NASA | /RI | 1/1 CTS | . 1 | ASS | | NMEN | IT S | ĒX | I TE | OA | DI T. | FI T.F | TERE | NTIAT | |) E | ET | WEEN |

VEHICLE DAMAGE EFFECTS (1/1), AND EXTERNAL LEAKAGE (3/1R) EFFECTS. IOA RECOMMENDS THAT THE EXTERNAL LEAKAGE (3/1R) EFFECTS ALSO BE INCLUDED ON THIS FMEA.

REPORT DATE 2/26/88

| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-297 NASA FMEA #: 03-3-4510-1 | | | | | | | | -1 | | | | | NZ H | ASA D. BASEL | ATA: INE NEW | : [[| x |] | |
|--|----------|-----------------|-------------------------|----------------|----------------|--------|---------|--------|--------|----------|--------|----------|---------|-----------------|--------------------|-------------|-----------|----------|------|
| SUBSYSTEN MDAC ID: ITEM: | M: | | | OM 29 PN | S 7 EUMA | \T | ٢C | PACK | C A | ssi | EMBLY | r Ho | ວບອ | SING | | | | | |
| LEAD ANA | LYS | ST | : | c. | D. 1 | PRI | JSI | 2 | | | | | | | | | | | |
| ASSESSME | NT: | : | | | | | | | | | | | | | | | | | |
| (| CRI H | IT Fl HDV | ICALI LIGHI W/FUN | CTY C IC | | | RI A | EDUND | AN | ICY B | SCRE | EN | s c | | | C: I' | IL Fen | М | |
| NASA IOA | [[| 2 3 | /1R /1R |]] | | [[| P P |]] | [[| P P |]] | [[| P P |]] | | [[| х |] | * |
| COMPARE | נ | N | / |] | | [| |] | [| |] | [| |] | | [| N |] | |
| RECOMMEN | DA' | rI¢ | ons: | | (If | đ | if | feren | nt | fr | om NA | SA |) | | | | | | |
| | [| | / |] | | [| |] | (| |] | [| |] | (A) |] ,00 | /DI |] ELI | ETE) |
| * CIL RE | TEI | NT: | ION I | RAI | NOI | AL) | E : | (If | aŗ | opl | icab] | le) I | A NA | DEQUA DEQUA | TE TE | [[| |] | |
| | | | | | | | | | | | | | | | _ | | | | |

IOA ACCEPTS NASA/RI 2/1R PPP, 1/1 ABORT ASSIGNMENT. NASA/RI AGREED TO ADD THIS MECHANICAL CONNECTION TO THE ITEM LIST ON THIS FMEA, AND TO ADD CORRESPONDING RETENTION RATIONALE TO THE CIL SHEET, PER IOA ISSUE.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-298 NONE | NASA BAS | DATA: ELINE [] NEW [] |
|--|------------------------------|-------------------------------|-------------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 298 PNEUMATIC PACK | HOUSING ASSEMBL | .Y |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL | ITY REDUNDA | ANCY SCREENS | CIL |
| HDW/FU | NC A | B C | L L MA John Marka |
| NASA [/ IOA [2 /1R |] []] [P] | [] [] [F] [P] | [] * [X] |
| COMPARE [N /N |] [N] | [N] [N] | [N] |
| RECOMMENDATIONS: | (If different | t from NASA) | |
| [/ |] [] | []][] | [] · (ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (If a | applicable) ADEQ INADEQ | UATE [] UATE [] |
| REMARKS: | - | | |
| IOA CAUSES ON AN BLOCKAGE" | ALYSIS SHEET SHO | JULD NOT INCLUDE | "F <u>1LTER</u> |
| NASA/RI DO NOT C | OVER RESTRICTED | FLOW IN A SEGME | NT OF LINE DUE TO |
| OBSTRUCTION OR D | EFORMATION (CRIN | MPING). SUCH AN | OCCURRENCE COULD |
| RESULT IN 2/1R E | FFECTS, HOWEVER | THE CREDIBILITY | OF SUCH AN WOULD FLOW TO |
| DOWNSTREAM FILTE | R OR COMPONENT. | IOA RECOMMENDS | THAT SUCH A |
| FAILURE BE ADDRE | SSED ON THE FMEA | A/CIL, BUT DOES | NOT REGARD THIS |

RECOMMENDATION AS AN OPEN ISSUE.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-299 03-3-4503-2 | NASA DATA BASELINI NEV | A: E [] W [X] | | | | | | | | | |
|--|--|--|---------------------------------|--|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | SSURE ISOLATION | | | | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | |
| HDW/FU | NC A | B C | | | | | | | | | | |
| NASA [3 /1R IOA [3 /1R |] [P]] [P] | [P] [P] [P] [P] | [X]* [X] | | | | | | | | | |
| COMPARE [/ |] [] | [][] | [] | | | | | | | | | |
| RECOMMENDATIONS: | (If differen | nt from NASA) | | | | | | | | | | |
| . [/ |] [] | [][]() | [] ADD/DELETE) | | | | | | | | | |
| * CIL RETENTION | RATIONALE: (If | applicable) ADEQUATE INADEQUATE | [] | | | | | | | | | |
| REMARKS: IOA NOW CLASSIFI A TAL ABORT, BAS PURGES WHICH MAY | ES THIS FAILUR ED ON INABILIT BE REQUIRED DU | E (FAILS CLOSED) AS A Y TO COMPLETE ALL ENG URING A TAL ABORT. | CRIT 1 DURING INE STARTS AND | | | | | | | | | |

NASA/RI AGREED TO MAKE THIS FMEA AN ABORT CRIT 1, PER IOA ISSUE. SEE ASSESSMENT SHEET OMS-303. IOA RECOMMENDS THAT THE "E" EFFECTS BE REVISED. THE DOWNSTREAM

REGULATOR IS NOT REDUNDANT FOR A FAILED CLOSED ISOL VALVE.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-300 NASA FMEA #: 03-3-4503-1 | | | | | | | | | Ņ | IASA D Basei | ATA: INE NEW | [[X |]] |
|--|------------|------------|----------------------|------------|----------|--------|-------------|-----|-------------------|-----------------|--------------------|-----------|-------------|
| SUBSYSTEM MDAC ID: ITEM: | 1: | | OMS 300 VALVE- | ·GN2 | 2 PRI | essui | RE | IS | OLATIC |)N | | · | · |
| LEAD ANAI | LYST | : | C.D. F | RUS | ST | | | | | | | | |
| ASSESSMEN | IT: | | | | | | | | | | | | |
| c | RIT | ICAL | (TY | I | REDUI | IDANG | CY | sc | REENS | | | CIL | м |
| | HD | W/FUN | 1C | 2 | ł | | в | | c | 2 | | | |
| NASA IOA | [3 [3 | /1R /1R |] | [] [] | ?] ?] |) (| F P |] | (E [E | >] | | [[|] *] |
| COMPARE | Γ | / |] | [|] | [| N |] | [|] | | [|] |
| RECOMMENI | DATI | ons: | (If | dif | ffere | ent i | fro | om | NASA) | | | | |
| | [| / |] | [|] | [| |] | [|] | (AI | [DD/D |] ELETE) |
| * CIL RET | CENT: | ION P | RATIONA | LE | : (I1 | f app | 91 ; | ica | nble) P INP | DEQUA | TE | [[|]] |
| NASA/RI I | TAIL | SBS | CREEN | ON | 03-: | 3-450 | 23- | -1 | BECAUS | E OF | "IN] | ERN | AL - |

LEAKAGE" FAILURE MODE ISSUE. (SEE ASSESSMENT SHEET OMS-301). "FAILS OPEN" MODE IS DETECTABLE VIA CRT DISPLAY "GNC SYS SUMM 2".

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-301 03-3-4503 | 3-1 | | NASA DATA BASELINE NEW | : [x |]] | | | | | | |
|---|--|--------------|------------|------------------------------|------------|-------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 301 VALVE-GN | 2 PRESSU | RE ISOL | TION | | | | | | | | |
| LEAD ANALYST: | C.D. PRU | ST | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL | | | | | | | | | | | | |
| HDW/FU | NC 2 | A | В | С | ± ± 10. | • | | | | | | |
| NASA [3 /1R IOA [3 /1R |] [] [| P] [P] [| F] P] | [P] [P] | [[|] *] | | | | | | |
| COMPARE [/ |] [|] [| N] | [] | [|] | | | | | | |
| RECOMMENDATIONS: | (If di | fferent | from NAS | SA) | | | | | | | | |
| · [/ |] [|] [| •] | [] (A |] מ/סם. |] ELETE) | | | | | | |
| * CIL RETENTION | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | |
| REMARKS: IOA NOW FAILS B NASA/RI ORIGINAL "FAIL" FOR THE " | EMARKS: OA NOW FAILS B SCREEN. ASA/RI ORIGINALLY PASSED B SCREEN, HOWEVER CHANGED B SCREEN TO FAIL" FOR THE "INTERNAL LEAKAGE" FAILURE MODE, PER IOA ISSUE. | | | | | | | | | | | |

LEAKAGE IS UNDETECTABLE DURING FLIGHT SINCE REG GOES TO LOCKUP AFTER EVERY BURN.

REPORT DATE 2/26/88

| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-302 NASA FMEA #: 03-3-4510-1 | | | | | | | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | | | | | |
|--|--------|------------------|-------------------------|----------------|-------------------|--------|---|--------|-----|--------|---------|--------|-----------|------------|----------------|--------------|-----------|-----------|----------|------|
| SUBSYSTE MDAC ID: ITEM: | EM: | | | 0M 30 VA | IS)2 \LVE· | -G} | 12 | PRI | ESS | UF | ۶E | IS | olai | ſI | ON | | | | | |
| LEAD ANA | LYS | ST | : | c. | D. 1 | PRI | JSI | 2 | | | | | | | | | | | | |
| ASSESSMI | ENT | : | | | | | | | | | | | | | | | | | | |
| | CR | ITI FI HDV | ICALI LIGHI N/FUI | ITY F NC | ! | | RE A | EDUI | NDA | NC | CY B | SC | REEN | 1S | С | - | | IL FEN | ſ | |
| NASA IOA | [[| 2 3 | /1R /1R |]] | | [[| P P |]] | | [[| P P |]] | [| [| P] P] | | [[| х |] | * |
| COMPARE | ۵ | N | / |] | | [| |] | | [| |] | (| |] | | [| N |] | |
| RECOMMEN | IDA | CIC | ONS: | | (If | đi | lff | ere | ent | f | irc | om I | NASZ | }) | | | | | | |
| | [| | / |] | | [| • |] | | [| |] | [| |] | (Al |] /0C | /DI |] ELF | ETE) |
| * CIL RI | ETEI | T I | ION I | RAΊ | TON | ALI | 3: | (I | fa | qq | olj | Lca | ble) I | EN | ADEQU ADEQU | JATE JATE |] [| 2 |]] | |
| IOA ACCI | EPT: | 5 1 | NASA | /R] | : 2/: | lR | PF | PP, | 1/ | 1 | AE | BOR | T AS | 5 <u>5</u> | IGNMI | ENT. | - <u></u> | | ()) | |

IOA ACCEPTS NASA/RI 2/1R PPP, 1/1 ABORT ASSIGNMENT. NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (STRUCTURAL FAILURE, RUPTURE, EXTERNAL LEAKAGE), BUT AGREED TO ADD THIS VALVE BODY TO THE ITEM LIST ON THIS FMEA, AND TO ADD CORRESPONDING RETENTION RATIONALE TO THE CIL SHEET, PER IOA ISSUE.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-303 03-3-4503-2 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | | |
|---|-----------------------------------|---|--------------------|--|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 303 VALVE-GN2 PRESSUR | RE ISOLATION | | | | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | |
| HDW/FU | NC A | ВС | | | | | | | | | | |
| NASA [3 /1R IOA [2 /1R |] [P] [] [P] [| P] [P] F] [P] | [X] * [X] | | | | | | | | | |
| COMPARE [N / |] [] [| и] [] | [] | | | | | | | | | |
| RECOMMENDATIONS: | (If different | from NASA) | | | | | | | | | | |
| [2 /1R |] [P] [| F] [P] (1 | [] ADD/DELETE) | | | | | | | | | |
| * CIL RETENTION | RATIONALE: (If ap) | plicable) ADEQUATE INADEQUATE | | | | | | | | | | |
| INADEQUATE [] REMARKS: NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (RESTRICTED FLOW), BUT ADDED IT TO 03-3-4503-2, PER IOA ISSUE. HOWEVER, IOA RECOMMENDS THAT "RESTRICTED FLOW" (ONLY) BE UPGRADED TO A 2/1R PFP, 1/1 ABORT AND PLACED ON A SEPARATE FMEA. THE INABILITY TO DETECT A FLOW RESTRICTION THROUGH THE VALVE UNTIL THE ACCUMULATOR HAS BEEN DEPLETED AND CANNOT BE REPLENISHED MAKE THE EFFECTS OF THIS FAILURE THE SAME AS 03-3-4505-2 (2/1R PFP, 1/1 ABORT). SEE ASSESSMENT SHEET OMS-305. | | | | | | | | | | | | |

THIS SINGLE FAILURE RESULTS IN THE LOSS OF ONE OMS ENGINE. THE "FAILED CLOSED" MODE IS DETECTABLE AND THE REMAINING ENGINE START CAN BE SAVED (3/1R PPP, 1/1 ABORT). THE DOWNSTREAM REGULATOR AND ACCUMULATOR ARE NOT REDUNDANT FOR THE "RESTRICTED FLOW" MODE.

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REPORT DATE 2/26/88

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| ASSESSM ASSESSM NASA FM | ENT ENT EA | D2 I1 #: | ATE: D: | 1/0 OMS NON | L/01/88 DMS-304 NONE | | | | | | | IASA BASE | DATA LINE NEW | : [[|]] | |
|---|------------------|-----------------------|----------------------|------------------------|----------------------------|-------------------------|------------------------------|----------------------|--------------------|--------------------------|----------------------------------|------------------------------|-----------------------------|---------------------|-----------------|-----------------------|
| SUBSYST MDAC ID ITEM: | EM: : | | | OMS 304 VAL | VE- | GN2 | PRI | ESSU | RE | ISO | LATIC | DN | | | | . • |
| LEAD AN | ALYS | ST | : | C.D | . P | RUS | т | | | | | | | | | |
| ASSESSM | ASSESSMENT: | | | | | | | | | | | | | | | |
| CRITICAL | | | | ITY REDUNDANCY SCREENS | | | | | | | EENS | | | CII ITE | M | |
| | FLIGH HDW/FUI | | | NC | | A | | В | | C | С | | | | | |
| NASA IOA |] [| 3 | / /3 |] | | [[|]]. | [[| |] | [[|]] | | [[|]] | * |
| COMPARE | [| N | /N |] | | [|] | [| |] | [|] | | [|] | |
| RECOMME | NDAT | FIC | ONS: | (| If | dif | fere | ent | froi | n N. | ASA) | | | | | |
| | [| | / |] | | [|] | [| |] | [|] | (AI | ן מ/סכ |] ELE | TE) |
| * CIL R | etei | 1TI | ION | RATI | ONA | LE: | (11 | t ap | plie | cab | le) A INA | DEQU DEQU | ATE ATE | [[|]] | |
| REMARKS NASA/RI FAILURE EFFECTS FMEA (0 | DO MOI OF | NC DE "I -49 | OT C NEE DELA | OVER D NO YED | TH T B OPE SE | IS E A Rat E A | FAII DDEI ION' SSES | LURE D TO ' AR | MOI THI E CO | DE E FI DVE SHE | (DELA MEA/C RED E ET OM | YED IL. BY TH IS-29 | OPERA THE E "FA 9. | ATIO WOR AILS | N). ST CL | THIS CASE OSED" |
| ······ | | | ۰، <u>۲۰۱</u> ۰ ۱ | | | | | ল গ্ৰন্থিয়া নি | | | | | | | | |
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REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-305 03-3-450 | 5-2 | | NASA DATA BASELINE NEW | : [] [X] | | | | | | | |
|--|--|-----------------------------------|------------|------------------------------|-------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 305 GN2 PRES | MS 05 N2 PRESSURE REGULATOR | | | | | | | | | | |
| LEAD ANALYST: | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICAL | ITY I | REDUNDA | NCY SCREE | INS | CIL ITEM | | | | | | | |
| HDW/FU | NC 2 | A | В | С | | | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [] [| P] P] | [F] [F] | [P] [P] | [X] * [X] | | | | | | | |
| COMPARE [/ |] [|] | [] | [] | []] | | | | | | | |
| RECOMMENDATIONS: | (If di | fferent | from NAS | SA) | | | | | | | | |
| · [/ |] [|] | [] | [] (A | [] DD/DELETE) | | | | | | | |
| * CIL RETENTION | RATIONALE | : (If a | pplicable | ≥) ADEQUATE INADEQUATE | [] | | | | | | | |
| REMARKS: NASA/RI ORIGINAL AS A 3/1R PPP. | EMARKS: ASA/RI ORIGINALLY CLASSIFIED THIS FAILURE MODE (FAILS TO OPEN) S A 3/1R PPP. HOWEVER, NASA/RI UPGRADED TO 2/1R PFP, 1/1 ABOR | | | | | | | | | | | |

AS A 3/1R PPP. HOWEVER, NASA/RI UPGRADED TO 2/1R PFP, 1/1 ABORT PER IOA ISSUE. CREW MAY NOT HAVE TIME FOR CORRECTIVE ACTION (INHIBIT PURGE) DURING SHORT OMS BURN. FIRST FAILURE COULD RESULT IN LOSS OF ONE ENGINE. FAILURE DURING TAL ABORT RESULTS IN INABILITY TO COMPLETE ALL NECESSARY ENGINE STARTS AND PURGES.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-306 03-3-45 | 05-1 | | NASA DATA BASELINE NEW | : [] [X] | | | | | | | |
|--|---|------------|----------------|---------------------------------------|-------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 306 GN2 PRES | SSURE RE | GULATOR | | - | | | | | | | |
| LEAD ANALYST: | C.D. PR | UST | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | |
| HDW/FUI | LIEM | | | | | | | | | | | |
| NASA [3 /1R IOA [3 /1R |] [] [| P] P] | [P] [P] | [P] [P] | [] * [] . | | | | | | | |
| COMPARE [/ |] [|] | [] | []]] | []] | | | | | | | |
| RECOMMENDATIONS: | (If d | ifferent | from NAS | 3A) | | | | | | | | |
| [/ |] [|] | [] | [] . (Al | [] DD/DELETE) | | | | | | | |
| * CIL RETENTION H | RATIONAL | E: (If a | pplicable | | · · · · · · · · · | | | | | | | |
| | | | | INADEQUATE | | | | | | | | |
| NO DIFFERENCES. | | | | | | | | | | | | |
| NOT 1/1 DURING TA ACCUMULATOR. IN PERFORM A START-1 | OT 1/1 DURING TAL ABORT SINCE 400 PSI LEFT IN STORAGE TANK AND CCUMULATOR. INFORMATION INDICATES THAT THIS IS ENOUGH TO ERFORM A START-PURGE-START CYCLE REQUIRED DURING TAL. | | | | | | | | | | | |
| n na sinan ngana ngana ngana ngana ngana ngana ngana ngana ngana ngana ngana ngana ngana ngana ngana ngana nga Ngana ngana | | · · · · · · · | · · · · · · · · · · · · · · · · · · · | н у | | | | | | | |

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | NASA DATA: BASELINE NEW | [] [X] | | | | | | | | | | |
|--|-------------------------------|--------------|-----------------|----------------------|---------------------------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 307 GN2 PRES | SSURE REGU | LATOR | | | | | | | | | |
| LEAD ANALYST: | C.D. PRI | JST | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | |
| HDW/FU | NC | A | В | с | ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ | | | | | | | |
| NASA [2 /1R IOA [3 /1R |] [] [| P][P][| P][P][| P] P] | [X]* [] | | | | | | | |
| COMPARE [N / |] [|] [|] [|] | [N] | | | | | | | |
| RECOMMENDATIONS: | (If d | ifferent f | from NASA) | | | | | | | | | |
| ί / |] [|] [|] [|] (AI | [] DD/DELETE) | | | | | | | |
| * CIL RETENTION | RATIONAL | E: (If app | olicable) IN | ADEQUATE ADEQUATE | | | | | | | | |
| INADEQUATE [] CEMARKS: COA ACCEPTS NASA/RI 2/1R PPP, 1/1 ABORT ASSIGNMENT. NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (STRUCTURAL FAILURE, RUPTURE, EXTERNAL LEAKAGE), BUT AGREED TO ADD THIS VALVE SODY TO THE ITEM LIST ON THIS FMEA, AND TO ADD CORRESPONDING RETENTION RATIONALE TO THE CIL SHEET, PER IOA ISSUE. | | | | | | | | | | | | |

REPORT DATE 2/26/88

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| ASSESSMEN ASSESSMEN NASA FMEA | ATE: D: | 1/01/8 OMS-30 03-3-4 | -2 | | | | | NASA BAS | DATA ELINE NEW | : [[|) x] | | | |
|-------------------------------------|------------|----------------------------|----------------------|------------|--------|--------|------------|-------------|----------------------|-------------|--------------|-----------|------------|------|
| SUBSYSTEM MDAC ID: ITEM: | [: | | OMS 308 GN2 PI | RESS | JRE 1 | REGU | עדנ | TOR | | un a um | | | | - |
| LEAD ANAI | YST | : | C.D. 1 | PRUS | Г | | | | | | | | | |
| ASSESSMEN | IT: | | | | | | | | | | | | | |
| c | RIT | | [TY | R | EDUN | DANG | CY | SCRI | EENS | 5 | | | L FM | |
| - p | HDV | V/FUN | 4C | A | | | В | | | С | | 111 | 214 | |
| NASA IOA | [2 [2 | /1R /1R |]] | [P [P |]] | [[| F P |]] | ((| P] P] | | []] | X] X] | * |
| COMPARE | [| / |] | [|] | [| N |] | [|] | | [|] | |
| RECOMMEND | ATIC | ONS: | (If | dif | fere | nt i | fro | om NZ | ASA) | | Ale . | - | | |
| | [| / |] | [|] | [| |] | [|] | (A) | [DD/I |] DELE | TE) |
| * CIL RET | ENT | ION P | RATION | ALE: | (If | app | 91 | [cab] | le) IN | ADEQ | UATE UATE | [|]] | |
| IOA NOW P | AIL | 5 B S | CREEN. | STF | י תידו | тнтя | 5 5 - F | ΙΤΤΑ | IRE | MODE | (LOW | OU | רטיי | א (י |

NASA/RI ORIGINALLY CLASSIFIED THIS FAILURE MODE (LOW OUTPUT) AS A 3/1R PPP. HOWEVER, NASA/RI UPGRADED TO 2/1R PPP, 1/1 ABORT PER IOA ISSUE. CREW MAY NOT HAVE TIME FOR CORRECTIVE ACTION (INHIBIT PURGE) DURING SHORT OMS BURN. FIRST FAILURE COULD RESULT IN LOSS OF ONE ENGINE. FAILURE DURING TAL ABORT RESULTS IN INABILITY TO COMPLETE ALL NECESSARY ENGINE STARTS AND PURGES.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-309 03-3-45 | NASA DATA: 09 BASELINE [] 4505-2 NEW [X] | | | | | | | | | | |
|---|--|---|------------|------------------|--------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 309 GN2 PRE | SSURE RE | GULATOR | | | | | | | | | |
| LEAD ANALYST: | C.D. PR | UST | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICAL | JITY | REDUNDA | NCY SCRE | ENS | CIL ITEM | | | | | | | |
| HDW/FU | | | | | | | | | | | | |
| NASA [2 /11 IOA [2 /11 | 2] [2] [| P] P] | [F] [F] | [P] [P] . | [X] * [X] | | | | | | | |
| COMPARE [/ |] [|] | [] | [] | [] | | | | | | | |
| RECOMMENDATIONS | (If d | ifferent | from NA | SA) | | | | | | | | |
| [/ |] [| .] | נז | [] | [] ADD/DELETE) | | | | | | | |
| * CIL RETENTION | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | |
| REMARKS: NASA/RI ORIGINALLY CLASSIFIED THIS FAILURE MODE (RESTRICTED FLOW) AS A 3/1R PPP. HOWEVER, NASA/RI UPGRADED TO 2/1R PFP, 1/1 ABORT PER IOA ISSUE. CREW MAY NOT HAVE TIME FOR CORRECTIVE ACTION (INHIBIT PURGE) DURING SHORT OMS BURN. FIRST FAILURE COULD | | | | | | | | | | | | |

RESULT IN LOSS OF ONE ENGINE. FAILURE DURING TAL ABORT RESULTS IN INABILITY TO COMPLETE ALL NECESSARY ENGINE STARTS AND PURGES.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | ENT ENT EA | D2 I1 #: | ATE: D: | 1/01/8 OMS-31 03-3-4 | 38 LO 151 | .0- | NASA DATA: BASELINE [] -1 NEW [X] | | | | | | | | | | |
|---|------------------|----------------|------------|----------------------------|-----------------|--------|--|-----------|--------|--------|----------|-----------|--------------------|----------|----------|-----------------|--|
| SUBSYSTE MDAC ID: ITEM: | E M : | | | OMS 310 GN2 PH | RES | SU | JRE LI | INE | ES | AND | ME | CHI | NICAL | FIT | TI | 1GS | |
| LEAD ANA | LYS | ST | • | C.D. I | PRU | ISI | 2 | | | | | | | | | | |
| ASSESSME | ENT | : | | | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | | | | | | |
| | H | HDV | V/FUI | 1C 1C | | A | | | В | | | С | | 1 | TEr | 1 | |
| NASA IOA | [[| 2 3 | /1R /1R |]] | [[| P P |] | [[| P P |]] | [. [| P P |]] | [[| х |] *] | |
| COMPARE | [| N | / |] | [| |] | [| |] | [| |] | [| N |] | |
| RECOMMEN | IDAT | FI C | ons: | (If | di | ff | ferent | : 1 | fro | om Nž | ASA |) | | | | | |
| | [| | 1 |] | [| |] | נ | |] | [| |] (2 |] ADD | /DI |] Elete) | |
| * CIL RE | ETEI | NT: | ION I | RATION | ALE | : | (If a | pp | oli | .cabi | le) I | AI NAI | DEQUATE DEQUATE | [| |]] | |
| IOA ACCE | EPTS | 51 | NASA | RI 2/1 | | PI | PP, 1/ | י1 דדי | AE | ORT | AS | SIC | NMENT. | I LVS | OA TS | ANALYZED | |

INDIVIDUAL LINE SEGMENTS SEPARATELY IN ORIGINAL ANALYSIS. NASA FMEA INCLUDES ALL GN2 LINE SEGMENTS. IOA CONSIDERS LEAKAGE OF THIS SEGMENT TO BE A 3/1R PPP.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: 1/01/88 NASA DATA: ASSESSMENT ID: OMS-311 BASELINE [] NASA FMEA #: NONE NEW [] | | | | | | | | | | | | | |
|---|--|-------|--------|----------|------|-----------------|------|------------|-----------|------------|-----|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 311 GN2 | PRESS | URE | LINES | AND | MECH | ANIC | AL F | ITTI | NGS | | | |
| LEAD ANALYST: | C.D. | PRUS | T | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITI | CALITY | R | SCR | EENS | | | CII | M | | | | | |
| HDW | *** | | | | | | | | | | | | |
| NASA [IOA [3 | /] /3] | | [[|] '] | * | | | | | | | | |
| COMPARE [N | /N] | [|] | Ľ |] | [|] | | [|] | | | |
| RECOMMENDATIO | 15: (I | f dif | fere | ent fro | om N | ASA) | | | | | | | |
| [| /] | [|] | Į |] | [|] | (A | [DD/I |] DELET | re) | | |
| * CIL RETENTI | ON RATIO | NALE: | (1 | f appl: | icab | le) A INA | DEQU | ATE ATE | [|]] | | | |
| REMARKS: IOA CAUSES ON BLOCKAGE". | ANALYSI | s she | EET S | SHOULD | NOT | INCI | UDE | "FIL | TER | - | | | |
| NASA/RI DO NO OBSTRUCTION O RESULT IN 3/3 | BLOCKAGE". NASA/RI DO NOT COVER RESTRICTED FLOW IN A SEGMENT OF LINE DUE TO OBSTRUCTION OR DEFORMATION (CRIMPING). SUCH AN OCCURRENCE COULD RESULT IN 3/3 EFFECTS, HOWEVER THE CREDIBILITY OF SUCH AN | | | | | | | | | | | | |

OCCURRENCE IS QUESTIONABLE. ANY CONTAMINATION WOULD FLOW TO DOWNSTREAM FILTER OR COMPONENT. IOA RECOMMENDS THAT SUCH A FAILURE BE ADDRESSED ON THE FMEA/CIL, BUT DOES NOT REGARD THIS RECOMMENDATION AS AN OPEN ISSUE.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-312 03-3-4506-1 | NAS BA | A DATA: SELINE [] NEW [X] |
|---|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 312 COUPLING, GN2 | REGULATOR TEST | PORT |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL | TY REDUNE | DANCY SCREENS | CIL ITEM |
| HDW/FUN | NC A | B C | |
| NASA [3 /1R IOA [3 /1R |] [F]] [P] | [F] [P] [P] [P] | [X]* [] |
| COMPARE [/ |] [N] | [N] [] | [N] |
| RECOMMENDATIONS: | (If differen | nt from NASA) | |
| [3 /1R |] [F] | [F] [·P] | [A] (ADD/DELETE) |
| * CIL RETENTION H | RATIONALE: (If | applicable) ADE INADE | QUATE [] OUATE [] |
| REMARKS: IOA AGREES WITH N VERIFY CONDITION AGREES WITH NASA, IOA RECOMMENDS TH | NASA/RI FAILURE OF CAP SEALS A /RI FAILURE OF HAT "POPPET FAI | C OF A SCREEN BA AFTER CAP INSTAI B SCREEN. LS OPEN (DURING | SED ON INABILITY TO LATION. IOA ALSO FLIGHT)" BE ADDED |

AS A FAILURE MODE ON THIS FMEA. THIS IS A CREDIBLE FAILURE MODE AND IS ADDRESSED ON RCS QD COUPLING FMEAS.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | SSESSMENT DATE:1/01/88NASA DATA:SSESSMENT ID:OMS-313BASELINE []ASA FMEA #:03-3-4506-3NEW [X]UDEVENTEM:OMS | | | | | | | | | | | | | |
|--|---|--------|--------|--------|------------------|------------------|-----------|-------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 313 COUPLING | , GN2 | REGU | LATOR | TEST | PORT | | | | | | | | |
| LEAD ANALYST: | C.D. PRU | ST | | | | | | | | | | | | |
| ASSESSMENT: | ASSESSMENT: | | | | | | | | | | | | | |
| CRITICAL | CIL | M | | | | | | | | | | | | |
| HDW/FU | NC | A | В | | С | | | • | | | | | | |
| NASA [3 /3 IOA [3 /3 |] [] [|]] | [[|]] | [[|]] | [[|] *] | | | | | | |
| COMPARE [/ |] [|] | |] | [|] | [|] | | | | | | |
| RECOMMENDATIONS: | (If di | fferen | t fr | om NAS | SA) | | | | | | | | | |
| [3 /3 |] [|] | [|] | [|] (A | [DD/D |] ELETE) | | | | | | |
| * CIL RETENTION | RATIONALE | : (If | appl | icable | e) AI INAI | EQUATE EQUATE | [[|]] | | | | | | |
| REMARKS: IOA FAILURE MODE: AND "RESTRICTED | EMARKS: [OA FAILURE MODES ON ANALYSIS SHEET SHOULD INCLUDE "FAILS CLOSED" AND "RESTRICTED FLOW". | | | | | | | | | | | | | |

IOA RECOMMENDS THAT "FAILS CLOSED" AND "RESTRICTED FLOW" BE ADDED TO THE FAILURE MODES ON THIS FMEA. THESE ARE CREDIBLE FAILURE MODES AND ARE ADDRESSED ON RCS QD COUPLING FMEAS.

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| ASSESSMEN ASSESSMEN NASA FMEN | 1T D2 NT II A #: | ATE: D: | 1/01/8 OMS-3: 03-3-4 | /88 NASA DATA: 314 BASELINE [] -4506-2 NEW [X] | | | | | | | | | | |
|---|-------------------------|-----------------------|----------------------------|---|--------------|--------|--------|------------------|--------------------|----------|-------------|----|--|--|
| SUBSYSTEM MDAC ID: ITEM: | 1: | | OMS 314 COUPL | ING, | GN2 I | REGUI | LATOR | TEST | I PORT | | | | | |
| LEAD ANAI | LYST: | : | C.D. 1 | PRUST | Г | | | | | | | | | |
| ASSESSMEN | 1 T : | | | | | | | | | | | | | |
| Ċ | CRITI | ICAL | ITY | RI | EDUNDA | ANCY | SCREI | ens | | CI | L | | | |
| | HDV | V/FUI | NC | A | | В | | С | | τ. | 1314 | | | |
| NASA IOA | [3 [3 | /3 /3 |]] | [[|] | [[|] | [[|]] | [[|] *] | | | |
| COMPARE | [| / |] | [|] | [|] | [|] | Ĺ |] | | | |
| RECOMMENI | DATIC | ONS: | (If | dif | ferent | ; fro | om NAS | SA) | | | | | | |
| | [| / |] | [|] | [|] | [|] (AI | [)D/ |] DELETE |) | | |
| * CIL RET | [ENT] | [ON] | RATION | ALE: | (If a | appli | icable | ≥) AI INAI | DEQUATE DEQUATE | [|]] | | | |
| REMARKS: IOA FAILU OPEN" ANI NO DIFFEI | JRE N D "RI RENCI | 10DE: ESTRI ES. | S ON AN ICTED 1 | NALYS FLOW' | SIS SH '. | IEET | SHOUI | LD NC | OT INCLUI | DE | "FAILS | то | | |

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | TE: 1/01/88 NASA DATA: : OMS-315 BASELINE [] 03-3-45011-2 NEW [X] | | | | | | | | | | | | |
|---|--|------------|---------------|------------|-------------------|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 315 VALVE-GN | 2 PRESSUR | E RELIEF | | | | | | | | | | |
| LEAD ANALYST: | C.D. PRU | ST | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | | |
| HDW/FU | NC | Α | В | с | | | | | | | | | |
| NASA [3 /1R IOA [3 /1R |] [] [| P][P][| NA] [P] [| P] P] | [] * [] | | | | | | | | |
| COMPARE [/ |] [|] [| и] [|] | [] | | | | | | | | |
| RECOMMENDATIONS: | (If di | fferent f | from NASA) | | | | | | | | | | |
| [/ | .] [|] [|] [|] (A) | [] DD/DELETE) | | | | | | | | |
| * CIL RETENTION | * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEOUATE [] | | | | | | | | | | | | |
| REMARKS: IOA NOW CLASSIFI NASA/RI ORIGINAI A 3/3, BASED ON | INADEQUATE [] REMARKS: IOA NOW CLASSIFIES B SCREEN AS "NA". NASA/RI ORIGINALLY CLASSIFIED THIS FAILURE MODE (FAILS CLOSED) AS A 3/3 BASED ON TEST DATA WHICH SHOWED THAT DOWNSTREAM LINES | | | | | | | | | | | | |

COULD WITHSTAND HIGH PRESSURE. HOWEVER, NASA/RI UPGRADED CRIT TO 3/1R PNP BASED ON IOA ISSUE WITH USING TEST DATA IN CRITICALITY DETERMINATION.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-316 03-3-45011-1 | NASA DATA: BASELINE [] -1 NEW [X] | | | | | | | |
|--|---|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 316 VALVE-GN2 PRES | SSURE RELIEF | | | | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICAL FLIGH HDW/FU | ITY REDUNI T NC A | DANCY SCREENS B C | CIL ITEM | | | | | | |
| NASA [3 /1R IOA [3 /1R |] [P]] [P] | [P] [P [P] [P |] [X]*] [] | | | | | | |
| COMPARE [/ |] [] | []][|] [N] | | | | | | |
| RECOMMENDATIONS: | (If differer | nt from NASA) | | | | | | | |
| · · [/ |] [] | ניז נ |] [] · · · · · · · · · · · · · · · · · | | | | | | |
| * CIL RETENTION | RATIONALE: (If | applicable) AD INAC | EQUATE [] EQUATE [] | | | | | | |
| REMARKS: NASA/RI ORIGINAL HOWEVER NASA/RI U PER IOA ISSUE ON MODES (SEE ASSES IOA DOES NOT CON TO BE AN ABORT CI CAUSE OVERPRESSUI THIS FAILURE MODI HOWEVER. IOA ACC | LY DID NOT CLAS UPGRADED THIS F THE "INTERNAL SMENT SHEETS OM SIDER THE "POPF RIT 1 SINCE A F RIZATION. IOA E TO BE 3/1R PN EPTS NASA/RI CF | SIFY THIS FMEA MEA TO A CRIT LEAKAGE", AND IS-317 AND 318) PET DOES NOT RE PREVIOUS FAILUR CONSIDERS THE IP. RIT ASSIGNMENT. | AS AN ABORT CRIT 1, 1 FOR A TAL ABORT "LOW OUTPUT" FAILURE | | | | | | |

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| ASSESSMEN ASSESSMEN NASA FMEN | NT NT A # | DAT ID: : | 'E : | 1/0 OMS 03- | 1/8 -31 -3-4 | 8 7 50 |)11 | 1 | | | | | | NZ H | ASA BASI | DAT ELIN NH | ra : Ne Ew | : [[| x |]] | |
|-------------------------------------|-----------------------|-----------------|------------|-------------------|--------------------|--------------|--------|----------------|-----|--------------------|--------|------|-----------|---------|-------------|-------------------|------------------|-------------|--------|----------|------|
| SUBSYSTEN MDAC ID: ITEM: | M: | | | OMS 317 VAI | , .ve- | G | 12 | PR | ESS | UR | E | REL | IEF | | | | | | | | - |
| LEAD ANA | LYS | T: | | c.[|). P | R | JSI | : | | | | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | | | | | | | | |
| (| CRITICALITY FLIGHT | | | | | | | | | REDUNDANCY SCREENS | | | | | | | | | | ſ | |
| | H | DM/ | FUI | NC | | | A | | | | B | | | С | | | | ** | | • | |
| NASA IOA | [[| 3 / 3 / | '1R '1R |]] | | [[| P P |] | | [[| P P |] | [[| P P |] | | | [[| X X |]] | * |
| COMPARE | C | / | , |] | | Ľ | |] [`] | | [| |] | [| |] | | | [| |] | |
| RECOMMEN | DAT | ION | is: | (| (If | d: | if | fer | ent | f | rc | om N | IASA |) | | | | | | | |
| | [| / | , |] | | [| |] | | [| |] | C | |] | · | (Al |] DD/ | ∕D₽ |] SLF | ETE) |
| * CIL RE | TEN | TIC | נאכ | RATI | [ON# | L | E: | (I | fa | pp | 11 | .cab | ole) I | A NA | DEQ DEQ | UATI UATI | E | [| |] | |
| REMARKS: NASA/RI | ORI | GIN | IAL: | LY I | DID | N | тс | CL | ASS | SIF | Y | тнј | IS F | AI: | LUR | E MO | ODI | E I | (11 | ITI | ERNA |

NASA/RI ORIGINALLY DID NOT CLASSIFY THIS FAILURE MODE (INTERNAL LEAKAGE) AS ABORT CRIT 1. HOWEVER, NASA/RI UPGRADED TO AN ABORT CRIT 1, PER IOA ISSUE. FAILURE COULD RESULT IN INABILITY TO COMPLETE ALL ENGINE STARTS AND PURGES REQUIRED DURING A TAL ABORT.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ENT ENT EA # | DA ID | ATE:): | 1/ ON 03 | 01/8 15-31 1-3-4 | 38 18 15(|)11 | 1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | |
|----------------------------------|--------------------|----------|----------------------|----------------|------------------------|-----------------|---------|-------|---|-------------|--------|----------|-----------|------------------|-----|------------|------------|------|
| SUBSYSTE MDAC ID: ITEM: | em: : | | | 01 31 V2 | is 18 Alve- | -GI | 12 | PRES | ទបា | RE | RELI | EF | | | | - | | |
| LEAD ANA | ALYS | ST: | | c. | D. I | PRI | JSI | ? | | | | | | | | | | |
| ASSESSME | ent : | | | | | | | | | | | | | | | | | |
| | CRI H | TI FL | CALI LIGH /FUN | ETY P VC | [| | re A | DUND | AN | CY B | SCRE | ENS | с | · • • • • • | | CII ITE | M | |
| NASA IOA | [[| 3 3 | /1R /1R |]] | | ((| P P |] | [[| P P |]] | [[| P P |] | | [} [} | (] (] | * |
| COMPARE | [| | / |] | • | [| |] | [| |] | ٢ | |] | | [|] | |
| RECOMMEN | IDAI | 'IC | ons: | | (If | đi | lff | erent | t : | fro | om NA | SA) | | | | | | |
| | [| | / |] | | (| |] | [| |] | [| |] | (AD | [D/T |] EL | ETE) |
| * CIL RI | ETEN | ITI | ON P | RAI | TION | LI | 3: | (If a | apj | 91 3 | icabl | e) IN | AI IAI | EQUATI EQUATI | E | [[|]] | |

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REMARKS: NASA/RI ORIGINALLY DID NOT CLASSIFY THIS FAILURE MODE (LOW OUTPUT) AS AN ABORT CRIT 1. HOWEVER, NASA/RI UPGRADED TO AN ABORT CRIT 1, PER IOA ISSUE. FAILURE COULD RESULT IN INABILITY TO COMPLETE ALL ENGINE STARTS AND PURGES REQUIRED DURING A TAL ABORT.

REPORT DATE 2/26/88

| ASSESSMEI ASSESSMEI NASA FME | NT NT A ‡ | D# II #: | ATE:): | 1/01/ OMS-3 03-3- | 1/88 NASA DATA: -319 BASELINE [] :3-4551-2 NEW [X] | | | | | | | | | | | | | | | |
|------------------------------------|--|----------------|------------|-------------------------|---|--------|-----|----|--------|--------|--------|------------|-----------|--------|--------------|----|----------|----------|----------|------|
| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 319 CHECH | K VZ | ALV | VE- | GN | 2 | | | | | _ | | | | | | |
| LEAD ANA | LYS | ST | : | C.D. | PR | JSI | Г | | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | | | | | | | |
| | CRITICALITY FLIGHT | | | | | | | | | СҮ | SCI | REENS | 5 | | | | CI | L ידי | r | |
| | FLIGHT HDW/FUNC A B C | | | | | | | | | | | 11CM | | | | | | | | |
| NASA IOA | [[| 2 2 | /1R /1R |] | [[| P P |] | | [[| F F |]] | [[| P P |]] | | | [[| X X |] | * |
| COMPARE | [| | / |] | [| |] | | [| |] | C | |] | | | [| |] | |
| RECOMMEN | DA' | FI | ONS: | (11 | f d | if | fer | en | t | fr | om 1 | NASA |) | | | | | | | |
| | ſ | | / |] | [| |] | | [| |] | [| |] | (. | AD | [)D/ | 'DF |] SLF | ETE) |
| * CIL RE | TEI | NT: | ION | RATIO | NAL | Е: | (1 | f | ap | pl: | ical | ble) II | AI NAI | DEQI | JATE JATE | | [[| |]] | |
| REMARKS: IOA FAIL FLOW". | REMARKS: IOA FAILURE MODES ON ANALYSIS SHEET SHOULD INCLUDE "RESTRICTED | | | | | | | | | | | | | | | | | | | |
| NASA/RI | OR | IG | INAL | LY PAS | SSE | D | BS | CR | EE | N, | AN | D DI | | TOP | CLA | SS | II | Y | TH | IIS |

NASA/RI ORIGINALLY PASSED B SCREEN, AND DID NOT CLASSIFY THIS FAILURE MODE (FAILS CLOSED) AS AN ABORT CRIT 1. HOWEVER, NASA/RI CHANGED B SCREEN TO "FAIL", AND UPGRADED TO AN ABORT CRIT 1, PER IOA ISSUE. FIRST FAILURE COULD RESULT IN LOSS OF ONE OMS ENGINE AND IN INABILITY TO COMPLETE ALL ENGINE STARTS AND PURGES REQUIRED DURING A TAL ABORT.

REPORT DATE 2/26/88

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| ASSESSMENT ASSESSMENT NASA FMEA # | DATE: ID: : | 1/01/88 OMS-320 03-3-45 | 8) 551· | -1 | | | | | <u>NASA</u> BASE | DATA: LINE NEW | [[X |] | | |
|--|-------------------|-------------------------------|----------------|--------|--------|--------|----------|----------|---------------------|----------------------|------------|-------------|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | | OMS 320 CHECK V | AL | VE-GN: | 2 | | <u>.</u> | | - - - | | | | | |
| LEAD ANALYS | г: | C.D. PH | RUS | r | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS FLIGHT | | | | | | | | | | | | CIL ITEM | | |
| H | DW/FUI | NC | A | | | B | | | C | je g | | | | |
| NASA [IOA [| 3 /1R 3 /1R |] (| P P |]] | [[| F F |]] | [[| P] P] | | [X [X |] *] | | |
| COMPARE [| 1 |] [| • |] | [| |] | [|] | | [|] | | |
| RECOMMENDAT | IONS: | (If d | lif | ferent | t f | rc | om NAS | A) | | | | | | |
| C | 1 |] [| • |]. | [| |] | נ |] | (AI | [DD/DI |] ELETE) | | |
| * CIL RETENT REMARKS: NO DIFFERENC | TION I | RATIONAI | LE: | (If a | app | 11 | cable | e) IN | ADEQU IADEQU | ATE ATE | [|]] | | |

REPORT DATE 2/26/88
| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-321 03-3-4551-1 | | NASA DATA BASELINE NEW | : [] [X] | | |
|--|-----------------------------------|-------------|------------------------------|-------------------|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 321 CHECK VALVE-G | SN2 | | | | |
| LEAD ANALYST: | C.D. PRUST | | | | | |
| ASSESSMENT: | | | | | | |
| CRITICAL FLIGH HDW/FU | ITY REDUN T NC A | IDANCY SCRE | ens C | CIL ITEM | | |
| NASA [3 /1R IOA [3 /1R |] [P]] [P] | [F] [F] | [P] [P] | [X]* [X] | | |
| COMPARE [/ |] [] | [] | [] | [] | | |
| RECOMMENDATIONS: | (If differe | ent from NA | SA) | | | |
| [/ |] [] | [] | [] (A | [] .DD/DELETE) | | |
| * CIL RETENTION | RATIONALE: (II | f applicabl | e) ADEQUATE INADEQUATE | [] | | |

NO DIFFERENCES.

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REPORT DATE 2/26/88

ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-322 1 NEW [X] NASA FMEA #: 03-3-4552-1 SUBSYSTEM: OMS MDAC ID: 322 GN2 ACCUMULATOR ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT HDW/FUNC В Α [P] [P] [P] NASA [2/1R]IOA [1/1]Î. (X) 1 ſ ſ COMPARE [N/N] [N] [N] [N][1 **RECOMMENDATIONS:** (If different from NASA) Γ (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) i en existe e és s ADEQUATE [INADEQUATE [1 **REMARKS:**

IOA RECOMMENDS THAT THE RUPTURE MODE BE UPGRADED TO A 1/1 AND PLACED ON A NEW FMEA, SEPARATE FROM THE EXTERNAL LEAKAGE FAILURE MODE. NSTS 22206 REQUIRES THAT POTENTIAL SHRAPNEL EFFECTS BE INCLUDED IN THE CRITICALITY ASSIGNMENT FOR RUPTURE OF NON-FILAMENT-WOUND PRESSURE VESSELS. SHRAPNEL COULD RESULT IN DAMAGE TO VEHICLE, TPS, OMS ENGINE, AND PROP LINES. i

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-323 03-3-4552-1 | NASA DAT BASELIN NE | A: E [] W [X] |
|--|-----------------------------------|------------------------------------|------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 323 GN2 ACCUMULATOR | | |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL | ITY REDUNDANC | Y SCREENS | CIL |
| HDW/FU | NC A | вс | 1154 |
| NASA [2 /1R IOA [2 /1R |] [P] [] [P] [| P] [P] P] [P] | [X]* [X] |
| COMPARE [/ |] [] [|] [] | [] |
| RECOMMENDATIONS: | (If different f | rom NASA) | |
| . [/ |] [] [| з [] (| [] ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (If app | licable) ADEQUATE INADEQUATE | [] |
| REMARKS: NO DIFFERENCES F SHEET OMS-322. | OR EXTERNAL LEAKAG | E FAILURE MODE. | SEE ASSESSMENT |

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT D NT I A #: | DATE: | 1/01/2 OMS-32 03-3-4 | 88 24 4510- | NASA DATA: BASELINE [] NEW [X] | | | | | | |
|--|----------------------|---------------|----------------------------|-------------------|---|------------|--------|----------|----------------------|-------------|-------------|
| SUBSYSTEM MDAC ID: ITEM: | M: | | OMS 324 GN2 PI | RESS | JRE L | INES | AND 1 | MEC | HANICAL F | - TTTI | NGS |
| LEAD ANALYST: C.D. PRUST | | | | | | | | | | | |
| ASSESSME | YT: | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS FLIGHT | | | | | | | | | С амала | CIL ITEM | |
| | пD | <i>m</i> /101 | | A | | 5 | | | 6 | | |
| NASA IOA | [2 [2 | /1R /1R |]] | [P [P |] | [P [P |]] | [[| P] P] | [X [X |] *] |
| COMPARE | [| / |] | [|] | [|]_ | [|] | [|] |
| RECOMMENI | DATI | ONS: | (If | diff | feren | t fr | om NAS | SA) | | | |
| | [| / |] | [|] | [|] | [|] (A | [נס/סס |] ELETE) |
| * CIL RET REMARKS: NO DIFFEI | rent Renc | ION I | RATION | ALE: | (If a | appl | icable | e) IN | ADEQUATE ADEQUATE | - [[|] |

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-325 NONE | | NASA DA BASELI N | ATA: INE [] NEW [] | | | | | | | | | |
|--|-------------------------------------|---|--|--|--|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 325 GN2 PRES | SURE LINES | AND MECHANICAL | L FITTINGS | | | | | | | | | |
| LEAD ANALYST: | C.D. PRU | IST | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITICAL | ITY | REDUNDANCY | SCREENS | CIL ITEM | | | | | | | | | |
| HDW/FU | NC | A B | С | | | | | | | | | | |
| NASA [/ IOA [2 /1R |] [] [|] [P] [F |] []] [P] | [] * [X] | | | | | | | | | |
| COMPARE [N /N |] [| N] (N |] [N] | [N] | | | | | | | | | |
| RECOMMENDATIONS: | (If di | fferent fr | om NASA) | | | | | | | | | | |
| [/ |] [|] [|] [] | [] (ADD/DELETE) | | | | | | | | | |
| * CIL RETENTION | RATIONALE | : (If appl | icable) | | | | | | | | | | |
| | | | ADEQUA INADEQUA | FE [] FE [] | | | | | | | | | |
| REMARKS: IOA CAUSES ON AN BLOCKAGE". | ALYSIS SH | IEET SHOULD | NOT INCLUDE " | FILTER | | | | | | | | | |
| NASA/RI DO NOT C OBSTRUCTION OR D RESULT IN 2/1R E | OVER RESI EFORMATIC FFECTS, H | TRICTED FLO ON (CRIMPIN HOWEVER THE | W IN A SEGMENT G). SUCH AN O CREDIBILITY O | OF LINE DUE TO CCURRENCE COULD F SUCH AN | | | | | | | | | |
| | TOTAL DI | | MUS MENTARICAN MOI | | | | | | | | | | |

OCCURRENCE IS QUESTIONABLE. ANY CONTAMINATION WOULD FLOW TO DOWNSTREAM FILTER OR COMPONENT. IOA RECOMMENDS THAT SUCH A FAILURE BE ADDRESSED ON THE FMEA/CIL, BUT DOES NOT REGARD THIS RECOMMENDATION AS AN OPEN ISSUE.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-326 03-3-400 | 01-2 | | NASA DATA: BASELINE NEW | : [] [X] |
|--|--------------------------------|-------------------------|------------------------|-------------------------------|------------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 326 VALVE-EI | NGINE CON | TROL | | |
| LEAD ANALYST: | C.D. PR | JST | | | |
| ASSESSMENT: | | | | | , |
| CRITICAL | LTY P | REDUNDAN | CY SCREENS | 5 | CIL ITEM |
| HDW/FUN | VC | Α | В | C | |
| NASA [2 /1R IOA [2 /1R |] [] [| P][P][| P][P][| P] P] | [X] * [X] |
| COMPARE [/ | J [|] [|] [| .] | [] |
| RECOMMENDATIONS: | (If d | ifferent | from NASA) | | • |
| [/] |] [|] [| ז נ |] (AI | [] DD/DELETE) |
| * CIL RETENTION H | RATIONALI | E: (If app | plicable) IN | ADEQUATE IADEOUATE | |
| REMARKS: NO DIFFERENCES. | | | | · · · · · | L J |
| IOA RECOMMENDS A MECHANICALLY LINE | SEPARATI KED TO TI | E FMEA FOI HE BIPROP | R THIS ITE VALVES. | M SINCE IT | r is not |
| IOA RECOMMENDS TH FMEA BE SEPARATED | AT THE S | SUBASSEMBI NDIVIDUAL | LY COMPONE FMEAS TO | NTS INCLUE PROVIDE BE | DED ON THIS ETTER INSIGHT |

INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-327 NEW [X] NASA FMEA #: 03-3-4001-1 OMS SUBSYSTEM: 327 MDAC ID: VALVE-ENGINE CONTROL ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT C В HDW/FUNC A [P] [P] [P] [P] [P] [P] [P] NASA [2 /1R] IOA [2 /1R] [X] * ſX1 COMPARE [/] [] [] [] [] RECOMMENDATIONS: (If different from NASA)] [[/] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE Γ 1 INADEQUATE ſ] **REMARKS:** NO DIFFERENCES. IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY. IOA RECOMMENDS A SEPARATE FMEA FOR THIS ITEM SINCE IT IS NOT MECHANICALLY LINKED TO THE BIPROP VALVES. IOA ALSO RECOMMENDS ADDING A STATEMENT TO THE EFFECTS ABOUT

POSSIBLE EXPOSURE OF EVA AND GROUND CREWS TO PROPELLANT.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-328 03-3-4001-4 | 1 | NASA DATA BASELINI NEV | A: E [] V [X] |
|--|---|--|--|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 328 VALVE-ENGIN | | | |
| LEAD ANALYST: | | | | |
| ASSESSMENT: | | | | |
| CRITICAL FLIGH | CIL ITEM | | | |
| HDW/FU | NC A | В | C | |
| NASA [2 /1R IOA [2 /1R |] [P]] [P] |] [P] [P |] [P]] [P] | [X]* [X] |
| COMPARE [/ |] [] |] [· |] [] | []] |
| RECOMMENDATIONS: | (If diffe | erent fro | m NASA) | |
| [/ |] [] |] [|] [] (2 | [] ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (| (If appli | cable) ADEQUATE INADEQUATE | |
| REMARKS: | an an an an an an an an an an an an an a | | - | |
| IOA RECOMMENDS T FMEA BE SEPARATE INTO THE FAILURE IOA RECOMMENDS A MECHANICALLY LIN | HAT THE SUBA D ONTO INDIV S POSSIBLE I SEPARATE FM KED TO THE E | ASSEMBLY VIDUAL FM IN THE AS MEA FOR T BIPROP VA | COMPONENTS INCLU EAS TO PROVIDE H SEMBLY. HIS ITEM SINCE H LVES. | JDED ON THIS BETTER INSIGHT IT IS NOT |
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| ASSESSME ASSESSME NASA FME | NT I NT J A #: | DATE: [D: | 1/01/ OMS-3 03-3- | 88 29 4510 | -1 | | | NAS BA | A DATA: SELINE NEW | [[X |] |
|----------------------------------|----------------------|----------------|-------------------------|------------------|------|------------|------|---------------------|--------------------------|------------|--------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 329 VALVE | -ENG | INE | CONTRO | DL | | | | |
| LEAD ANALYST: C.D. PRUST | | | | | | | | | | | |
| ASSESSME | NT: | | • | | | | | | | | |
| | CRIT | FICAL | ITY | R | EDUN | IDANCY | SCR | EENS | | CIL | ı M |
| | HI | SUIGH | NC | А | | В | | С | | | |
| NASA IOA | [2 | 2 /1R 2 /1R |] | [P [P |] | [P [P |] | [P [P | | [X [X |] *] |
| COMPARE | [| 1 |] | [|] | Γ |] | C 3 | | [|] |
| RECOMMEN | DAT | IONS: | (If | dif | fere | ent fro | om N | ASA) | | | |
| | ľ | 1 |] | [|] | [|] | [| (A) | |] DELETE) |
| * CIL RE | TEN: | TION | RATION | ALE: | (11 | f appl: | icab | le) ADI INADI | EQUATE EQUATE | [[|]] |
| REMARKS: NASA/RI | AGRI | EED T | O ADD | THIS | VAI | LVE BO | DY T | O THE | TEM LI | ST C | N THIS |

NASA/RI AGREED TO ADD THIS VALVE BODY TO THE ITEM LIST ON THIS FMEA, AND TO ADD CORRESPONDING RETENTION RATIONALE TO THE CIL SHEET, PER IOA ISSUE.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-330 NONE | | | NASA DATA BASELINE NEW | : [] [X] |
|---|---|---|---|--|---|
| SUBSYSTEM: MDAC ID: ITEM: | | | | | |
| LEAD ANALYST: | C.D. PRI | UST | | | |
| ASSESSMENT: | | | | | |
| CRITICAL FLIGH | ITY F | REDUNDAN | CY SCREENS | 5 | CIL ITEM |
| HDW/FU | NC | A | В | С | |
| NASA [/ IOA [2/1R |] [] [|] [P] [|] [P] [|] P] | [X] * [X] |
| COMPARE [N /N |] [| N] [| N] [| N] | [] |
| RECOMMENDATIONS: | (If. d: | ifferent : | from NASA |) | |
| [2 /1R |] [| P] [| P] [| P] (A) | [A] DD/DELETE) |
| * CIL RETENTION | RATIONAL | E: (If ap) | plicable) II | ADEQUATE NADEQUATE | [] [] |
| REMARKS: NASA/RI DO NOT CO FAILURE MODE ON 03-3-4001-2 DOES ORIFICE" AS CAUS 1/1 ABORT FMEA B CONSIDERS RESTRIC COMPONENTS WITH MECHANICALLY LIN INCLUDED ON THE | OVER REST A FMEA. INCLUDE ES, HOWEY E GENERAT CTED FLOW INLET FIN KED TO TH "FAILS CH | TRICTED FI "CONTAMIN VER IOA RI TED FOR TH N TO BE A LTERS OR (HE BIPROP LOSED" BIN | LOW OF THI NATION" AN ECOMMENDS HIS ITEM A CREDIBLE ORIFICES. VALVES AN PROP VALVI | E CONTROL V ND "PLUGGE! THAT A NEW AND FAILUR! FAILURE MO THIS ITE! ND SHOULD I E FMEA (03) | VALVE AS A D OPENING W 2/1R PPP, E MODE. IOA ODE FOR M IS NOT NOT BE -3-4001-2). |

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 1 OMS-331 03-3-4001-3 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | | |
|---|--|--|--|--|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 331 VALVE-ENGINE CONTROL | | | | | | | | | | | |
| LEAD ANALYST: | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICAL FLIGH HDW/FU | ITY REDUNDANCY SCREENS T NC A B | CIL ITEM C | | | | | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [P] [F] [] [P] [P] [| P] [X]* P] [X] | | | | | | | | | | |
| COMPARE [/ |] [] [N] [|] [] | | | | | | | | | | |
| RECOMMENDATIONS: | (If different from NASA) | | | | | | | | | | | |
| [/ |] [] [] [|] [] (ADD/DELETE) | | | | | | | | | | |
| * CIL RETENTION | RATIONALE: (If applicable) IN | ADEQUATE [] ADEQUATE [] | | | | | | | | | | |
| REMARKS: NASA/RI ORIGINAL OPERATION) AS A PFP, 1/1 ABORT, SCREEN. IOA RECOMMENDS T FMEA BE SEPARATE INTO THE FAILURE IOA RECOMMENDS A MECHANICALLY LIN | LY CLASSIFIED THIS FAILURE 3/3. HOWEVER, NASA/RI HAS PER IOA ISSUE. IOA ACCEPTS HAT THE SUBASSEMBLY COMPONE D ONTO INDIVIDUAL FMEAS TO S POSSIBLE IN THE ASSEMBLY. SEPARATE FMEA FOR THIS ITE KED TO THE BIPROP VALVES. | MODE (DELAYED UPGRADED TO A 2/1R NASA/RI FAILURE OF B NTS INCLUDED ON THIS PROVIDE BETTER INSIGHT M SINCE IT IS NOT THIS FAILURE MODE IS | | | | | | | | | | |

LISTED AS A CAUSE ON SEVERAL 1/1 FMEAS.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | NASA DATA: BASELINE [] NEW [] | |
|--|--|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 332 ORIFICE-ENGINE CONTROL VAL | VE INLET |
| LEAD ANALYST: | C.D. PRUST | |
| ASSESSMENT: | | |
| CRITICAL | ITY REDUNDANCY SCREENS | CIL ITEM |
| HDW/FU | NC A B | C |
| NASA [/ IOA [2 /1R |] [] [] []] [P] [P] [] | P] [X]* |
| COMPARE [N /N |] [N] [N] [] | и] [И] |
| RECOMMENDATIONS: | (If different from NASA) | |
| [/ |] [] [] [|] [] (ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (If applicable) IN | ADEQUATE [] ADEQUATE [] |
| REMARKS: THIS ITEM AND FA COVERED ON 03-3- A CAUSE FOR FAIL COMPONENT LEVEL | ILURE MODE (RESTRICTED FLOW 4001-2, WHICH LISTS "PLUGGE URE TO OPEN. AN ADDITIONAL IS NOT REQUIRED. |) ARE ADEQUATELY D OPENING ORIFICE" AS FMEA AT THE SUB- |
| a da substantia Antonio de la composición de la composición de la composición de la composición de la composición de la composi Antonio de la composición de la composición de la composición de la composición de la composición de la composic | ent of the the second second second second second second second second second second second second second second | n na ser en en en en en en en en en en en en en |

REPORT DATE 2/26/88

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| ASSESSMEN ASSESSMEN NASA FMEA | T T I I I I | DA II ; | ATE: D: | 1/01/ OMS-3 NONE | ′88 33 | | | | | | | | NA E | asa Basi | DATA ELINE NEW | : [] | |]] | |
|-------------------------------------|----------------------------|------------------|-------------------------|------------------------|-----------|---------|--------|--------|---------|--------|-----|----------|-----------|-------------|----------------------|-------------|------------|----------|------|
| SUBSYSTEM MDAC ID: ITEM: | 1: | | | OMS 333 ORIFI | ICE- | -EN | IGINI | EC | ONT | [RO | LV | AI | JVE | e vi | ENT | | | | |
| LEAD ANAI | LYS | ST : | : | C.D. | PRU | JSI | 2 | | | | | | | | | | | | |
| ASSESSMEN | IT : | : | | | | | | | | | | | | | | | | | |
| c | CR] F | (T) FI HDV | ICALI LIGHI N/FUN | [ТҮ Г 1С | | RI A | EDUNI | DAN | СҮ В | SC | REE | NS | ; c | | | C: I' | I L Fei | M | |
| NASA IOA | [[| 2 | / /1R |]] | [[| P |]] | [[| P |]] | | [[| P |]] | | [[| x |] | * |
| COMPARE | [| N | /N |] | [| N |] | נ | N |] | | נ | N |] | | [| N |] | |
| RECOMMENI | DAT | FI C | ONS: | (11 | t d: | if | ferei | nt | fro | om 1 | NAS | A) | | | | | | | |
| | [| | 1 |] | ļ | |] | [| |] | | [| |] | (A |] DD, | /DI |] ELI | ETE) |
| * CIL RET | ſEÌ | NT: | ION I | RATIO | IAL | E: | (If | ap | pl: | ica | ble | :) Il | IA IAI | DEQI | UATE UATE | [[| |]] | |
| REMARKS: | | | | | | | | | | | | | | | | | | | |

THIS ITEM AND FAILURE MODE (RESTRICTED FLOW) ARE ADEQUATELY COVERED ON 03-3-4001-1, WHICH LISTS "FAILS TO VENT" AS A CAUSE FOR FAILED OPEN CONTROL VALVE. AN ADDITIONAL FMEA AT THE SUB-COMPONENT LEVEL IS NOT REQUIRED.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-334 NASA FMEA #: NONE | | | | | | | | | NASA DATA: BASELINE [] NEW [] | | | | | | | | |
|---|----------|----------|----------------|---------------------|--------|---------|--------|--------|---------------------------------------|--------|----------|----------|------------------|-------------|-------------|--|--|
| SUBSYSTEM MDAC ID: ITEM: | M: | | | OMS 334 CHECK | v | AL7 | /E-E | ENGI | NE | CON | TRO | L V | ALVE VE | ENT | | | |
| LEAD ANA | LYS | ST : | : | C.D. 1 | PRI | JSI | 2 | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | | | | |
| | CRI H | T] FI | ICALI LIGHI | LTY F NC | | RI A | EDUN | IDAN | СҮ В | SCR | EENS | 5 C 1 | áter a c | CIL ITEN | м | | |
| NASA IOA | [[| 2 | / /1R |]] | [[| P |]] | [[| P |]] | [[| P |] | [[X |] *] | | |
| COMPARE | [| N | /N |] | [| N |] | [| N |] | [| N |] | [N |] | | |
| RECOMMEN | DAI | IC | ons: | (If | đ | ifi | fere | ent | fro | om N | ASA |) | | | | | |
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| * CIL RE | ren | 1T] | ION I | RATION | ALI | E: | (If | ap: | pl: | icab | le) I | | EQUATE EQUATE | [[|]] | | |
| REMARKS: | MT 23 | MI | ነ ፑል | TIIRE I | ഹ | DE | (FA | TTS | CI | LOSE | נ ומ | ARE | ADEOUA | TELY | COVERI | | |

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THIS ITEM AND FAILURE MODE (FAILS CLOSED) ARE ADEQUATELY COVERED ON 03-3-4001-1, WHICH LISTS "FAILS TO VENT" AS A CAUSE FOR A FAILED OPEN CONTROL VALVE. A SEPARATE FMEA AT THE SUB-COMPONENT LEVEL IS NOT REQUIRED.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-335 NONE | | | NASA DAT BASELIN NI | FA: VE [] SW [] |
|---|----------------------------|----------|------------|-------------------------------|-------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 335 CHECK VA | LVE-ENG | INE CON | TROL VALVE V | VENT |
| LEAD ANALYST: | C.D. PRU | IST | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY | REDUNDA | NCY SCR | EENS | CIL ITEM |
| HDW/FU | NC | A | В | C | |
| NASA [/ IOA [2 /1F |] [;] [|] P] | [] [F] | [] [P] | [] * [X] |
| COMPARE [N /N |] [| N] | [N] | [и] | [N] |
| RECOMMENDATIONS: | (If di | fferent | : from NA | ASA) | |
| [/ |] [|] | [] | [] | [] (ADD/DELETE) |
| * CIL RETENTION | RATIONALE | 2: (If a | applicab | le) ADEQUATI INADEQUATI | E [] E [] |
| REMARKS: | יאאית ידאדיכ | TTEM AN | ID FATLI | RE MODE (FA | ILS OPEN) BE |

IOA RECOMMENDS THAT THIS ITEM AND FAILURE MODE (FAILS OPEN) BE ADDED AS A CAUSE ON FMEA 03-3-4001-2. AN ADDITIONAL FMEA AT THE SUB-COMPONENT LEVEL IS UNNECESSARY.

REPORT DATE 2/26/88

| ASSESSM ASSESSM NASA FM | ENT ENT EA | D2 I1 #: | ATE: D: | 1/0 OMS- NONI | 1/88 -336 E | | | | | | . <i>1</i> - | NZ] | ASA DA BASELI N | ATA: INE NEW | [[|]] | |
|-------------------------------|------------------|----------------|----------------|---------------------|-------------------|-----|-------|--------|-------------|--------|--------------|---------|-----------------------|--------------------|------------|---------|------|
| SUBSYST MDAC ID ITEM: | em: : | | | OMS 336 CHE | CK V | AL7 | /e-ei | 1GI | NE | CON | TROI | L 7 | VALVE | VEN | T | | |
| LEAD AN | ALYS | ST | : | C.D | . PRI | JSI | C | | | | | | | | | | |
| ASSESSMI | ENT | : | | | | | | | | | | | | | | • | |
| | CR | IT: FI | [CAL] LIGHT | LTY P | | RI | EDUNI | DAN | CY | SCR | EENS | 5 | | | CII ITI |] EM | |
| | I | HDV | V/FUI | 1C | | A | | | В | | | С | | | | | |
| NASA IOA | [[| 2 | / /1R |]] | [[| P |] | [[| F |]] | [[| P |] | | [] | [۲ | * |
| COMPARE | [| N | /N |] | [| N |] | [| N |] | | N |] | | [] | 1] | ÷ |
| RECOMMEN | NDA | C IC | ONS: | (] | [f d | Ĺfſ | ferer | nt | fro | om N. | ASA) |) | | | | | |
| | נ | | / |] | [| |] | [| |] | [| |] | (AD | [•D/I |) EL | ETE) |
| * CIL R | ETEI | NT] | ION F | RATIC | ONALI | 2: | (If | ap | pl i | lcab | le) | | | | _ | _ | |

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REMARKS:

IOA RECOMMENDS THAT THIS ITEM AND FAILURE MODE (INTERNAL LEAKAGE) BE ADDED AS A CAUSE ON FMEA 03-3-4001-2. AN ADDITIONAL FMEA AT THE SUB-COMPONENT LEVEL IS UNNECESSARY.

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-337 03-3-4001 | 1-2 | | NASA BAS | A DATA: SELINE [] NEW [X] |
|--|---------------------------------|------------|----------------|-------------------------|------------------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 337 PNEUMATIO | C ACTUA | TOR | | |
| LEAD ANALYST: | C.D. PRUS | ST | | | |
| ASSESSMENT: | | | | | |
| CRITICAL FLIGH | ITY I T | REDUNDA | NCY S | CREENS | CIL ITEM |
| HDW/FU | NC 2 | A | В | С | |
| NASA [2 /1R IOA [2 /1R |] [] | P] P] | [P] [P] | [P] [P] | [X]* [X] |
| COMPARE [/ |] [|] | [] | [] | [] |
| RECOMMENDATIONS: | (If di | fferent | : from | NASA) | |
| [/ |] [|] | [] | []] | [] (ADD/DELETE) |
| * CIL RETENTION | RATIONALE | : (If a | pplic | able) ADE(INADE(| QUATE [] QUATE [] |
| REMARKS: NO DIFFERENCES. TOA RECOMMENDS T | HAT THE S | UBASSEM | IBLY C | OMPONENTS | INCLUDED ON THI |

IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT NT A | D. I #: | ATE D: | : 1/ ON 03 | /01/8 15-33 3-3-4 | 38 38 10(| 01- | -1 | | | | | NZ E | ASA DATA BASELINE NEW | : [] | X |]] | and in the | |
|---|--------------------------|-------------------|-------------------------|----------------------|-------------------------|------------------|------------------|-------------------------|-----------------|----------------|----------------------|-------------------|-----------|--|-------------|------------|-------------|------------|---|
| SUBSYSTE MDAC ID: ITEM: | M: | | | on 33 Pi | as 38 Neuma | \T] | cc | ACTU | ATC | OR | | | | | | | | | |
| LEAD ANA | LYS | ST | : | c. | .D. I | PRI | JSI | 2 | | | | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | | 1. L | | | | |
| | CR | IT: | | LITY | Z | | RE | EDUND | ANG | CY | SCRE | EENS | 5 | | C: T' | IL PEN | Л | | |
| | I | HDI | W/F | ÜNC | | | A | | | B | | | С | en de Service de la composition Service de la composition de la composition de la composition de la composition de la Composition de la composition de la compo | - | | - | | |
| NASA IOA | [[| 2 2 | /1 /1 | R] R] | · |] [| P P |]] | [[| P P |] | [[| P P |] |]] | X X |] | * | |
| COMPARE | [| | / |] | | [| |] | [| |] | [| |] | [| |] | | |
| RECOMMEN | IDA' | FI (| ONS | : | (If | dj | lff | ferent | t 1 | fro | om NA | SA) | | | | | | | |
| | [| | / |] | | [| |] | [| |] | [| |] |] ,00 | /DI |] ELE | TE) | |
| * CIL RE | TEI | NT: | ION | RAT | TIONA | LE | 3: | (If a | app | pli | cabl | .e) IN | AI IAI | EQUATE | [[| |] | | |
| REMARKS: NO DIFFE IOA RECO FMEA BE INTO THE | REI MMI SEI SEI | NCI ENI PAI | ES. DS RAT LUR | THAT ED (ES 1 | THE NTO POSSI | E S IN (BI | SUE 1DI LE | BASSEI VIDU IN TI | MBI AL HE | LY FN AS | Comp IEAS SEMB | ONE TO BLY. | ENT PF | S INCLUI ROVIDE BI |)El STI |) C LEE | N N I | THIS | ſ |
| IOA ALSO POSSIBLE | RI E | EC(XP(| OMM OSU | ENDS RE (| S ADI DF EV | DIN 7A | ig An | STAT | emi Dun | IN 1D | S TO CREW |) TH IS I | IE C | EFFECTS PROPELL | RI N'I | IGA C. | RĽ | ING | |

REPORT DATE 2/26/88

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NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-339 NEW [X] 03-3-4001-3 NASA FMEA #: SUBSYSTEM: OMS 339 MDAC ID: PNEUMATIC ACTUATOR ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT HDW/FUNC В С Α [P] [F] [X]* IASA [2 /1R] IOA [2 /1R] [P] NASA [X] [P] [P] [P] [[] [] [N]] COMPARE RECOMMENDATIONS: (If different from NASA)] [] [/] [] [(ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [1 **REMARKS:** NASA/RI ORIGINALLY CLASSIFIED THIS FAILURE MODE (FAILS MID-TRAVEL) AS A 3/3. HOWEVER, NASA/RI HAS UPGRADED TO A 2/1R PFP, 1/1 ABORT, PER IOA ISSUE. IOA ACCEPTS NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

THIS FAILURE MODE IS LISTED AS A CAUSE ON SEVERAL 1/1 FMEAS.

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-340 BASELINE [1 NEW [X] 03-3-4001-2 NASA FMEA #: SUBSYSTEM: OMS 340 MDAC ID: PNEUMATIC ACTUATOR ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT A B Classification HDW/FUNC NASA [2/1R] [P] [P] [P] IOA [3/1R] [P] [F] [P] [X]* [X] COMPARE [N/] [] [N] [] [] **RECOMMENDATIONS:** (If different from NASA) (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [1 **REMARKS:** NASA/RI DO NOT COVER PISTON SEAL LEAKAGE AS A FAILURE MODE, HOWEVER DO LIST PISTON SEAL LEAKAGE AS CAUSE FOR A FAILED CLOSED ACTUATOR ON FMEA 03-3-4001-2. IOA CONSIDERS THIS ACCEPTABLE. IOA ACCEPTS NASA/RI REEVALUATION AND RATIONALE FOR 2/1R PPP, 1/1 ABORT CRIT ASSIGNMENT. IOA INCLUDED REDUNDANT PISTON SEAL IN 3/1R CRIT ASSIGNMENT. IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

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| ASSESSMEN ASSESSMEN NASA FMEA | IT D. IT I: A #: | ATE: D: | 1/01/8 OMS-34 03-3-4 | 88 1 1001- | -5 | | | | NAS. BA | A DATA SELINE NEW | : [] | x |]] | |
|-------------------------------------|------------------------|--------------|----------------------------|------------------|------------|----------|--------|----------|-------------|-------------------------|-------------|----------|----------|-----|
| SUBSYSTEN MDAC ID: ITEM: | 1: | | OMS 341 PNEUMA | TIC | ACTU | JATOR | | | | | | | | |
| LEAD ANAI | LYST | : | C.D. 1 | RUSI | r | | | | | | | | | |
| ASSESSMEN | IT: | | | | | | | | | | | | | |
| · | CRIT F | ICAL LIGH | ITY F | RI | EDUNI | DANCY | SCREE | INS | ; | | C] I] | L CEN | 1 | |
| | HD | W/FUI | NC | A | | В | | | с | | | | | |
| NASA IOA | [2 [1 | /1R /1 |]] | [P [|] | [P [|]] | [[| P]] | | [[| X X |]] | * |
| COMPARE | [N | /N |] | [N |] | [] |] | [| N] | | [| |] | |
| RECOMMENI | DATI | ons: | (If | dif | ferei | nt fr | om NAS | SA) | | | | | | |
| | [| / |] | [|] | [|] | [|] | (A) |] DD, | /DI |] SLE | TE) |
| * CIL RE | TENT | ION | RATION | ALE: | (If | appl | icable | ≥) IN | ADE IADE | QUATE QUATE | [[| |]] | |
| REMARKS: | INAL | LYT | DENTIF | IED S | SHRA | PNEL | EFFECT | rs | OF | ACTUAT | OR | R | JPI | URE |

IOA ORIGINALLY IDENTIFIED SHRAPNEL EFFECTS OF ACTUATOR RUPTURE. IOA RECOMMENDS THAT SHRAPNEL EFFECTS BE CONSIDERED BUT DOES NOT CONSIDER THIS RECOMMENDATION TO BE AN OPEN ISSUE. IOA AGREES WITH NASA/RI RATIONALE FOR 2/1R PPP, 1/1 ABORT CRIT ASSIGNMENT. IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

REPORT DATE 2/26/88

C-251

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- Winder

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-342 NONE | NASA DATA: BASELINE NEW | [] |
|---|---|---|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 342 PNEUMATIC ACTUATO | PR | |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICALI FLIGHT HDW/FIN | ITY REDUNDANC | EY SCREENS | CIL ITEM |
| HDW/FOF | | | |
| NASA [/ IOA [3 /1R |] [] [] [P] [|] [] NA] [P] | [] * [] |
| COMPARE [N /N |] [N] [| N] [N] | Ċ J |
| RECOMMENDATIONS: | (If different f | rom NASA) | |
| [3 /1R |] [P] [| F] [P] (AD | [A] D/DELETE) |
| * CIL RETENTION F | RATIONALE: (If app | licable) | |
| | · · · · · | ADEQUATE INADEQUATE | [] [] |
| REMARKS: IOA NOW FAILS B S NASA/RI DO NOT CO DUE TO SEAL FAILU ACTUATOR SEALS CO ACTUATOR CAVITIES CORROSION, FIRE, IOA RECOMMENDS TH PAST SEALS INTO TO DETECTABLE DURING | SCREEN. DVER THIS FAILURE JRES). LEAKAGE OF DULD RESULT IN MIX S OR LEAKAGE INTO EXPLOSION, AND EX HAT A 3/1R PFP FME THE ACTUATOR CAVIT S FLIGHT (FAIL B S | MODE (PROP LEAKAGE PROP PAST BALL VAL ING OF HYPERGOLIC P THE POD CAUSING POS POSURE OF EVA AND G A BE ADDED FOR PROP IES. SEAL FAILURES CREEN). | OR MIXING VE SEALS AND ROPS IN SIBLE ROUND CREWS. LEAKAGE NOT |

| ASSESSME ASSESSME NASA FME | ENT ENT EA ‡ | DZ II #: | ATE: D: | 1/0 OMS 03- |)1/8 -34 -3-4 | 8 3 0(| 01- | •5 | | | | | NZ H | ASA BASE | DATZ ELINH NEV | A: E [V [| x |]] | |
|----------------------------------|--------------------|----------------|------------|-------------------|---------------------|--------------|--------|--------|------|------------|--------|-----------|---------|-------------|----------------------|------------------|----------|---------|------|
| SUBSYSTE MDAC ID: ITEM: | E M : : | | | OMS 343 PNE | S SUMA | (T) | IC | ACI | rua: | FOR | 1 | | | | | | | | |
| LEAD ANA | ALYS | ST: | | c.[|). F | R | JSI | 2 | | | | | | | | | | | |
| ASSESSMI | ENT: | : | | | | | | | | | | | | | | | | | |
| | CRI | TI E | ICAL | ITY | | | RI | DUN | NDAI | NCY | SCF | REEN | S | | | () | IL TE | M | |
| | F | HDV | N/FUI | NC | | | A | | | E | 5 | | С | | | - | | | |
| NASA IOA | [[| 2 2 | /1R /1R |]] | | [[| P P |]] | | (F (F |)] | [[| P P |] | · | ((| X X |] | * |
| COMPARE | [| | / |] | | [| |] | | [|] | [| |] | | [| |] | |
| RECOMMEN | NDA | FI (| ONS: | l | (If | đ: | if | fere | ent | fr | om N | IASA |) | | | | | | |
| | [| | / |] | | [| |] | | [|] | [| |] | (2 | ADI | ò∕D |] EL | ETE) |
| * CIL RI | ETEI | T' | ION | RATI | IONA | L | E: | (11 | fa] | ppl | icak | ole) I | A NA | DEQU | JATE JATE | | |]] | |
| NO DIFFI | - EREI | NC | ES. | | | | | | | | | | | | | | | | |

REPORT DATE 2/26/88

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| ASSESSM ASSESSM NASA FM | ENT ENT EA | D/ I! #: | ATE: D: | 1/0: OMS- 03-3 | L/88 -344 3-40 | 3 1 201 | 3 | | | | | NA E | SA DA BASELI N | TA: NE IEW | [[|] | |
|-------------------------------|------------------|----------------|---------------|----------------------|----------------------|---------------|------|-------|----------|------|-------------|-----------|----------------------|------------------|------------|------------|-----------|
| SUBSYST MDAC ID ITEM: | EM: | | | OMS 344 PNEU | JMAT | ric | : A | CTUAI | ror | | | B | | | - | | |
| LEAD AN | ALYS | ST | : | C.D. | . PI | RUS | T | | | | | | | | | | |
| ASSESSM | ENT | : | | | | | | | | | | | | | | | |
| | CRI | IT: Fl | ICAL | ITY F | | F | ED | UNDAN | ICY B | SCR | EENS | ; | | | CIL ITE | м | |
| | 1 | 101 | | | | | | | | _ | | _ | - | | | - | |
| NASA IOA | · [| 2 2 | /1R /1R |] | | F | ,] | [| F P |] | ן נ | P P |] | | [X [X |] | * |
| COMPARE | [| | / |] | 1 | - |] | [| N |] | [| |] | | C |] | |
| RECOMME | NDAI | | ONS: | () | [f d | lif | fe | rent | fr | om N | ASA) | | | | | | |
| | [| | / |] | l | • |] | [| • |] | C | |] | (AE | [)D/D |] ELF | Ste) |
| * CIL R | eten | 1 T] | EON I | RATIC | IAN | LE: | () | If ap | pl | icab | le) IN | AD IAD | EQUAT EQUAT | 'E 'E | [[|] | |
| NASA/RI | ORI | [G] | ENALI HOWI | LY DI | D NZ | IOT | ' C(| OVER | TH: | IS F | AILU THT | RE | MODE | C RE | ELA MOD | YEI E 7 |) 10 0 |

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OPERATION). HOWEVER, NASA/RI HAS ADDED THIS FAILURE MODE TO 03-3-4001-3. IOA ACCEPTS NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT DATE: NT ID: A #: | 1/01/8 OMS-34 NONE | 8 5 | NASA DATA: BASELINE [] NEW [] | | | | | | | | |
|----------------------------------|----------------------------|--------------------------|--------|---------------------------------------|-------------|-----------------|----------------|------------------|----------------|--------------|--|--|
| SUBSYSTE MDAC ID: ITEM: | M: | OMS 345 COUPLI | ng, | VENT | POR | I ACTU | JATO | r shaf' | T SEAL | , . | | |
| LEAD ANA | LYST: | C.D. F | RUSI | r | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | |
| | CRITICAL | ITY | RI | EDUNDA | ANCY | SCREE | ens | | CIL | i M | | |
| | HDW/FU | NC | A | | В | | С | | *** | | | |
| NASA IOA | [/ [3 /3 |] | [[|]] | [[|]] | [[|]] | [[|] *] | | |
| COMPARE | [N /N |] | [| <u>ן</u> | Γ |] | [|] | ٢ |] | | |
| RECOMMEN | DATIONS: | (If | dif | feren | t fr | om NAS | SA) | | | | | |
| | [3 /3 |] | [|] | [|] | [|] |] (ADD/D |] DELETE) | | |
| * CIL RE | TENTION | RATION | LE: | (If a | appl | icable | ∍) A INA | DEQUAT DEQUAT | E [E [|]] | | |
| LEAKAGE | OF THESE OES NOT | COUPLI | | (CPO BE AD | 01, DRES | CP002 SED OI | , CP N TH | 005, C E FMEA | P006, /CIL. | CP007, | | |

CP008) DOES NOT APPEAR TO BE ADDRESSED ON THE FMEA/CIL. IOA RECOMMENDS THAT LEAKAGE OF ALL ENGINE TEST PORTS BE ADDRESSED ON THE FMEA/CIL AND/OR THE OMRSD. LEAKAGE OF THESE PORTS WOULD EXPOSE THE BIPROP VALVE ASSEMBLY INTERNAL PARTS TO AMBIENT, AND COULD LEAD TO CONTAMINATION OF THE ASSEMBLY. HOWEVER, LEAKAGE BY ITSELF IS NO EFFECT.

REPORT DATE 2/26/88

| ASSESS ASSESS NASA F | MENT MENT MEA | " D " I #: | ATE: D: | 1/0 OMS- NONI | 1/88 -346 E | NASA DATA: BASELINE [] NEW [] | | | | | | | | |
|----------------------------|---------------------|------------------|------------|---------------------|-------------------|---------------------------------------|--------|--------|--------|--------|---------------|------------|-----------|------|
| SUBSYS MDAC I ITEM: | D: | : | | OMS 346 COUI | PLING, | VEN | IT POR | T A(| CTUATC | R SH | AFT | SEAI | - | |
| LEAD A | NALY | ST | : | C.D. | PRUS | г | | | | | | | | |
| ASSESS | MENT | : | | | | | | | | | | | | |
| | CF | TIS T | | LITY | R | EDUN | IDANCY | SCI | REENS | | | CII TTF | m | |
| | | HD | W/FU | INC | A | | В | | C | ! | | | | |
| NAS IC | 5A [)A [| 3 | / /3 |]] | [[|]] | [[|]] | [[|]] | | [[|]] | * |
| COMPAR | E (| N | /N |] | ۵ |] | [|] | [|] | | [|] | |
| RECOMM | IENDA | TI | ons: | (1 | [f dif: | fere | ent fr | om 1 | NASA) | | | | | |
| | (| 3 | /3 |] | ſ |] | [|] | L |] | (Al | [00/1 |] DELI | ETE) |
| * CIL | RETE | INT | ION | RATIC | ONALE: | (If | appl | icał | ole) | DEON | א ח די | r | ٦ | |

ADEQUATE [] INADEQUATE []

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REMARKS: FAILURE OF THESE COUPLINGS (CP001, CP002, CP005, CP006, CP007, CP008) TO COUPLE DOES NOT APPEAR TO BE ADDRESSED ON THE FMEA/CIL. IOA RECOMMENDS THAT FAILURE TO COUPLE OF ALL ENGINE TEST PORTS BE ADDRESSED ON THE FMEA/CIL AND/OR THE OMRSD. FAILURE HAS NO EFFECT.

REPORT DATE 2/26/88

| ASSESSMENT DATE: 1 ASSESSMENT ID: 0 NASA FMEA #: 1 | 1/01/88 OMS-347 NONE | NA E | ISA DATA: BASELINE [] NEW [] | |
|---|--|---|--------------------------------------|------|
| SUBSYSTEM: C MDAC ID: C ITEM: C | OMS 347 COUPLING, VENT 1 | PORT ACTUATOR | SHAFT SEAL | |
| LEAD ANALYST: | C.D. PRUST | | | |
| ASSESSMENT: | | | | |
| CRITICALI FLIGHT | TY REDUNDAN | NCY SCREENS | CIL ITEM | |
| HDW/FUNC | C A | B C | | |
| NASA [/ IOA [3 /3 |] []] [] | |] [] | * |
| COMPARE [N /N |] [] | [][|] [] | |
| RECOMMENDATIONS: | (If different | from NASA) | | |
| [3 /3 |] [] | [⁻] [|] [] (ADD/DEL | ETE) |
| * CIL RETENTION RA | ATIONALE: (If a) | pplicable) AI INAI | DEQUATE [] DEQUATE [] | |
| REMARKS: THESE FAILURES (FACUPLINGS (CP001, APPEAR TO BE ADDR | AILS TO OPEN, FA CP002, CP005, C ESSED ON THE FM | AILS TO CLOSI CP006, CP007, EA/CIL. | 3) FOR THESE , CP008) DO NO | т |
| IOA RECOMMENDS TH | AT THESE FAILUR | E FOR ALL ENG | JINE TEST PORT | S BE |

- ADDRESSED ON THE FMEA/CIL AND/OR THE OMRSD. FAILURES HAVE NO EFFECT.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | ENT ENT EA # | DATE: ID: : | : 1/01 OMS- 03-3 | /88 348 -4001 | -2 | | | 1 | NASA D Basel | ATA: JINE [NEW [|] x] | |
|----------------------------------|---------------------|-------------------------|--------------------------|-------------------------|--------------------|-------------------------|-------------------------|-----------------------|-----------------|-------------------------|------------|----------------|
| SUBSYSTI MDAC ID: ITEM: | EM : : | | OMS 348 PINI | ON GE | AR A | נס מאי | RIVE | ASSEN | IBLY | | | |
| LEAD ANA | ALYS | T: | C.D. | PRUS | T | | | | | | | |
| ASSESSME | ENT: | | | | | | | | | | | |
| | CRI | TICAI FLIGH DW/FU | LITY IT JNC | R | EDUN | IDANC | Y SCR | EENS | · · · · · · | CI IT | L EM | |
| NASA IOA | [[| /11 2 /11 2 /11 | 2] 2] | [P [P |] | [] | P] P] | [] [] | ?] ?] | [| X] X] | * |
| COMPARE | C | 1 |] | ٢ |] | [|] | [|] | ſ |] | |
| RECOMMEN | IDAT | IONS: | (1 | f dif; | fere | ent fi | rom N | ASA) | | | | |
| - | נ | / | 1 | [|] | נ |] | נ |] |] (ADD/ |] DELE | TE) |
| * CIL RE | ETEN | TION | RATIO | NALE: | (If | app: | licab | le) A INA | DEQUA | TE (TE (|]] | |
| REMARKS: NO DIFFE | : EREN | CES W | /ITH " | FAILS | CLO | SED" | FAIL | URE M | IODE. | | | |
| IOA RECO FMEA BE INTO THE | DMME SEP E FA | NDS T ARATE | THAT T D ONT S POS | HE SU O IND SIBLE | BASS IVID IN | EMBLY UAL I THE 2 | Y COM FMEAS ASSEM | PONEN TO I BLY. | TS IN PROVID | CLUDED E BETT | ON ER I | THIS NSIGHT |

REPORT DATE 2/26/88 C-258

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-348A 03-3-400 | 1-1 | NASA DATA: BASELINE NEW | [] [X] | | | | | | |
|---|---------------------------------|------------------|---------------------------------|-------------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 348 PINION G | EAR AND DRIV | E ASSEMBLY | | | | | | | |
| LEAD ANALYST: | C.D. PRU | ST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAL | ITY | REDUNDANCY S | CREENS | CIL ITEM | | | | | | |
| HDW/FU | NC | A B | С | | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [] [| P] [P] P] [P] | [P] [P] | [X]* [X] | | | | | | |
| COMPARE [/ |] [|] [] | [] | [] | | | | | | |
| RECOMMENDATIONS: | (If di | fferent from | NASA) | | | | | | | |
| τ / |] [|] [] | [] (A) | [] DD/DELETE) | | | | | | |
| * CIL RETENTION | RATIONALE | : (If applic | able) ADEQUATE INADEQUATE | [] | | | | | | |
| REMARKS: NO DIFFERENCES WITH "FAILS OPEN" FAILURE MODE. IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY. | | | | | | | | | | |
| TOA ALSO RECOMME | UTON SOUL | G STATEMENIS | , TA THE PLICE | | | | | | | |

POSSIBLE EXPOSURE OF EVA AND GROUND CREWS TO PROPELLANT.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-349 03-3-4001- | [] [X] | | | | | | | | | | |
|---|----------------------------------|----------------------|-----------------------|---------------------------|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 349 PINION GEA | · · · · · | | | | | | | | | | |
| LEAD ANALYST: C.D. PRUST | | | | | | | | | | | | |
| ASSESSMENT: | ASSESSMENT: | | | | | | | | | | | |
| CRITICAL FLIGH HDW/FU | ITY RE T NC A | DUNDANCY SCREEN B | S C Z | CIL ITEM | | | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [P] [P |] [P] [] [P] [| P] P] | [X] * [X] | | | | | | | | |
| COMPARE [/ |] [|] [] [|] | [] | | | | | | | | |
| RECOMMENDATIONS: | (If diff | erent from NASA |) | · | | | | | | | | |
| τ / |] [|] [] [|] (AD | [] D/DELETE) | | | | | | | | |
| * CIL RETENTION | RATIONALE: | (If applicable) | ADEQUATE NADEOUATE | . <u></u> . [] [] | | | | | | | | |
| INADEQUATE [] REMARKS: NO DIFFERENCES. NASA/RI LIST BROKEN GEARS, TEETH, OR SHAFT AS CAUSE FOR FAILURE OF GEAR DRIVE ASSEMBLY ON 03-3-4001-2. A SEPARATE GEAR ASSEMBLY STRUCTURAL FAILURE FMEA IS UNNECESSARY. IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY. | | | | | | | | | | | | |

REPORT DATE 2/26/88

| 1/01/88 OMS-350 NONE | NASA DATA: BASELINE [] NEW [] | | | | | | | | | | |
|---|---|--|--|--|--|--|--|--|--|--|--|
| OMS 350 GN2 PRESSURE LINES 2 | AND MECHANICAL FITTINGS | | | | | | | | | | |
| C.D. PRUST | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| TY REDUNDANCY | SCREENS CIL ITEM | | | | | | | | | | |
| IC A B | C | | | | | | | | | | |
|] [] [] [P] [P |] [] [] *] [P] [] | | | | | | | | | | |
|] [N] [N | [и] [| | | | | | | | | | |
| (If different from | m NASA) | | | | | | | | | | |
|] [] [|] [] [] (ADD/DELETE) | | | | | | | | | | |
| RATIONALE: (If appli | cable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | |
| ALYSIS SHEET SHOULD OVER RESTRICTED FLOW EFORMATION (CRIMPING /1 ABORT EFFECTS, HO QUESTIONABLE. ANY R OR COMPONENT. IOA | NOT INCLUDE "FILTER IN A SEGMENT OF LINE DUE TO). SUCH AN OCCURRENCE COULD WEVER THE CREDIBILITY OF SUCH CONTAMINATION WOULD FLOW TO RECOMMENDS THAT SUCH A | | | | | | | | | | |
| | 1/01/88 OMS-350 NONE OMS 350 GN2 PRESSURE LINES C.D. PRUST TY REDUNDANCY C.D. PRUST TY REDUNDANCY IC A B] [P] [P] [N] [N (If different fro] [] [N (If different fro] [] [] [PATIONALE: (If appli ALYSIS SHEET SHOULD OVER RESTRICTED FLOW EFORMATION (CRIMPING '1 ABORT EFFECTS, HO QUESTIONABLE. ANY & OR COMPONENT. IOA | | | | | | | | | | |

REPORT DATE 2/26/88

RECOMMENDATION AS AN OPEN ISSUE.

| ASSESSMI ASSESSMI NASA FMI | ENT <u>D</u> ENT I EA #: | ATE: D: | 1/01, OMS- 03-3 | /88 351 -4508 | 3-2 | | | NASA DA BASELI N | TA: NE [] EW [X] | |
|--|--------------------------------|--|-------------------------------|---------------------|---------------|---------------|--------------|------------------------------|--|------|
| SUBSYSTI MDAC ID: ITEM: | E M : ; | - | OMS 351 VALVE-GN2 PURGE | | | | | | | |
| LEAD AN? | LYST | : | c.d. | PRUS | ST | | | | | |
| ASSESSME | en t : | | | | | | | | | |
| | CRIT F HD | ICAL LIGH W/FU | ITY T NC | 1 1 | REDUN | IDANCY B | SCI | REENS C | CIL ITEM | |
| NASA IOA | [3 [3 | /3 /2R |]] | [[1 |)] | [[P |]] | [] [P] | [X].* [] | |
| COMPARE | [| /N |] | [] | 1] | [N |] | [N] | [N] | |
| RECOMMEN | IDATI | ons: | (1 | f di | fere | ent fr | om 1 | VASA) | | |
| | ſ | / |] | [|] | [|] | [] | · [] (ADD/DELETE) | |
| * CIL RI | ETENT | ION | RATIO | NALE | (If | appl | icał | ole) ADEQUAT INADEQUAT | E [] E [] | |
| REMARKS: IOA AGRI CRITICAI CREDIBLI | : EES W LITY. E. | ITH TW | NASA/I O DUA | RI RA L-ENG | ATION SINE | OMS B | EGAI URÑS | RDING 3/3, 1 S WITHIN 10 | /1 ABORT MINUTES IS NO | - MC |
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| 1 24 ≠ 777 ± | | 1 - <u>1</u> - <u>1</u> - <u>1</u> - <u>1</u> - <u>1</u> | | ÷ | r div. | an na stara | · · . | an an sao | | |
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REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT NT A | D/ II #: | ATE: D: | 1/0 0MS 03- |)1/88 5-352 -3-45 | 08- | -1 | | | | | | | NA E | ISA BASE | DAI LIN NE | 'A: IE W | [[| x |]] | |
|---|---------------|----------------|-------------------------|-------------------|-------------------------|---------|--------|-----|--------|-------------|--------|------|---------|-----------|--------------|------------------|----------------|------------------|-----------|----------|-----|
| SUBSYSTE MDAC ID: ITEM: | : M | | | 0M9 352 VAI | G 2 LVE-GI | N2 | PUI | RGE | | | | - | | | | | | | | | |
| LEAD ANA | LYS | ST | : | c.1 | D. PR | US | r | | | | | | | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | | | | | | | | |
| | CR: | IT F HD | ICALI LIGHI W/FUI | ITY F NC | | RI A | EDUI | NDA | NC | Y B | sc | REE | NS | s c | | | | CI IT | [L [E] | 1 | |
| NASA IOA | [[| 3 3 | /1R /1R |]] | [[| P P |]] | | [[| F P |]] | | [[| P P |]] | | | [[| х |]] | * |
| COMPARE | [| | / |] | [| |] | | [| N |] | | [| |] | | | [| N |] | |
| RECOMMENDATIONS: (If different from NASA) | | | | | | | | | | | | | | | | | | | | | |
| | [| | / |] | [| |] | | [| |] | | [| |] | | (AI |] סכ <i>ו</i> | /DI |] ELJ | ETE |
| * CIL RE | TE | NT | ION | RAT | IONAL | E: | (I: | fa | pŗ |)]j | Lca | able |) Il | IA IAI | DEQU DEQU | JATI JATI | E | [[| |]] | |

REMARKS: STATUS OF PURGE VALVE POSITION IS TELEMETERED TO GROUND AND IS NOT AVAILABLE TO CREW. THEREFORE, PER NSTS 22206, NASA/RI IS CORRECT IN FAILING B SCREEN.

REPORT DATE 2/26/88

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| ASSESSMEN ASSESSMEN NASA FMEA | IT DA IT II . #: | ATE: D: | 1/01/8 OMS-35 03-3-4 | 8 53 50 | 8-1 | | | | | NAS. BA | A DATA SELINE NEW | .: [[] | к] | |
|-------------------------------------|------------------------|------------|----------------------------|---------------|-------------------|--------|--------|--------|-----------|-------------|-------------------------|--------------------|-------------|------|
| SUBSYSTEM MDAC ID: ITEM: | [: | | OMS 353 VALVE- | -GN | 2 PI | JRGE | | | | | | | | |
| LEAD ANAL | YST | : | C.D. H | PRUS | ST | | | | | | | | | |
| ASSESSMEN | IT: | | | | | | | | | | | | | |
| CRITICALITY F | | | | | REDUNDANCY SCREEN | | | | | INS | | | CIL ITEM | |
| | HD | W/FUI | 1C | 1 | A | | В | | | С | | | | |
| NASA IOA | [3 [3 | /1R /1R |]] | [] [] | P] P] | [[| F F |]] | [[| P] P] | | [] | K] K] | * |
| COMPARE | [| / |] | [|] | [| |] | [| ·] | | C |] | |
| RECOMMEND | ATIC | ONS: | (If | di | ffei | rent | fr | om NZ | ASA) |) | | | | |
| | נ | / |] | [|] | [| |] | <u></u> [|] | (A |] 1\DD. |] DELE | ETE) |
| * CIL RET | 'ENT | ION I | RATIONA | LE | : (] | f ap | pl | icabl | Le) IN | ADE IADE | QUATE QUATE | [[|]] | |
| REMARKS: NO DIFFER | ENC | ES. | | | | | | | | | | | _ | |

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | : [] [X] | | | | | | | | | | |
|--|---|--------------|------------------------|------------------------------|--------------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 354 VALVE-G | | | | | | | | | | |
| LEAD ANALYST: C.D. PRUST | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRITICAL FLIGH HDW/FU | ITY T NC | REDUNDA A | ANCY SCREI B | ens C | CIL ITEM | | | | | | |
| NASA [2 /1R IOA [3 /2R |] [] [| P] P] | [P] [P] | [P] [P] . | [X]* [] | | | | | | |
| COMPARE [N /N |] [|] | [] | [] | [N] | | | | | | |
| RECOMMENDATIONS: | RECOMMENDATIONS: (If different from NASA) | | | | | | | | | | |
| [/ |] [| .] | [] | [] (A | [] ADD/DELETE) | | | | | | |
| * CIL RETENTION | RATIONAL | E: (If a | applicable | e) ADEQUATE INADEQUATE | [] | | | | | | |
| REMARKS: IOA FAILURE MODES ON ANALYSIS SHEET SHOULD NOT INCLUDE "(DOWNSTREAM OF FIRST VALVE)". IOA AGREES WITH NASA/RI RATIONALE FOR 2/1R PPP, 1/1 ABORT | | | | | | | | | | | |
| CRITICALITY ASSIGNMENT. NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (EXTERNAL LEAKAGE) FOR THIS ITEM. HOWEVER, NASA/RI AGREED TO ADD THIS VALVE BODY TO THE ITEM LIST ON THIS FMEA, AND TO ADD | | | | | | | | | | | |
| CORRESPONDING RE ISSUE. A FAILURE OF THE RESULT IN PROP I | TENTION HOUSING LEAKAGE. | RATIONA | LE TO THE HE INTERN | AL CHECK VAI | VE COULD | | | | | | |

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| ASSESSMENT DATÉ: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-355 03-3-4508 | -2 | | NASA DATA: BASELINE NEW | [] [X] | | | | | |
|---|---------------------------------|--------------------------|----------------|-------------------------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 355 VALVE-GN2 | PURGE | | | | | | | | |
| LEAD ANALYST: | C.D. PRUS | T | | | | | | | | |
| ASSESSMENT: | | | | | n An an airte an Anna Anna Anna Anna Anna Anna Anna | | | | | |
| CRITICAL FLIGH HDW/FU | ITY R T NC A | REDUNDANC | Y SCREENS | с | CIL ITEM | | | | | |
| 110w/10 | | | | | r v 1 + | | | | | |
| NASA [3 /3 IOA [3 /2R |] [P |) [| P] [| P] | | | | | | |
| COMPARE [/N |] [N | [] [| N] [| N] | [N] | | | | | |
| RECOMMENDATIONS: | (If dif | ferent f | rom NASA) | 171 1 | | | | | | |
| [/ |) (|] [|] [|] (AD | [] D/DELETE) | | | | | |
| * CIL RETENTION | RATIONALE: | (If app | licable) IN | ADEQUATE ADEQUATE | [] []. | | | | | |
| REMARKS: NASA/RI DID NOT ORIGINALLY COVER THIS FAILURE MODE (RESTRICTED FLOW). HOWEVER, NASA/RI ADDED RESTRICTED FLOW AS A FAILURE MODE | | | | | | | | | | |
| IOA AGREES WITH ASSIGNMENT. | NASA/RI RA | TIONALE | FOR 3/3, | 1/1 ABORT | CRITICALITY | | | | | |
| in to the training | het ne s | nin Thin M <u>A</u> lbu. | 161 | 10011 | n mana an an an an an an an an an an an an | | | | | |

REPORT DATE 2/26/88 C-266

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| ASSESSME ASSESSME NASA FME | NT NT A | D2 II #: | ATE: D: | 1/01 OMS- NONE | /88 356 | | | | | | | NAS BA | SA DATA ASELINE NEW | :: ; [7 [|]] | |
|----------------------------------|---------------|----------------|------------|----------------------|------------|-----|--------|--------|-----|--------|------------|-------------|---------------------------|------------------|-----------|------|
| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 356 VALV | E-Gl | N2 | PUR | GE | | | | | | | | |
| LEAD ANA | LY | ST | : | c.p. | PR | USI | C | | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | | | |
| | CR | IT | | ITY | | RI | EDUN | IDAN | CY | SCR | REENS | ; | | CI | L EM | |
| |] | HD | W/FU | NC | | A | | | в | | | с | | | | |
| NASA IOA | [[| 3 | / /2R |]] | [[| P |]] | ((| P |]] | [[| P |] | [[|]] | * |
| COMPARE | [| N | /N |] | [| N |] | (| N |] | C | N |] | [|] | |
| RECOMMEN | DA' | TI | ons: | (I | fd | if | fere | eņt | fr | om N | IASA) | | | | | |
| | [| | 1 |] | [| |] | [| |] | [| • |) (2 | [ADD/ |] DELI | ETE) |
| * CIL RE | TE | NT | ION | RATIO | NAL | E: | (If | ā ar | pl. | icak | ole) IN | ADI IADI | EQUATE EQUATE | [[|]] | |
| REMARKS: NASA/RI | DI | D] | NOT | COVER | TH | IS | FAI | | E | MODE | E (DI | ELA | YED OPI | ERAT | ION | |

THIS FAILURE MODE NEED NOT BE ADDED TO THE FMEA/CIL. THE WORST CASE EFFECTS OF "DELAYED OPERATION" ARE COVERED BY THE "FAILS CLOSED" FMEA (03-3-4508-2).

REPORT DATE 2/26/88

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| ASSESSM ASSESSM NASA FM | IENT IENT IEA | DZ II #: | ATE: D: | 1/0 OMS 03- | 1/88 -357 3-45 | 08 [,] | -2 | | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | |
|-------------------------------|---------------------|----------------|-------------|-------------------|----------------------|-----------------|------------|--------------|---|-----|-----------|---------|--------------|--------------|----------|----------|--------------|-------------|
| SUBSYST MDAC ID ITEM: | EM: | | | OMS 357 CHE | CK V | AL | VE- | GN2 | PU | RGE | | | | | | | | |
| LEAD AN | ALYS | ST | : | c.D | . PR | US | r | | | | | | | | | | | |
| ASSESSM | ENT | : | | | | | | | | | | | | | | | | |
| | CR | IT] FI | CAL LIGH | ITY F | | R | EDU | NDAN | ICY | sc | REEN | s | | | CI IT | L LEN | 1 | |
| | 1 | HDV | ¶∕FUI | NC | | A | | | В | | | С | | | | | | |
| NASA IOA | | 3 3 | /3 /2R |]] | [[| P |]] | [| P |] | [[| P |]] | | [[| х |] | * |
| COMPARE | ; ; | | /N |] | [| N |] | (| N |] | [| N |] | | [| N |] | |
| RECOMME | NDA | ric | ons: | (| If d | if: | fer | ent | fr | om | NASA |) | | | | | | |
| | ٢ | | / |] | [| |] | (| |] | ſ | |] | (A |] DD/ | /DI |] SLF | ETE) |
| * CIL R | ETEI | T I | ION I | RATI | ONAL | E: | (I | f a <u>r</u> | pl | ica | ble) I | A NA | DEQU DEQU | VATE VATE | [[| |] | |
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IOA AGREES WITH NASA/RI RATIONALE FOR 3/3, 1/1 ABORT CRITICALITY ASSIGNMENT. NASA/RI ADDED CHECK VALVE TO PURGE VALVE ASSEMBLY FMEA (03-3-4508-2) DURING REEVALUATION.

| ASSESSMENT ASSESSMENT NASA FMEA | DATE: ID: #: | 1/01/88 OMS-358 03-3-45 | '01/88 NASA DATA: IS-358 BASELINE [] 3-3-4508-1 NEW [X] | | | | | | | | | |
|--|--------------------|-------------------------------|---|--------|------------|--------|--------|------------|-----------|------------|------|--|
| SUBSYSTEM: MDAC ID: ITEM: | | OMS 358 CHECK V | AL | /E-GN: | 2 PU1 | RGE | | | | | | |
| LEAD ANALY | ST: | C.D. PR | USI | r | | | | | | | | |
| ASSESSMENT | : | | | | | | | | | | | |
| CR | ITICAL FLIGH | ITY T | RI | EDUNDA | ANCY | SCREE | ens | 6 | CI IT | L EM | | |
| | HDW/FU | NC | A | | в | | | | | | | |
| NASA [IOA [| 3 /1R 3 /1R |] [] [| P P |]] | [F [F |]] | [[| P] P] | [[| x] x] | * | |
| COMPARE [| . / |] [| |] | [|] | [|] | [|] | | |
| RECOMMENDA | TIONS: | (If d | if | feren | t fr | om NAS | SA) | | | | | |
| [| . / |] [| |] | [|] | [|] (/ | [ADD/ |] DEL | ETE) | |
| * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | | | |
| REMARKS: NO DIFFERENCES. NASA/RI ADDED CHECK VALVE TO PURGE VALVE ASSEMBLY FMEA (03-3-4508-1) DURING REEVALUATION. | | | | | | | | | | | | |

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-359 03-3-4508 | 8-1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | |
|--|---------------------------------|------------|---|--------------------------|-------------------|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 359 CHECK VAI | VE-GN2 | PURGE | 77 | | | | | | |
| LEAD ANALYST: | C.D. PRUS | T | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAL | ITY F | EDUNDAN | ICY SCREE | INS | CIL | | | | | |
| HDW/FU | NC A | L | в | С | l i CM | | | | | |
| NASA [3 /1R IOA [3 /1R |] [F]] |) [] [| F] F] | [P] [P] | [X]* [X] | | | | | |
| COMPARE [/ | J C |] [|] | [] | [] | | | | | |
| RECOMMENDATIONS: | (If dif | ferent | from NAS | SA) | | | | | | |
| |] [|] [|] | [] (AI | [] DD/DELETE) | | | | | |
| * CIL RETENTION | RATIONALE: | (If ap | plicable | adequate Inadequate | [] [] | | | | | |
| REMARKS: NO DIFFERENCES. ASSEMBLY FMEA (0 | NASA/RI A 3-3-4508-1 | DDED CH | IECK VALV Ig Reeval | E TO PURGE V JUATION. | ALVE | | | | | |

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-360 03-3-4508 | NASA DATA: BASELINE [] -2 NEW [X] | | | | | | | | |
|--|---------------------------------|--|-----------------------|-----------------------|-------------|------------|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 360 ORIFICE-GI | N2 PURGE | | | | | | | | |
| LEAD ANALYST: | C.D. PRUS | D. PRUST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAL FLIGH | ITY R T | EDUNDANCY | SCREENS | | CIL ITEM | [| | | | |
| HDW/FU | NC A | В | С | | | | | | | |
| NASA [3 /3 IOA [3 /2R |] [] [P |] [] [P |] [] [P |]] | [X [|] *] | | | | |
| COMPARE [/N |] [N |] [N |] [N |] | [N |] | | | | |
| RECOMMENDATIONS: | (If dif | ferent fro | om NASA) | | | | | | | |
| [/ |] [|] [|] [|] [.] (AD | [D/DE |] LETE) | | | | |
| * CIL RETENTION | RATIONALE: | (If appl: | icable) AD INAD | EQUATE EQUATE | [[|]] | | | | |
| REMARKS: IOA AGREES WITH | NASA/RI RA | TIONALE F | OR 3/3, 1/ | 1 ABORT | CRIT | ICALI | | | | |

IOA AGREES WITH NASA/RI RATIONALE FOR 3/3, 1/1 ABORT CRITICALITY ASSIGNMENT. NASA/RI ADDED ORIFICE TO PURGE VALVE ASSEMBLY FMEA (03-3-4508-2) DURING REEVALUATION.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-361 03-3-4508 | 8-2 | NASA DATA: BASELINE [] NEW [X] | | | | | | | |
|--|---------------------------------|-----------|---|----------------------|-------------------|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 361 GN2 PURG | E VALVES | TEST PORT | | | | | | | |
| LEAD ANALYST: | C.D. PRUS | ST . | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAL | | REDUNDANC | Y SCREENS | | CIL | | | | | |
| HDW/FU | | A | В | С | 1154 | | | | | |
| NASA [3 /3 IOA [3 /2R |] [| P] [|] [P] [|] P] | [X]* [] | | | | | |
| COMPARE [/N |] [] | и] [| и] [| N] | [N] | | | | | |
| RECOMMENDATIONS: | (If di | fferent f | rom NASA) | | | | | | | |
| · [/ |] [|] [|] . [|] (AD | [] DD/DELETE) | | | | | |
| * CIL RETENTION 1 | RATIONALE | : (If app | licable) IN | ADEQUATE ADEQUATE | [] | | | | | |
| REMARKS: NASA/RI ORIGINALLY DID NOT COVER THIS ITEM (CP010) AND FAILURE MODE (EXTERNAL LEAKAGE). HOWEVER, NASA/RI ADDED THE TEST PORT TO THE PURGE VALVE FMEAS (03-3-4508). | | | | | | | | | | |

IOA AGREES WITH NASA/RI RATIONALE FOR 3/3, 1/1 ABORT CRITICALITY ASSIGNMENT.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-362 03-3-6408 | -1 | | NASA DA BASELI N | ATA: INE [] IEW [X] |
|--|---------------------------------|------------|---------|--------------------------|------------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 362 GIMBAL RI | NG | | | |
| LEAD ANALYST: | C.D. PRUS | T | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | LITY R | EDUNDANC | Y SCREE | INS | CIL ITEM |
| HDW/FU | JNC A | | В | С | |
| NASA [1 /1 IOA [1 /1 |] [] [|] [] [|]] | [] [] | [X]* [X] |
| COMPARE [/ |] [|] [|] | [] | [] |
| RECOMMENDATIONS | : (If dif | ferent f | rom NAS | SA) | |
| [/ |] [|] [|] | [] | [] (ADD/DELETE) |
| * CIL RETENTION REMARKS: NO DIFFERENCES. | RATIONALE: | (If app | licable | ≥) ADEQUA INADEQUA | re [] re [] |

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-363 03-3-64 | 09-1 | | NASA DATA: BASELINE [] NEW [X] | | | | | | | |
|--|-------------------------------|------------|----------------|---|-------------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 363 BEARING | -GIMBAL | RING | | | | | | | | |
| LEAD ANALYST: | C.D. PR | UST | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRITICAI FLIGH | JITY T | REDUNDA | NCY SCRE | ENS | CIL ITEM | | | | | | |
| HDW/FU | NC | A | в | C | | | | | | | |
| NASA [2 /1F IOA [2 /1F |] [] [| P] P] | [P] [P] | [P] [P] | [X]* [X] | | | | | | |
| COMPARE [/ | J . [|] | [] | [] | [] | | | | | | |
| RECOMMENDATIONS: | (If d | ifferent | : from NA | SA) | | | | | | | |
| [2 /1F | j (| P] | [P] | [P] (A | [] DD/DELETE) | | | | | | |
| * CIL RETENTION REMARKS: | RATIONAL | E: (If a | ıpplicabl | e) ADEQUATE INADEQUATE | [] [] | | | | | | |
| TAL DRAAMSTRA | | | | T WARD DT TT | ADJDDD MA | | | | | | |

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IOA RECOMMENDS THAT THIS ITEM AND FAILURE MODE BE UPGRADED TO A 2/1R PPP, 1/1 ABORT. THE INCREASED RCS ACTIVITY REQUIRED TO MAINTAIN VEHICLE CONTROL DURING TAL POST-MECO TWO-ENGINE OMS OPS WITH ONE ENGINE FAILED OUT OF POSITION MAY CONSUME RCS PROP NEEDED TO COMPLETE THE ABORT.

REPORT DATE 2/26/88

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| 1/01/88 OMS-364 03-3-64011 | 1 | | NASA DATA: BASELINE NEW | [] [X] | | | | | | |
|----------------------------------|---|--|--|--|--|--|--|--|--|--|
| OMS 364 GIMBAL RIN | MS 64 IMBAL RING MOUNTING PAD | | | | | | | | | |
| C.D. PRUST | D. PRUST | | | | | | | | | |
| | | | | | | | | | | |
| ITY RE | DUNDANCY | SCREEN | S | CIL ITEM | | | | | | |
| NC A | В | | с | | | | | | | |
|] [] [|] [] [|] [] [|] | [X]* [X] | | | | | | |
|] [|] [|] [|] | [] | | | | | | |
| (If diff | ferent fro | om NASA |) | | | | | | | |
|] [|] [|] [|] (AI | [] DD/DELETE) | | | | | | |
| RATIONALE: | (If appl | icable) I | ADEQUATE NADEQUATE | [] | | | | | | |
| | <pre>1/01/88 OMS-364 03-3-64011 OMS 364 GIMBAL RIN C.D. PRUST ITY RE T NC A] [] [] [] [] [(If diff] [RATIONALE:</pre> | <pre>1/01/88 OMS-364 03-3-64011-1 OMS 364 GIMBAL RING MOUNTIN C.D. PRUST ITY REDUNDANCY T NC A B] [] [] [] [</pre> | <pre>1/01/88 OMS-364 03-3-64011-1 OMS 364 GIMBAL RING MOUNTING PAD C.D. PRUST ITY REDUNDANCY SCREEN T NC A B] [] [] [] [] [] [] [] [] [] [</pre> | 1/01/88 NASA DATA: BASELINE OMS-364 BASELINE 03-3-64011-1 NEW OMS 364 GIMBAL RING MOUNTING PAD C.D. PRUST ITY REDUNDANCY SCREENS T REDUNDANCY SCREENS T I ITY REDUNDANCY SCREENS T I I I< | | | | | | |

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REPORT DATE 2/26/88

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Table.

| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-365 NASA FMEA #: 03-3-6401-1 | | | | | | | | | | | NZ 1 | ASA D. BASEL | ATA: INE NEW | [[X |] | | |
|--|---------------------|-----------|------------|-------------------|-------------------------------|--------|--------|------|------------|-----|-----------|-----------------|--------------------|----------|------------|----------|-----|
| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 365 MOT | MS 65 OTOR-GIMBAL DRIVE | | | | | | | | | | | | |
| LEAD ANA | ANALYST: C.D. PRUST | | | | | | | | | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | | | | |
| | CRI | נדו דו | ICAL | ITY r | | R | EDU | NDA | NCY | sc | REEN | 5 | | | CIL ITE | M | |
| | H | HD | W/FUI | NC | | A | | | B | • | | С | | | | - | |
| NASA IOA | [[| 3 3 | /1R /1R |] | [[| P P |]] | | (P (P |] | [[| P P |]] | | [[|]] | * |
| COMPARE | [| | / |] | נ | |] | | [|] | [| |] | | [|] | |
| RECOMMEN | DAJ | FI | ONS: | (| If d | if: | fer | ent | fr | om | NASA |) | | | | | |
| • | [| | / |] | [| |] | | [|] | [| |] | (AI | ן וס/סמ |] Ele | TE) |
| * CIL RE | TEI | NT: | ION I | RATI | ONAL | E: | (I | f aj | ppl | ica | ble) I | IA IAN |)EQUA')EQUA' | TE TE | [[|] | |
| REMARKS: | | 101 | 80 | | | | | | - | | | | | | | | |

NO DIFFERENCES.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-366 NONE | | | NASA DATA BASELINE NEW | : [] [] | | | | | |
|--|----------------------------|----------|--------------|------------------------------|----------------|-----|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 366 MOTOR-G | IMBAL DI | RIVE | | | | | | | |
| LEAD ANALYST: | C.D. PR | UST | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAL | LITY | REDUNDA | ANCY SCREE | ens | CIL ITEM | | | | | |
| HDW/F | INC | A | В | С | | | | | | |
| NASA [/ IOA [3 /1] |] [2] [|] P] | [] [P] | [] [P] | [] | * | | | | |
| COMPARE [N /N |] [| ן א | [И] | [И] | [] | | | | | |
| RECOMMENDATIONS | (If d | ifferent | t from NAS | SA) | | | | | | |
| [3 /1] | ۶] [| P] | [P] | [P] (A | [] DD/DELE | TE) | | | | |
| * CIL RETENTION | RATIONAL | E: (If a | applicable | e) ADEQUATE INADEQUATE | [] | | | | | |
| REMARKS: NASA/RI DO NOT COVER THIS FAILURE MODE (ERRONEOUS/ERRATIC OPERATION). | | | | | | | | | | |

IOA RECOMMENDS THAT THIS FAILURE MODE BE ADDED TO 03-3-6401-1 AND THAT "MOTOR SYNCHRO ARMATURE ROTATION" BE ADDED AS A CAUSE. THE FAILURE HISTORY OF THIS ITEM INCLUDES THIS FAILURE MODE AND THIS CAUSE. THE SSM AGREED WITH THE IOA ISSUE.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-367 03-3-64 | 02-2 | | NASA <u>DATA:</u> BASELINE [] NEW [X] | | | | | | | |
|--|-------------------------------|---------------------|------------------------|--|-------------------------|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 367 ACME SC | REW/NUT | TUBE | ·. | | | | | | | |
| LEAD ANALYST: | C.D. PR | JST | - | , | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRITICAL | ITY | REDUNDA | NCY SCREI | ENS | CIL | | | | | | |
| HDW/FU | NC | A | В | с | TIEM | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [| P] P] | [P] [P] | [P] [P] | [X]* [X] | | | | | | |
| COMPARE [/ |] [|] | [] | [] | []] | | | | | | |
| RECOMMENDATIONS: | (If d | ifferent | from NAS | SA) | | | | | | | |
| [2 /1R |] [| P] | [P] | [P] (A | [] DD/DELETE) | | | | | | |
| * CIL RETENTION | RATIONAL | E: (If a | pplicable | e) ADEQUATE INADEQUATE | [] | | | | | | |
| REMARKS: IOA RECOMMENDS T 2/1R PPP, 1/1 AB | HAT THIS ORT. TH | ITEM AN E INCREA | D FAILURI SED RCS 2 | E MODE BE UP ACTIVITY REQU | GRADED TO A UIRED TO | | | | | | |
| MAINTAIN VEHICLE WITH ONE ENGINE | FAILED O | JURING JT OF PO | SITION MA | AY CONSUME R | CS PROP | | | | | | |

NEEDED TO COMPLETE THE ABORT. 03-3-6402-2 COVERS THE "GIMBAL OUTPUT DRIVE ASSEMBLY". IOA ALSO RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

REPORT DATE 2/26/88

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NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-368 NEW [X] 03-3-6402-1 NASA FMEA #: OMS SUBSYSTEM: 368 MDAC ID: ACME SCREW/NUT TUBE ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT C В HDW/FUNC Α [X] * NASA [1/1] [] [] [] [P] [P] [P] [X] IOA $\begin{bmatrix} 2 / 1R \end{bmatrix}$ COMPARE [N/N] [N] [N] [N][] **RECOMMENDATIONS:** (If different from NASA) [٦ (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE Ι INADEQUATE [1 **REMARKS:** IOA AGREES WITH NASA/RI RATIONALE FOR 1/1 CRIT ASSIGNMENT. 03-3-6402-1 COVERS THE "GIMBAL OUTPUT DRIVE ASSEMBLY". THE SSM REVISED THE EFFECTS PER IOA ISSUE.

IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-369 NONE | | | NASA I BASEI | DATA: LINE NEW | [|] |
|--|----------------------------|------------|--------------------|-------------------------|----------------------|----------------|----------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 369 REDUCTION | GEAR | | | | | |
| LEAD ANALYST: | C.D. PRUST | r | | | | | |
| ASSESSMENT: | | · | | | | | |
| CRITICAL | ITY RI | EDUNDANC | CY SCREE | INS | | CIL | |
| HDW/FU | NC A | | В | с | | 1154 | |
| NASA [/ IOA [3 /1R |] [] [P |] [] [|] P] | [] [P] | | [] | * |
| COMPARE [N /N |] [N |] [· | N] | [N] | | [] | |
| RECOMMENDATIONS: | (If dif: | ferent f | rom NAS | A) | | | |
| [3 /1R |] [P |] [| P] | [P] | (AD | [] D/DEI | LETE) |
| * CIL RETENTION 1 | RATIONALE: | (If app | olicable |) ADEQUA INADEQUA | ATE ATE | [] [] | |
| REMARKS: NASA/RI DO NOT CO IOA RECOMMENDS TI | OVER THIS | TEM OR | FAILURE FAILURE | MODE (1 MODE BI | SINDII E ADDI | NG/JI RESSI | AMMING). |

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IOA RECOMMENDS THAT THIS ITEM OR FAILURE MODE (BINDING/JAMMING IOA RECOMMENDS THAT THIS ITEM AND FAILURE MODE BE ADDRESSED ON THE FMEA/CIL. THE REDUCTION GEAR IS A MOVING, LOAD-BEARING COMPONENT WHOSE FAILURE WOULD RESULT IN THE LOSS OF A CHANNEL.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-370 NONE | | | | | | | NA E | ASA I BASEI | DATA: LINE NEW | : [[|]] |
|--|----------------------------|-----|-------|--------|-----------|--------|----------|-----------|----------------|----------------------|-------------|-------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 370 REDUCTIO | ON | GEAR | | | | | | | | | |
| LEAD ANALYST: | C.D. PR | บรา | 2 | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | |
| CRITICAL | JTY T | RI | EDUND | ANC | CY | SCREE | ENS | 5 | | | CIL ITEI | M |
| HDW/FU | NC | A | | | В | | | С | | | | |
| NASA [/ IOA [3 /1R |] [;] [| P |] | [[| Ρ |]] | [[| P |]] | | [[|] *] |
| COMPARE [N /N |] [| N |] | [| N |] | [| N |] | | [|] |
| RECOMMENDATIONS: | (If d | if: | feren | ti | fro | om NAS | SA |) | | | | |
| [3 /1F | 2] [| P |] | [| P |] | [| P |] | (Al | [נס/סס |] ELETE) |
| * CIL RETENTION | RATIONAL | E: | (If | apj | 91 | lcable | ≥) II | AI NAI | DEQU DEQU | ATE ATE | [[|] |
| REMARKS: NASA/RI DO NOT (FAILURE). | OVER THI | S I | ITEM | OR | FZ | AILURI | 2 J | NOI | DE (| STRU | CTUR | AL |
| IOA RECOMMENDS 7 | HAT THIS | _I' | FEM A | ND | F2 | AILURI | E 1 | MOI | DE B | | DRES | SED ON |

THE FMEA/CIL. THE REDUCTION GEAR IS A MOVING, LOAD-BEARING COMPONENT WHOSE FAILURE WOULD RESULT IN THE LOSS OF A CHANNEL.

REPORT DATE 2/26/88

| ASSESSMEN ASSESSMEN NASA FMEN | -1 | | | | | | N2 I | ASA BAS | DATA ELINI NEV | A: 5 [▼ [] |] x] | | | | | | |
|-------------------------------------|------------|---------------|----------------------------|--------|--------|--------|---------|------------|----------------------|--------------------|------------|-----------|--------|--------------|------------|----------|------|
| SUBSYSTEM MDAC ID: ITEM: | 1: | | OMS 371 ANTIE | BACH | ĸ | DEV | ICE | | | | | | | | | | |
| LEAD ANAL | LYST | : | C.D. | PRU | JSI | Г | | | | | | | | | | | |
| ASSESSMEN | IT: | | | | | | | | | | | | | | | | |
| (| CRIT | ICAL | LTY F | | RI | EDUI | NDA | NC | Y | SCI | REENS | з С | | | CI IT | L EM | |
| | nD | w /r01 | | | А | | | | D | | | C | | | | | |
| NASA IOA | [3 [3 | /1R /1R |]] | [[| P P |]] | | [| P P |]] | [[| P P |]] | | [[|] | * |
| COMPARE | [| / |] | ĺ | |] | | [| |] | ۵ | |] | | [|] | |
| RECOMMENI | DATI | ons: | (If | di | ff | fere | ent | f | ro | m ł | IASA) | | | | 1 Q. | | |
| | [| / |] | [| |] | | [| |] | [| |] | (2 | [.DD/1 |] DEL | ETE) |
| * CIL RET | CENT: | ION P | RATION | ALE | : | (1: | f aj | pp: | li | cat | ole) IN | AI IAI | DEQ | UATE UATE | [[|] | |
| NO DIFFEI | RENC | ES. | s de la secono Companya | -7. | | · •. | | ź.s | | ÷., | | | | · · · · · | . zere | : | |

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REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-372 NONE | | | | | | | NA B | SA DAT BASELIN NE | A: E W | [[|]] | |
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| SUBSYSTEM: MDAC ID: ITEM: | OMS 372 ANTIBAC | KC | EVICE | 2 | | | | | | | | | |
| LEAD ANALYST: | C.D. PR | USI | ! | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITICAL FLIGH HDW/FU | ITY T NC | RE A | DUND | AN (| CY B | SCREE | INS | c | | | CIL ITEN | 4 | |
| NASA [/ IOA [3 /1R |] [] [| P |] | [[| P |] | [| P |] | | [[|] | * |
| COMPARE [N /N |] [| N |] | ٢ | N |] | [| N |] | | [|] | |
| RECOMMENDATIONS: | (If d | iff | erent | t 1 | fro | om NAS | SA) | | | | | | |
| [3 /1R |] [| P |] | [| P |] | [| P |] (| AI | [ס/סמ |] ELF | ETE) |
| * CIL RETENTION | RATIONAL | E: | (If a | apj | pl i | icable |) IN | AE IAE | DEQUATE DEQUATE |] | [[|]] | |
| REMARKS: NASA/RI DO NOT C UNUSED CHANNEL). IOA RECOMMENDS T FMEA/CIL. A STR ROTATION OF THE CHANNEL. | OVER THI HAT THIS UCTURAL UNUSED C | s i Fa Fai Han | FAILUR AILURI ILURE NNEL N | RE E I CJ WOI | | DDE (1 DE BE SING 7 D RESU | IA AI CHE JLJ | | 5 TO ST RESSED INABILI IN THE | OF OF TY LC | PROT | raj E Sj Of | LION LOP ONE |

THE SSM AGREED THAT "STRUCTURAL FAILURE" SHOULD BE ADDED AS A CAUSE ON 03-3-6403-1. SEE ASSESSMENT SHEET OMS-373.

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REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | 01/8 S-37 NE | 38 73 | | | | | | | | | N <i>F</i> E | ASA D BASEL | ATA: INE NEW | ; [[| |]] | | | | | | | |
|----------------------------------|--------------------|--------------|---------|-------------|----------------|----------------|-------------|-----|--------|--------|-----------------|----------------|--------------------|-------------|--------|--------|--------------|------|----------|---------|----------------|----------|----|
| SUBSYSTE MDAC ID: ITEM: | M: | | | | 0M 37 AN | S 3 TIB/ | ACI | ĸı | DEV | ICE | 1 | | | | | | | | | | | | |
| LEAD ANA | LYS | 5 T : | : | | c. | D. 1 | PRI | JSI | C | | | | | | | | | | | | | | |
| ASSESSME | INT | : | | | | | | | | | | | | | | | | | | | | | |
| | CRI | [T] | IC | AL] | TY | | | RI | EDUI | NDA | NC | CY | sci | REE | NS | 5 | | | CI | L | | | |
| | F | FI IDV | W/I | SH'I FUN | 1C | | | A | | | | в | | | | С | | | Τ.1 | EM | | | |
| NASA IOA | [[| 2 | / /1 | LR |]] | | [[| P |]] | | [[| P |]] | | [[| P |] | | [[| x | י [[| * | |
| COMPARE | Γ | N | /1 | 1 |] | | [| N |] | | [| N |] | | [| N |] | | [| N |] | | |
| RECOMMEN | IDAJ | | ONS | 5: | | (If | d | if | fer | ent | 1 | îrc | n l | NÁS. | A) | | | | | | | | |
| | נ | 2 | /1 | LŔ |] | | [| P |] | | [| Ρ |] | | [| P |] | (A[|] /0(| A DE |] LET | TE) | |
| * CIL RE | TEN | 1 T] | ION | I F | ۱TAS | ION | \L I | Ξ: | (I | fa | p | pli | .cal | ble |) | | | | - | | - | | |
| | | | | | | | | | | | | | | | IN | | EQUA EQUA | TE | L [| |] | | |
| REMARKS: NASA/RI | DO | NC | от | cc | VE. | R TH | IIS | 5 I | TAI | LUR | E | MC | DE | (S' | TF | UC | TURA | L FA | Î | ŪR | E) ; | . | |
| IOA RECO | MMI | ENI | DS | TF | IAT | TH | [S | FZ | /IL | JRE | ŀ | 10[|)E] | BE | AC | DF | RESSE | D ON | ΓŢ | ΉĒ | ÷ • • | | |
| FMEA/CIL | ' MJ | [T] | HA | 1 2 | !/1] | R PI | 2P | ,] | l/1 | AB | OF | TS. | CR: | IT. | | A | STRU | CTUF | LAS | , F. | AII | LUR | E |
| OF THE A | UT. | [-] | BAC | CK | DE | VICE | 5 (| | JSII | NG | TF | 1E | | ABI | LI | TY. | | TRAN | ISM | TL | _TC ≣ | JRQ | JE |
| AND STOP | <u>K</u> | 27.5 | 9.T. 1 | LOV | | r Th | 15 | Ur | 1021 | ςυ | <u> </u> | IAU | | | AU | SE | | 33 (| 11 | TU. | С ^с | | |

AND STOP ROTATION OF THE UNUSED CHANNEL CAUSES LOSS OF THE ACTUATOR AND LOSS OF TVC FOR ONE ENGINE. THE INCREASED RCS ACTIVITY REQUIRED TO MAINTAIN VEHICLE CONTROL DURING TAL POST-MECO TWO-ENGINE OMS OPS WITH ONE ENGINE FAILED OUT OF POSITION MAY CONSUME RCS PROP NEEDED TO COMPLETE THE ABORT. THE SSM AGREED THAT "STRUCTURAL FAILURE" SHOULD BE ADDED AS A FAILURE MODE ON 03-3-6403-1, HOWEVER THIS IS A 3/1R PPP. - 1

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REPORT DATE 2/26/88

| ASSESSMENT DATE: 1/01/ ASSESSMENT ID: OMS-3 NASA FMEA #: NONE SUBSYSTEM: OMS | | | | | | | | | | | | | NZ H | ASA BASE | DATA LINE NEW | י [[|]] | |
|---|--------|-----|----------|----------------|------------------|--------|-----|--------|-----------------|-----|-----|------------|---------|-------------|---------------------|------------------|----------|-----|
| SUBSYSTEM MDAC ID: ITEM: | : | | | OM 37 BE | IS 4 CARIN | G- | -G] | MBAI | L T | HRU | JST | DRIV | νE | | | | | |
| LEAD ANAL | YS | T | : | c. | D. P | RL | JSJ | ? | | | | | | | | | | |
| ASSESSMEN | т: | | | | | | | | | | | | | | | | | |
| с | RI | T | [CAL] | [T] | ſ | | RI | DUNE |)AN | CY | sc | REENS | 5 | | | CIL | M | |
| | н | | V/FUI | | | | A | | | В | | | С | | | | | |
| NASA IOA | [[| 3 | / /1R |]] | | [[| P |]] | [[| P |] | ((| P |] | | [[|]] | * |
| COMPARE | [| N | /N |] | | [| N |] | [| N |] | [| N |] | | [|] | |
| RECOMMEND | AT | 'IC | ons: | | (If | di | lfi | erer | nt _. | fr | mc | NASA |) | | | | | |
| | נ | 2 | /1R |] | | [| P |] | [| P |] | [| P |] | (Al | [A]]D/D |] Elf | TE) |
| * CIL RET | EN | TT: | ION | RAJ | TIONA | LI | Ξ: | (If | ap | pl. | ica | able) I | A NA | DEQU | JATE JATE | [[|]] | |
| REMARKS: NASA/RI D | ю | N | OT CO | OVI | ER TH | IS | 5_1 | TAILU | JRE | M | DDE | (ST) | RU | CTUR | AL F | | RE) | • |

NASA/RI DO NOT COVER THIS FAILURE MODE (STRUCTURAL FAILURE). IOA RECOMMENDS THAT THIS FAILURE MODE BE ADDRESSED ON THE FMEA/CIL WITH A 2/1R PPP, 1/1 ABORT CRITICALITY. A STRUCTURAL FAILURE OF THIS BEARING COULD CAUSE LOSS OF THE ACTUATOR DUE TO BINDING OF THE GIMBAL DRIVE OR LOSS OF MESHING BETWEEN THE GIMBAL DRIVE AND ONE CHANNEL. THE INCREASED RCS ACTIVITY REQUIRED TO MAINTAIN VEHICLE CONTROL DURING TAL POST-MECO TWO-ENGINE OMS OPS WITH ONE ENGINE FAILED OUT OF POSITION MAY CONSUME RCS PROP NEEDED TO COMPLETE THE ABORT.

REPORT DATE 2/26/88

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| ASSES ASSES NASA | SSMEI SSMEI FME | NT NT A # | DA ID | ATE:): | 1/ OM 03 | 01/8 S-37 -3-6 | 88 75 54(|)4- | -1 | | | | | NZ I | ASA I BASEI | DATA: LINE NEW | : [[X |] | | |
|------------------------|------------------------|------------------|------------------|----------------------|-------------------|----------------------|-----------------|-----------|-------------|-------------|-------------|----------|----------------|-----------|----------------|----------------------|---------------|----------|--------|-------------|
| SUBSY MDAC ITEM | YSTEN ID: : | M: | | | OM 37 BE | S 5 ARIN | IG- | -G] | MBA | L TH | IRU | JST | DRI | VE | | | • | | | |
| LEAD | ANA | LYS | ;T: | | c. | D. I | PRI | JSI | 2 | | | | | | | | | | | |
| ASSES | SSMEI | ŅT: | ŕ | | | | | | | | | | | | | | | | | |
| | (| CRI H | TI FI IDW | CAL IGH | ETY F IC | | | RE A | EDUN | DANG | CY B | SC | REEN | s c | | | CIL ITE | м | | |
| NZ | ASA IOA | [[| 3 3 | /1R /1R |] | | ((| P P |]] | [[| P P |]] | [[| P P |]] | | [[|] | * | |
| COMP | ARE | [| | / |] | | [| |] | [| |] | [| |] | | [|] | | |
| RECO | MENI | DAT | 10 | NS: | | (Ìf | đi | lff | ere | nt i | fro | om I | NASA |) | - | | | <u></u> | | |
| | • | [| | / |] | | [| |] | [| |] | [| |] | (AI | [DD/D |] ELE | TE | :) |
| * CI | L RES | ren | ITI | ON I | TAS | ION | LI | 3: | (If | apı | 91 j | lca | ble) Il | IA IAI | DEQUA | ATE ATE | [[|] | | |
| THE I ACCOU | FUNC JNT 1 THRUS | FIC FOF ST |)NA { T BE | L DI HE S ARII | ESC SEC NGS | RIPI ONDA | R | ON (Î | AND DRIV | QUZ E GI | AN'I EAF | RIT B | Y NEI EARII | ED NGS | TO E 5, WF | BE CO | ORRE THE | CTE | D M | TO SAYS |
| | | | | | | | | - | | | | | | | ,- | | | | | |
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REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-376 03-3-64 | 02-2 | | NASA DATA BASELINE NEW | : [] [X] |
|---|--|---|--|---|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 376 BEARING | -SPHERIC | AL ROD EN | D | |
| LEAD ANALYST: | C.D. PR | UST | | | |
| ASSESSMENT: | | | | - | |
| CRITICAL | ITY | REDUNDAN | ICY SCREE | NS | CIL |
| HDW/FU | NC | A | В | С | * * *** |
| NASA [2/1R IOA [2/1R |] [] [| P] | P] P] | [P] [P] | [X]* [X] |
| COMPARE [/ |] [|] |] | [] | [] |
| RECOMMENDATIONS: | (If d | ifferent | from NAS | A) | |
| [2 /1R | J . [| P] | [P] | [P] (A | [] DD/DELETE) |
| * CIL RETENTION | RATIONAL | E: (If a <u>r</u> | pplicable |) ADEQUATE INADEQUATE | [] |
| REMARKS: IOA RECOMMENDS T 2/1R PPP, 1/1 AB MAINTAIN VEHICLE WITH ONE ENGINE NEEDED TO COMPLE | HAT THIS ORT. TH CONTROL FAILED O TE THE A | ITEM ANI E INCREAS DURING 7 UT OF POS BORT. | D FAILURE SED RCS A TAL POST- SITION MA | MODE BE UP CTIVITY REQ MECO TWO-EN Y CONSUME R | GRADED TO A UIRED TO GINE OMS OPS CS PROP |

03-3-6402-2 COVERS THE "GIMBAL OUTPUT DRIVE ASSEMBLY". IOA ALSO RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

ASSESSMENT ID: 0MS-377 NASA FMF2 #-NASA DATA: BASELINE [1 NEW [X] NASA FMEA #: 03-3-6402-1 SUBSYSTEM: OMS 377 MDAC BEARING-SPHERICAL ROD END ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CILITEM FLIGHT A B C HDW/FUNC [X] * NASA [1/1] [] [] [] IOA [2/1R] [P] [P] [P] [X] COMPARE [N/N] [N] [N] [N][] RECOMMENDATIONS: (If different from NASA) [] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [1 **REMARKS:** IOA AGREES WITH NASA/RI RATIONALE FOR 1/1 CRIT ASSIGNMENT. 03-3-6402-1 COVERS THE "GIMBAL OUTPUT DRIVE ASSEMBLY". THE SSM REVISED THE EFFECTS PER IOA ISSUE. IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

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REPORT DATE 2/26/88

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ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-378 NASA FMEA #: 03-3-6406-1 NASA DATA: BASELINE [] NEW [X]

SUBSYSTEM:OMSMDAC ID:378ITEM:MECHANICAL STOP-SNUBBER

LEAD ANALYST: C.D. PRUST

ASSESSMENT:

| | CRITICALITY FLIGHT | | | | | | EDUN | DAN | CY | SCF | REEN | S | | С] тч | L CEN | r | | |
|-------------|-----------------------|--------|-----------|----|--------|---------|---------|--------|---------|---------|--------|---------|---------|----------|----------|---|---|--|
| | F | HD | N/FUI | NC | | A | | | В | | | С | | | | | | |
| NASA IOA | [[| 3 2 | /3 /1R |] | [[| NZ P | 4]] | ן נ | N/ P | A]] | [[| NZ P | A]] | [[| x |] | * | |
| COMPARE | [| N | /N |] | [| N |] | [| N |] | [| N |] | [| N |] | | |

RECOMMENDATIONS: (If different from NASA)

[2/1R] [P] [P] [P] [A] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [] INADEQUATE []

REMARKS:

SSM STATES THAT CRIT WAS DOWNGRADED FROM 2/1R TO 3/3 AS A RESULT OF A REVIEW WITH THE VENDOR. IOA RECOMMENDS THAT THIS ITEM AND FAILURE MODE BE UPGRADED TO A 2/1R PPP, 1/1 ABORT AND PLACED ON THE CIL.

IOA MAINTAINS CONCERN THAT THE WORST CASE EFFECT OF A SNUBBER FAILURE COULD BE BINDING OR JAMMING OF THE GIMBAL OUTPUT DRIVE ASSEMBLY OR INCORRECT TVC RESULTING IN LOSS OF THE AFFECTED ENGINE. THE INCREASED RCS ACTIVITY REQUIRED TO MAINTAIN VEHICLE CONTROL DURING TAL POST-MECO TWO-ENGINE OMS OPS WITH ONE ENGINE FAILED OUT OF POSITION MAY CONSUME RCS PROP NEEDED TO COMPLETE THE ABORT.

REDUNDANCY SCREENS SHOULD BE BLANK PER NSTS 22206.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-379 03-3-6402-2 | | NASA D BASEL | ATA: INE [] NEW [X] |
|---|--|---|---|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 379 BEARING-NUT T | UBE/OUTPU | IT SHAFT | |
| LEAD ANALYST: | C.D. PRUST | | | |
| ASSESSMENT: | | | | |
| CRITICAL FLIGH HDW/FU | ITY REDUN T NC A | DANCY SCH B | REENS C | CIL ITEM |
| NASA [2 /1R |] [P] | - [P] | [P] | []* |
| IOA [3 /1R |] [P] | [P] | [P] | [] |
| COMPARE [N / |] [] | [] | [] | [] |
| RECOMMENDATIONS: | (If differen | nt from N | IASA) | |
| [2 /1R |] [P] | [P] | [P] | [] (ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (If | applicat | ole) ADEQUA INADEQUA | TE [] TE [] |
| REMARKS: IOA RECOMMENDS A BEARINGS, WHICH SURROUNDING TUBU TO MAINTAIN VEHI OPS WITH ONE ENG NEEDED TO COMPLE THIS ITEM AND FA INCLUDED ON 03-3 ASSEMBLY". IOA RECOMMENDS T SEPARATED ONTO I THE FAILURES POS | 2/1R PPP, 1/1 ALLOW THE DRIVI LAR HOUSING. 2 CLE CONTROL DUI INE FAILED OUT TE THE ABORT. ILURE MODE (BII -6402-2, WHICH HAT THE COMPONI NDIVIDUAL FMEAS SIBLE IN THE AS | ABORT FO E SHAFT 1 THE INCRE RING TAL OF POSIT NDING/JAM COVERS 1 ENTS INCI S TO PROV SSEMBLY. | OR BINDING/ TO ROTATE W CASED RCS A POST-MECO TION MAY CO MING) ARE THE "GIMBAL LUDED ON TH VIDE BETTER | JAMMING OF THESE ITHIN THE CTIVITY REQUIRED IWO-ENGINE OMS NSUME RCS PROP APPARENTLY OUTPUT DRIVE IS FMEA BE INSIGHT INTO |

REPORT DATE 2/26/88

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| LEAD ANAL | LYS | ST: | : | c. | D. F | PRI | JSI | ſ | | | | | | | | | | | |
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| NASA IOA | [[| 3 | / /1R |]] | | [[| P |]] | | [[| P |] | [[| P |] | | ((|] | * |
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| * CIL RE | ren | 1 T] | ION 1 | RAJ | TONA | L | E: | (1: | fa | pp | 1 i | cabl | ∍) I] | IA IAN | DEQ DEQ | UATE UATE | [ſ |] | |
| REMARKS: | | | | | | | | | | | | | | | ~ | | | • | |

IOA RECOMMENDS THAT "STRUCTURAL FAILURE" OF THESE BEARINGS (BETWEEN THE DRIVE SHAFT AND THE SURROUNDING TUBULAR HOUSING) BE ADDED AS A CAUSE ON 03-3-6402-2 (GIMBAL OUTPUT DRIVE ASSEMBLY, BINDING JAMMING). SUCH A FAILURE WOULD CAUSE BINDING OF THESE BEARINGS, AND LOSS OF THE ACTUATOR. SEE ASSESSMENT SHEET OMS-379.

REPORT DATE 2/26/88

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| ASSESS ASSESS NASA F | MEN MEN MEA | ΙΤ ΙΤ \ \ # | DA II : | ATE: | 1/01/ OMS-3 03-3- | 88 81 6402 | -1 | | | N 2 1 | ASA I BASEI | DATA LINE NEW |]]] | X |]] | | |
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REPORT DATE 2/26/88

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| SUBSYSTE MDAC ID: ITEM: | :M: | | OMS 382 GIM | BAL 2 | ACI | TUAT | OR CO | NTRO | LLER | | | | | |
| LEAD ANA | LYS | T: | C.D | . PR | USI | C | | | | | | | | |
| ASSESSME | ENT: | | | | | | | | | | | | | |
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| NASA IOA | [| 3 /1R 3 /1R |] | [[| P P |]] | [] [] | 9] 9] | [[| P] P] | | [[|] *] | |
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NO DIFFERENCES.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-383 NASA FMEA #: 03-3-6407 SUBSYSTEM: OMS | | | | | | | | | | | | | NZ I | ASA Basi | DATA ELINE NEW | : [] |] X] | |
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| SUBSYSTE MDAC ID: ITEM: | ruat | OR | C | SN | ITROL | LEI | 2 | | | | | | | | | | | | |
| LEAD ANALYST: C.D. PRUS | | | | | | | | | | | | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | | | | | | |
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| * CIL RE | TE | NT: | ION | RAT | IONZ | L | E : | (If | i aj | pp: | Li | .cabl | e) Il | AI JAI | DEQU | JATE JATE | [r |] | |
| REMARKS: NO DIFFE | REI | NC | ES. | | | | | | | | • | | | | | | L | ŗ | |

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ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [OMS-20001X] ASSESSMENT ID: NEW [1 NONE NASA FMEA #: SUBSYSTEM: OMS 20001 MDAC ID: ITEM: GN2 FILTER C.D. PRUST LEAD ANALYST: ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT В C HDW/FUNC Α] * [] [F] [] [] [P] [P] NASA Γ [2 /1R] ſ 1 IOA ſ 1 COMPARE [N /N] RECOMMENDATIONS: (If different from NASA) [1 [(ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [1 **REMARKS:**

IOA DID NOT COVER THIS FAILURE MODE IN THE ORIGINAL ANALYSIS. NASA/RI DELETED THE FMEA FOR THIS GN2 FILTER (03-3-4504-2) PER IOA ISSUE. THE GN2 FILTER IS A SUBASSEMBLY COMPONENT AND IS ADEQUATELY COVERED UNDER THE ANALYSIS OF THE GN2 REGULATOR.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-2000 NONE | 02X | | NASA DATA: BASELINE [] NEW [] | | | | | | |
|--|-----------------------------|-----------|-----------------------|---------------------------------------|--------------------|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: ATTACHMENT | OMS 20002 GIMBAL F | RING BEA | RING, GIN | IBAL RING/MO | UNTING PAD | | | | | |
| LEAD ANALYST: | C.D. PRU | UST | | | | | | | | |
| ASSESSMENT: | | | | • | | | | | | |
| CRITICAL FLIGHT | CTY F | REDUNDA | NCY SCREE | ENS | CIL ITEM | | | | | |
| HDW/FUI | YC | A | В | C | | | | | | |
| NASA [/ IOA [1 /1 |] [] [|] | [] [] | [] | [] * [X] | | | | | |
| COMPARE [N /N |] [| ן א | [N] | [И] | [N] | | | | | |
| RECOMMENDATIONS: | (If di | ifferent | from NAS | SA) | | | | | | |
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| * CIL RETENTION P | RATIONALE | E: (If a) | pplicable |) ADEQUATE INADEQUATE | | | | | | |
| REMARKS: | | | | | | | | | | |
| CIMBAL RING BEAR | (ZE THIS | FAILURE | MODE (SI TNAL ANAT | YSTS. NASA | /RI DO NOT | | | | | |
| CURRENTLY ADDRESS | 5 THIS FA | AILURE M | ODE ON TH | HE FMEA/CIL | (BINDING OF | | | | | |
| THIS BEARING IS C | COVERED C | ON 03-3- | 6409-1). | - - | - | | | | | |
| IOA RECOMMENDS TH | IAT A NEW | N 1/1 FM | EA BE GEN | IERATED FOR | THIS ITEM AND | | | | | |
| IN DISATTACHMENT | BETWEEN | THE ENG | INE AND G | INBAL RING | OR GIMBAL | | | | | |

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IN DISATTACHMENT BETWEEN THE ENGINE AND GIMBAL RING OR GIMBAL RING AND VEHICLE, RESULTING IN LOSS OF ENGINE RESTRAINT AND POSSIBLE VEHICLE DAMAGE OR PROP LINE BREAKAGE.

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| ASSESSMEN ASSESSMEN NASA FMEN | NT D. NT I A #: | ATE: D: | 1/01/8 OMS-20 03-3-4 | 38 00032 1001- | K - 3 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | |
|-------------------------------------|-----------------------|----------------|----------------------------|----------------------|----------|---|--------|----------------------|---------------|-------------|-------------|--|--|--|--|
| SUBSYSTEM MDAC ID: ITEM: | 1: | | OMS 20003 PINIO | I GEA | AR AN | D DR | IVE AS | SEMBLY | | | | | | | |
| LEAD ANA | LYST | : | C.D. 1 | PRUST | r | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | | |
| (| CRIT F | ICALI LIGHT | LTY P | RI | EDUND | ANCY | SCREI | ENS | | CIL ITEN | М | | | | |
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| NASA IOA | [2 [2 | /1R /1R |]] | [P [P |] | [F [P |]] | [P] [P] | | [X [X |] *] | | | | |
| COMPARE | [| / |] | [|] | [N |] | [·] | | [|] | | | | |
| RECOMMEN | DATI | ONS: | (If | dif | feren | t fr | om NAS | SA) | | | | | | | |
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| * CIL RE | FENT | I NOI | RATION | ALE: | (If | appl | icable | ≥) ADEQ INADEQ | UATE QUATE | [[|]] | | | | |
| REMARKS : | | | | | | | | | | | | | | | |

NASA/RI ORIGINALLY DID NOT COVER THIS FAILURE MODE (DELAYED OPERATION). HOWEVER, NASA/RI NOW ADDRESS THIS FAILURE MODE ON 03-3-4001-3. IOA ACCEPTS NASA/RI FAILURE OF B SCREEN. IOA RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURES POSSIBLE IN THE ASSEMBLY.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-200042 03-3-1009 | X -4 | | NASA DATA BASELINE NEW | .: · · · · : [7 [|]]] |
|--|------------------------------------|------------|----------------|------------------------------|--------------------------|-------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 20004 VALVE - PI | RESSURE | RELIEF A | SSEMBLY | | - |
| LEAD ANALYST: | C.D. PRUS | r | | | | |
| ASSESSMENT: | | | | | | |
| CRITICAL | ITY R | EDUNDAN | CY SCREEN | S | CIL TTEM | |
| HDW/FU | NC A | | В | C | 1110M | |
| NASA [3 /1R IOA [3 /1R |] [P] [P |] [] [| NA] [NA] [| P] P] | [[|] *] |
| COMPARE [/ |] [|] [| ·] [|] | [|] |
| RECOMMENDATIONS: | (If dif: | ferent | from NASA | .) | | |
| [/ |] [|] [|] [|] (A | [\DD/DE |] LETE) |
| * CIL RETENTION | RATIONALE: | (If ap | plicable) I | ADEQUATE NADEQUATE |] |]. |
| IOA AND NASA/RI | DRIGINALLY | DID NO | T COVER T | HIS FAILUR | E MOD | E |

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(RESTRICTED FLOW). HOWEVER, NASA/RI AGREED TO ADD THIS FAILURE MODE TO 03-3-1009-4, PER IOA ISSUE.

REPORT DATE 2/26/88

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| ASSESSM | ENT | : | | | | | | | | | | | | |
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| RECOMME | NDA' | FI (| ONS: | ; 1 | (If dif | fere | ent fr | om N | IASA) | | | | | |
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ADEQUATE [] INADEQUATE []

REMARKS:

IOA DID NOT COVER THIS FAILURE MODE (RESTRICTED FLOW) IN THE ORIGINAL ANALYSIS. NASA/RI DO NOT CURRENTLY ADDRESS THIS FAILURE MODE. IOA RECOMMENDS THAT THIS FAILURE MODE BE ADDRESSED ON A NEW 1/1 FMEA. THIS FAILURE COULD RESULT IN STRUCTURAL FAILURE OF THE BIPROP VALVE HOUSING AND LEAKAGE OF PROP. THE BIPROP VALVE HOUSING COULD FAIL BEFORE THE BALL VALVE SEALS FAIL AND RELIEVE PRESSURE. SEE ASSESSMENT SHEET OMS-262. IOA CONSIDERS RESTRICTED FLOW TO BE A CREDIBLE FAILURE MODE FOR ALL COMPONENTS WITH INTEGRAL FILTERS.

REPORT DATE 2/26/88

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| ASSESSMI | ENT | : | | | | | | | | | | | | | | | | | | |
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| COMPARE | Ĩ | | / |] | | [| |] | [| N |] | [| |] | | [| |] | | |
| RECOMMEN | NDA | TI | ons: | | (If | dj | lff | ere | nt : | fro | om | NASA |) | | | | | | | |
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| * CIL R | ETE | NT | ION | RAT | IONA | LE | 2: | (If | apı | 91 : | ica | uble) Il | IA IAI | DEQU DEQU | JATE JATE | [[| |] | | |
| REMARKS NASA/RI TRAVEL) 4001-3. IOA RECO FMEA BE INTO THU | OR I OMM SE E F | IG HO OA EN PA | INAI WEVE ACC DS I RATE LURE | LY R, EPT HAT D O S P | DID NASA S NA THE NTO OSSI | NC A/F ASA E S IN BI | OT RI A/F SUE IDI LE | COV NOW I F SASS VID | ER 1 ADI AILU EMBI UAL THE | THI ORI JRI LY FN AS | IS ESS CC IEA ESE | FAILU THIS OF B S OMPONI AS TO CMBLY | JRI 5 1 5CI ENT PI | e Mo Faii Reen Is I Rovi | DDE (F LURE M J. INCLUE IDE BE | AII IODI DED TTT | LS CO ER | М ИО И | ID- 03 THI NSI | -3- S GHT |
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REPORT DATE 2/26/88

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| | H | IDV | V/FUI | NC | | | A | | | В | | | С | | | | ** | | • | |
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| COMPARE | · [| | / |] | | Γ | |] | [| |] | [| |] | | | [| |] | |
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| REMARKS: | | | | | | | | | | | | | | | | | Ľ | | • | |

IOA RECOMMENDS THAT THE QUANTITY AND FUNCTION DESCRIPTION BE CORRECTED TO INCLUDE THE BEARINGS ON EITHER SIDE OF THE SECONDARY DRIVE GEAR. IOA WAS NOT ABLE TO CONFIRM THAT THESE BEARINGS WERE THRUST BEARINGS, HOWEVER THE SSM STATES THAT THESE ARE THRUST BEARINGS AND ARE COVERED BY 03-3-6404-1.

REPORT DATE 2/26/88

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| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 20008 BEARIN | IG | - | SECO | ND | ARY | . DR | IVE | GI | EAR | | | | |
| LEAD ANA | LYS | ST | : | C.D. I | PRI | JSI | C | | | | | | | | | | |
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| COMPARE | [| N | /N |] | [| N |] | [| N |] | [| N |] | נ | N |] | |
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| * CIL RE | TEI | 1T] | ION P | RATIONA | LI | 2: | (If a | app | pli | cab | le) IN | AI IAI | DEQUATE DEQUATE | [[| |] | |
| NASA/RI | DO | NC | от со | OVER TH | IIS | 5 E | FAILUI | RE | MC | DE | (STF | ເບດ | TURAL F | ١I | LUR | E) | . I |

NASA/RI DO NOT COVER THIS FAILURE MODE (STRUCTURAL FAILURE). IOA RECOMMENDS THAT THIS ITEM AND FAILURE MODE BE ADDRESSED ON THE FMEA/CIL WITH A 2/1R PPP, 1/1 ABORT CRIT. STRUCTURAL FAILURE OF THESE BEARINGS COULD CAUSE BINDING OF THE GIMBAL DRIVE AND LOSS OF TVC FOR THE AFFECTED ENGINE. THE INCREASED RCS ACTIVITY REQUIRED TO MAINTAIN VEHICLE CONTROL DURING TAL POST-MECO TWO-ENGINE OMS OPS WITH ONE ENGINE FAILED OUT OF POSITION MAY CONSUME RCS PROP NEEDED TO COMPLETE THE ABORT. THE SSM STATES THAT THESE BEARINGS (ON EITHER SIDE OF THE SECONDARY DRIVE GEAR) ARE THRUST BEARINGS.

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REPORT DATE 2/26/88
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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA # : | 1/01/88 OMS-20009X 03-3-6402-2 | NASA DATA BASELINE NEW | : [] [X] |
|--|--|--|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 20009 DRIVE GEARS, PRI | MARY AND SECONDARY | |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICAL FLIGH | ITY REDUNDAN T | CY SCREENS | CIL ITEM |
| HDW/FU | NC A | B C | |
| NASA [2 /1R IOA [2 /1R | [P] [] [P] [| P] [P] P] [P] | [X] * [X] |
| COMPARE [/ |] [] [|] [] | [] |
| RECOMMENDATIONS: | (If different | from NASA) | |
| [2 /1R | <pre> [P] [] </pre> | P] [P] (A | [] DD/DELETE) |
| * CIL RETENTION | RATIONALE: (If ap | plicable) ADEQUATE INADEQUATE | [] |
| REMARKS: THE SSM STATES T DRIVE GEARS) IS ASSEMBLY, BINDIN IOA RECOMMENDS T FMEA BE SEPARATE INTO THE FAILURE IOA ALSO RECOMME 2/1R PPP, 1/1 AE MAINTAIN VEHICLE WITH ONE ENGINE REQUIRED TO COME | THAT THIS FAILURE COVERED BY 03-3-6 IG/JAMMING). THAT THE SUBASSEMB DONTO INDIVIDUAL MODES POSSIBLE I ENDS THAT THIS FAI BORT. THE INCREAS CONTROL DURING T FAILED OUT OF POS PLETE THE ABORT. | MODE (STRUCTURAL FA 402-2 (GIMBAL OUTPU LY COMPONENTS INCLU FMEAS TO PROVIDE B N THE ASSEMBLY. LURE MODE BE CLASSI ED RCS ACTIVITY REQ AL POST-MECO TWO-EN ITION MAY CONSUME R | ILURE OF THE T DRIVE DED ON THIS ETTER INSIGHT FIED AS A UIRED TO GINE OMS OPS CS PROP |

REPORT DATE 2/26/88

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| ASSESSMEN ASSESSMEN NASA FMEA | T DA T II #: | TE: 1/01/88): OMS-20010X 03-3-6402-1 | | | | | NASA DATA: BASELINE [] NEW [X] | | | |] | |
|--|--------------------|---|----------------------------|--------------------|---------------------------|-------------------------|---|---------------------|------------------------|-----------------------|---------------------|-----------------|
| SUBSYSTEM MDAC ID: ITEM: HARDWARE | | | OMS 20010 ENGINI | E/A | CTUATO | OR ANI | D AC | TUATO | R/VEI | HICLE | E ATT | ГАСН |
| LEAD ANAL | YST | : | C.D. 1 | PRU | ST | | | | | | | |
| ASSESSMEN | T: | | | | | | | | | | | |
| C | RIT] FI | CAL | ITY r |] | REDUNE | DANCY | SCRI | EENS | | | CIL | A. |
| | HDV | V/FUI | 1C | i | A | B | | C | 1 | | TIDI | • |
| NASA IOA | [1 [1 | /1 /1 |]] | ((|] | [[|]] | [[|]] | | [X [X |] *] |
| COMPARE | [| / |] | [|] | [|] | [|] | | [|] |
| RECOMMEND | ATIC | ONS: | (If | di | fferen | t fro | om N2 | ASA) | | | | |
| | [| / |] | [|] | [|] | [|] | (AD | [DD/DE |] CLETE) |
| * CIL RET | ENTI | ON I | RATIONA | ALE : | : (If | appli | [cab] | e) | DEOU | | r 1 | ٦ |
| | | _ | | | | | | INA | DEQUA | ATE ATE | L [|] |
| IOA RECOM THIS FMEA | MENI /CII |)S TH | AT "IN | IPRO | OPER A | SSEME | BLY" | BE A | DDED | AS A | CAU | ISE ON |
| IOA ALSO I THIS FMEA INSIGHT I | RECC BE NTO | MMEN SEPA THE | IDS THA RATED FAILUP | ONT ONT RE N | THE SU TO IND MODES | BASSI IVIDU POSSI | EMBLY JAL F IBLE | COM MEAS IN T | PONEN TO F HE AS | ITS I ROVI SEMB | NCLU DE E LY. | DED ON ETTER |

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-20011X 03-3-6402-2 | 1 | VASA DATA: BASELINE NEW | [] [X] | | | | |
|---|--------------------------------------|-----------------------|-------------------------------|------------------|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 20011 BEARING - A | CTUATOR/VEHICLE | ATTACHMEN | Т | | | | |
| LEAD ANALYST: | C.D. PRUST | D. PRUST | | | | | | |
| ASSESSMENT: | | | · | | | | | |
| CRITICAL | ITY RED | OUNDANCY SCREENS | | CIL ITEM | | | | |
| HDW/FU | NC A | В | C | | | | | |
| NASA [2 /1R IOA [2 /1R |] [P]] [P] | [P] [[P] [| P] P] | [X]* [X] | | | | |
| COMPARE [/ |] [] | [][|] | [] | | | | |
| RECOMMENDATIONS: | (If diffe | erent from NASA) | | | | | | |
| [2 /1R |] [P] | [P] [3 | P] (AD | [] D/DELETE) | | | | |
| * CIL RETENTION | RATIONALE: (| (If applicable) IN | ADEQUATE ADEQUATE | [] | | | | |
| REMARKS: IOA RECOMMENDS THAT THIS FAILURE MODE BE UPGRADED TO A 2/1R PPP, 1/1 ABORT. THE INCREASED RCS ACTIVITY REQUIRED TO MAINTAIN VEHICLE CONTROL DURING TAL POST-MECO TWO-ENGINE OMS OPS WITH ONE ENGINE FAILED OUT OF POSITION MAY CONSUME RCS PROP NEEDED TO COMPLETE THE ABORT. | | | | | | | | |

IOA ALSO RECOMMENDS THAT THE SUBASSEMBLY COMPONENTS INCLUDED ON THIS FMEA BE SEPARATED ONTO INDIVIDUAL FMEAS TO PROVIDE BETTER INSIGHT INTO THE FAILURE MODES POSSIBLE IN THE ASSEMBLY.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | ENT ENT EA # | DATE ID: : | : 1/01 OMS- 03-3 | /88 200122 -45013 | (L-3 | | | NASA D Basei | ATA: INE NEW | [[X |]] | |
|----------------------------------|--------------------|------------------------|------------------------|-------------------------|----------|-------------|-----------|----------------------------|--------------------|--------------|-----------------|----|
| SUBSYSTE MDAC ID: ITEM: | EM : | | OMS 2001 GN2 | 2 PRESSU | JRE RE | GUL | ATO | R AND PRESS | URE | RELI | EF VAL | VE |
| LEAD ANA | LYS | T: | C.D. | PRUST | 2 | | | | | | | |
| ASSESSME | ENT: | | | | | | | | | · | | |
| | CRI H | TICA FLIGI DW/FU | LITY HT JNC | RI A | DUNDA | NCY B | SC | REENS C | | CIL ITEM | | |
| NASA IOA | [[| 2 /11 2 /11 | R] R] | [P [P |]] | [P [P |] | [P] [P] | | [X [X |] *] | |
| COMPARE | [| 1 |] | [|] | [|] | [] | | [|] | |
| RECOMMEN | IDAT | IONS | : (I | f difi | ferent | : fr | m | NASA) | | | | |
| | [| 1 |] | [|] | [|] | [] | (AC | [DD/DE |] LETE) | |
| * CIL RE | TEN | TION | RATIC | NALE: | (If a | ippl: | ica | ble) ADEQUA INADEQUA | TE TE | [[|]] | |
| REMARKS: IOA DID (SIMULTA | NOT NEO | | ER THI EG FAI | S FAII L OPEN | URE M | IODE REL | IN IEF | THE ORIGIN VALVE FAIL | AL A | NALY SED) | sis | |

NO DIFFERENCES.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-20013 03-3-1004 | X -3 | | NASA DATA BASELINE NEW | .: [[] 7 [X] |
|--|-----------------------------------|------------|------------|------------------------------|------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 20013 HELIUM PF | RESSURE | E REGULAT | OR ASSEMBLY | |
| LEAD ANALYST: | C.D. PRUS | ST | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY F | REDUNDA | ANCY SCRE | ENS | CIL |
| HDW/FU | NC A | A | В | с | 1154 |
| NASA [3 /2R IOA [3 /2R |) [F | 9] 9] | [F] [F] | [P] [P] | [X]* [X] |
| COMPARE [/ |] [|] | []] | [] | [] |
| RECOMMENDATIONS: | (If dif | fferent | : from NA | SA) | |
| [/ |] [|] | [] | [] | [] ADD/DELETE) |
| * CIL RETENTION REMARKS: | RATIONALE: | : (If a | applicabl | ADEQUATE INADEQUATE | [] [] |

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-20014X NONE | NASA DATA: BASELINE NEW | [] |
|--|---|-------------------------------|-----------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 20014 VALVE - PROPELLANT TANK | ISOLATION | - |
| LEAD ANALYST: | C.D. PRUST | | |
| ASSESSMENT: | | | |
| CRITICALI FLIGHT HDW/FUN | TY REDUNDANCY SCREE | C C | CIL ITEM |
| NASA [/ IOA [3 /1R |] [] []] [P] [NA] | [] [P] | []* |
| COMPARE [N /N | [и] [и] | [N] | [] |
| RECOMMENDATIONS: | (If different from NAS | SA) | |
| [3 /1R |] [P] [NA] | [P] (AD | [] D/DELETE) |
| * CIL RETENTION F | ATIONALE: (If applicable | e) ADEQUATE INADEQUATE | [] |

NASA/RI DO NOT COVER THIS FAILURE MODE (RELIEF DEVICE FAILS CLOSED). IOA RECOMMENDS THAT A 3/1R PNP FMEA BE GENERATED FOR THIS FAILURE MODE. FAILURE OF PARALLEL DEVICES COULD RESULT IN OVERPRESSURIZATION AND RUPTURE OF DOWNSTREAM PROP LINES. A PREVIOUS FAILURE IS REQUIRED BEFORE THE VALVES WILL BE CLOSED. FAILURE MODE IS LISTED AS A CAUSE ON PROP LINE RUPTURE FMEA (03-3-2101-1), AND ADDRESSED ON RCS FMEAS.

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID:] OMS-20015X NEW [] NASA FMEA #: NONE OMS SUBSYSTEM: MDAC ID: 20015 VALVE - CROSSFEED ITEM: LEAD ANALYST: C.D. PRUST ASSESSMENT: CIL REDUNDANCY SCREENS CRITICALITY ITEM FLIGHT В С HDW/FUNC Α NASA [L] L ŢPĴ ŢNAĴ ŢPĴ IOA $\begin{bmatrix} 3 \\ 1R \end{bmatrix}$ 1 [N] [N] [N] Г COMPARE [N /N] 1 RECOMMENDATIONS: (If different from NASA)] [3/1R] [P] [NA] [P] ſ (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE l INADEQUATE [1 **REMARKS:** NASA/RI DO NOT COVER THIS FAILURE MODE (RELIEF DEVICE FAILS CLOSED). IOA RECOMMENDS THAT A 3/1R PNP FMEA BE GENERATED FOR THIS ITEM AND FAILURE MODE. FAILURE OF ALL REDUNDANT DEVICES COULD RESULT IN OVERPRESSURIZATION AND RUPTURE OF CROSSFEED LINES.

FAILURE IS LISTED AS A CAUSE ON CROSSFEED LINE RUPTURE FMEA (03-3-2102-1), AND IS ADDRESSED ON RCS FMEAS.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-384 05-6L-2176-1 | NASA DATA BASELINE NEW | .: [] [X] |
|--|---|------------------------------------|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 384 CONTROLLER, REMOI | 'E POWER | |
| LEAD ANALYST: | W.A. HAUFLER | | |
| ASSESSMENT: | | | |
| CRITICAL | ITY REDUNDANC | Y SCREENS | CIL |
| HDW/FU | NC A | B C a marked and | |
| NASA [3 /1R IOA [3 /1R |] [P] [] [P] [| P] [P] P] [P] | [] * [] |
| COMPARE [/ |] [] [|] [] | [] |
| RECOMMENDATIONS: | (If different f | rom NASA) | |
| [/ |] [] [|] [] (A | [] DD/DELETE) |
| * CIL RETENTION | RATIONALE: (If app | licable) ADEQUATE INADEQUATE | [] |
| REMARKS: NO DIFFERENCES. | e e compañía de compañía de compañía de compañía de compañía de compañía de compañía de compañía de compañía de | | n na sa sa sa sa sa sa sa sa sa sa sa sa sa |

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REPORT DATE 2/26/88 C-310

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ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-385 NEW [X] NASA FMEA #: 05-6L-2176-2 SUBSYSTEM: OMS MDAC ID: 385 CONTROLLER, REMOTE POWER ITEM: W.A. HAUFLER LEAD ANALYST: ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT C HDW/FUNC Α В <u>]</u> * [P] [P] [P] NASA [3/1R][P] [[P] IOA [3/1R][P] ٢] COMPARE [/] [] [] [] **RECOMMENDATIONS:** (If different from NASA) Γ 1 (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [ADEQUATE]] **REMARKS:** NO DIFFERENCES.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-386 05-6L-217 | 6-1 | | NASA DATA BASELINA NEW | A: E [] V [X] |
|--|---------------------------------|------------|----------------|------------------------------|------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 386 CONTROLLE | R, REMO | DTE POWE | R | |
| LEAD ANALYST: | W.A. HAUF | LER | | | |
| ASSESSMENT: | | | | F .4 | |
| CRITICAL | ITY R | EDUNDAN | NCY SCRE | ENS | CIL |
| HDW/FU | NC A | | B | с | LIEM |
| NASA [3 /1R IOA [3 /1R |] [P]] [P | | [P] [P] | [P] [P] | [] * [] |
| COMPARE [/ |] [|) (| []] | [] | []] |
| RECOMMENDATIONS: | (If dif | ferent | from NA | SA) | |
| [/ |] [|] (| [] | [.] | [] ADD/DELETE) |
| * CIL RETENTION | RATIONALE: | (If ag | plicabl | e) ADEQUATE INADEQUATE | [] |
| NO DIFFERENCES. | | | | | |

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-387 BASELINE [1 NEW [X] NASA FMEA #: 05-6L-2176-2 OMS SUBSYSTEM: MDAC ID: 387 CONTROLLER, REMOTE POWER ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CIL REDUNDANCY SCREENS CRITICALITY ITEM FLIGHT HDW/FUNC В С Α NASA [3/1R][P] [P] [P] [] * [P] [P] [P] IOA [3/1R]Γ] Γ COMPARE [/] 1 **RECOMMENDATIONS:** (If different from NASA) [] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE ADEQUATE [INADEQUATE [-1 1 **REMARKS:** NO DIFFERENCES.

| ASSESSME ASSESSME NASA FME | NT I NT I A #: | DATE: ID: : | 1/01/3 OMS-33 05-6L | 88 88 -217 | 6-1 | | | · | NASA DAT. BASELIN NEW | A: E [W [| x] |
|----------------------------------|----------------------|----------------------------|---------------------------|------------------|-------|------------|--------|----------|-----------------------------|------------------|--------------|
| SUBSYSTE MDAC ID: ITEM: | М: | | OMS 388 CONTRO | OLLE | R, RI | emote | POWEI | R | | | |
| LEAD ANA | LYSI | C: | W.A. 1 | HAUF | LER | | | | | | |
| ASSESSME | NT: | | | | | | | | | | |
| | CRIT HI | FICALI FLIGHT OW/FUN | [TY [1C | R A | EDUNI | DANCY B | SCREI | ens | c | CI IT | E EM |
| NASA IOA | [3 | 3 /1R 3 /1R |]] | [P [P |] | [P [P |]] | [[| P] P] | [[|] *] |
| COMPARE | [| 1 |] | [|] | [|] | [|] | [|] |
| RECOMMEN | DATI | cons: | (If | dif | ferer | nt fro | om NAS | 5A) | | | |
| | [| / |] | [|] | [|] | [|] | [ADD/ |] Delete) |
| * CIL RE | TENI | TION P | RATION | ALE: | (If | appl | icable | ∍) IN | ADEQUATE ADEQUATE | [[|]] |
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NO DIFFERENCES.

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REPORT DATE 2/26/88 C-314

| | ASSESSMI ASSESSMI NASA FMI | ent Ent Ea # | DA II : | ATE:): | 1/01/3 OMS-33 05-6L | 88 89 -21 | 176 | 5-2 | | | | | NASA I BASEI | DATA: LINE NEW | : [[] |] K] | |
|---|----------------------------------|--------------------|---------------|---------------|---------------------------|-----------------|--------|--------|--------|--------|--------|----------|-----------------|----------------------|---------------|----------|------|
| • | SUBSYSTI MDAC ID: ITEM: | E M : : | | | OMS 389 CONTRO | OLI | LEF | R, RE | emoj | Έ | POWE | ER | | | | | |
| | LEAD AND | ALYS | ST: | | W.A. | HAU | JFI | LER | | | | | | | | | |
| | ASSESSMI | ENT: | | | | | | | | | | | | | | | |
| | | CRI | T] FI | CALI LIGHT | CTY C | | RI | EDUNI | DANC | Y | SCRE | EEN | 5 | | | L EM | |
| | | H | IDW | i/Fui | 4C | | A | | | В | | | С | | | | |
| | NASA IOA | [[| 3 3 | /1R /1R |] | ׂ [] י | P P |]] | ([| P P |]] | [[| P] P] | | [[|] | * |
| | COMPARE | [| | / |] | [| |] | [| |] | [|] | | [|] | |
| | RECOMMEN | NDAI | TIC | ONS: | (If | d: | ifi | ferer | nt f | ir | om NZ | SA |) | | | | |
| | | [| | / |]. | [| |] | [| |] | [| ·] | (Al |] 1/00 |] DEI | ETE) |
| | * CIL R | ETEN | [T] | ION I | RATION | ALI | E: | (If | app | 51: | icab] | le) I | ADEQUA | ATE ATE | [[|] | |
| | REMARKS | | 101 | - | | | | | | | | | ~~~ | | • | | |

NO DIFFERENCES.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-390 05-6L-217 | 6-1 | | NASA DATA BASELINE NEW | : [] [X_] |
|--|---------------------------------|------------|------------|------------------------------|-------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 390 CONTROLLE | R, REMO | TE POWEF | | |
| LEAD ANALYST: | W.A. HAUF | LER | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY R | EDUNDAN | ICY SCREE | INS | CIL |
| HDW/FU | NC A | • | В | с | l I CM |
| NASA [3 /1R IOA [3 /1R |] [P]] [P |) [] [| P] P] | [P] [P] | []* |
| COMPARE [/ |] [|] [|] | [] | [] |
| RECOMMENDATIONS: | (If dif | ferent | from NAS | A) | |
| [/ |] [|] [| .] | [] (A | [] DD/DELETE) |
| * CIL RETENTION D | RATIONALE: | (If ap | plicable | e) ADEQUATE INADEQUATE | [] |

NO DIFFERENCES.

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REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-391 05-6L-2176 | -2 | NASA DATA BASELINE NEW | .: [] 7 [X] |
|--|----------------------------------|----------------|--------------------------------|----------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 391 CONTROLLER | , REMOTE PO | WER | |
| LEAD ANALYST: | W.A. HAUFL | ER | | |
| ASSESSMENT: | | | | |
| CRITICAL | ITY REI | DUNDANCY SC | REENS | CIL ITEM |
| HDW/FUN | NC A | В | С | |
| NASA [3 /1R IOA [3 /1R |] [P] [P |] [P]] [P] | [P] [P] | [] * [] |
| COMPARE [/ |] [|] [] | [] | [] |
| RECOMMENDATIONS: | (If diff | erent from 1 | NASA) | |
| [/ | J [| | [] | [] ADD/DELETE) |
| * CIL RETENTION D REMARKS: | RATIONALE: | (If applica) | ble) ADEQUATE INADEQUATE | [] |

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|----------------------------------|--------------------|----------|---------------|----------------|------------------------|----------------|--------|--------|------|------------|------------|------|---------|-----------|--------------|-------------------|----------------|---------------|-----------|------|
| SUBSYSTE MDAC ID: ITEM: | : M | | | 01 39 C(| 1S 22 ONTRO | OL: | LEI | R, | REM | OTI | E F | OWER | | | | | | | | |
| LEAD ANA | LYS | T: | 1 | W. | .A. 1 | HA | UFI | LER | ٤ | | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | | | | - | | | |
| | CRI | TI FI | CAL LIGH | ITY T | Ľ | | RI | EDU | INDA | NCY | X S | CREE | NS | 5 | | | | CII ITI | l Em | |
| | H | DW | I/FU | NC | | | A | | | F | 3 | | | С | | | | | | |
| NASA IOA |] [| 3 3 | /1R /1R |] | | [[| P P |]] | | [] [] | ?] ?] | | [[| P P |]] | | | [[|]] | * |
| COMPARE | [| | / |] | | [| |] | | [|] | | [| |] | | | [|] | |
| RECOMMEN | DAT | IC | NS: | | (If | d: | if | fer | ent | fı | com | NAS | A) | | | | | | | |
| | [| | / |] | | [| | נ | | [|] | | [| |] | l | (AI |] 1\00 |] DELF | ETE) |
| * CIL RE | TEN | TI | : on 1 | RAJ | TON | ALI | 2: | (I | fa | pp] | Lic | able |) IN | AE IAE |)EQI)EQI | UATI UATI | 2 | [[|] | |
| NO DIFFE | REN | CE | s. | | | | | | | | | | | | | | | | | |

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| ASSESSME ASSESSME NASA FME | NT DATE NT ID: A #: | : 1/01/ OMS-3 05-6L | 88 93 -2176 | 5-2 | | | N | ASA DATA BASELINE NEW | : [[X |] |
|----------------------------------|---------------------------|---------------------------|-------------------|--------|------------|--------|------------|-----------------------------|---------------|--------------|
| SUBSYSTE MDAC ID: ITEM: | M: | OMS 393 CONTR | OLLEI | R, RE | MOTE | POWE | R | | | |
| LEAD ANA | LYST: | W.A. | HAUFI | LER | | | | | | |
| ASSESSME | NT: | | | | | | | | | |
| | CRITICA | LITY HT | RI | DANCY | SCRE | ENS | | CII ITE | M | |
| | HDW/F | TUNC | A | | В | | C | | | |
| NASA IOA | [3 /1 [3 /1 | .R] .R] | [P [P |]] | [P [P |]] | [P [P |] | [[|] *] |
| COMPARE | [/ | 3 | C |] | C |] | [|] | [|] |
| RECOMMEN | DATIONS | S: (If | dif | ferer | nt fr | om NA | SA) | | | |
| | [• / |] | [|] | [|] | [|] () | |] DELETE) |
| * CIL RE | TENTION | RATION | ALE: | (If | appl | icabl | e) A | DEQUATE | [|] |
| REMARKS: NO DIFFE | RENCES. | | | | | | THU | DIQUAIL | L - | L |

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| ASSESSME ASSESSME NASA FME SUBSYSTE | NT NT A # | DZ II #: | ATE: D: | 1, 01 03 | /01/3 MS-39 5-6L MS | 88 96 -2 | 170 | 5-1 | | | | | | N7 | ASA BAS | DA' ELII NI | TA : NE EW | [|] X] | |
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| ASSESSMENT DAT ASSESSMENT ID: NASA FMEA #: | E: 1/01/88 OMS-397 05-6L-2 | 3 7 2176-2 | | NASA DAT BASELIN NE | 'A: IE[] XW[X] |
|--|----------------------------------|------------------|----------------|--------------------------------|----------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 397 CONTROI | LLER, RE | MOTE POV | VER" | |
| LEAD ANALYST: | W.A. HZ | UFLER | | - | |
| ASSESSMENT: | | | | | |
| CRITIC | ALITY | REENS | CIL TTEM | | |
| HDW/ | FUNC | A | В | C | <u> </u> |
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| COMPARE [/ |] (| []] | [] | [] | [] |
| RECOMMENDATION | S: (If d | lifferen | t from 1 | NASA) | |
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REPORT DATE 2/26/88 C-323

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| ASSESSME ASSESSME NASA FME | NT NT A ‡ | D2 II ‡: | ATE: D: | 1/ OM 05 | 01/8 IS-39 -6L- | 38 98 -2: | 170 | 5-1 | | | | | | N | ASA BAS | DA' ELII N | TA: NE EW | : [] | x |] | |
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| * CIL RE | TEN | T | ION I | RAT | IONA | LI | 2: | (I | fa | pp | li | cab | le) I | AI NAI | | UATI UATI | E | [r | |] | |
| REMARKS: | | | 10 | | | | | | | | | | | | | | _ | L | | - | |

NO DIFFERENCES.

REPORT DATE 2/26/88 C-324

ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-399 NEW [X] 05-6L-2176-2 NASA FMEA #: OMS SUBSYSTEM: 399 MDAC ID: CONTROLLER, REMOTE POWER" ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT в С HDW/FUNC Α [P] [P] [P] NASA [3/1R]Γ [X] [P] [F] IOA [3/1R][P] COMPARE [/] [] [N] [] [N] **RECOMMENDATIONS:** (If different from NASA) [A] [3/1R] [P] [F] [P] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE 1 INADEQUATE (

IOA RECOMMENDS FAILING THE B SCREEN. THIS FAILURE IS NOT DETECTABLE UNTIL THE ASSOCIATED SWITCH IS PUT IN OPEN POSITION, BUT THIS CAUSES VALVE TO BE STUCK OPEN. IF THE CREW HAD KNOWN ABOUT THE FAILURE, THEY MIGHT NOT HAVE THROWN THE SWITCH INTO OPEN, TO AVOID STICKING THE VALVE OPEN. THEREFORE, FAILURE IS DETECTED BUT DETECTED TOO LATE.

REPORT DATE 2/26/88

REMARKS:

| ASSESSME ASSESSME NASA FME | NT NT A | D I I I I | ATE: D: | 1/ 01 05 | /01/3 15-40 5-6L | 88 00 -2 | 25: | 1-1 | | | | | | N2 I | ASA BASI | DA ELI N | TA NE EW | : [[] | [x | | |
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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-401 05-6L-2251 | L-2 | | NASA DATA BASELINE NEW | : [] [X] |
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| SUBSYSTEM: MDAC ID: ITEM: | OMS 401 DIODE | | | | |
| LEAD ANALYST: | W.A. HAUFI | LER | | | |
| ASSESSMENT: | | | | | |
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| HDW/FU | NC A | | В | С | |
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| RECOMMENDATIONS: | (If dif | ferent | from NAS | A) | |
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| ASSESSME ASSESSME NASA FME | NT D NT I A #: | ATE: D: | 1/01/8 OMS-40 05-6L- | 38 02 -22 | 51-1 | | | N2 1 | ASA DAT. BASELIN NE | A: E [W [X |] |
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| NASA IOA | [3 [3 | /1R /1R |]] | [] | P] P] | [] | P] | [P [P |] | [[|] *] |
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| REMARKS: NO DIFFE | RENC | ES. | | | | . 1. : | | | ·::: | : . | - <u>-</u> ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ ـ |

REPORT DATE 2/26/88

ASSESSMENT DATE: 1/01/88 NASA DATA: ASSESSMENT ID: OMS-403 BASELINE [NEW [X] NASA FMEA #: 05-6L-2251-2 SUBSYSTEM: OMS MDAC ID: 403 ITEM: DIODE LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT HDW/FUNC С A В [F] [F] [P] [P] [P] [P] NASA [3/1R][X] * IOA [3/1R][] COMPARE [/] [N] [N] [N] **RECOMMENDATIONS:** (If different from NASA) [. 1 (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS: IOA AGREES WITH THIS NASA FMEA.

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| ASSESSME ASSESSME NASA FME | NT NT A ‡ | D2 I1 #: | ATE: D: | 1/ ON 05 | '01/ 15-4 5-6L | 88 04 -2 | 25: | 1-1 | | | | | N2 I | ASA BASE | DATA LINI NEV | A: E (W (| x |] | |
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ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-405 NEW [X] NASA FMEA #: 05-6L-2251-2 SUBSYSTEM: OMS MDAC ID: 405 DIODE ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT HDW/FUNC В С A [F] [F] [P] [P] [F] [P] [P] [P] NASA [3 /1R] [X] * IOA [3 /1R] ſ 1 [N] COMPARE [/] [N] [N] · [] **RECOMMENDATIONS:** (If different from NASA) [/][][][] [<u>j</u> (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [-1 INADEQUATE [] **REMARKS:** IOA AGREES WITH THIS NASA FMEA.

REPORT DATE 2/26/88

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| SUBSYSTEM: MDAC ID: ITEM: | | OMS 406 DIODE | | | | | | | | | | | | |
| LEAD ANALYST | : | W.A. HA | UF | LER | | | | . – | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | |
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| RECOMMENDATI | ONS: | (If d | lif | feren | nt 1 | Ero | om NA | SA) |) | | | | | |
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| ASSESSME ASSESSME NASA FME | ENT E ENT J EA #: | DATE: [D: ; | 1/01 OMS- 05-6 | L/88 -407 5L-22 | 51 - 2 | | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | |
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| SUBSYSTE MDAC ID: ITEM: | EM : | | OMS 407 DIOI | DE | | | | | | | | | | | | |
| LEAD AND | LYSI | C: | W.A. | W.A. HAUFLER | | | | | | | | | | | | |
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| SUBSYSTEM: MDAC ID: ITEM: | OMS 408 DIODE | | | | | |
| LEAD ANALYST: | W.A. | HAUFLER | | | | |
| ASSESSMENT: | | | | | •. | |
| CRITI FI | CALITY LIGHT | REDUN | DANCY SCI | REENS | CII ITF | M |
| HDW | /FUNC | A | В | C | · · | |
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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-409 05-6L-225 | 51-2 | | NASA DATA: Baseline [New [X | | | | | | | | |
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| SUBSYSTEM: MDAC ID: ITEM: | OMS 409 DIODE | | | | | | | | | | | |
| LEAD ANALYST: | W.A. HAUI | W.A. HAUFLER | | | | | | | | | | |
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| IOA AGREES WITH | THIS NASA | FMEA. | | | | | | | | | | |

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-410 05-6L-2252-1 | NA B | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | | |
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| SUBSYSTEM: MDAC ID: ITEM: | OMS 410 DIODE | | | | | | | | | | | | |
| LEAD ANALYST: | W.A. HAUFLER | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
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| SUBSYSTEM MDAC ID: ITEM: | OMS 411 DIODE | | | | | | | | | | | | | | | | | |
| LEAD ANAI | LYST | : | W.A. HAUFLER | | | | | | | | | | | | | | | |
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| LEAD ANALYST: | W.A. HAUF | LER | | | |
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| LEAD ANALYST: | W.A. HAUI | FLER | | | |
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| SUBSYSTEM: MDAC ID: ITEM: | OMS 418 DIODE | | | | |
| LEAD ANALYST: | W.A. HAUI | FLER | | | |
| ASSESSMENT: | | | | | |
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| LEAD ANALYST: | W.A. HAUF | FLER | | | |
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ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-421 NEW [X] NASA FMEA #: 05-6L-2201-2 SUBSYSTEM: OMS MDAC ID: 421 DRIVER, HYBRID ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT HDW/FUNC С A В [P] NASA [3/1R][P] [P]] * [P] ſ IOA [3/1R][P] [P] Γ 1 COMPARE [/] [] [] [] Г] **RECOMMENDATIONS:** (If different from NASA) Γ 1 (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS: NO DIFFERENCES.

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ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-423 1 NEW [X] 05-6L-2201-2 NASA FMEA #: SUBSYSTEM: OMS MDAC ID: 423 DRIVER, HYBRID ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT HDW/FUNC A В C NASA [3/1R][P] [P] [P] [P] [P] [P] [____* IOA [3/1R]1 COMPARE [/] [] [] [] RECOMMENDATIONS: (If different from NASA) [1 (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS: NO DIFFERENCES. .

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| COMPARE | [| / | '] | | [|] | [|] | [|] | | [|] |
| RECOMMEN | IDAI | LION | IS: | (I | f dif: | fere | nt fr | om N | ASA) | | | | |
| | [| / | '] | Ì | [|] | [|] | [|] | (A | |) Delete) |
| * CIL RE | ETEN | NTIC | ON RA | ATIO | NALE: | (If | appl | icab | le) 1 IN2 | ADEQU ADEQU | JATE JATE | |]] |
| NO DILL | 10.01 | メヘリン | | | | | | | | | | | |

| ASSESSMENT D ASSESSMENT I NASA FMEA #: | ATE: 1/01, D: OMS- 05-61 | /88 427 L-2077-1 | | NASA DATA: BASELINE [] NEW [X] | | | | | |
|--|--------------------------------|------------------------|------------|---|----------------|-------------|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 427 RESIS | STOR, 1.2 | K 2W | | | | | | |
| LEAD ANALYST | : W.A. | HAUFLER | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRIT | ICALITY | REDUN | DANCY SCR | EENS | CIL TTE | м | | | |
| нр | W/FUNC | Α | В | С | | | | | |
| NASA [3 IOA [3 | /3] /3] | [] [] | 〔 〕 〔 〕 | [] [] | [|] *] | | | |
| COMPARE [| /] | [] | [] | [] | ſ |] | | | |
| RECOMMENDATI | ONS: (I | f differe | nt from N | IASA) | | | | | |
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| * CIL RETENT REMARKS: NO DIFFERENC | ION RATIO | NALE: (If | applicat | ole) ADEQUA INADEQUA | \TE [\TE [|]] | | | |

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| ASSESSME ASSESSME NASA FME | SSESSMENT DATE: 1/01/88 SSESSMENT ID: OMS-428 IASA FMEA #: 05-6L-2076-1 | | | | | | | | 1 | NASA BASE | DATA LINE NEW | : [] |] (] | |
|----------------------------------|---|--------------|----------|-------------------|---------|--------|--------|--------|-----------|----------------|---------------------|-------------|------------|-----|
| SUBSYSTE MDAC ID: ITEM: | S M : : | | | oms 428 Res | ISTOR, | 5.] | LK 1/4 | W | | | | | | |
| LEAD AND | LYS | 5 T : | : | W.A | . HAUF | LER | | | | | | | | |
| ASSESSME | ENT : | : | | | | | | | | | | | | |
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| | F | HD | N/FU | INC | A | | В | ·=. | (| C | | | | |
| NASA IOA | [[| 3 3 | /3 /3 |]] | ָ [|]] | [[|]] | [[|]] | | [[|] '] | * |
| COMPARE | [| | / |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | NDAT | rI(| ONS: | (| If dif: | fere | ent fr | om N | ASA) | | | | | |
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| * CIL RI | etei | NT: | ION | RATI | ONALE: | (11 | f appl | icab | le) IN | ADEQU ADEQU | JATE JATE | [[|]] | |
| REMARKS | : EREI | NC | ES. | | | | | | | | | | | |

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| ASSESSME ASSESSME NASA FME | NT DATH NT ID: A #: | 2: 1/01 OMS- 05-6 | 1/01/88 NASA DATA: OMS-429 BASELINE [] 05-6L-2076-1 NEW [X] | | | | | | | | |
|----------------------------------|---------------------------|-------------------------|--|--------|--------|----------|-----------------|----------------------|------------|--------------|--|
| SUBSYSTE MDAC ID: ITEM: | M: | OMS 429 RESI | STOR, | 5.1 | K 1/4 | W | | | | | |
| LEAD ANA | LYST: | W.A. | HAUF | LER | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | |
| | CRITIC | LITY | R | EDUN | DANCY | SCR | EENS | | CII | | |
| | HDW/1 | FUNC | A | | В | k | Ċ | 2 | 111 | | |
| NASA IOA | [3 /: [3 /: | 8] 8] | [[|]] | [[|]] | [[|] | [[|] *] | |
| COMPARE | [|] | [|] | [|] | [|] | Γ |] | |
| RECOMMEN | DATION | 5: (I | f dif: | fere | nt fr | om N | ASA) | | | | |
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| * CIL RE REMARKS: NO DIFFE | TENTIO | N RATIO | NALE: | (If | appl | icab | le) / IN/ | ADEQUATE ADEQUATE | [[|]] | |

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| ASSESSMI ASSESSMI NASA FMI | ent Ent Ea f | D) I) #: | ATE: D: | 1/0 OMS 05- | 01/88 NASA DATA: S-430 BASELINE [] -6L-2076-1 NEW [X] | | | | | | | | | |
|----------------------------------|--------------------|----------------|------------|-------------------|---|--------|--------|--------|-------------|----------------|------------|-----------------------|-----------|-----|
| SUBSYSTI MDAC ID: ITEM: | EM : : | | | OMS 430 RES | ISTOR, | 5.3 | 1K 1/ | 4W | | | | | | |
| LEAD ANA | ALYS | ST | : | W.A | . HAUF | LER | | | | | | | | |
| ASSESSME | ENT : | : | | | | | | | | | | | | |
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| | ł | IDI | W/FU | NC | A | | ÷. | B | | С | | 4 _ 4 . | LM | |
| NASA IOA | [[| 3 3 | /3 /3 |]] | [[|]] | [[|]] | [[|] | | [[|]] | * |
| COMPARE | [| | / |] | [|] | [|] | C |] | | [|] | |
| RECOMMEN | IDAJ | CI (| ONS: | (| If dif | fere | ent f | rom N | IASA) | | | | | |
| | [| | Ĺ |] | נ ^י |] | Γ |] | [|] | (A) |] 1/00 |] DELE | TE) |
| * CIL RE | ETEN | (T | ION | RATI | ONALE: | (I1 | f appi | licat | ole) INZ | ADEQU ADEQU | ATE ATE | [[|] | |
| REMARKS: | REN | 101 | 75 | | • | | | | | | | | | |

NO DIFFERENCES.

| ASSESSMENT DAT ASSESSMENT ID: NASA FMEA #: | E: 1/01/88 OMS-431 05-6L-2 | 076-1 | | NASA BASE | DATA LINE NEW | : [[X |] | |
|--|----------------------------------|---------|--------|--------------|-----------------------|---------------|-----------|--------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 431 RESISTO | R, 5.1K | 1/4W | | | | | |
| LEAD ANALYST: | W.A. HA | UFLER | | | | | | |
| ASSESSMENT: | | | | | | | | |
| CRITIC | ALITY | REDUND | ANCY | SCREEI | NS | | CIL | ' M |
| HDW/ | FUNC | A | в | | C | | | ** |
| NASA [3 / IOA [3 / | 3][3][|]] | [[|] | [] | | [[|] *] |
| COMPARE [/ |] [|] | [|] | [] | | [|] |
| RECOMMENDATION | S: (If d | ifferen | t fro | m NASI | A) | | | |
| [/ |]. [|] | [|] | [] | (A) | [DD/D |] DELETE) |
| * CIL RETENTIO REMARKS: NO DIFFERENCES | N RATIONAL | E: (If | appli | cable |) ADEQU INADEQU | JATE JATE | [|]] |

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| ASSESSME ASSESSME NASA FME | ent ent ea # | DAT ID: | re : : | 1/01/ OMS-4 05-61 | /88 132 L-2071 | 7-1 | | | ľ | IASA BASE | DATA LINE NEW | [[] |] (] |
|----------------------------------|--------------------|------------|-----------|-------------------------|----------------------|------|--------|--------|-----------------|----------------|---------------------|-------------|--------------|
| SUBSYSTE MDAC ID: ITEM: | EM : | | | oms 432 Resis | STOR, | 1.2 | K 2W | | | | | | |
| LEAD ANA | LYS | T: | | W.A. | HAUF | LER | | | | | | | |
| ASSESSME | ENT: | | | | | | | | | | | | |
| | CRI | TIC | | (TY | RI | EDUN | DANCY | SCR | EENS | | | CII | 7 Mr |
| | Н | | /FUN | 1C | A | | В | | C | 3 | | TTT | 211 |
| NASA IOA | [[| 3/ 3/ | /3 /3 |] | [[|] | [[|]] | [[|] | | [[|] *] |
| COMPARE | [| / | / |] | [|] | [|] | [|] | | [|] |
| RECOMMEN | IDAT | 101 | NS: | (11 | f dif: | fere | nt fr | om N | ASA) | | | | |
| | ſ | / | / |] | ſ |] | נ |] | [|] | (A) | [DD/I |] DELETE) |
| * CIL RE | ETEN | TIC | ON F | RATIO | NALE: | (If | appl | icab | le) Z INZ | ADEQU ADEQU | ATE ATE | [[|]] |
| REMARKS: NO DIFFE | EREN | ICES | 5. | | | | | | | | | | - 19 M |

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| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-433 NASA FMEA #: 05-6L-2077-1 | | | | | | | | | M | IASA BASE | DATA LINE NEW | : [[} |] (] | |
|---|-----------|-----------|------------|-------------------|---------|--------|--------|--------|-----------------|----------------|---------------------|---------------|-----------|------|
| SUBSYSTE MDAC ID: ITEM: | M: | | | oms 433 Res | ISTOR, | 1.2 | 2K 2W | | | | | | | |
| LEAD ANA | LYS | ST | : | W.A | . HAUF | LER | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | |
| | CR | [T] | | LITY | R | EDUN | NDANCY | SCR | EENS | | | CII | | |
| | H | F. HDI | W/FU | IT INC | A | | E | 3 | C | 3 | | 111 | 214 | |
| NASA IOA | [[| 3 3 | /3 /3 |]] | [[|]] | [[|]] | [[|]] | | [[|] | * |
| COMPARE | [| | / | נ | [|] | [|] | [|] | | [|] | |
| RECOMMEN | IDA: | rı(| ONS : | ; (| If dif | fere | ent fr | om N | ASA) | | | | | |
| | [| | / |] | ľ |] | [|] | [|] | (A | [DD/I |] DELF | ETE) |
| * CIL RE REMARKS: NO DIFFE | TEI | NT: | ION ES. | RATI | CONALE: | (1 | f appl | icab. | le) / IN/ | ADEQU ADEQU | JATE JATE | [[|]] | |

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| ASSESSME ASSESSME NASA FME | INT INT IA # | DATE: ID: : | 1/01/ OMS-4 05-61 | 88 34 -2076 | 5-1 | | | NASA DATA: BASELINE [] NEW [X] | | | | | | |
|----------------------------------|--------------------|-------------------|-------------------------|-------------------|-------|--------|--------|---|--------------------|----------|------------|-----------|------|--|
| SUBSYSTE MDAC ID: ITEM: | :M : | | oms 434 RESIS | TOR, | 5.14 | (1/4 | W | | · | | | | | |
| LEAD ANA | LYS | T: | W.A. | HAUFI | LER | | | | | | | | | |
| ASSESSME | INT : | | | | | | | | | | | • | | |
| | CRI | TICAL | ITY | RI | EDUNE | ANCY | SCRE | ENS | | | CII | J M | | |
| | Н | DW/FU | NC | A | | E | 3 | C | 2 <u>a</u> | | 111 | 21-1 | | |
| NASA IOA | [[| 3 /3 3 /3 |]] | [[|] | [[|]] | ן נ |]] | | [[|]] | * | |
| COMPARE | [| / |] | [|] | ۵ |] | נ |] | | [|] | | |
| RECOMMEN | IDAT | IONS: | (If | dif | ferer | nt fr | om NA | SA) | | | | | | |
| | [| 1 |] | E |] | [|] | [|] | (AI |] D/D/1 |] DELF | ETE) | |
| * CIL RE REMARKS: NO DIFFE | ETEN EREN | TION | RATION | ALE: | (If | appl | icabl. | .e) 7 IN7 | ADEQUAT ADEQUAT | re re | [|] | | |

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| ASSESSME ASSESSME NASA FME | NT NT A ‡ | DA' ID ‡: | TE: : | 1/0 OMS 05- | 1/01/88 NASA DATA: OMS-435 BASELINE [] 05-6L-2076-1 NEW [X] | | | | | | | | |
|----------------------------------|-----------------|-----------------|----------|-------------------|--|--------|--------|--------|------------------|----------------|--------------|-----------|--------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 435 RES | ISTOR, | 5.3 | LK 1/4 | W | | - | | | |
| LEAD ANA | LYS | ST: | | W.A | . HAUF | LER | | | | | | - | |
| ASSESSME | NT | : | | | | | | | | | | | |
| CRITICALITY REDUND | | | | | | | NDANCY | SCR | EENS | | | CII | |
| | F | HDW, | /FU | JNC | А | | В | | c | 2 | | T.T.T | - M |
| NASA IOA | [[| 3 3 | /3 /3 |]] | [[|]] | [[|]] | [[|]] | | [[|] * |
| COMPARE | [| | / |] | C |] | [|] | [|] | | [|] |
| RECOMMEN | DA' | rio: | NS : | : (| If dif: | fere | ent fr | om N | ASA) | | | | |
| | [| | / |] | C |] | [|] | Ì |] | (A |] DD/I |] DELETE) |
| * CIL RE REMARKS: NO DIFFE | TEI | NTI | ON S. | RATI | ONALE: | (1: | f appl | icab | ole) P INP | ADEQU ADEQU | JATE JATE | [[|]] |

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| ASSESSME ASSESSME NASA FME | NT NT A # | DATE: ID: : | 1/01/88 NASA OMS-436 BASE 05-6L-2076-1 | | | | | | | | DATA: LINE [] NEW [X] | | | | |
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| SUBSYSTE MDAC ID: ITEM: | : M : | | OMS 436 RESIS | STOR, | 5.1 | .K 1/4 | W | • | | | | | | | |
| LEAD ANA | LYS | ľ: | W.A. | HAUF | LER | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | | |
| | CRI | FICAL | ITY | R | EDUN | DANCY | SCR | EENS | | | CIL | M | | | |
| | н | DW/FU | NC | A | | E | 5 | c | 3 | 5 | . | 11 | | | |
| NASA IOA | [] | 3 /3 3 /3 |]] | [[|] | [[|]] | [[|]] | | [[|]] | * | | |
| COMPARE | [| / |] | [|] | [|] | [|] | | [|] | | | |
| RECOMMEN | DAT | LONS: | (11 | f dif: | fere | nt fr | om N | ASA) | | | | | | | |
| | נ | 1 |] | [|] | Ľ |] | [|] | (AD | [D/ D |] ELE | TE) | | |
| * CIL RE REMARKS: NO DIFFE | TEN | CES. | RATION | ALE: | (If | appl | icab | le) A INA | ADEQUAI ADEQUAI | 'E 'E | [[|] | | | |

| ASSESSMEI ASSESSMEI NASA FMEI | NT DA NT II A #: | ATE: D: | 1/01/ OMS-4 05-61 | '88 37 -207 | 6-1 | NASA DATA: BASELINE [] NEW [X] | | | | | | |
|-------------------------------------|------------------------|--------------|-------------------------|---------------------|--------|---|--------|------------|----------|-------------|------------|-----|
| SUBSYSTEN MDAC ID: ITEM: | 4: | | OMS 437 RESIS | STOR, | 5.1 | .K 1/41 | 1 | | | | | |
| LEAD ANA | LYST | : | W.A. | HAUF | 'LER | | | | | | | |
| ASSESSME | T: | | | | | • | | | | | | |
| (| CRIT: F | ICAL LIGH | ITY T | R | EDUN | DANCY | SCR | EENS | | CII ITH | E M | |
| | HD | W/FU | NC | A | | В | | C | 2 | | | |
| NASA IOA | [3 [3 | /3 /3 |]] | [[|]] | [[|]] | [[|]] | [[|]* | |
| COMPARE | [| / |] | [|] | [|] | C |] | [|] | |
| RECOMMEN | DATI | ons: | (If | dif | fere | ent fro | om N | ASA) | | | | |
| | C | 1 |] | [|] | Ĵ |] | Γ |] | [(ADD/I |] DELET | 'E) |
| * CIL RE | FENT | ION | RATION | VALE: | (If | appl | icab | le) TNZ | ADEQUATI | 2 [7 r |] | |
| REMARKS: NO DIFFE | RENC | ES. | | | | | | | | - L | 3 | |

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMŠ-438 NONE | /01/88 NASA DATA: MS-438 BASELINE [] ONE NEW [] | | | | | | | | |
|---|------------------------------|---|-------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: A | OMS 438 SWITCH TOGGLE, | LT/RT OMS HE PRESS VA | APOR ISOL VLV | | | | | | | |
| LEAD ANALYST: | W.A. HAUFLER | | | | | | | | | |
| ASSESSMENT: | · | | | | | | | | | |
| CRITICAL | ITY REDUNDA | ANCY SCREENS | CIL | | | | | | | |
| HDW/FU | NC A | ВС | 1154 | | | | | | | |
| NASA [/ IOA [3 /1R |] []] [P] | [] [] [P] [P] | [] * | | | | | | | |
| COMPARE [N /N |] [N] | [N] [N] | [] | | | | | | | |
| RECOMMENDATIONS: | (If different | t from NASA) | | | | | | | | |
| [3 /1R |] [P] | [P] [P] (AI | [] DD/DELETE) | | | | | | | |
| * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] | | | | | | | | | | |
| REMARKS: IOA RECOMMENDS THAT NASA GENERATE A FMEA WITH THIS "STUCK IN OPEN POSITION (BOTH CONTACT SETS)" FAILURE MODE. THE CLOSEST EXISTING MATCH AVAILABLE IS NASA'S FMEA 05-6L-2026-1 WITH A "FAILS TO TRANSFER, FAILS TO CLOSE, FAILS TO CONDUCT (ONE CONTACT SET)" FAILURE MODE, WHICH IS ALREADY MATCHED TO MDAC-440 AND 443. | | | | | | | | | | |

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REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA # : | 1/01/88 OMS-439 05-6L-2026-2 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | |
|--|------------------------------------|---|--------------------|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: A | OMS 439 SWITCH TOGGLE, | LT/RT OMS HE PRESS V | APOR ISOL VLV | | | | | | | | |
| LEAD ANALYST: | W.A. HAUFLER | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRITICAL FLIGH HDW/FU | ITY REDUNDA T NC A | ANCY SCREENS B C | CIL ITEM | | | | | | | | |
| NASA [2 /1R IOA [2 /1R |] [P].] [P] | [P] [P] [P] [P] | [X]* [X] | | | | | | | | |
| COMPARE [/ |] [] | | [] | | | | | | | | |
| RECOMMENDATIONS: | (If different | t from NASA) | | | | | | | | | |
| τ / |] [] | []][] (A | [] .DD/DELETE) | | | | | | | | |
| * CIL RETENTION REMARKS: | RATIONALE: (If a | applicable) ADEQUATE INADEQUATE | [] [] | | | | | | | | |

IOA AGREES WITH THIS NASA FMEA.

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_____ REPORT DATE 2/26/88

| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-440 NASA FMEA #: 05-6L-2026-1 | | | | | | | | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | |
|---|---|-------------------------|-------------------|-----|------------|-------|--------|---|--------|------|-----------------|-------|-----|----------|-----------------|------|-----|
| SUBSYSTEM MDAC ID: ITEM: A | [: | | OMS 440 SWI | тсн | I TO | GGLE, | , L/I | r/1 | RT | oms | HE | PRESS | VA | POI | RI | SOL | VLV |
| LEAD ANAL | YST: | : | W.A | . н | IAUF | LER | | | | | | | | | | | |
| ASSESSMEN | IT: | | | | | | | | | | | | | | | | |
| Ċ | RITI FI HDW | ICALI LIGHI V/FUI | ITY F NC | | R A | EDUNI | DANC | CY B | sc | REEI | 4 5 C | | | | L E M | | |
| NASA IOA | [3 [2 | /1R /1R |]] | • | [P [P | | [[| P P |]] | | [P [P | .] | | [| x] | * | |
| COMPARE | [И | / |] | | [|] | נ | |] | - | [|] | | [] | N] | | |
| RECOMMEND | ATIC | ONS: | (| If | dif | ferer | nt f | fro | om | NASZ | A) | | | | | | |
| | [| / |] | | [|] | [| |] | | [|] | (AD | [D/1 |] DEL | ETE) |) |
| * CIL RET REMARKS: IOA AGREE | CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] EMARKS: OA AGREES WITH THIS NASA FMEA. | | | | | | | | | | | | | | | | |

REPORT DATE 2/26/88

| ASSESSMI ASSESSMI NASA FMI | ENT ENT EA ‡ | DZ II ; | ATE: D: | 1/ OM 05 | 01/8 S-44 -6L- | 38 41 -2(| 020 | 5-2 | | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | |
|---|--------------------|---------------|------------|----------------|----------------------|-----------------|--------|------|--------|---|-----|-----|----------|-----------|------------------|------------|------|------------|----|
| SUBSYSTI MDAC ID: ITEM: B | em : : | | | om 44 SW | S 1 ITCI | roo | GGLE | , L | T/ | RT | OMS | 5 н | E | PRESS | VAP | or | ISOL | , VLV | |
| LEAD ANALYST: W.A. HAUFLER | | | | | | | | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | | | | | | | | |
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| NASA IOA | [[| 2 2 | /1R /1R |] | | L [| P P |] | l [| P P |] | | [| P P |] | Ĺ | X |] | |
| COMPARE | [| | / |] | | [| |] | [| |] | | [| |] | [| |] | |
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IOA AGREES WITH THIS NASA FMEA.

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REPORT DATE 2/26/88

| ASSESSMI ASSESSMI NASA FMI | ENT DAT ENT ID: EA #: | E: 1/01, OMS- NONE | /88 442 | NASA DATA: BASELINE [] NEW [] | | | | | | | | |
|---|-----------------------------|--------------------------|------------|---------------------------------------|-------------------------------|---------------------|--|--|--|--|--|--|
| SUBSYSTI MDAC ID: ITEM: B | EM : : | OMS 442 SWIT | CH TOGGLE, | , LT/RT O | MS HE PRESS | VAPOR ISOL VLV | | | | | | |
| LEAD ANA | ALYST: | W.A. | HAUFLER | | | | | | | | | |
| ASSESSMI | ent : | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C | | | | | | | | | | | | |
| NASA IOA | [/ [3 / |] 1R] | [] [P] | [] [P] | [] [P] | [] * [] | | | | | | |
| COMPARE | [N/ | ן א | [N] | [N] | [N] | [] | | | | | | |
| RECOMMEN | NDATION | (I: | f differer | nt from N | ASA) | . | | | | | | |
| | [3/ | 1R] | [P] | [P] | [P] | [] (ADD/DELETE) | | | | | | |
| * CIL RI | etentio | N RATIO | NALE: (If | applicab | le) ADEQUATI INADEQUATI | 5 [.] 5 [.] | | | | | | |
| TON DECO | MMENDO | | AGA GENEDI | | A WITH THIS | "STUCK IN OPEN | | | | | | |

IOA RECOMMENDS THAT NASA GENERATE A FMEA WITH THIS "STUCK IN OPEN POSITION (BOTH CONTACT SETS)" FAILURE MODE. THE CLOSEST EXISTING MATCH AVAILABLE IS NASA'S FMEA 05-6L-2026-1 WITH A "FAILS TO TRANSFER, FAILS TO CLOSE, FAILS TO CONDUCT (ONE CONTACT SET)" FAILURE MODE, WHICH IS ALREADY MATCHED TO MDAC-440 AND 443.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-443 05-6L-2026-1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | | | |
|--|------------------------------------|---|---------------------|--|--|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: B | OMS 443 SWITCH TOGGLE, | LT/RT OMS HE PRESS | VAPOR ISOL VLV | | | | | | | | | | |
| LEAD ANALYST: W.A. HAUFLER | | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITICAI FLIGH HDW/FU | LITY REDUNE IT INC A | B C | CIL ITEM | | | | | | | | | | |
| NASA [3 /1F IOA [2 /1F | R] [P] R] [P] | [P] [P] [P] [P] | [] * [X] | | | | | | | | | | |
| COMPARE [N / |] [] | [][] | [N] | | | | | | | | | | |
| RECOMMENDATIONS: | (If differen | nt from NASA) | · . | | | | | | | | | | |
| [/ |] [] | []][] | [] (ADD/DELETE) | | | | | | | | | | |
| * CIL RETENTION REMARKS: | RATIONALE: (If | applicable) ADEQUATI INADEQUATI | 3 [] 3 [] | | | | | | | | | | |

IOA AGREES WITH THIS NASA FMEA.

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| ASSESSM ASSESSM NASA FM | ent Ent Ea \$ | DA II #: | ATE: D: | 1/ ON 05 | L/01/88 DMS-444 D5-6L-2153-1 | | | | | | | | NASA DATA: BASELINE [] NEW [X] | | | | | | | | |
|-------------------------------|---------------------|----------------|---------------|----------------|------------------------------------|--------|-----|--------|--------|-----|-------|-----------|---|--------|--------------|--------|-----------|----------|-----|--|--|
| SUBSYST MDAC ID ITEM: | EM: : | | | ON 44 MI | is 4 Eter, | . (| OMS | S PRI | ess | URI | E N2, | /HE | TZ | ANK | | | | | | | |
| LEAD AN | ALYS | ST | : | W. | A. F | IA | JFI | LER | | | | | | | | | | | | | |
| ASSESSM | ENT | : | | | | | | | | | | | | | | | | | | | |
| | CRI | [T] FI | ICALI LIGH | CTY C | Z | | RI | EDUNI | DAN | CY | SCR | EENS | 5 | | | | CIL | M | | | |
| | ŀ | HDV | V/FUI | 1C | | | Α | | | в | | | C | | | | | | | | |
| NASA IOA | [[| 3 3 | /3 /2R |]] | | [[| P |]] | [[| P |] | [[| P |]] | | | [[|]] | * | | |
| COMPARE | נ | | /N |] | | [| N |] | [| Ń |] | [| N |] | | | [|] | | | |
| RECOMME | NDAT | CIC | ONS: | | (If | d: | iff | ferer | nt | fro | om N. | ASA) |) | | | | | | | | |
| | [| 3 | /2R |] | | C | P |] | [| P |] | [| P |] | | AD | [0D/D |] Elf | TE) | | |
| * CIL R | etei | T . | ION 1 | RAI | TION | L | E: | (If | ap | pl: | icab | le) Il | AI NAI | DEQI | UATE UATE | [] | [[|]] | | | |
| KEMAKKS | • | | | 3 = 1 | | | | | | | | | | | | | | | | | |

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IOA DOES, BUT NASA DOES NOT, IMPLY THAT CRT DISPLAYS AND MISSION CONTROL CENTER ARE REDUNDANT TO ITEM TO GET NITROGEN AND HELIUM PRESSURE MEASUREMENTS. LOSS OF FUNCTION CAN LEAD TO FALSELY FAILING ONE OMS HE TANK OR TWO OMS GN2 TANKS, AND THUS LOSS OF MISSION OR AN ATO.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-445 03-3-18 | 8 5 801-1 | NASA DATA: Baseline [] New [X] | | | | | | | | | | |
|--|-------------------------------|------------------------------------|---|------------------------------|-------------------------|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 445 SENSOR | PRESSURE | , HE TANI | K NO.1 | | | | | | | | | |
| LEAD ANALYST: W.A. HAUFLER | | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITICAI FLIGH | ITY T | REDUNDA | NCY SCREI | ENS | CIL ITEM | | | | | | | | |
| HDW/FU | NC | Α | В | C | | | | | | | | | |
| NASA [3 /3 IOA [3 /2F |] [;] [|] P] | [] [P] | [] [P] | []* | | | | | | | | |
| COMPARE [/N |] [| [N] | [N] | [N] | [] | | | | | | | | |
| RECOMMENDATIONS: | (If d | lifferent | from NAS | SA) | • | | | | | | | | |
| [3 /2F | [] | P j | [P] | [P] (A | [] DD/DELETE) | | | | | | | | |
| * CIL RETENTION | RATIONAL | E: (If a | pplicable | e) ADEOUATE | Г] | | | | | | | | |
| | nengu egyin T | , | | INADEQUATE | נֿי <u></u> ז | | | | | | | | |
| LOSS OF ALL REDU TANK DURING ASCH NOT BE ENOUGH TI | NDANCY C NT REQUI | CAN RESUL IRING AN ERIFY THE | T IN FALS ATO BE CA FAILURE | SELY FAILING Alled, since | THE HELIUM THERE MAY | | | | | | | | |

SEE FLIGHT RULE 6-1.

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| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-446 NASA FMEA #: 03-3-1801-1 | | | | | | | | NASA DATA: BASELINE [] NEW [X] | | | | | | | | |
|--|--------------------------|--------------------------|------------------------------|-----------------|-----------------|---------------------|-------------------|---|-------------|------------------------|--------|-----------|---------------------|-------------|------------------|--|
| SUBSYSTI MDAC ID ITEM: | em : : | | oms 446 Sensof | E | PRE | essu | RE, | H | E | TANI | Ç 1 | NO . | 2 | - | | |
| LEAD ANALYST: W.A. HAUFLER | | | | | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | | | | | |
| | н | DW/FUI | NC | | A | | | E | J | | | С | | 1164 | 1 | |
| NASA IOA | [[| 3 /3 3 /2R |]] | [[| P |]] | . [| F | • |] | [[| P |] | [[|] *] | |
| COMPARE | [| /N |] | [| N |] | [| N | ſ |] | [| N |] | [|] | |
| RECOMME | NDAT | IONS: | (If | di | ff | ere | nt | fr | 0 | m NAS | SA) |) | | | | |
| | Ĺ | 3 /2R | ſ | [| P |] | (| F | > |] | [| P |] (AI | [DD/DI |] ELETE) | |
| * CIL R | eten | TION 1 | RATIONA | LE | 2: | (If | ar | pl | i | cable | ≥) | | | | | |
| | | | | | | | | | | | II | IA IAV | DEQUATE DEQUATE | [[|] | |
| REMARKS LOSS OF TANK DUI NOT BE | : ALL RING ENOU | REDUI ASCEI GH TII | NDANCY NT REQU ME TO V | CA IIF EF | N RIN RIF | RES IG A Ty T | ULI N A 'HE | TC TC | N) I | FALS BE CA LURE. | E | LY LEI | FAILING), SINCE | THE THEF | HELIUM RE MAY | |

SEE FLIGHT RULE 6-1.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT DATE: NT ID: A #: | : 1/01/88 OMS-447 03-3-18 | 3 7 302-1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | |
|--|----------------------------|-------------------------------------|-------------------------------|---|-------------------------------|-------------------------|--|--|--|--|--|--|--|
| SUBSYSTEM:OMSMDAC ID:447ITEM:SENSOR TEMPERATURE, OMS HE TANK UPPER | | | | | | | | | | | | | |
| LEAD ANALYST: W.A. HAUFLER | | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | | | | |
| | HDW/FU | JNC | Α | В | С | | | | | | | | |
| NASA IOA | [3 /3 [3 /2] |] R] | [] [P] | [] [P] | [] [P] | []* | | | | | | | |
| COMPARE | [/N |] [| [א] | [N] | [N] | [] | | | | | | | |
| RECOMMEN | DATIONS | : (If d | liffere | nt from NA | SA) | | | | | | | | |
| | [3 /2] | R] | [P] | [P] | [P] (A | [] NDD/DELETE) | | | | | | | |
| * CIL RE | TENTION | RATIONAL | LE: (If | applicabl | .e) ADEOUATE | r ı | | | | | | | |
| | | | | | INADEQUATE | i j | | | | | | | |
| REMARKS: LOSS OF TANK DUR NOT BE E | ALL REDU ING ASCI | UNDANCY (ENT REQUI IME TO VI | CAN RES IRING A ERIFY T | ULT IN FAI N ATO BE C HE FAILURE | SELY FAILING CALLED, SINCE | THE HELIUM THERE MAY | | | | | | | |

SEE FLIGHT RULE 6-1.

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REPORT DATE 2/26/88 C-373

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| ASSESSMI ASSESSMI NASA FMI | 1/01/8 OMS-44 03-3-1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | | | | |
|----------------------------------|----------------------------|---|----------|--------------------------------|------------|--------|---------|--------|------------|---------------|----------------|------------|-----------|------|
| SUBSYSTI MDAC ID: ITEM: | EM : : | | | oms 448 Sensor Temp 2 | R TEN 2 | ſP, | OX/HE | TE | ST PC | ORT F | TTTING | ; TE | MP | 1, & |
| LEAD AND | ALYS | ST | : | W.A. H | IAUFI | LER | | | | | | | | |
| ASSESSMI | ENT | : | | | | | | | | | | | | |
| | CR | נדו ות | ICAL | ITY | RI | EDUN | IDANCY | SC | REENS | 5 | | CII ITE | M | |
| | ł | HDV | ¶∕FU | NC | A | | В | | | С | | | | |
| NASA IOA | [[| 3 3 | /3 /3 |]] | [[|]] | [[|]] | [[|]] | | [[|]] | * |
| COMPARE | [| | / |] | [|] | [|] | [|] | | [|] | |
| RECOMMEN | NDA | FI (| ONS: | (If | dif | fere | ent fro | cm 1 | NASA) | - | | | | |
| : | Ľ | | / |] | [|] | [|] |] |] | (AI | [00/[|] DELH | ETE) |
| * CIL R | ette | NT: | ION . | RATION | ALE: | II) | fappl | ica | ble) Il | ADEÇ NADEÇ | QUATE QUATE | [|]] | |
| NO DIFF | ERE | | ES. | | | | | | | | | | | |

NO DIFFERENCES.
| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-449 05-6L-2 | 033-1 | | NASA D. BASEL | ATA: INE [] NEW [X] |
|--|-------------------------------|----------|------------|----------------------------|------------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 449 SWITCH / | TOGGLE | , oms N2 | /HE PRESSUR | E DISPLAY SELECT |
| LEAD ANALYST: | W.A. HA | UFLER | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY | REDUN | IDANCY SC | REENS | CIL |
| HDW/FU | NC | A | В | с | 11EM |
| NASA [3/3 IOA [3/2R |] [] [|] P] | [] [P] | [] [P] | [] * [] |
| COMPARE [/N |] [| N] | [И] | [N] | [] |
| RECOMMENDATIONS: | (If d | iffere | ent from | NASA) | |
| [3 /2F | ן נ | P] | [P] | [P] | [] (ADD/DELETE) |
| * CIL RETENTION | RATIONAL | E: (I1 | f applica | ble) ADEQUA INADEQUA | TE [] TE [] |
| IOA DOES, BUT NA | SA DOES | NOT, 1 | MPLY THA | T CRT DISPL | AYS AND MISSION |

IOA DOES, BUT NASA DOES NOT, IMPLY THAT CRT DISPLAYS AND MISSION CONTROL CENTER ARE REDUNDANT TO ITEM TO GET NITROGEN AND HELIUM PRESSURE MEASUREMENTS. LOSS OF FUNCTION CAN LEAD TO FALSELY FAILING ONE OMS HE TANK OR TWO OMS GN2 TANKS, AND THUS LOSS OF MISSION OR AN ATO.

REPORT DATE 2/26/88

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NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-450 1 NEW [X] NASA FMEA #: 05-6L-2253-1 OMS SUBSYSTEM: 450 MDAC ID: DIODE ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CRITICALITY CIL ITEM FLIGHT C HDW/FUNC В A [X]* [X] NASA [2/1R] [P] [P] [P] [P] [F] [P] IOA [3/1R]COMPARE [N /] [N] [] [] Γ] **RECOMMENDATIONS:** (If different from NASA)] [1 (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE 1 Γ **REMARKS:**

IOA AGREES WITH THIS NASA FMEA.

REPORT DATE 2/26/88

C-376

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-4502 05-6L-22 | A 253A-1 | | NASA DATA: BASELINE NEW | [] [X] |
|--|---------------------------------|-----------------------------------|----------------------|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 450 DIODE | | | | |
| LEAD ANALYST: | W.A. HAU | JFLER | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY | REDUNDAN | ICY SCREE | NS | CIL ITEM |
| HDW/FU | NC | A | В | с | |
| NASA [2 /1R IOA [3 /1R |] [] [| P][F][| P] P] | [P] [P] | [X] * [X] |
| COMPARE [N / |] [| м] [|] | [] | [] |
| RECOMMENDATIONS: | (If d: | ifferent | from NAS | A) | |
| [3 /1R |] [| P] [| P] | [P] (AI | [D] DD/DELETE) |
| * CIL RETENTION | RATIONAL | E: (If ap | oplicable |) ADEQUATE INADEQUATE | |
| REMARKS: IOA'S RECOMMENDE FMEA 03-3-2007-1 FALL OPEN ACCO | D CRITIC | ALITY OF THIS FAII THE LAST | 3/1R IS LURE CAUS | DRIVEN BY ON ES TANK ISOI LE NASA CRIJ | AS HARDWARE L VALVE TO FICALITY, |

FMEA 03-3-2007-1, SINCE THIS FAILURE CAUSES TANK ISOL VALVE TO FAIL OPEN. ACCORDING TO THE LAST AVAILABLE NASA CRITICALITY, THIS FMEA SHOULD BE IN THE NEW NASA CIL LIST BUT IS NOT. IOA ASSUMES THAT NASA DOWNGRADED THIS TO A NON-CIL.

REPORT DATE 2/26/88

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| ASSESSMI ASSESSMI NASA FMI | SSMENT DATE: 1/01/88 SSMENT ID: OMS-450B FMEA #: 05-6L-2253B-1 | | | | | | | | | | | | N2] | ASA D BASEL | ATA: INE NEW | [[} | (] | |
|----------------------------------|--|------------------|----------------------|----------------|-----------------|--------|---------|--------|----------|---------|--------|------------|-----------|----------------|--------------------|------------|-------------|------|
| SUBSYSTI MDAC ID: ITEM: | em: : | | | OM 45 DI | IS 0 CODE | | | | | | | | - | | | | | |
| LEAD AND | ALY | ST | : | W. | A. F | IAI | JFI | LER | | | | | | | | | | |
| ASSESSMI | ENT | : | | | | | | | | | | | | | | | | |
| | | IT: Fi HDI | ICAL LIGH W/FU | ITY T NC | | | RI A | EDUN | IDAN | ст В | sc | REEN | 5 C | | | CII ITE | _ EM | |
| NASA IOA | [[| 3 3 | /1R /1R |]] | | [[| P F |]] | ((| P P |]] | [[| P P |]] | | [] |] (| * |
| COMPARE | C | | / |] | | [| N |] | [| |] | [| |] | | [] | i .] | |
| RECOMMEN | NDA' | TIC | ons: | | (If | d: | if | fere | ent | fr | om. | NASA |) | | | | | |
| | [| | / |] | | [| |] | נ | |] | ۵ | |] | (AI | [)D/I |] DEL | ETE) |
| * CIL RI | ETE: | NT: | ION | RAT | ION | L | E: | (If | ap : | pl | ica | ble) Il | AI NAI | DEQUA DEQUA | TE TE | [|]] | |
| IOA AGRI | EES | W | ITH | THI | S NA | S | A I | MEA | . | ÷, | 1 E | | | - N | 2.11.87 | | | |

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REPORT DATE 2/26/88 C-378

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| ASSESSME ASSESSME NASA FME | ENT DATE: ENT ID: EA #: | 1/01/88 OMS-450C 05-6L-22 | 53C-1 | | NASA DAT BASELIN NE | 'A: IE [] W [X] |
|----------------------------------|-------------------------------|---------------------------------|------------|----------------------|--|--|
| SUBSYSTE MDAC ID: ITEM: | E M : | OMS 450 DIODE | | | | |
| LEAD ANA | ALYST: | W.A. HAU | FLER | | | |
| ASSESSME | ENT: | · | | | | |
| | CRITICAL | ITY T | REDUNDA | NCY SCF | REENS | CIL ITEM |
| | HDW/FU | NC | A | В | С | |
| NASA IOA | [3 /1R [3 /1R |] [] [| P] F] | [P] [P] | [P] [P] | [] * [X] |
| COMPARE | [/ |] [| N] | [] | [] | [N] |
| RECOMMEN | NDATIONS: | (If di | fferent | : from N | IASA) | |
| | [3 /1R |] [| P] | [F] | [₽] | [A] (ADD/DELETE) |
| * CIL RE | ETENTION | RATIONALE | :: (If a | pplicat | ole) Adequati Inadequati | E [] E [] |
| REMARKS: IOA RECO POSITION | : Ommends f | AILING TH T READILY | IE B SCI | REEN SIN STBLE BY | ADEQUATI INADEQUATI NCE THE MCA & (THE CREW. | E [] E [] STATUS OF THEREFORI |

POSITIONS ARE NOT READILY ACCESSIBLE BY THE CREW. THEREFORE, "CLOSE" RELAYS WHICH DO NOT OPEN AND "OPEN" RELAYS WHICH DO NOT CLOSE BECAUSE OF A FAILED OPEN DIODE ARE NOT DETECTABLE AND THE FAILED DIODE IS NOT DETECTABLE INFLIGHT.

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT D. NT II A #: | ATE: D: | 1/01/8 OMS-45 05-6L- | 8 10D •22 | 53 | 3D-1 | | | | | NZ E | ASA DAT BASELIN NE | YA: IE IW | x |]] | |
|----------------------------------|------------------------|----------------|----------------------------|---------------------|-------------|--------|--------|--------|-----------|--------|-----------|--------------------------|-------------------|--------------------|---------------|-------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 450 DIODE | DMS 150 DIODE | | | | | | | | | | | | |
| LEAD ANA | LYST | : | W.A. E | IAU | FI | LER | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | | - | |
| | CRIT | ICAL | ITY | | RE | EDUNDA | 4N(| CY | SCR | EENS | 5 | | (| CIL | | |
| | F HD | LIGH' W/FUI | r NC | | A | | | В | | | С | : | | - TE | M . | |
| NASA IOA | [3 [3 | /2R /1R |]] | [| P F |]] | [[| P P |]] | [[| P P |]] | | x |]] | * |
| COMPARE | [. | /N |] | [| N |] | [| |] | [| |] | 1 | N |] | |
| RECOMMEN | DATI | ons: | (If | di | ff | ferent | | fro | om N | iasa) |) | | | | | |
| | [3 | /1R |] | [| P |] | [| P |] | [| P |] | ADI | D/D |] Elf | ĪTE) |
| * CIL RE | TENT | ION I | RATIONA | LE | : | (If a | apj | pli | cab | ole) | ÷ - | | | - 11 2. | . 55. Tato | |
| | • | · · - | · · · · · · · · · | | | | | | | IN | IA IAI | DEQUATE DEQUATE | | : |] | |
| REMARKS: IOA'S CR | ITIC | ALIT | Y OF 3/ | '1R | <u>ا</u> _1 | IS DR | | EN | BY | OMS | HZ | RDWARE | E FI | IEA | 03 | 3-3- |
| 2007-1, | SINC | E TH | IS FAII | LUR | E | CAUSI | ΞS | TZ | NK | ISOI | 7 נ | ALVE 1 | :0 I | AI | гc |)PEN. |

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: BASELINE [OMS-450E NEW [X] NASA FMEA #: 05-6L-2255-1 SUBSYSTEM: OMS MDAC ID: 450 ITEM: DIODE LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT В С HDW/FUNC Α [F] [P] [P] [X] * NASA [3/1R]ĨP] [P] [X] [F] IOA [3/1R][/] [N] [N] [] COMPARE [] **RECOMMENDATIONS:** (If different from NASA) [D] [3/3] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE INADEQUATE **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE

MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

REPORT DATE 2/26/88 C-381

| ASSESSM ASSESSM NASA FM | 5-1 | | | | | N | ASA BASI | DATA LINE NEW | : [] | x |]] | | | | | | | | |
|--|------------------------------|-------------------------------|---|---|---------------------------------|--------------------------------------|-------------------------------|---|--------------------------------|---------------------------------------|---|--------------------------|-------------------------------------|--|-------------------------------|-----------------------|---------------------|-----------------------------------|----------|
| SUBSYST MDAC ID ITEM: | EM : : | | | OMS 450 DIODI | E | | | | | | | | - | | | | | | |
| LEAD AN | ALY | ST | : | W.A. | HAU | JFI | LER | | | | | | | | | | | | |
| ASSESSM | ENT | : | | | | | | | | | | | | | | | | | |
| | CR | IT] FI | ICAL | ITY r | | RI | EDU | NDAN | CY | S | CREEN | S | | | C] I] | IL PEM | ſ | | |
| | | HDV | N/FUI | NC | | A | | | В | | | С | | | | | - | | |
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PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE S SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-451 05-6L-2253 | 3-2 | NAS BA | A DATA: SELINE [NEW [|] x] |
|--|----------------------------------|----------------|------------------------|------------------------------|----------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 451 DIODE | | | | |
| LEAD ANALYST: | W.A. HAUFI | LER | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY RI | EDUNDANCY | SCREENS | C T | IL TEM |
| HDW/FUI | NC A | В | С | • • • • • • • • • • • | |
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| REMARKS: IOA AGREES WITH | THIS NASA | FMEA. | | n in inge | - - |
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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-451A 05-6L-2253A-2 | NASA DATA: Baseline New | [] [x] |
|--|--------------------------------------|---------------------------------|--------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 451 DIODE | | |
| LEAD ANALYST: | W.A. HAUFLER | | |
| ASSESSMENT: | | | |
| CRITICAL | LITY REDUNDANCY SCREE | NS C | CIL (TEM |
| HDW/FU | INC A B | С | |
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| * CIL RETENTION | RATIONALE: (If applicable |) ADEQUATE INADEQUATE | |
| REMARKS: | | | |

IOA RECOMMENDS REMOVING THIS FMEA FROM THE CIL. ACCORDING TO THE LAST AVAILABLE NASA CRITICALITY, THIS FMEA SHOULD BE IN THE NEW NASA CIL LIST BUT IS NOT. IOA ASSUMES THAT NASA DOWNGRADED THIS TO A NON-CIL, AND IOA TENTATIVELY CONCURS. IOA BELIEVES THIS FAILURE HAS NO EFFECT, SINCE ONLY A MULTIPLEXER-DEMULTIPLEXER (MDM) IS BEHIND THE "GPC CLOSE" DIODES, AND THAT IS WELL PROTECTED INTERNALLY FROM REVERSE CURRENT.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-4511 05-6L-22 | B 253 B- 2 | | NASA DATA BASELINE NEW | A: 5 [] 7 [X] |
|--|---------------------------------|----------------------|--------------|------------------------------|------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 451 DIODE | | | | |
| LEAD ANALYST: | W.A. HAU | JFLER | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY T | REDUNDA | NCY SCREI | Ens | CIL ITEM |
| HDW/FU | NC | A | В | C | |
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| REMARKS: IOA AGREES WITH | THIS NAS | A FMEA. | | | |

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| ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-451C NASA FMEA #: 05-6L-2256B- | | | | | | | | | -2 | | | | | NZ J | ASA I BASEI | DATA: LINE NEW | : [[| x |]] | |
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| | H | IDI | V/FUI | NC | | | A | | | | В | | | С | | | | | | |
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SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

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| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 452 DIOD |)E | | | | | | | | | | | | | | | | |
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| * CIL RE | TENTION | RATIONAL | E : | (If a | appl | icable | ≥) IN | AI JAI |)EQUATE)EQUATE | [| |]] | |
| REMARKS: | | | | | | | | | | | | | |

IOA'S RECOMMENDED CRITICALITY OF 3/1R IS DRIVEN BY OMS HARDWARE FMEA 03-3-2007-1, SINCE THIS FAILURE CAUSES TANK ISOL VALVE TO FAIL OPEN. ACCORDING TO THE LAST AVAILABLE NASA CRITICALITY, THIS FMEA SHOULD BE IN THE NEW NASA CIL LIST BUT IS NOT. IOA ASSUMES THAT NASA DOWNGRADED THIS TO A NON-CIL.

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| ASSESSME ASSESSME NASA FME | NT NT A # | | ATE:): | 1/0 OMS 05- | 1/88 -452 6L-2 | 2C 225 | 30 | 2-1 | | | | | | NA E | ASA I BASEI | DATA LINE NEW | : [[| x |]] | | |
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| SUBSYSTE MDAC ID: ITEM: | M: | | | 0MS 452 DIO | DE | | | | | | | | | | | | | | | | |
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| REMARKS: IOA RECO POSITION | MMI IS 2 | ENI | os f. E no | AILI T RE | NG 1 | CHE LY | i I A(| B SC CCES | | EE CB | N LF | SINCE E BY 1 | C C CHI | CHI E (| E MC. CREW | ASI | la'i TA'i | 'US 'RE | O FO | F RE | RE |

LAY "CLOSE" RELAYS WHICH DO NOT OPEN AND "OPEN" RELAYS WHICH DO NOT CLOSE BECAUSE OF A FAILED OPEN DIODE ARE NOT DETECTABLE AND THE FAILED DIODE IS NOT DETECTABLE INFLIGHT.

REPORT DATE 2/26/88 C-391

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NASA DATA: BASELINE [] ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-452D NASA FMEA #: NEW [X] 05-6L-2253D-1 OMS SUBSYSTEM: 452 MDAC ID: ITEM: DIODE LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С HDW/FUNC A В NASA [3 /2R] IOA [3 /1R] [P] [F] [P] [P] [P] [P] [X] COMPARE [/N] [N] [] [] [N] **RECOMMENDATIONS:** (If different from NASA) [3/1R] [P] [P] [P] [(ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE Ε 1

REMARKS:

IOA'S CRITICALITY OF 3/1R IS DRIVEN BY OMS HARDWARE FMEA 03-3-2007-1, SINCE THIS FAILURE CAUSES TANK ISOL VALVE TO FAIL OPEN. REPORT DATE 2/26/88

C-392

이 이 가지 못했다. 그렇게 가지 않는 것이 가지?

NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-452E NEW [X] NASA FMEA #: 05-6L-2255-1 OMS SUBSYSTEM: 452 MDAC ID: DIODE ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С В HDW/FUNC Α [P] [F] [F] [P] [X] * [P] NASA [3/1R][P] [X] IOA $\begin{bmatrix} 3 \\ 1R \end{bmatrix}$ [N] [N] [] ·[] [/] COMPARE RECOMMENDATIONS: (If different from NASA) [D] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE 1 INADEQUATE [1 **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE

THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT DA NT II A #: | ATE: D: | 1/01/0 0MS-49 05-6L | 38 52F -22 | 56-1 | | | N | ASA DA BASELI N | ATA: INE NEW | [|] X] | 1977 - 1989 - |
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| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 452 DIODE | | | | | | | | | | . <u>1</u> 2., |
| LEAD ANA | LYST | : | W.A. 1 | HAU | FLER | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | ÷ | |
| | CRITI FI | ICAL | ĽTY r | | REDUN | DANCY | SCR | EENS | | | CI IT | L EM | |
| | HDV | N/FUI | NC | | A | В | | С | | | | | |
| NASA IOA | [2 [3 | /1R /1R |]] | [| P] F] | [F [P |]] | [P [P |] | | [[| X] X] | * |
| COMPARE | [N | / |] | [| N] | [N |] | [|] | | [|] | |
| RECOMMEN | DATIC | DNS: | (If | di | ffere | nt fr | om N | ASA) | _ | | _ | | |
| | [_3 | /3 |] | [|] | [|] | [|] | (AI |] /תנ | D] DEI | LETE) |
| * CIL RE | TENT | ION I | RATION | ALE | : (If | appl | icab | le) Al INA | DEQUA1 DEQUA1 | ſE ſĒ | [[|] | |
| IOA RECO | MMENI | DS TI | HAT BE | LLO | WS FA | ILURE | SHO | ULD NO | OT BE | CON | ISI | DEF | ED AND |
| CRITICAL | ITY 1 D FAI | rhus I Luri | REDUCI | ED, CH | SINC IS BE | E IT YOND | CONS THE | TITUTI SCOPE | ES A " OF IC | 'MUI DA'S | JTI: S | PLE | 2 |
| INTERPRE | TATIC | | F NSTS | 22 | 206. | NASA | IS | RIGHT | THAT | THI | S | FAI | LURE |
| THE SIGN | AL TI | HROU | CH THIS | 90 5 I' | TEM W | OULD | ASS INHI | BIT C | | JAF (| 5) | , S PEN | IING |
| WHEN THE SCENARIO | VAL WIT | VES I H ANG | DTHER | FUL | L CLO LURE | SED O CONSI | R OP STIN | EN. I G OF I | BELLOW | SR, VS F | NA UP | SA' TUF | S NE IS |
| IRRELEVA COMPONEN | NT. A | A BEI ND VI | LLOWS I ALVE MO | RUP OTO | TURE . R TO | ANYTI PROPE | ME E LLAN | XPOSI T IS : | NG ELE SERIOU | CTR | IC. | AL TJ | UST |
| WHEN THE | VAL | VE MOT | OTOR IS | S C RTC | ONTIN | UOUSL | Y ON | AND I | HOT. THE F | THA SELI | T AW | IS, s f | THIS |
| FAILURE. | FUI | RTHE | RMORE, | TH | E VAL | VES A | RE P | ROTEC' | TED FF | RON | CO | NTI | NUOUS |
| POWER BY MOTOR AT | AN I NO I | ELEC. | THAN | тн 352 | F, A | SHUT ND, A | OFF CCOR | DEVIC | E WITH TO THE | ILN E SF | TH EC | ΕV S, | 'ALVE "THE - |
| MOTOR AN | D AC | TUAT: | ION ME | CHA | NISM | SHALL | NOT | FAIL | AS A | RES | UL | тс |)F |

PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-452G 05-6L-2256A-1 | NASA DATA BASELINE NEW | : [] [X] |
|--|--|--|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 452 DIODE | | |
| LEAD ANALYST: | W.A. HAUFLER | | |
| ASSESSMENT: | | | |
| CRITICAL | ITY REDUND | ANCY SCREENS | CIL |
| HDW/FU | NC A | B C | |
| NASA [3 /1R IOA [3 /1R |] [P]] [F] | [F] [P] [P] [P] | [X]* [X] |
| COMPARE [/ |] [N] | [И] [И] | [] |
| RECOMMENDATIONS: | (If differen | t from NASA) | |
| [3 /3 |] [] | [][](A) | [D] .DD/DELETE) |
| * CIL RETENTION | RATIONALE: (If | applicable) ADEQUATE INADEQUATE | [] |
| REMARKS: IOA RECOMMENDS T CRITICALITY THUS UNRELATED FAILUR INTERPRETATION O COULD CAUSE CONT THE SIGNAL THROU WHEN THE VALVES SCENARIO WITH AN IRRELEVANT. A BE COMPONENTS AND V WHEN THE VALVE M FAILURE DOES NOT FAILURE. FURTHE POWER BY AN ELEC | HAT BELLOWS FAI REDUCED, SINCE E" WHICH IS BEY F NSTS 22206. INUOUS POWER ON GH THIS ITEM WO REACH FULL CLOS OTHER FAILURE OF LLOWS RUPTURE A YALVE MOTOR TO F OTOR IS CONTINU SIGNIFICANTLY RMORE, THE VALV TRICAL THERMAL | LURE SHOULD NOT BE CO IT CONSTITUTES A "MU OND THE SCOPE OF IOA' NASA IS RIGHT THAT TH THE ASSOCIATED VALVE OULD INHIBIT CLOSING O ED OR OPEN. HOWEVER, CONSISTING OF BELLOWS NYTIME EXPOSING ELECT PROPELLANT IS SERIOUS, JOUSLY ON AND HOT. TH CONTRIBUTE TO THE BEI VES ARE PROTECTED FROM SHUTOFF DEVICE WITHIN | NSIDERED AND LTIPLE S IS FAILURE S(S), SINCE OR OPENING NASA'S RUPTURE IS RUPTURE IS TRICAL NOT JUST LAT IS, THIS LOWS RUPTURE I CONTINUOUS THE VALVE |

MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

REPORT DATE 2/26/88 C-395

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-453 05-6L-2: | 253-2 | | NASA DATA BASELINE NEW | : |
|--|--------------------------------|--|--|---|-----------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 453 DIODE | | | | |
| LEAD ANALYST: | W.A. HAU | UFLER | | | |
| ASSESSMENT: | | ÷ | | | |
| CRITICAL | LTY r | REDUNDA | NCY SCREI | ens | CIL |
| HDW/FU | NC | A | В | C C | |
| NASA [3 /1R IOÁ [2 /1R |] [] [| P] F] | [P] [P] | [P] [P] | [] * [X] [*] |
| COMPARE [N / |] [| и] | [] | [] | [N] |
| RECOMMENDATIONS: | (If d | ifferent | from NAS | SA) | |
| [/ |] [|] | [] | [] (A) | [] DD/DELETE) |
| * CIL RETENTION H | RATIONAL | E: (If a | pplicable | e) | |
| | - | | | ADEQUATE INADEQUATE | |
| REMARKS: IOA AGREES WITH | THIS NAS | A FMEA. | | | |
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| | una ficulta ente | n er state <u>state</u> seren S | | usunn in u m sin nsin | |
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NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-453A NASA FMEA #: 05-6L-2253A-2 NEW [X] SUBSYSTEM: OMS 453 MDAC ID: ITEM: DIODE W.A. HAUFLER LEAD ANALYST: ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С HDW/FUNC B Α [P] [F] NASA [2/1R] [P] [P] [P] [P] [X] * [X] IOA $\begin{bmatrix} 2 / 1R \end{bmatrix}$ COMPARE [/] [N] [] [] [] RECOMMENDATIONS: (If different from NASA) [D] [3/3]] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE Γ] INADEQUATE 1 **REMARKS:**

IOA RECOMMENDS REMOVING THIS FMEA FROM THE CIL. ACCORDING TO THE LAST AVAILABLE NASA CRITICALITY, THIS FMEA SHOULD BE IN THE NEW NASA CIL LIST BUT IS NOT. IOA ASSUMES THAT NASA DOWNGRADED THIS TO A NON-CIL, AND IOA TENTATIVELY CONCURS. IOA BELIEVES THIS FAILURE HAS NO EFFECT, SINCE ONLY A MULTIPLEXER-DEMULTIPLEXER (MDM) IS BEHIND THE "GPC CLOSE" DIODES, AND THAT IS WELL PROTECTED INTERNALLY FROM REVERSE CURRENT.

REPORT DATE 2/26/88

| ASSESSMENT DATE: | 1/01/88 | NASA DATA | A: |
|---------------------------------|---------------------------|------------------------|-------------------|
| ASSESSMENT ID: NASA FMEA #: | OMS-453B 05-6L-2253B-2 | BASELINI NEV | 3 [] 7 [X] |
| SUBSYSTEM: MDAC ID: ITEM: | OMS 453 DIODE | | : |
| LEAD ANALYST: | W.A. HAUFLER | | |
| ASSESSMENT: | | | |
| CRITICAL | TY REDUNDANC | SCREENS | CIL |
| HDW/FUN | ic A | c c c c | 11EM |
| NASA [3 /3 IOA [2 /1R |] [] [[] [F] [] |) [] ?] [P] | [] * [X] |
| COMPARE [N /N |] [и] [1 | [И] [| [N] |
| RECOMMENDATIONS: | (If different f | com NASA) | |
| [/ |] [] [|] [] (2 | [] ADD/DELETE |
| * CIL RETENTION H | ATIONALE: (If app | licable) | · |
| | | ADEQUATE INADEQUATE | |
| REMARKS: IOA AGREES WITH 7 | THIS NASA FMEA. | | . |
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REPORT DATE 2/26/88 C-398

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| ASSESSME ASSESSME NASA FME | ESSMENT DATE: 1/01/88 ESSMENT ID: OMS-453C A FMEA #: 05-6L-2256B-2 | | | | | | | | | | | NA B | SA D. ASEL | ATA: INE NEW | : [[] |) K] | | |
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| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 453 DIODI | E | | | | | | | | | | | | | |
| LEAD ANA | 'LA | ST | : | W.A. | HAU | JFI | LER | | | | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | | | | | |
| | CR | IT | ICAL | ITY | | RI | EDUN | DANG | CY | SCR | EENS | 5 | | | | L FM | | |
| | 1 | r. HDI | W/FU | NC | | A | | | В | | | С | | | *** | 514 | | |
| NASA IOA | [[| 3 2 | /1R /1R |]] | [[| P F |]] | [[| F P |]] | [[| P P |] | | []] | X] X] | * | |
| COMPARE | [| N | / |] | Ε | N |] | [| N |] | [| |] | | [|] | | |
| RECOMMEN | IDA! | FI | ons: | (1 | fd | if | fere | nt : | fro | om Ni | ASA) | | | | | | | |
| | . [| 3 | /3 |] | [| |] | [| |] | [| |] | (Al | [] [/] | D] DEL | ETE) | |
| * CIL RE | TE | NT | ION | RATIO | NAL | E: | (If | apj | p1 : | icab | le) IN | AC JAC |)EQUA)EQUA | TE TE | [[|] | | |
| REMARKS IOA RECO CRITICAI UNRELATH INTERPRI COULD CA THE SIGN WHEN THI SCENARIC IRRELEVA COMPONEN WHEN THI FAILURE FAILURE FAILURE FAILURE MOTOR AN PROLONGI SECT. 3 |)MM LIT ID ITA ID IAUS IAUS IAUS IAUS IAUS IAUS IAUS IAUS | EN FAI E TI ALIT · A ALSFU NO ACO 3 | DS T THUS ILUR ON O CONT HROU VES H AN A BE ND V NOT RTHE ELECC MORE TUAT WER .2.1 | HAT B REDU E" WH F NST INUOU GH TH REACH OTHER LLOWS ALVE OTOR SIGN RMORE TRICA THAN ION M APPLI .2.9, | ELL CED ICH S P IS FA RU TS IS IS IS IS IS IS IS IS IS IS IS IS IS | OW 22 OW ILL PT CO CA HE 2 AN 2 2 | S FA SINC S BE 06. ER W CLO URE URE TO NTIN NTLY VAL RMAL SM ISM N." 1.2. | ILUI E I YONI OULI SED CON ANY PRO UOU VES SH ND, SHA SE 11. | RE D SA HE D SI TI PE: SL NT LL LL | SHO CONS THE IS ASS INHI R OP STIN ME E LLAN Y ON RIBU RE P OFF CCOR NOT AC M | ULD TITU SCOI RIGH OCIA BIT EN. G OH XPOS T IS ANI TE T ROTH DEVI DINC FAI OTOH | NCE PETTEL TEL TEL TEL TEL TEL TEL TEL | T BE S A OF I THAT D VA OSIN OSIN OSIN OSIN OSIN OSIN OSIN OSIN | COI "MU OA': TH: LVE G OI ER, WS I ECT US, TH BEL ROM HIN E S SP | NSI LTI S IS (S) R NA RUP RICC NA LOW CO TH CO TH SUL EC | DER PLE FAI SAI TUR SUR TIS, RUR S, C C MC2 | ED AN LURE INCE ING S E IS UST THIS UPTUR NUOUS ALVE "THE F 84-04 | D E 30 |

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-454 05-6L-22 | 257-1 | | NASA DATA: BASELINE NEW | [] [X] |
|---|--|--|---|---|---|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 454 DIODE | | | · · · · · · · · · · · · · · · · · · · | |
| LEAD ANALYST: | W.A. HAU | JFLER | | | |
| ASSESSMENT: | | - | | | |
| CRITICAL | ITY | REDUNDANC | Y SCREENS | ; | CIL |
| HDW/FU | NC | A | В | Č | |
| NASA [3 /1R IOA [3 /2R |] [] [| P][F][| P][P][| P] P] | [] * [X] |
| COMPARE [/N |] [| N] [|] [|] | [N] |
| RECOMMENDATIONS: | (If di | ifferent f | rom NASA) | | |
| [3 /2R |] [| P] [| F] [| P] (AI | [A] DD/DELETE) |
| * CIL RETENTION | RATIONALI | E: (If app | olicable) IN | ADEQUATE IADEQUATE | |
| REMARKS: IOA'S RECOMMENDE HARDWARE FMEA 03 CROSSFEED VALVE SCREEN SINCE THE ACCESSIBLE BY TH | D CRITICA -3-2008-2 TO FAIL (MCA STAT E CREW. | ALITY OF 3 2, SINCE I CLOSED. I TUS OF REI THEREFORE | /2R IS IN OSS OF RE OA RECOMM AY POSITI , "CLOSE" | IDIRECTLY I DUNDANCY (IENDS FAIL) ONS ARE NO RELAYS WI | DRIVEN BY OMS CAUSES ING THE B DT READILY HICH DO NOT |

OPEN AND "OPEN" RELAYS WHICH DO NOT CLOSE BECAUSE OF A FAILED OPEN DIODE ARE NOT DETECTABLE AND SO THE FAILED DIODE IS NOT DETECTABLE INFLIGHT.

REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-4547 05-6L-22 | /01/88 MS-454A 5-6L-2257A-1 | | | | | | NA B | SA DATA: ASELINE NEW | [[| x |] | |
|---|----------------------------------|-----------------------------------|---------------------------|--------------|----------|------------------------|----------------|---------|----------------------------|-----------|-----------|----------|------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 454 DIODE | | | | | | | | | | | | |
| LEAD ANALYST: | W.A. HAU | JFL | ER | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | |
| CRITICAL | ITY | RE | DUNDAI | NC | Y | SCREE | NS | | | C] Th | L PEM | ſ | |
| HDW/FU | NС | A | | | в | | | С | | - | | • | |
| NASA [2 /1R IOA [3 /2R |] [] [| P F |]] | ((| P P |] | [[| P P |] | [[| X X |] | * |
| COMPARE [N /N |] [| N |] | [| |] | [| |] | [| |] | |
| RECOMMENDATIONS: | (If d | iff | ferent | f | rc | m NAS | A) | | | | | | |
| [3 /2R |] [| P |] . | [| Ρ |] | [| P |] (Al |] ,00 | D / DI |] ELE | TE) |
| * CIL RETENTION | RATIONAL | Е: | (If a | pp | li | .cable | :) т N | | EQUATE | [r | |] | |
| REMARKS: IOA'S RECOMMENDE FMEA 03-3-2008-2 TO FAIL CLOSED. | D CRITIC , SINCE ' ACCORDI | AL] TH] NG | ITY OF IS FAI TO TH | 3 LU E | /2 RE | R IS CAUS AST AV | DF ES AI | | VEN BY OI THE CROSS | MS SFI | H2 EEI | ARI | WARE |

CRITICALITY, THIS FMEA SHOULD BE IN THE NEW NASA CIL LIST BUT IS NOT. IOA ASSUMES THAT NASA DOWNGRADED THIS TO A NON-CIL.

REPORT DATE 2/26/88 C-401

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| ASSESSMENT DATE: | 1/01/88 | | | NASA DATA | ¥: |
|---------------------------------|---------------------|-------------|----------------|-------------------------------|--------------------|
| ASSESSMENT ID: NASA FMEA #: | OMS-454 05-6L-2 | B 257B-1 | | BASELINI NEV | ≤ [] ▼ [X] |
| SUBSYSTEM: MDAC ID: ITEM: | OMS 454 DIODE | | | | |
| LEAD ANALYST: | W.A. HA | UFLER | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY | REDUNI | DANCY SCR | EENS | CIL |
| HDW/FU | NC | A | в | с | LTEM |
| NASA [3 /1R IOA [3 /2R |] [| P] F] | [P] [P] | [P] [P] | [] * [X] |
| COMPARE [/N |] [| N] | [] | [] | [N] |
| RECOMMENDATIONS: | (If d | ifferen | nt from N | ASA) | |
| [/ | ן _ר נ |] | [] | [] | [] ADD/DELETE) |
| * CIL RETENTION | RATIONAL | E: (If | applicab | le) ADEQUATE INADEQUATE | [] |
| REMARKS: TOA AGREES WITH | THIS NAS | A FMÉA. | - 1 - 1 - 1 | | |
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REPORT DATE 2/26/88

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-454 05-6L-2 | C 257C-1 | | NASA DA' BASELII NI | FA: NE [] EW [X] |
|--|-------------------------------|-------------|----------------|-----------------------------|---------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 454 DIODE | | | | |
| LEAD ANALYST: | W.A. HA | UFLER | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY T | REDUND | ANCY SCRE | EENS | CIL ITEM |
| HDW/FU | NC | A | В | С | |
| NASA [3 /1R IOA [3 /2R |] [| P] F] | [P] [P] | [P] [P] | [] * [X] |
| COMPARE [/N |] [| N] | [] | [] | [N] |
| RECOMMENDATIONS: | (If d | ifferen | t from NA | ASA) | |
| [3 /1R |] [| P] | [F] | [P] | [A] (ADD/DELETE) |
| * CIL RETENTION | RATIONAL | E: (If | applicabl | Le) ADEQUAT INADEQUAT | E [] E [] |
| REMARKS: IOA RECOMMENDS F | AILING T | HE B SC | REEN SING | CE THE MCA | STATUS OF RE |

IOA RECOMMENDS FAILING THE B SCREEN SINCE THE MCA STATUS OF RELAY POSITIONS ARE NOT READILY ACCESSIBLE BY THE CREW. THEREFORE, "CLOSE" RELAYS WHICH DO NOT OPEN AND "OPEN" RELAYS WHICH DO NOT CLOSE BECAUSE OF A FAILED OPEN DIODE ARE NOT DETECTABLE AND THE FAILED DIODE IS NOT DETECTABLE INFLIGHT.

REPORT DATE 2/26/88

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| ASSESSMEN ASSESSMEN NASA FMEN | | NASA DATA: Baseline [] New [X] | | | | | | | | | | | | | | | | |
|-------------------------------------|------------|---|---------------------|--------|--------|------|--------|--------|---------|----------|-----------|----------------|------------|-------------|-----|----------|-----|--|
| SUBSYSTEM MDAC ID: ITEM: | M: | | OMS 454 DIODE | | | | | | | | | | | | | | | |
| LEAD ANAL | LYST | : | W.A. H | IAU | FL | ER | | | | | | | | | | | | |
| ASSESSMEN | NT: | | | | | | | | | | | | | | | | | |
| CRITICALITY | | | | | | DUND | AN | СХ | SCREENS | | | | | CIL ITEM | | | | |
| | HD | W/FUI | NC | | A | | | В | | | С | | | ī. | | | | |
| NASA IOA | [3 [3 | /2R /2R |]] | [[| P F |] | [[| P P |] | [[| P P |]] | | [[| x |]]· | * | |
| COMPARE | [| / |] | [| N |] | [| |] | [| |] | | [| N |] | | |
| RECOMMENI | DATI | ons: | (If | di | ff | eren | t | fr | om NAS | A) | I | | | | | | | |
| | [| 1 |] | [| |] | [| |] | [| |] | (AI | [)D/ | ′DF |] ELE | TE) | |
| * CIL RE | TENT | ION | RATION | ALE | : | (If | ap | pl: | icable | e) IN | AI IAI | DEQUA DEQUA | ATE ATE | [| |] | | |
| REMARKS: IOA AGREI | es W | ITH ' | THIS NZ | ASA | F | MEA. | | | | | | | | - | | - | | |

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-454E 05-6L-2258-1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | | | | |
|--|-------------------------------------|---|--------------------|--|--|--|--|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 454 DIODE | | | | | | | | | | | | | |
| LEAD ANALYST: | W.A. HAUFLER | | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | |
| CRITICAL | ITY REDUNDANC | CY SCREENS | CIL | | | | | | | | | | | |
| HDW/FU | NC A | B C | 1124 | | | | | | | | | | | |
| NASA [3 /1R IOA [3 /2R |] [P] [] [F] [| F] [P] P] [P] | [X] * [X] | | | | | | | | | | | |
| COMPARE [/N |] [N] [| N] [] | [] | | | | | | | | | | | |
| RECOMMENDATIONS: | (If different a | from NASA) | | | | | | | | | | | | |
| [/ |] [] [|] [] (| [] ADD/DELETE) | | | | | | | | | | | |
| * CIL RETENTION | RATIONALE: (If ap) | plicable) ADEQUATE INADEQUATE | | | | | | | | | | | | |
| REMARKS: IOA AGREES WITH | THIS NASA FMEA. | | | | | | | | | | | | | |

REPORT DATE 2/26/88

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| ASSESSME ASSESSME NASA FME | NT DAT: NT ID: A #: | E: 1/01 OMS- 05-6 | /88 454F L-22 | 59-1 | | | ł | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | |
|--|--|--|--------------------------------|--------------------------------|-----------------------------------|--------------------------|----------------------------------|---|----------------------|----------------|-------------------|--------|--|--|--|--|--|
| SUBSYSTE MDAC ID: ITEM: | M: | OMS 454 DIOD | E | | | | | | | | | | | | | | |
| LEAD ANA | LYST: | W.A. | HAU | FLER | | | | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | | | | |
| | CRITIC |] | REDUN | DANCY | SCF | EENS | | | CIL | | | | | | | | |
| | HDW/ | FUNC | i | A | В | | Ċ | : | <u>.</u> | 1.1 | EM. | | | | | | |
| NASA IOA | [3 /2 [3 /2 | 1R] 2R] | [| P] F] | [F [P |]] | [] [] |)) | | [[| X] X] | * | | | | | |
| COMPARE | [/1 | ן א | [] | и] | [N |] | ſ |] | | [|] | | | | | | |
| RECOMMEN | DATION | S: (I | f di: | ffere | nt fro | om N | iasa) | | | | | | | | | | |
| | [3/: | 3] | [|] | [|] | [|] | (AE | [D/0(| D] DEL | ETE) | | | | | |
| * CIL RE | TENTIO | N RATIO | NALE | : (If | appl | icab | le) A INA | | ATE ATE | [|] | | | | | | |
| REMARKS: IOA RECO CRITICAL UNRELATE INTERPRE | MMENDS ITY THU D FAILU TATION | THAT B US REDU URE" WH OF NST | ELLO CED, ICH I 5 221 | WS FA SINC IS BE 206. | ILURE E IT (YOND) NASA | SHO CONS THE IS | ULD N TITUI SCOPE RIGHI | IOT BE YES A COF I | CON "MUI COA'S | ISI TI S | DER PLE FAI | ED AND | | | | | |

UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11. ----

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-454G NEW [X] 05-6L-2260-1 NASA FMEA #: SUBSYSTEM: OMS MDAC ID: 454 DIODE ITEM: W.A. HAUFLER LEAD ANALYST: ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT В С HDW/FUNC A [P] [F] [P] [X] * NASA [2/1R][F] [P] [P] [X] [3 / 2R]IOA COMPARE [N /N] [N] [N] [] [] RECOMMENDATIONS: (If different from NASA) [3/3]] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE Γ] INADEQUATE] l **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S

CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-454H 1 NEW [X] NASA FMEA #: 05-6L-2260A-1 SUBSYSTEM: OMS 454 MDAC ID: DIODE ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT C В HDW/FUNC A [P] [F] [F] [P] [P] [P] [3 /1R] [X] * NASA 1 3 /2R 1 ΓΧΊ IOA COMPARE [/N] [N] [N] [] [] RECOMMENDATIONS: (If different from NASA) [3/3] [] [] [] [D] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-454I NEW [X] 05-6L-2260B-2 NASA FMEA #: OMS SUBSYSTEM: 454 MDAC ID: DIODE ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С В HDW/FUNC A [P] [P] [P] [F] [F] [X] * NASA [3/1R][P] **[X]** [3 /2R] IOA COMPARE [/N] ſ] **RECOMMENDATIONS:** (If different from NASA) [D] [3/3] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE Γ] INADEQUATE 1 Γ **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS FAILURE. POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE

MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: SUBSYSTEM: MDAC ID: ITEM: | | | | 1/ 0M 05 | 01/ IS-4 5-6L | 88 55 -22 | 25 | 7-2 | | NASA DATA BASELINE NEW | | | | | | | | | : [] | x |]] | |
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| | | | | 0M 45 DI | OMS 455 DIODE | | | | | | | | | | | | | | | | | |
| LEAD AN | AL | YS | F : | W. | A. | HAU | JFI | LER | | | | | | | | | | | | | | |
| ASSESSM | EN | T: | | | | | | | | | | | | | | | | | | | | 1 E . 1 |
| CRITICAL | | | | LITY IT | | | REDUNDANCY SCRE | | | | | EĒ | ENS | | | | | CIL ITEM | | | | |
| | HDW/FU | | | JNC | NC | | | A | | | В | | | С | | | | | | | | |
| NASA IOA | | [| 3 /11 3 /21 | R] R] | | [[| P F |]] | | [[| P P |]] | | [[| P P |] | | | [[| x |]] | * |
| COMPARE | 1 | [| /N |] | | [| N |] | | [| |] | | [| |] | | | [| N |] | |
| RECOMME | ND. | AT: | IONS | : | (If | đ | if: | fer | ent | f | r | om N | IAS | A) |): 2 | | | | | | | |
| | | [| 3 /21 | R j | | [| P |] | | [| P |] | | [| P | 1 | | (A |] DD | / DI |] ELI | ETE) |
| * CIL R | ET | EN' | TION | RAI | NOI | AL | E: | (I | fa | pp | 1 i | icab | ole |) 11 | A NA | DEQ | 2UA' 2UA' | re Fe | [| |]] | |
| REMARKS IOA'S R FMEA 03 TO FAIL | EC -3 | 0M -2 LO | MENDI 008-: SED. | ED C 2, S | CRIT | IC E | AL: TH: | ITY Is | OF FAI | 3 LU | /2 RI | 2R I E CA | s NUS | DI ES | RIY 5 1 | ven Fhe | B C | Y C Ros | MS SF | H EEI | ARI D V | DWARE VALVE |
| e e en aj s antiga en al | | | · · · · · | | | | | | | | | in en en Sins en en en | · · | | | | | | | | | an the second |
| 1847 | | | | | i e L | | | | | њ. | :. | | ita, et | | | | | | | | | . : : |
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REPORT DATE 2/26/88
| ASSESSME ASSESSME NASA FME | ENT ENT EA ‡ | DZ II #: | ATE: D: | 1/0 0 M 05 | /01/88 MS-455A 5-6L-2257A-2 | | | | | | | | | NZ E | ASA BASI | DAT ELIN NE | 'A: IE IW | [[| x |] | |
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| SUBSYSTE MDAC 'ID: ITEM: | E M : | | | OM 45 DI | S 5 ODE | | | | | | | | | | | | | | | | |
| LEAD ANA | LYS | ST | : | W. | A. H | IAI | JFI | ER | | | | | | | | | | | | | |
| ASSESSME | ENT | : | | | | | | | | | | | | | | | | | | | |
| | CRI | ITI FI | ICALI LIGHT | ITY F | | | RI | EDUN | IDA | NC | Y | SCRI | EENS | 3 | | | | C] [] | il Cen | 4 | |
| | H | HDV | V/FUI | NC | | | A | | | | В | | | С | | | | | | | |
| NASA IOA | [[| 2 3 | /1R /2R |] | | [[| P F |] | | [[| P P |]] | [[| P P |]] | | | [[| X X |]] | * |
| COMPARE | [| N | /N |] | | [| N |] | | [| |] | [| |] | | | [| |] | |
| RECOMMEN | IDA: | FI C | ONS: | | (If | d: | ifi | fere | ent | f | rc | om N2 | ASA |) | | | | | | | |
| | נ | 3 | /3 |] | | [| |] | | [| |] | [| |] | | (AI |] D, | D / DI |) Eli | ETE) |
| * CIL RI | etei | NT: | ION | RAT | IONZ | ΥĽ | E: | (If | fa | pp | 11 | cab: | le) I | A NA | DEQ DEQ | UATI UATI | E E | [[| |] | |

REMARKS:

IOA RECOMMENDS REMOVING THIS FMEA FROM THE CIL. ACCORDING TO THE LAST AVAILABLE NASA CRITICALITY, THIS FMEA SHOULD BE IN THE NEW NASA CIL LIST BUT IS NOT. IOA ASSUMES THAT NASA DOWNGRADED THIS TO A NON-CIL, AND IOA TENTATIVELY CONCURS. IOA BELIEVES THIS FAILURE HAS NO EFFECT, SINCE ONLY A MULTIPLEXER-DEMULTIPLEXER (MDM) IS BEHIND THE "GPC CLOSE" DIODES, AND THAT IS WELL PROTECTED INTERNALLY FROM REVERSE CURRENT.

REPORT DATE 2/26/88

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| ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #: | : 1/01/88 OMS-455 05-6L-2 | B 257B-2 | | NASA DA BASELI N | TA: NE [] EW [X] |
|---|---------------------------------|------------------|----------------------------------|-----------------------------|---------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 455 DIODE | | | | |
| LEAD ANALYST: | W.A. HA | UFLER | | | |
| ASSESSMENT: | | | | | 7 |
| CRITICA FLIG HDW/F | LITY HT UNC | REDUNE A | ANCY SCRE | C C | CIL ITEM |
| NASA [3 /3 IOA [3 /2 |] [R] [|] F] | [] [P] | [] [P] | [] * [X] |
| COMPARE [/N |] [| N] | [N] | [N] | [N] |
| RECOMMENDATIONS | : (If d | ifferen | t from NA | SA) | |
| [/ |] [|] | [] | [] | [] (ADD/DELETE) |
| * CIL RETENTION | RATIONAL | E: (If | applicabl | .e) ADEQUAT INADEQUAT | E [] E [] |
| REMARKS: IOA AGREES WITH | THIS NAS | A FMEA. | 원은 <u>전통</u> 활약으로 1773년 1973년 | ni i <u>si</u> i | |
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REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-456 05-6L-22 | 57-1 | | BASELINE [] NEW [X] | | | | | |
|--|--------------------------------|--------------------------|--------------------|------------------------------|--------------------------------------|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 456 DIODE | | | | | | | | |
| LEAD ANALYST: | W.A. HAU | FLER | | | | | | | |
| ASSESSMENT: | | | | | | | | | |
| CRITICAL | ITY | REDUNDANC | CY SCREE | NS | CIL | | | | |
| HDW/FU | NC | A | В | С | | | | | |
| NASA [3 /1R IOA [3 /2R |] [] [| P][F][| P] P] | [P] [P] | [] * [X] | | | | |
| COMPARE [/N |] [| N] [|] | [] | [N] | | | | |
| RECOMMENDATIONS: | (If di | fferent 1 | from NAS | A) | | | | | |
| [3 /2R |] [| P] [| F] | [P] . (Al | [A] DD/DELETE) | | | | |
| * CIL RETENTION | RATIONALE | : (If app | plicable |) ADEQUATE INADEQUATE | [] | | | | |
| REMARKS: IOA'S RECOMMENDE HARDWARE FMEA 03 | D CRITICA -3-2008-2 | ALITY OF 3 2, SINCE 1 | 3/2R IS LOSS OF | INDIRECTLY REDUNDANCY (| DRIVEN BY OMS CAUSES ING THE B | | | | |

CROSSFEED VALVE TO FAIL CLOSED. IOA RECOMMENDS FAILING THE B SCREEN SINCE THE MCA STATUS OF RELAY POSITIONS ARE NOT READILY ACCESSIBLE BY THE CREW. THEREFORE, "CLOSE" RELAYS WHICH DO NOT OPEN AND "OPEN" RELAYS WHICH DO NOT CLOSE BECAUSE OF A FAILED OPEN DIODE ARE NOT DETECTABLE AND SO THE FAILED DIODE IS NOT DETECTABLE INFLIGHT.

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-456A 1 05-6L-2257A-1 NEW [X] NASA FMEA #: SUBSYSTEM: OMS MDAC ID: 456 ITEM: DIODE LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CRITICALITY CIL FLIGHT ITEM Ċ HDW/FUNC A В
 IASA
 [2 /1R]
 [P]
 [P]

 IOA
 [3 /2R]
 [F]
 [P]
NASA [2 /1R] [X]* [X] COMPARE [N/N] [N] []][] RECOMMENDATIONS: (If different from NASA) [3/2R] [P] [P] [P] [D] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [1 INADEQUATE [1 **REMARKS:** IOA'S RECOMMENDED CRITICALITY OF 3/2R IS DRIVEN BY OMS HARDWARE

FMEA 03-3-2008-2, SINCE THIS FAILURE CAUSES THE CROSSFEED VALVE TO FAIL CLOSED. ACCORDING TO THE LAST AVAILABLE NASA CRITICALITY, THIS FMEA SHOULD BE IN THE NEW NASA CIL LIST BUT IS NOT. IOA ASSUMES THAT NASA DOWNGRADED THIS TO A NON-CIL.

REPORT DATE 2/26/88 C-414

| ASSESSME ASSESSME NASA FME | ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-456B NASA FMEA #: 05-6L-2257B-1 SUBSYSTEM: OMS | | | | | | | | | | N <i>A</i> E | ASA DA BASELI N | TA: NE EW | : [] | x |] | |
|----------------------------------|---|------------|-------------|--------|--------|--------|--------|--------|--------|---------|-----------------|-----------------------|-----------------|-------------|-----------|----------|------|
| SUBSYSTE MDAC ID: ITEM: | SUBSYSTEM:OMSMDAC ID:456ITEM:DIODELEAD ANALYST:W.A. HAUFLER | | | | | | | | | | | | | | | | |
| LEAD ANA | LYST: | | W.A. | HA | UFI | LER | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | | | | |
| | CRITI FL | CAL | ITY F | | RI | EDUNI | ANC | Y | SCRE | EN | 5 | | | | [L [en | 4 | |
| FLIGHT HDW/FUNC A | | | | | | | | B | | | С | | | | | | |
| NASA IOA | [3 [3 | /1R /2R |]] | [[| P F |]] | [[| P P |]] | [[| P P |] | | [[| x |] | * |
| COMPARE | [| /N |] | [| N |] | [| |] | [| |] | | [| N |] | |
| RECOMMEN | IDATIO | NS: | (If | d | if: | ferer | nt f | r | om NA | SA |) | | | | | | |
| | [| / · |] | [| |] | [| |] | ľ | |] | (A) |] DD, | /DI |] Ele | ETE) |
| * CIL RI REMARKS | ETENTI : :Es Wi | ON] | RATION | AL | E: | (If | app | 1: | icabl | e) I | Al NAI | DEQUAT DEQUAT | 'E 'E | [[| |]] | |
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REPORT DATE 2/26/88

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C-415

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-4560 05-6L-22 | C 257C-1 | | NASA DATA BASELINE NEW | : [] [X] |
|--|---------------------------------|----------------------|----------------|-------------------------------|-------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 456 DIODE | | | | |
| LEAD ANALYST: | W.A. HAU | JFLER | | | |
| ASSESSMENT: | | | | | |
| CRITICAL FLIGH | ITY T | REDUNDA | ANCY SCREI | ENS | CIL ITEM |
| HDW/FU | NC | A | B | C <u>in the second</u> | |
| NASA [3 /1R IOA [3 /2R |] [] [| P] F] | [P] [P] | [P] [P] | [] * [X] |
| COMPARE [/N |] [| N] | [] | [] | [N] |
| RECOMMENDATIONS: | (If d | ifferent | t from NAS | SA) | |
| · [3 /1R |] [| P] | [F] | [P] (AI | [A] DD/DELETE) |
| * CIL RETENTION | RATIONAL | 2: (If a | applicable | ≥) ADEQUATE INADEQUATE | [] |
| REMARKS: IOA RECOMMENDS F POSITIONS ARE NO | AILING TH T READILY | IE B SCI (ACCESS | REEN SINCI | THE MCA STA | ATUS OF RE HEREFORE, |

IOA RECOMMENDS FAILING THE B SCREEN SINCE THE MCA STATUS OF RELAY POSITIONS ARE NOT READILY ACCESSIBLE BY THE CREW. THEREFORE, "CLOSE" RELAYS WHICH DO NOT OPEN AND "OPEN" RELAYS WHICH DO NOT CLOSE BECAUSE OF A FAILED OPEN DIODE ARE NOT DETECTABLE AND THE FAILED DIODE IS NOT DETECTABLE INFLIGHT.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-456D 05-6L-2257D-1 | NAS/ BAS | A DATA: SELINE [] NEW [X] |
|--|--------------------------------------|-----------------------------|------------------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 456 DIODE | | |
| LEAD ANALYST: | W.A. HAUFLER | | |
| ASSESSMENT: | | | |
| CRITICAL FLIGH | ITY REDUNI F | DANCY SCREENS | CIL ITEM |
| HDW/FU | NC A | B C | |
| NASA [3 /2R IOA [3 /2R |] [P]] [F] | [P] [P] [P] [P] | [] * [X] |
| COMPARE [/ |] [N] | [][] | [N] |
| RECOMMENDATIONS: | (If differe | nt from NASA) | |
| <u>ر</u> / |] [] | [][] | [] (ADD/DELETE) |
| * CIL RETENTION | RATIONALE: (If | applicable) ADE INADE | QUATE [] QUATE [] |
| REMARKS: IOA AGREES WITH | THIS NASA FMEA | | |

REPORT DATE 2/26/88

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| ASSESSMEI ASSESSMEI NASA FMEI | NT DA NT IA A #: | ATE: D: | 1/01/8 OMS-49 05-6L- | 38 56E -22! | 58-1 | | |] | NASA DATA BASELINE NEW | 2: [7 [X | ,] |
|-------------------------------------|------------------------|------------|----------------------------|-------------------|------------|------------|-------------|-------------|------------------------------|------------------|--------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 456 DIODE | | | | | - N (19 4*) | | | |
| LEAD ANA | lyst | : | W.A. 1 | HAU | FLER | | | | | | |
| ASSESSME | NT: | | | | | | | | · · = . · · · | | |
| (| CRIT F | ICAL | ITY F |] | NDANCY | SCRI | eens | | CII ITE | E M | |
| | HD | W/FUI | NC | ž | В | | (| C | 1 N 11 | | |
| NASA IOA | [3 [3 | /1R /2R |] | [] [] | P] F] | [F [P |]] | [נ | P] P] | K] K] | (] * [] |
| COMPARE | נ | /N |] | [] | 4] | [N |] | [|] | [|] |
| RECOMMEN | DATI | ons: | (If | di | ffere | ent fr | om Ni | ASA) | | | |
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| REMARKS: IOA AGRE | ES W | ITH ' | THIS NA | A. - | | | an an an Ar | | | | |

REPORT DATE 2/26/88

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NASA DATA: ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: BASELINE [OMS-456F NEW [X] NASA FMEA #: 05-6L-2259-1 OMS SUBSYSTEM: MDAC ID: 456 DIODE ITEM: LEAD ANALYST: W.A. HAUFLER **ASSESSMENT:** REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT В С HDW/FUNC Α [P] [X] * [P] [F] NASA [3/1R][F] [P] [P] [X] IOA [3/2R][N] [N] [] ſ] COMPARE Г /N] RECOMMENDATIONS: (If different from NASA) [D]] [] [[] [3/3] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE 1 INADEQUATE 1 **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S

INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS FAILURE. POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-456G 05-6L-2260- | 1 | NASA DATA BASELINE NEW | : [x] |
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| SUBSYSTEM: MDAC ID: ITEM: | OMS 456 DIODE | | ан 1917 — ан | |
| LEAD ANALYST: | W.A. HAUFLE | R | | |
| ASSESSMENT: | | | | |
| CRITICAL FLIGH HDW/FU | ITY RED T NC A | UNDANCY SCREI B | ENS C | CIL ITEM |
| NASA [2 /1R IOA [3 /2R |] [P]] [F] | [F] [P] | [P] [P] | [X]* [X] |
| COMPARE [N /N |] [N] | [N] | [] | [] |
| RECOMMENDATIONS: | (If diffe | rent from NAS | SA) | |
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| * CIL RETENTION | RATIONALE: (| If applicable | e) ADEQUATE INADEQUATE | [] [] |
| REMARKS: IOA RECOMMENDS T CRITICALITY THUS UNRELATED FAILUR INTERPRETATION O COULD CAUSE CONT THE SIGNAL THROU WHEN THE VALVES SCENARIO WITH AN IRRELEVANT. A BE COMPONENTS AND V WHEN THE VALVE M FAILURE DOES NOT FAILURE. FURTHE POWER BY AN ELEC MOTOR AT NO MORE MOTOR AND ACTUAT PROLONGED POWER SECT. 3.1, 3.2.1 | HAT BELLOWS REDUCED, SI E" WHICH IS F NSTS 22206 INUOUS POWER GH THIS ITEM REACH FULL C OTHER FAILUR LLOWS RUPTUR ALVE MOTOR T OTOR IS CONT SIGNIFICANT RMORE, THE V TRICAL THERM THAN 352 F, ION MECHANIS APPLICATION. .2.9, 3.2.1. | FAILURE SHOU NCE IT CONST BEYOND THE SO NASA IS R ON THE ASSO WOULD INHIB LOSED OR OPEN E CONSISTING E ANYTIME EXI O PROPELLANT INUOUSLY ON A LY CONTRIBUT ALVES ARE PRO AL SHUTOFF DI AND, ACCORD M SHALL NOT I " SEE AC MO 2.11. | LD NOT BE CO ITUTES À "MU COPE OF IOA' IGHT THAT TH CIATED VALVE IT CLOSING O N. HOWEVER, OF BELLOWS POSING ELECT IS SERIOUS, AND HOT. TH E TO THE BEL DTECTED FROM EVICE WITHIN ING TO THE S FAIL AS A RE TOR VALVE SP | NSIDERED AND LTIPLE S IS FAILURE (S), SINCE R OPENING NASA'S RUPTURE IS RICAL NOT JUST AT IS, THIS LOWS RUPTURE CONTINUOUS THE VALVE PECS, "THE SULT OF EC MC284-0430 |

REPORT DATE 2/26/88

ASSESSMENT DATE: 1/01/88 NASA DATA: ASSESSMENT ID: BASELINE [OMS-456H NEW [X] NASA FMEA #: 05-6L-2260A-1 OMS SUBSYSTEM: MDAC ID: 456 ITEM: DIODE LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT В С HDW/FUNC A [F] [P] [X] [P] NASA [3/1R][P] [F] [X] [P] IOA [3/2R][N] [N] [] ſ] COMPARE F /N] **RECOMMENDATIONS:** (If different from NASA)] [D] [3/3] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE] INADEQUATE 1 **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS FAILURE. POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE

MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-456I 05-6L-2260B-2 NEW [X] NASA FMEA #: SUBSYSTEM: OMS 456 MDAC ID: DIODE ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С В HDW/FUNC A [P] [F] [P] [X]* [F] [P] [P] [X] NASA [3/1R]IOA [3/2R]COMPARE [/N] [N] [N] [] Γ] **RECOMMENDATIONS:** (If different from NASA) [D] [3/3] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE ſ] INADEQUATE [1 **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE-MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF

PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

REPORT DATE 2/26/88

| ASSESSMEN ASSESSMEN NASA FMEZ | NT DATE: NT ID: A #: | 1/01/88 OMS-457 05-6L-22 | 257 | -2 | | | | NASA DATA BASELINE NEW | : [x] |] |
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| SUBSYSTEN MDAC ID: ITEM: | 4 : | OMS 457 DIODE | | | | | | | | |
| LEAD ANAL | LYST: | W.A. HAU | JFI | ER | | | | | | |
| ASSESSME | IT: | | | | | | | | | |
| (| CRITICAL FLIGH | ITY F | RE | DUNDA | NCY | SCREE | INS | C | CIL ITE | M |
| | HDW/FU | NC | A | | Б | | | | | |
| NASA IOA | [3 /1R [3 /2R |] [] [| P F |] | [P [P |] | [[| P] P] | [[X |] * [] |
| COMPARE | [/N |] [| N |] | [|] | [| .] | [N | [] |
| RECOMMEN | DATIONS: | (If d | if | ferent | : fro | om NAS | SA) | | | |
| • | [3 /2R |] [| P |] | [P |] | [| P] (A | [DD/D |] DELETE |
| * CIL RE | TENTION | RATIONAL | Е: | (If a | appl | icable | ≤) Il | ADEQUATE IADEQUATE | [|]] |
| REMARKS: | | | | | | | | | | |

IOA'S RECOMMENDED CRITICALITY OF 3/2R IS DRIVEN BY OMS HARDWARE FMEA 03-3-2008-2, SINCE THIS FAILURE CAUSES THE CROSSFEED VALVE TO FAIL CLOSED.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | ENT DATE: 1/01/88 ENT ID: OMS-457A EA #: 05-6L-2257A-2 | | | | | | | | 2 | | | | | N | iasa Basi | DAT ELIN NE | 'A: E W | [[| x |]] | |
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| SUBSYSTE MDAC ID: ITEM: | M: | | | 01 4 9 D | IS 57 LODE | | | | | | | | | | | | | | | | |
| LEAD ANA | LY | st | : | W | .A. | HA | UF | LER | | | | | | | | | | | | | |
| ASSESSME | NT | : | | | | | | | | | | | | | | | | | | | |
| | CR: | IT F HD | ICAL LIGH W/FUI | ITY F NC | č | | RI A | EDUI | ND | ANC | CY B | SCF | REEI | NS C | : | | (| CI CT | L 'EM | [: | |
| NASA IOA | [[| 2 3 | /1R /2R |]] | | [[| P F |] | | [[| P P |] | | [F [F |)] | | | Ē | X X |]] | * |
| COMPARE | [| N | /N |] | | נ | N |] | | [| |] | | [|] | | (| - | |] | |
| RECOMMEN | DA' | FI (| ons: | | (If | đ | if | fere | ent | t f | rc | om N | IAS | ¥) | | | | | | | |
| • | Ĺ | 3 | /3 |] | | [| |] | | [| |] | | [|] | (|] ADI | 5/ | D DE |] :LE | ETE) |
| * CIL RE | TEI | NT: | ION I | RAJ | TON | ALJ | E: | (11 | Ēā | app | oli | cab | ole) .1 | A ENA | DEQU DEQU | JATE JATE | [| • | |]] | |
| REMARNS : | | | | | | | | | | | | | | | | | | | | | |

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IOA RECOMMENDS REMOVING THIS FMEA FROM THE CIL. ACCORDING TO THE LAST AVAILABLE NASA CRITICALITY, THIS FMEA SHOULD BE IN THE NEW NASA CIL LIST BUT IS NOT. IOA ASSUMES THAT NASA DOWNGRADED THIS TO A NON-CIL, AND IOA TENTATIVELY CONCURS. IOA BELIEVES THIS FAILURE HAS NO EFFECT, SINCE ONLY A MULTIPLEXER-DEMULTIPLEXER (MDM) IS BEHIND THE "GPC CLOSE" DIODES, AND THAT IS WELL PROTECTED INTERNALLY FROM REVERSE CURRENT.

REPORT DATE 2/26/88

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-457B 05-6L-2257B-2 | NASA DATA Baseline Nev | A: 5 [] 7 [X] |
|--|--------------------------------------|---|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 457 DIODE | | |
| LEAD ANALYST: | W.A. HAUFLER | | |
| ASSESSMENT: | | | |
| CRITICAL | ITY REDUNDANCY | SCREENS | CIL ITEM |
| HDW/FU | NC A E | S C | |
| NASA [3/3 IOA [3/2R |] [] [] [F] [F |) [P] | [] * [X] |
| COMPARE [/N |) [N] [N | [И] | [N] |
| RECOMMENDATIONS: | (If different fr | com NASA) | |
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| * CIL RETENTION | RATIONALE: (If appl | .icable) | r 1 |
| | | INADEQUATE | |
| REMARKS: IOA AGREES WITH | THIS NASA FMEA. | | |
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| | | , Markov (1997), stantov († 1997) 1997 – Stantov A. († 1997) 1997 – Stantov A. († 1997) | |
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| SUBSYST MDAC ID ITEM: | em : : | | | 01 45 DF | AS 58 RIVEF | ٤, | НŻ | BRI | D | | | | | | | | | |
| LEAD AN | ALYS | ST: | : | W. | A. F | IAI | JFI | LER | | | | | | | | | | |
| ASSESSMI | ENT | : | | | | | | | | | | | | | | | | |
| | CR | IT] FI | CAL | ITY T | 2 | | RI | EDUN | DAN | CY | SCRE | EENS | 5 | | (| CIL TEN | ſ | |
| | I | HDV | V/FU | NC | | | A | | | B | | | С | | - | | - | |
| NASA IOA | [[| 3 3 | /3 /2R |] | | [[| P |]] | [[| Р |]] | [[| P |]] | (| - |]] | * |
| COMPARE | [| | /N |] | | [| N |] | (| N |] | נ | N |] | l | [|] | |
| RECOMME | NDA | FI C | ONS: | | (If | d: | if | fere | nt | fro | om NA | ASA) |) | | | | | |
| | [| 3 | /2R |] | | [| P |]. | . [| Ρ | 3 | [| P |] (4 | ADI | [D/DH |] ELE | TE) |
| * CIL R | ETEI | NTI | EON | RA: | rion# | L | E: | (If | ap | pl: | icabl | le) Il | A IA | DEQUATE DEQUATE | | [|] | |
| REMARKS | • | | | | | | | | | | | | | | | - | - | |

WORST CASE IS VALVE DECLARED FAILED CLOSED AND REDUNDANT VALVE IS USED TO COMPLETE CROSSFEED. LOSS OF ALL REDUNDANCY COULD RESULT IN FALSELY FAILING THE CROSSFEED SYSTEM RESULTING IN LOSS OF MISSION. NASA WOULD BE RIGHT IF SENSORS CAN BE USED REDUNDANTLY TO TALKBACKS TO DETERMINE VALVE POSITION. BUT FLIGHT AND MALFUNCTION PROCS DO NOT MENTION THIS AND OMS FIRING SEQUENCER SOFTWARE DOES NOT USE THESE TALKBACKS. SEE JSC 10588 PAGE 5-18.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-459 05-6L-2204-1 | NASA DATA BASELINE NEW | : [] [X] | | | | | | | |
|--|------------------------------------|-------------------------------------|-------------------|--|--|--|--|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 459 DRIVER, HYBRID | | | | | | | | | |
| LEAD ANALYST: | W.A. HAUFLER | | - ··· | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM | | | | | | | | | | |
| HDW/FUN | NC A | B C | 1164 | | | | | | | |
| NASA [3 /3 IOA [3 /2R |] [] [] [P] [| P][P] | []* | | | | | | | |
| COMPARE [/N |] [N] [| и] [и] | []] | | | | | | | |
| RECOMMENDATIONS: | (If different f | From NASA) | r 1 | | | | | | | |
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| * CIL RETENTION F | RATIONALE: (If app | olicable) ADEQUATE INADEQUATE | [] [] | | | | | | | |
| REMARKS: WORST CASE IS VALVE DECLARED FAILED CLOSED AND REDUNDANT VALVE IS USED TO COMPLETE CROSSFEED. LOSS OF ALL REDUNDANCY COULD RESULT IN FALSELY FAILING THE CROSSFEED SYSTEM RESULTING IN LOSS OF | | | | | | | | | | |

USED TO COMPLETE CROSSFEED. LOSS OF ALL REDUNDANCY COULD RESULT IN FALSELY FAILING THE CROSSFEED SYSTEM RESULTING IN LOSS OF MISSION. NASA WOULD BE RIGHT IF SENSORS CAN BE USED REDUNDANTLY TO TALKBACKS TO DETERMINE VALVE POSITION. BUT FLIGHT AND MALFUNCTION PROCS DO NOT MENTION THIS AND OMS FIRING SEQUENCER SOFTWARE DOES NOT USE THESE TALKBACKS. SEE JSC 10588 PAGE 5-18.

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-460 05-6L-22 | 04-1 | | NASA DATA: BASELINE NEW | [] [X] |
|---|--------------------------------|----------------------|-----------------------------------|---|-------------------------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 460 DRIVER, 1 | HYBRID | | | |
| LEAD ANALYST: | W.A. HAU | FLER | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY : | REDUNDANC | CY SCREEI | NS | CIL |
| HDW/FU | NC | A | В | C | LIEM |
| NASA [3 /3 IOA [3 /2R |] [] |] [P] [|] P] | [] [P] | []* |
| COMPARE [/N |] [] | и] [| N] | [и] | [] |
| RECOMMENDATIONS: | (If di | fferent f | from NAS | A) | |
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| REMARKS: WORST CASE IS VAN USED TO COMPLETE IN FALSELY FAILT | LVE DECLA CROSSFEE | RED FAILE D. LOSS | D CLOSEI OF ALL I SYSTEM RI | D AND REDUNI REDUNDANCY (ESULTING IN | OANT VALVE IS COULD RESULT |

MISSION. NASA WOULD BE RIGHT IF SENSORS CAN BE USED REDUNDANTLY TO TALKBACKS TO DETERMINE VALVE POSITION. BUT FLIGHT AND MALFUNCTION PROCS DO NOT MENTION THIS AND OMS FIRING SEQUENCER SOFTWARE DOES NOT USE THESE TALKBACKS. SEE JSC 10588 PAGE 5-18.

REPORT DATE 2/26/88

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| ASSESSMEN ASSESSMEN NASA FMEA | TT DA TT IC X #: | ATE:): | 1/01/8 OMS-46 05-6L- | 88 51 -22 | 204 | -1 | | | | | NA E | ASA DAT BASELIN NE | A: E W | [[X |] | |
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| SUBSYSTEM MDAC ID: ITEM: | (: | | OMS 461 DRIVEF | ٤, | НУ | BRID | | | | | | | | | | |
| LEAD ANAI | LYST: | : | W.A. H | IAl | JFI | ER | | | | | | | | | | |
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| c | RITI | [CAL] | ITY | | RF | DUND | łИС | CY | SCR | EENS | 5 | | | CIL | r | |
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| * CIL RET | rent] | EON I | RATION | ALI | E: | (If a | apj | p1 : | icat | ole) IN | IA IAI | DEQUATE DEQUATE | | [|]] | |
| REMARKS: WORST CAS USED TO (IN FALSE) | SE IS COMPI LY F7 | S VA LETE AILII | LVE DEC CROSSI NG THE | CL FEI CI | ARI ED . ROS | ED FAI LOS SSFEEI | ILI SS D S | ED OI SYS | CLC F AI STEM | DSED LL RI I RES | AN EDU EUI | ND REDU JNDANCY LTING I | INE C N | ANT COULI LOSS | VA DR GO | LVE IS ESULT F |

IN FALSELY FAILING THE CROSSFEED SYSTEM RESULTING IN LOSS OF MISSION. NASA WOULD BE RIGHT IF SENSORS CAN BE USED REDUNDANTLY TO TALKBACKS TO DETERMINE VALVE POSITION. BUT FLIGHT AND MALFUNCTION PROCS DO NOT MENTION THIS AND OMS FIRING SEQUENCER SOFTWARE DOES NOT USE THESE TALKBACKS. SEE JSC 10588 PAGE 5-18.

REPORT DATE 2/26/88

| ASSESSMI ASSESSMI NASA FMI | ENT ENT EA | D2 I1 #: | ATE: D: | 1/ OM 05 | 01/8 S-46 -6L- | 38 52 -22 | 204 | 4-1 | | | | | N. | ASA I Basei | DATA: LINE NEW | [[X |] | | |
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| LEAD ANA | ALY: | ST | : | W. | A. F | IAI | JFI | LER | | | | | | | | | | | |
| ASSESSME | ENT | • | | | | | | | | | | | | | | | | | |
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| |] | HDI | W/FU | NC | | | A | | | В | | | С | | | | | | |
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| TO TALK | BAC | KS | TO | DET | ERM | ENI | E 1 | JAL | TE P | OS: | ITI | ON. | B | UT FI | LIGHT | AN | D | | |
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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-463 05-6L-22 | 204- | 1 | | | | NA E | SA DA' ASELII NI | FA: NE EW | [[X |]] |
|--|--------------------------------|-------------|--------------|----------|----------------|----------|-----------|------------------------|-----------------|---------------|-----------------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 463 DRIVER, | нув | RID | | <u>.</u> | | | | | | |
| LEAD ANALYST: | W.A. HAN | JFLE | R | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRITICAL | ITY | RED | UNDAN | CY | SCREE | NS | 5 | | | CIL | a |
| HDW/FU | NC | A | | В | | | С | | | | • |
| NASA [3/3 IOA [3/2R |] [] [|] P] | [[| P |] | [[| P |]] | | [[|] *]. |
| COMPARE [/N |] [| N] | Γ | N |] | [| N |] | | [|] |
| RECOMMENDATIONS: | (If d | iffe | rent : | fro | om NAS | A) | | | | | |
| [3 /2R |] [| P] | [| Þ |] | [| P |] | (AI | [DD/DE |] Elete) |
| * CIL RETENTION | RATIONAL | E: (| If ap | pli | icable | e) IN | AI IAI |)EQUAT | E E | [|]] |
| REMARKS: WORST CASE IS VA USED TO COMPLETE | LVE DECL CROSSFE | AREC ED. | FAIL LOSS | ED Ol | CLOSE F ALL | D RI | AN EDU | ID RED INDANC | UNI Y (| OANT COULI | VALVE D RESU |

WORST CASE IS VALVE DECLARED FAILED CLOSED AND REDUNDANT VALVE IS USED TO COMPLETE CROSSFEED. LOSS OF ALL REDUNDANCY COULD RESULT IN FALSELY FAILING THE CROSSFEED SYSTEM RESULTING IN LOSS OF MISSION. NASA WOULD BE RIGHT IF SENSORS CAN BE USED REDUNDANTLY TO TALKBACKS TO DETERMINE VALVE POSITION. BUT FLIGHT AND MALFUNCTION PROCS DO NOT MENTION THIS AND OMS FIRING SEQUENCER SOFTWARE DOES NOT USE THESE TALKBACKS. SEE JSC 10588 PAGE 5-18.

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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-464 05-6L-22 | 04-1 | | NASA DATA: BASELINE NEW | [] [X] |
|--|------------------------------------|-----------------------------------|------------------------------------|---|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 464 DRIVER, | HYBRID | а с с | | · · · · · · · · |
| LEAD ANALYST: | W.A. HAU | FLER | | | |
| ASSESSMENT: | | | | | |
| CRITICAL | ITY | REDUNDANC | Y SCREENS | 3 | CIL |
| HDW/FU | NC | A | B | C | LIEM |
| NASA [3/3 IOA [3/2R |] [] [|] [P] [|] [P] [|] P]. | [] * [] |
| COMPARE [/N |] [| и] [И | N] [| N] | [] |
| RECOMMENDATIONS: | (If di | fferent f | rom NASA) |) | |
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| * CIL RETENTION | RATIONALE | : (If app | licable) Il | ADEQUATE NADEQUATE | [] |
| REMARKS: WORST CASE IS VA USED TO COMPLETE IN FALSELY FAILI | LVE DECLA CROSSFEE NG THE CR | RED FAILE D. LOSS OSSFEED S | D CLOSED OF ALL RI YSTEM RES | AND REDUND EDUNDANCY C SULTING IN | DANT VALVE IS COULD RESULT LOSS OF |

MISSION. NASA WOULD BE RIGHT IF SENSORS CAN BE USED REDUNDANTLY TO TALKBACKS TO DETERMINE VALVE POSITION. BUT FLIGHT AND MALFUNCTION PROCS DO NOT MENTION THIS AND OMS FIRING SEQUENCER SOFTWARE DOES NOT USE THESE TALKBACKS.

SEE JSC 10588 PAGE 5-18.

REPORT DATE 2/26/88 C-432

NASA DATA: ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-465 BASELINE [05-6L-2204-1 NEW [X] NASA FMEA #: SUBSYSTEM: OMS 465 MDAC ID: ITEM: DRIVER, HYBRID LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С HDW/FUNC A В IASA [3/3] [] [] IOA [3/2R] [P] [P] NASA [3 /3] [] [P] [/N] [N] [N] [COMPARE] **RECOMMENDATIONS:** (If different from NASA) [3/2R] [P] [P] [P] Γ (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [1 INADEQUATE 1 **REMARKS:** WORST CASE IS VALVE DECLARED FAILED CLOSED AND REDUNDANT VALVE IS USED TO COMPLETE CROSSFEED. LOSS OF ALL REDUNDANCY COULD RESULT IN FALSELY FAILING THE CROSSFEED SYSTEM RESULTING IN LOSS OF MISSION. NASA WOULD BE RIGHT IF SENSORS CAN BE USED REDUNDANTLY TO TALKBACKS TO DETERMINE VALVE POSITION. BUT FLIGHT AND MALFUNCTION PROCS DO NOT MENTION THIS AND OMS FIRING SEQUENCER SOFTWARE DOES NOT USE THESE TALKBACKS. SEE JSC 10588 PAGE 5-18.

REPORT DATE 2/26/88

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| ASSES ASSES NASA | smen Smen Fme2 | SMENT DATE: 1/01/88 SMENT ID: OMS-466 FMEA #: 05-6L-2202-1 | | | | | | | | | | | N2 I | ASA 1 BASE1 | DATA LINE NEW | : [[X |] | |
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| ASSES | SME | NT : | : | | | | | | | | | | | | | | | |
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| NA I | SA OA | [[| 3 3 | /3 /2R |]] | [[| P |]] | [[| P |]] | [[| P |] | | [[|]] | * |
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| RECOM | MENI | נאכ | TIC | ONS: | (If | di | .f1 | feren | ti | Ēro | om I | NASA |) | | | | | |
| | | נ | 3 | /2R |] | [| P |] | [| P |] | | P |] | (AI |] D/D |] ELE | TE) |
| * CII | L REI | re n | 1 T] | ION I | RATION | ALE | : | (If | app | 51 | lca | ble) Il | AI NAI | DEQUA | ATE ATE | [[|]] | |
| REMAF LOSS TALKE VALVE CONSI NASA TALKE MALFU SOFTW DETEF | CKS: OF 1 BACK CLC DER1 WOUI BACKS UNCTIVARE WINI | ALI TC DSI ATJ LD S) LON E V | L I ED ED BI T(V I DES /AI | REDUI CREW RESU VS, E RIC D DE PROCS S NO LVE (| NDANCY WORS ULTING GHT IF FERMINI S DO NO F USE S CLOSURI | WC ST IN SE E V OT THE E V | OUI CA I I ENS VAI MI ESI | LD RE ASE W LOSS SORS LVE P ENTIO E TAL A A P | SUI OUI OF CAN OSI N XBZ RES | LT MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ | IN BE ISS BE ION IS KS. JRE | LOS: FALS ION USED . BI AND PHY SENS | S (SEI DUI (1 UT OMS SOI | OF D LY F E TO E DUI FLIC S FII CALI 2, E2 | IREC AILIN SAFI NDAN GHT J RING LY CJ KCEPI | r va Ng t Ety ND Seq ANNO F DU | LVE HE TO UEN T RIN | A OR B CER G A |
| BURN. PRESS THERE | JURE E IS | USI DI NC | [([F])] | CLOS FEREI FLUII | ING A 2 NCE JUS D MOVEI | ran St Men | IK DC IT. | ISOL DWNST | AT] REA | [0] \M | 1 V. (U) | ALVE NLESS | W] 5 B | ILL 1 BURNI | NOT (ING (| CAUS DMS) | E A SI | NCE |

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| SUBSYSTER MDAC ID: ITEM: | M: | OMS 467 DRIVEF | х, НY | YBRID | I | | | | | | |
| LEAD ANA | LYST: | W.A. H | IAUF | LER | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | |
| (| CRITICA | LITY | R | EDUND | ANCY | SCRE | ENS | | 4 | CIL | r |
| | HDW/F | UNC | A | | В | | c | 2 | | LIEP | 1 |
| NASA IOA | [3 /3 [3 /3 |]] | [[. |] | [[|]] | [[|]] | | [[|] *] |
| COMPARE | [/ |] | Γ |] | [|] | ٢ |] | | [|] |
| RECOMMEN | DATIONS | : (If | dif | feren | t fr | om NA | SA) | | | | |
| • | [/ |] | [|] | C |] | [|] | (AD | [D/DI |] ELETE) |
| * CIL RE REMARKS: NO DIFFE | TENTION | RATION | ALE: | (If | appl | icabl | .e) INZ | ADEQUAT ADEQUAT | 'E 'E | [[|] |

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|----------------------------------|----------------------|--------------|-------------------------|----------------------|--------|--------|--------|------------------|----------------|---------------------|---------------|--------------|
| SUBSYSTE MDAC ID: ITEM: | M: | | OMS 468 DRIVI | ER, HY | YBRI | D | | | | | | |
| LEAD ANA | LYSI | C: | W.A. | HAUF | LER | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | |
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| NASA IOA | [3 | 3 /3 3 /3 |]] | [[|]] | [[|]] | [[|]] | | [[|] *] |
| COMPARE | ۵ | / |] | [|] | [|] | [|] | | [|] |
| RECOMMEN | DATI | cons: | (11 | f dif: | fere | nt fr | om N | ASA) | | | | |
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| * CIL RE REMARKS: NO DIFFE | TENI | CES. | RATION | NALE: | (If | appl | icab | le) // IN/ | ADEQU ADEQU | ATE ATE | [[|]] |

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NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-469 NEW [X] 05-6L-2202-2 NASA FMEA #: OMS SUBSYSTEM: 469 MDAC ID: DRIVER, HYBRID ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CIL REDUNDANCY SCREENS CRITICALITY ITEM FLIGHT В С HDW/FUNC Α [] [P] [] [P] [] [P] NASA [3/3] IOA [3/2R][/N] [N] [N] [N] ſ] COMPARE **RECOMMENDATIONS:** (If different from NASA) [3/2R] [P] [P] [P] Γ (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE ſ 1 **REMARKS:** LOSS OF ALL REDUNDANCY WOULD RESULT IN LOSS OF DIRECT VALVE TALKBACK TO CREW. WORST CASE WOULD BE FALSELY FAILING THE A OR B VALVE CLOSED RESULTING IN LOSS OF MISSION DUE TO SAFETY CONSIDERATIONS. NASA WOULD BE RIGHT IF SENSORS CAN BE USED (REDUNDANTLY TO TALKBACKS) TO DETERMINE VALVE POSITION. BUT FLIGHT AND MALFUNCTION PROCS DO NOT MENTION THIS AND OMS FIRING SEQUENCER SOFTWARE DOES NOT USE THESE TALKBACKS. PHYSICALLY CANNOT DETERMINE VALVE CLOSURE VIA A PRESSURE SENSOR, EXCEPT DURING A BURN. JUST CLOSING A TANK ISOLATION VALVE WILL NOT CAUSE A PRESSURE DIFFERENCE JUST DOWNSTREAM (UNLESS BURNING OMS) SINCE THERE IS NO FLUID MOVEMENT.

REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-470 1 05-6L-2202-1 NEW [X] NASA FMEA #: SUBSYSTEM: OMS MDAC ID: 470 DRIVER, HYBRID ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT В С HDW/FUNC Α NASA [3 /3 [] [P] [] [P] [] [P]] IOA [3 /2R] 1 COMPARE [/N] [N] [N] [] RECOMMENDATIONS: (If different from NASA) [3/2R] [P] [P] [P] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [1 **REMARKS:** LOSS OF ALL REDUNDANCY WOULD RESULT IN LOSS OF DIRECT VALVE TALKBACK TO CREW. WORST CASE WOULD BE FALSELY FAILING THE A OR B VALVE CLOSED RESULTING IN LOSS OF MISSION DUE TO SAFETY CONSIDERATIONS. NASA WOULD BE RIGHT IF SENSORS CAN BE USED (REDUNDANTLY TO TALKBACKS) TO DETERMINE VALVE POSITION. BUT FLIGHT AND MALFUNCTION PROCS DO NOT MENTION THIS AND OMS FIRING SEQUENCER SOFTWARE DOES NOT USE THESE TALKBACKS. PHYSICALLY CANNOT DETERMINE VALVE CLOSURE VIA A PRESSURE SENSOR, EXCEPT DURING A BURN. JUST CLOSING A TANK ISOLATION VALVE WILL NOT CAUSE A PRESSURE DIFFERENCE JUST DOWNSTREAM (UNLESS BURNING OMS) SINCE THERE IS NO FLUID MOVEMENT.

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|--|-----------------------------------|---------------------|---------|---------|-----------------------------|------------------------|-------|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 471 DRIVER | R, HYBRI | ID | | | | |
| LEAD ANALYST | W.A. H | HAUFLER | | | | | |
| ASSESSMENT: | | | | | | | |
| CRIT | CALITY | REDUI | NDANCY | SCREE | 1S | CIL | |
| r HD | /FUNC | A | В | | с | LICM | |
| NASA [3 IOA [3 | /3] /3] | [] [] | [[|] | [] | [] [] | * |
| COMPARE [| /] | [] | Γ |] | []] | [] | |
| RECOMMENDATI | NS: (If | differ | ent fro | om NASI | A) | | |
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| * CIL RETENT REMARKS: NO DIFFERENC | ON RATION | ALE: (I: | f appli | .cable; |) ADEQUATE INADEQUATE | [] [] | |

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| SUBSYSTE MDAC ID: ITEM: | :M : | | OMS 472 DRIV | VER, HY | BRI | D | | | • | | | | |
| LEAD ANA | LYS | T: | W.A. | . HAUFI | LER | | | | | | | | |
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| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-473 05-6L-2202-2 | NASA DATA Baseline Nev | v [X] v [X] | | | | | | |
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| SUBSYSTEM: MDAC ID: ITEM: | OMS 473 DRIVER, HYBRID | | | | | | | | |
| LEAD ANALYST: | W.A. HAUFLER | | | | | | | | |
| ASSESSMENT: | • | | | | | | | | |
| CRITICAL FLIGH HDW/FU | JITY REDUNDAN T NC A | CY SCREENS B C | CIL ITEM | | | | | | |
| NASA [3/3 IOA [3/2R |] [] [2] [P] [|] [] P] [P] | [] * [] | | | | | | |
| COMPARE [/N | ן נא ז נ | N] [N] | [] | | | | | | |
| RECOMMENDATIONS: | (If different | from NASA) | | | | | | | |
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| * CIL RETENTION | RATIONALE: (If ap | oplicable) ADEQUATE INADEQUATE | [] | | | | | | |
| REMARKS: LOSS OF ALL REDUNDANCY WOULD RESULT IN LOSS OF DIRECT VALVE TALKBACK TO CREW. WORST CASE WOULD BE FALSELY FAILING THE A OR B VALVE CLOSED RESULTING IN LOSS OF MISSION DUE TO SAFETY CONSIDERATIONS. NASA WOULD BE RIGHT IF SENSORS CAN BE USED (REDUNDANTLY TO TALKBACKS) TO DETERMINE VALVE POSITION. BUT FLIGHT AND MALFUNCTION PROCS DO NOT MENTION THIS AND OMS FIRING SEQUENCER SOFTWARE DOES NOT USE THESE TALKBACKS. PHYSICALLY CANNOT DETERMINE VALVE CLOSURE VIA A PRESSURE SENSOR, EXCEPT DURING A BURN. JUST CLOSING A TANK ISOLATION VALVE WILL NOT CAUSE A PRESSURE DIFFERENCE JUST DOWNSTREAM (UNLESS BURNING OMS) SINCE | | | | | | | | | |

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| SUBSYSTI MDAC ID: ITEM: | OMS 474 FUSE | :, | 1A | L | | | | | | | | | | | | | | - | | | | | |
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| ASSESSME | ENT : | ; | | | | | | | | | | | | | | | | | | | | | |
| | CRI | TI FL | CAL IGH | ETY C | | REDUND | | | | DANCY | | | SCREENS | | | S | | | CIL ITEM | | | | |
| | F | IDW | I/FUI | 1C | | Α | | | | В | | | | С | | - | • • | | | | | | |
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| COMPARE | [| | /N |] | | [| |] | 1 | [| N |] | | [| |] | | [| N |] | | | |
| RECOMMEN | IDAJ | ric | NS: | (I | f | di | .f1 | er | ent | 1 | Erc | om l | NAS | A) | | | | | | | | | |
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| * CIL RE | ETEN | ITI | ON I | RATIO | NA | LE | : | (I: | f ag | pţ | 51 i | lcal | ble |) IN | AI IAI |)EQU)EQU | ATE ATE | [[| |] | | | |
| REMARKS: IOA RECO CRITICAI UNRELATH INTERPRI COULD CA THE SIGN WHEN THE SCENARIC IRRELEVA COMPONEN WHEN THE FAILURE FAILURE FAILURE DOWER BY MOTOR AT | MMI LITY ED F ETAT AUSE IAL E VA NTS E VA DOF MT E VA DOF MT E NC | ENC TAL TAL THALV THALV THALV THALV TUR TUR TUR TUR TUR | S TH HUS LURI N OI CONT IROU TES I ANC ES r>I I I I I I I I I I I I I I I I I I | IAT B REDU E" WH 7 NST INUOU GH TH REACH DTHER LLOWS ALVE DTOR SIGN RMORE FRICA THAN ION M | EL CE S S F R MO IS IF | LC D, H22 PO I UI AI UF C TH TH 52 HA | WS S 2 WF L L U T C N S C N S C N S C N S C N S S C S S C S S C S S C S S C S S S C C N F F L L C N F S S C S S S S S C S S S S S S S S S S | Final Sector Sec | AILI CE EYON NZ ON WOUI OSEI CON OSEI CON PRO NUOU Y CO LVES L SI AND | | E SA IE OF SIS SIS SIS SIS SIS SIS SIS SIS SIS SI | SHO CONS THE IS ASS INH CONS TIME CLAN CONS TIME CONS CCONS NO | OUL STI SCC RI SOCC IBI PEN NG EXP NT A UTE PRO DE RDI F | D TU OF F T OF S NI TE VI AI | NC THE THE THE THE THE THE THE THE THE THE | OT B OF THA D V OSI OWE SELLA G E SERI OT. THE TED C TI AS | E CO "MU IOA' I TH ALVE NG O VER, OWS LECT OUS, TH BEL FROM FROM HE S A RE | NS IT S S S S S S S S S S S S S S S S S S | IDI IPI F2), OPI AS2 PT(CA OT IS WS ON HE CS LT | ERE LE AII SI ENI A'S JRE JU S, RU JU S, VA VA OF | URE NCE NG IST THI PTU UOU LVE | ND S RE S | |

PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

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| ASSESSME ASSESSME NASA FME | NT DATE: NT ID: A #: | 1/01/88 OMS-475 05-6L-20 | 004-1 | NASA DATA: BASELINE [] NEW [X] | | | | | | | | | | |
|---|---|--|--|--|---|---|---|--|--|--|--|--|--|--|
| SUBSYSTE MDAC ID: ITEM: | M: | OMS 475 FUSE, 12 | A | | | | | | | | | | | |
| LEAD ANA | LYST: | W.A. HAUFLER | | | | | | | | | | | | |
| ASSESSME | NT: | | | | | | | | | | | | | |
| | CRITICAL FLIGH | ITY T | REDUNDA | NCY S | CREENS | | CIL ITEM | | | | | | | |
| | HDW/FU | NC | A | В | | С | | | | | | | | |
| NASA IOA | [3 /1R [3 /2R |] [] [| P] P] | [F] [P] | [[| P] P] | [X]* [] | | | | | | | |
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| REMARKS: IOA RECO CRITICAL UNRELATE INTERPRE COULD CA THE SIGN WHEN THE SCENARIO IRRELEVA COMPONEN WHEN THE FAILURE FAILURE FAILURE POWER BY MOTOR AN PROLONGE SECT. 3. | MMENDS T LITY THUS D FAILUR TATION O USE CONT LUSE CONT VALVES WITH AN NT. A BE TS AND V VALVE M DOES NOT FURTHE AN ELEO NO MORE D ACTUAT D POWER 1, 3.2.1 | HAT BELL REDUCED E" WHICH F NSTS 2 INUOUS P GH THIS REACH FU OTHER FA LLOWS RU ALVE MOT SIGNIFI CRORE, T TRICAL T TRICAL T THAN 35 ION MECH APPLICAT | OWS FAIL , SINCE IS BEYO 2206. 1 OWER ON ITEM WOO LL CLOSI ILURE CO PTURE AN OR TO PI CONTINUO CANTLY O HE VALVI HERMAL SI 2 F, ANI ANISM SI ION." SI 2.1.2.1 | LURE S IT CC OND TH VASA I THE A JLD IN ED OR ONSIST VYTIME ROPELI DUSLY CONTRI ES ARE SHUTOE D, ACC HALL N SEE AC | HOULD INSTITU IE SCOP S RIGH SSOCIA IHIBIT OPEN. TING OF E EXPOS ANT IS ON AND BUTE T F DEVI CORDING IOT FAI C MOTOF | NOT BE CO TES A "MU PE OF IOA'S T THAT TH TED VALVE CLOSING OF HOWEVER, BELLOWS SING ELECT SERIOUS, HOT. TH SERIOUS, HOT. THE SERIOUS, TO THE BEL CTED FROM CE WITHIN TO THE SE L AS A RE VALVE SP | NSIDERED AND LTIPLE S IS FAILURE (S), SINCE R OPENING NASA'S RUPTURE IS RICAL NOT JUST AT IS, THIS LOWS RUPTURE CONTINUOUS THE VALVE PECS, "THE SULT OF EC MC284-0430 | | | | | | | |

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REPORT DATE 2/26/88

NASA DATA: ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: BASELINE [OMS-477 NEW [X] 05-6L-2004-1 NASA FMEA #: SUBSYSTEM: OMS MDAC ID: 477 FUSE, 1A ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CIL CRITICALITY REDUNDANCY SCREENS ITEM FLIGHT В С HDW/FUNC Α [F] [P] [P] [3 /1R] [P] [X]* NASA Ţ Ţ [P] IOA [3/2R]COMPARE /N] [N] Γ RECOMMENDATIONS: (If different from NASA) [3/2R] [P] [F] [P] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [1 **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE

INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

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REPORT DATE 2/26/88

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ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [] NEW [X] ASSESSMENT ID: OMS-481 NASA FMEA #: 05-6L-2002-1 SUBSYSTEM: OMS MDAC ID: 481 FUSE, 1A ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM ВС HDW/FUNC A
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IOA AGREES WITH THIS NASA FMEA.

| ASSESSME ASSESSME NASA FME | SSESSMENT DATE: 1/01/88 SSESSMENT ID: OMS-482 ASA FMEA #: 05-6L-2130-1 | | | | | | | | | | | | NASA BAS | DATA ELINE NEW | 1: [] [] | x |] | |
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REPORT DATE 2/26/88 C-450

ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-483 NEW [X] NASA FMEA #: 05-6L-2131-2 SUBSYSTEM: OMS MDAC ID: 483 ITEM: RELAY LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CIL CRITICALITY REDUNDANCY SCREENS FLIGHT ITEM В С HDW/FUNC Α [P] [F] [X] * NASA [3 /1R] [P] [ſ IOA [3/3] 1 1 1 [N] [N] COMPARE [/N] [N] [N] RECOMMENDATIONS: (If different from NASA) [D] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEOUATE [INADEQUATE 1 **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND

CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS FAILURE. POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

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| SUBSYSTEM: MDAC ID: ITEM: | C 4 F | MS 84 Relay | | | | | |
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REPORT DATE 2/26/88 C-452

ASSESSMENT DATE: 1/01/88 NASA DATA: ASSESSMENT ID: OMS-485 BASELINE [NEW [X] NASA FMEA #: 05-6L-2130-2 SUBSYSTEM: OMS MDAC ID: 485 ITEM: RELAY LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT HDW/FUNC Α В C [P] [F] [P] [X] * NASA [2/1R][P] IOA [3/2R]COMPARE [N/N] [] [N] []RECOMMENDATIONS: (If different from NASA)] [3/2R] [P] [F] [P] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE Γ INADEOUATE ſ 1

REMARKS: IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS FAILURE. POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

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REPORT DATE 2/26/88

ASSESSMENT DATE: 1/01/88 NASA DATA: OMS-487 ASSESSMENT ID: BASELINE [NEW [X] 05-6L-2131-2 NASA FMEA #: SUBSYSTEM: OMS 487 MDAC ID: ITEM: RELAY LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC Α В С [F] [P] [] [] [P] r 1 NASA [3 /1R] [P] IOA [3 /3] [] [X]* COMPARE [/N] [N] [N] [N] [N]RECOMMENDATIONS: (If different from NASA) [3/3] [] [] [] [D] . (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE I INADEQUATE [1 **REMARKS:**

IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

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NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-489 NEW [X] 05-6L-2130-2 NASA FMEA #: SUBSYSTEM: OMS 489 MDAC ID: ITEM: RELAY W.A. HAUFLER LEAD ANALYST: ASSESSMENT: CIL CRITICALITY REDUNDANCY SCREENS ITEM FLIGHT В C HDW/FUNC Α [P] [F] [P] [X] * [2 /1R] NASA [P] [P] [P] [3 /2R] IOA COMPARE [N/N] [] [N] [1 [N] **RECOMMENDATIONS:** (If different from NASA) [3/2R] [P] [F] [P] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE E INADEQUATE **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS

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REPORT DATE 2/26/88

ASSESSMENT DATE: 1/01/88 NASA DATA: ASSESSMENT ID: OMS-493 BASELINE [NASA FMEA #: 05-6L-2126-2 NEW [X] SUBSYSTEM: OMS MDAC ID: 493 RELAY ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT В С HDW/FUNC Α [P] [X] * NASA [2 /1R] [P] [F] 1 ſ Γ IOA [3/3] 1 1 COMPARE [N /N] [N] [N] [N] [N] RECOMMENDATIONS: (If different from NASA) (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [1 INADEQUATE [] **REMARKS:** IOA CONCURS WITH NASA'S CRITS AND SCREENS, BUT IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED IN THE EFFECTS

FIELD, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F. IOA'S CRITICALITY IS DRIVEN BY OMS HARDWARE FMEA 03-3-2007-1. SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-494 05-6L-2127-1 | NASA DATA: BASELINE [] NEW [X] |
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| SUBSYSTEM: MDAC ID: ITEM: | OMS 494 RELAY | |
| LEAD ANALYST: | W.A. HAUFLER | |
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NASA DATA: ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: BASELINE [OMS-495 NEW [X] 05-6L-2127-2 NASA FMEA #: SUBSYSTEM: OMS MDAC ID: 495 RELAY ITEM: W.A. HAUFLER LEAD ANALYST: **ASSESSMENT:** CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT Α В С HDW/FUNC [P] [F] [P] [3 /1R] [X] * NASA [3 /3 Г Γ 1 IOA 1 1 1 [N] COMPARE [/N] [N] **RECOMMENDATIONS:** (If different from NASA)] [(ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE I INADEQUATE Γ 1 **REMARKS:** IOA CONCURS WITH NASA'S CRITS AND SCREENS, BUT IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED IN THE EFFECTS FIELD, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO HOT. THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE

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REPORT DATE 2/26/88

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ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-497 NASA FMEA #: NEW [X] 05-6L-2126-2 SUBSYSTEM: OMS MDAC ID: 497 RELAY ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT В С HDW/FUNC A [F] [P] [2 /1R] [P] NASA [X] * IOA $\begin{bmatrix} 3/3 \end{bmatrix}$ ſ Γ 1 ٦ 1 [N] [N] [N] [N] COMPARE [N /N] **RECOMMENDATIONS:** (If different from NASA) (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [1 **REMARKS:**

IOA CONCURS WITH NASA'S CRITS AND SCREENS, BUT IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED IN THE EFFECTS FIELD, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F. IOA'S CRITICALITY IS DRIVEN BY OMS HARDWARE FMEA 03-3-2007-1. SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

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REPORT DATE 2/26/88 C-466

NASA DATA: ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-499 BASELINE [NEW [X] 05-6L-2131-2 NASA FMEA #: SUBSYSTEM: OMS MDAC ID: 499 RELAY ITEM: W.A. HAUFLER LEAD ANALYST: ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT С В HDW/FUNC A [X] * [3 /1R] [P] [F] [P] NASA 1 [1 IOA [3/3] [[] [N] [N] [N] [N] COMPARE [/N] **RECOMMENDATIONS:** (If different from NASA) [3/3] [] [] [] [D] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [

REMARKS:

IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

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REPORT DATE 2/26/88

ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-501 NEW [X] NASA FMEA #: 05-6L-2130-2 SUBSYSTEM: OMS 501 MDAC ID: ITEM: RELAY LEAD ANALYST: W.A. HAUFLER **ASSESSMENT:** REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT HDW/FUNC Α B С [P] [F] [P] [P] [P] [X]* NASA [2/1R][P] IOA [3 /2R] COMPARE [N/N] [] [N] [][N] RECOMMENDATIONS: (If different from NASA) [3/2R]· [P] [F] [P] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE Γ INADEQUATE [1 **REMARKS:**

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REPORT DATE 2/26/88 C-469

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C-470

REPORT DATE 2/26/88

ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-503 NEW [X] NASA FMEA #: 05-6L-2131-2 SUBSYSTEM: OMS MDAC ID: 503 RELAY ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT В С HDW/FUNC A NASA [3 /1R] [P] [F] [P] [X] * IOA [3/3] ſ [] [1 1 [N] [N] [N] [N] COMPARE [/N] **RECOMMENDATIONS:** (If different from NASA) [D] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable)

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REMARKS:

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IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

REPORT DATE 2/26/88 C-471

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REPORT DATE 2/26/88 C-472

ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-505 NASA FMEA #: 05-6L-2130-2 NASA DATA: BASELINE [] NEW [X]

SUBSYSTEM:OMSMDAC ID:505ITEM:RELAY

LEAD ANALYST: W.A. HAUFLER

ASSESSMENT:

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RECOMMENDATIONS: (If different from NASA)

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* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [] INADEQUATE []

REMARKS:

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REPORT DATE 2/26/88 C-473

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REPORT DATE 2/26/88

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ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-507 NEW [X] NASA FMEA #: 05-6L-2127-2 OMS SUBSYSTEM: 507 MDAC ID: RELAY ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT С В HDW/FUNC Α NASA [3 /1R] [P] [F] [P] [X] * IOA ſ 1 [1 [3/3] 1 [[N] COMPARE /N] [N] [N] [N]ſ **RECOMMENDATIONS:** (If different from NASA) Γ /][][][] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE E INADEQUATE [1

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| LEAD ANA | LYST | : | W.A. | HAU | FLE | ર | | | | | | | | | | |
| ASSESSME | ent: | | | | | | | | | | | | | | | |
| | CRIT F | ICALI LIGH | CTY C |] | | JNDAN | CY | SCR | EENS | 5 C | | | CII ITE |] IM | | |
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| NASA IOA | [3 [3 | /1R /1R |] | [] | P] | [נ | NZ F | A]] | [[| P P |] | |] [X |] [] | * | |
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| RECOMMEN | IDATI | ONS: | (If | di | ffe | rent | fro | om Ni | AŚA) | | | | | | | |
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REMARKS:

IOA RECOMMENDS FAILING THE B SCREEN. THESE RELAYS ARE NOT STANDBY REDUNDANT TO ANY OTHER ITEMS SINCE THEY ARE NORMALLY OPERATIONAL. SOME OF THESE RELAYS FAILING HAVE NO IMMEDIATE EFFECT AND CANNOT BE DETECTED EXCEPT VIA MCA STATUS SIGNALS WHICH ARE NOT READILY USED BY THE CREW.

REPORT DATE 2/26/88

ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-509 NEW [X] 05-6L-2126-2 NASA FMEA #: SUBSYSTEM: OMS MDAC ID: 509 ITEM: RELAY LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT HDW/FUNC Α В C r] [P]] [7 [F] [] [X]* [P] NASA [2/1R][] IOA $\begin{bmatrix} 3/3 \end{bmatrix}$ [[] [] ן א ן COMPARE [N /N] RECOMMENDATIONS: (If different from NASA) ſ (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [1

REMARKS:

IOA CONCURS WITH NASA'S CRITS AND SCREENS, BUT IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED IN THE EFFECTS FIELD, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F. IOA'S CRITICALITY IS DRIVEN BY OMS HARDWARE FMEA 03-3-2007-1. SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

| ASSESSME ASSESSME NASA FME | ENT ENT EA # | | ATE:): | 1/01, OMS-9 05-6 | /88 510 L-2: | 120 | 5-2 | | | | ATA INE NEW | : [[X |] | | | |
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| SUBSYSTI MDAC ID: ITEM: | EM: | | | OMS 510 RELA | Y | | | | · | | | | • • | | 2 - À 1 | : |
| LEAD ANZ | LYS | ST: | ; | W.A. | HAU | JFI | LER | | | • | | | | | - | - |
| ASSESSME | ent : | ; | | | | | | | | | | | | | | |
| | CRI | TI FI | CAL | ITY r | | RI | EDUN | 'DAI | 1CY | SCR | EEN | IS | | | CII ITE | , M |
| | H | IDW | I/FUI | NC | | A | | | В | • | | C | | | | |
| NASA IOA | [[| 2 3 | /1R /3 |]] | [[| Ρ |]] | | [F |] | . (| P |] | | (X [| 【] *]: ,. |
| COMPARE | [| N | /N |] | [| N |] | | [N |] | (| N |] | | [N | [] |
| RECOMMEN | IDAI | TIC | ONS: | (I | fd | ifi | fere | nt | fr | om N | IASA | .) | | | | |
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REMARKS:

IOA CONCURS WITH NASA'S CRITS AND SCREENS, BUT IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED IN THE EFFECTS FIELD, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F. IOA'S CRITICALITY IS DRIVEN BY OMS HARDWARE FMEA 03-3-2007-1. SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

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ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [] NEW [X] ASSESSMENT ID: OMS-511 NASA FMEA #: 05-6L-2127-1 SUBSYSTEM: OMS MDAC ID: 511 ITEM: RELAY LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY FLIGHT ITEM HDW/FUNC Α В С [P] [F] [P] [] [X]* NASA [2/1R]IOA [3/3] [] [N] COMPARE [N/N] [N] [N] RECOMMENDATIONS: (If different from NASA) Γ 1 (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [] 1 **REMARKS:** IOA AGREES WITH THIS NASA FMEA.

REPORT DATE 2/26/88

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| SUBSYST MDAC ID ITEM: | em : : | | OMS 512 RELAY | | | | | | | | | | | | | | |
| LEAD AN | ALYST | : | W.A. 1 | HAU | FI | LER | | - | | | | | | | | | |
| ASSESSM | ENT: | | | | | | | | | | | | | | | | - |
| | CRIT F | ICAL | ITY P | | RE | DUN | IDAI | 1CY | SCI | REENS | 5 | | - Weitze | C] [] | L TEN | 1 | |
| | HD | W/FUI | NC | | Α | | | В | | | С | | | | | | |
| NASA IOA | [3 [3 | /1R /3 |]] | [[| Ρ |]] | | [F [|] | [[| P |]] | | [[| х |]] | * |
| COMPARE | ٢ | /N |] | [| N |] | | [N |] | [| N |] | | [| N |] | |
| RECOMME | NDATI | ons: | (If | di | ff | iere | ent | fr | om 1 | NASA |) | | | | | | |
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| * CIL R | ETENT | ION | RATION | ALE | : | (If | E aj | ppl | ical | ole) II | AI NAI |)EQUA | TE | [[| |] | |
| REMARKS IOA CON THAT BE | : CURS LLOWS | WITH FAII | NASA'S | S C HOU | RI | TS NC | ANI DT 1 |) S BE | CREI CONS | ENS, SIDEI | BUREI | JT IC) IN | A RE | ECC |) MN FF | IEN SCI | IDS S |

FIELD, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OPEN. OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO HOT. THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F. SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-513 NEW [X] 05-6L-2126-1 NASA FMEA #: OMS SUBSYSTEM: MDAC ID: 513 ITEM: RELAY LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT С HDW/FUNC А В [P] [NA] [P] [P] [F] [P] [3 /1R] [NASA [X] IOA [3/1R]COMPARE [/] [] [N] [] [N] RECOMMENDATIONS: (If different from NASA) [3/1R] [P] [F] [P] [A] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE E INADEQUATE [**REMARKS:**

IOA RECOMMENDS FAILING THE B SCREEN. THESE RELAYS ARE NOT STANDBY REDUNDANT TO ANY OTHER ITEMS SINCE THEY ARE NORMALLY OPERATIONAL. SOME OF THESE RELAYS FAILING HAVE NO IMMEDIATE EFFECT AND CANNOT BE DETECTED EXCEPT VIA MCA STATUS SIGNALS WHICH ARE NOT READILY USED BY THE CREW.

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-514 05-6L-2083 | -1 | N2 1 | ASA DATA: BASELINE NEW | [] [X] |
|---|---|---|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 514 RESISTOR, | 1.2K 1/4 | - | | |
| LEAD ANALYST: | W.A. HAUFL | ÆR | | | |
| ASSESSMENT: | | | | | |
| CRITICAL FLIGH | ITY RE F | DUNDANCY | SCREENS | | CIL ITEM |
| HDW/FU | NC A | В | C | _ 1 | |
| NASA [2 /1R IOA [3 /2R |] [P] [F |] [P] [P |] [P]] [P] |] | [X]* [X] |
| COMPARE [N /N |] [N |] [|] [|] | [] |
| RECOMMENDATIONS: | (If diff | erent fro | om NASA) | | |
| [3 /2R |] [P |] [P |] [P |] (AD | [D] D/DELETE) |
| * CIL RETENTION | RATIONALE: | (If appl: | icable) AI INAI | DEQUATE DEQUATE | |
| REMARKS: IOA RECOMMENDS T CRITICALITY THUS UNRELATED FAILUR INTERPRETATION O COULD CAUSE CONT THE SIGNAL THROU WHEN THE VALVES SCENARIO WITH AN IRRELEVANT. A BE | HAT BELLOWS REDUCED, S E" WHICH IS F NSTS 2220 INUOUS POWE GH THIS ITE REACH FULL OTHER FAILU LLOWS RUPTU | FAILURE INCE IT BEYOND C. NASA R ON THE M WOULD CLOSED ON RE CONSIS RE ANYTIN | SHOULD NO CONSTITUTI THE SCOPE IS RIGHT ASSOCIATI INHIBIT CI R OPEN. H STING OF H ME EXPOSIN | OT BE CON OF IOA'S THAT THI ED VALVE (LOSING OR HOWEVER, BELLOWS R NG ELECTR | SIDERED AND TIPLE S FAILURE S), SINCE OPENING NASA'S UPTURE IS ICAL |
| WHEN THE VALVE M | OTOR IS CON | TINUOUSL | Y ON AND I | HOT. THA | T IS, THIS |

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COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

REPORT DATE 2/26/88
| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | | NASA DATA: BASELINE [] NEW [] | | | | | | | | |
|--|----------------------------|---------------------------------------|--------|--------|-----------|--------------------|-------------|--------------|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 515 RESISTOR, | OMS 515 RESISTOR, 1.2K | | | | | | | | |
| LEAD ANALYST: | LEAD ANALYST: W.A. HAUFLER | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAL | ITY REDUNDANCY SCREENS | | | | | | CIL | | | |
| HDW/FU | JNC A | T NC A | | | | с | 111 | TTEN | | |
| NASA [/ IOA [3 /3 |) [] [|]] | [[|]] | [[|]] | [[|] *] | | |
| COMPARE [N /N |] [|] | Γ |] | [. |] | C |] | | |
| RECOMMENDATIONS: (If different from NASA) | | | | | | | | | | |
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| * CIL RETENTION | RATIONALE | : (If | appl | icab: | le) IN | ADEQUAT ADEQUAT | E (E (|]] | | |
| NO ISSUE. IOA | DENTIFIED | A NON | CRED | IBLE | FAI | LURE MO | DE. | | | |

REPORT DATE 2/26/88

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NASA DATA: ASSESSMENT DATE: 1/01/88 BASELINE [ASSESSMENT ID: OMS-516] NEW [X] 05-6L-2091-1 NASA FMEA #: OMS SUBSYSTEM: 516 MDAC ID: RESISTOR, 12K 1/4W ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT В С HDW/FUNC Α IASA [3 /3] IOA [3 /3] NASA [[] [[1 [[]] i 1 COMPARE [/] [] [.] [] Γ] RECOMMENDATIONS: (If different from NASA)] Γ] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE ľ 1 INADEQUATE [1 **REMARKS:** NO DIFFERENCES.

| ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: | 1/01/88 OMS-517 NONE | | | NASA DATA BASELINA NEV | X: 2 [] 7 [] | | | | | |
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| SUBSYSTEM: MDAC ID: ITEM: | OMS 517 RESISTOR | , 12K 1 | L/4W | | | | | | | |
| LEAD ANALYST: | W.A. HAU | FLER | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | |
| CRITICAL FLIGH | ITY I T | REDUNDA | EENS | CIL ITEM | | | | | | |
| HDW/FU | NC 2 | A | В | С | | | | | | |
| NASA [/ IOA [3 /2R |] [] |] F] | [] [P] | [] [P] | [] * [X] | | | | | |
| COMPARE [N /N |] [] | И] | [N] | [N] | [N] | | | | | |
| RECOMMENDATIONS: (If different from NASA) | | | | | | | | | | |
| [/ |] [|] | [] | [] | [] ADD/DELETE) | | | | | |
| * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [] INADEQUATE [] REMARKS: | | | | | | | | | | |
| NO ISSUE. IOA IDENTIFIED A NONCREDIBLE FAILURE MODE. | | | | | | | | | | |

REPORT DATE 2/26/88

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ASSESSMENT DATE: 1/01/88 NASA DATA: BASELINE [ASSESSMENT ID: OMS-518 NEW [X] NASA FMEA #: 05-6L-2082-1 SUBSYSTEM: OMS 518 MDAC ID: RESISTOR, 5.1K 1/4W ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT С A B HDW/FUNC [] [] [] [] [F] [P] [P] [X] NASA [3 /3 IOA [3 /2R] COMPARE [/N] [N] [N] [N] [N]**RECOMMENDATIONS:** (If different from NASA) [3/2R] [P] [P] [P] [] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [1 INADEQUATE [1 **REMARKS:** WORST CASE IS VALVE DECLARED FAILED CLOSED AND REDUNDANT VALVE IS USED TO COMPLETE CROSSFEED. LOSS OF ALL REDUNDANCY COULD RESULT IN FALSELY FAILING THE CROSSFEED SYSTEM RESULTING IN LOSS OF MISSION. NASA WOULD BE RIGHT IF SENSORS CAN BE USED REDUNDANTLY TO TALKBACKS TO DETERMINE VALVE POSITION. BUT FLIGHT AND

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SOFTWARE DOES NOT USE THESE TALKBACKS. SEE JSC 10588 PAGE 5-18.

REPORT DATE 2/26/88

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MALFUNCTION PROCS DO NOT MENTION THIS AND OMS FIRING SEQUENCER

| ASSESSMENT DA' ASSESSMENT ID NASA FMEA #: | TE: 1/01/3 : OMS-53 NONE | 88 19 | | NASA DATA: Baseline [] New [] | | | | | | | |
|---|--------------------------------|------------------------|--------|---------------------------------------|-----------------------|--------------|-----------|-------------|--|--|--|
| SUBSYSTEM: MDAC ID: ITEM: | OMS 519 RESIS | IOR, 5.1 | K 1/4V | 7 | | | | | | | |
| LEAD ANALYST: | W.A. 1 | HAUFLER | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | |
| CRITI | CALITY | TTY REDUNDANCY SCREENS | | | | | CIL | | | | |
| HDW, | /FUNC | A | В | В | | с | | | | | |
| NASA [IOA [3] | /] /3] | [] [] | [[|]] | [] [] | | [[|] *] | | | |
| COMPARE [N | /м] | [] | [|] | [] | | [|] | | | |
| RECOMMENDATIONS: (If different from NASA) | | | | | | | | | | | |
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| * CIL RETENTI | ON RATION | ALE: (If | appl: | icable |) ADEQI INADEQI | JATE JATE | [[|]] | | | |
| REMARKS: NO ISSUE. IO | A IDENTIF | IED A NO | NCRED | IBLE F | AILURE | MODE | • | | | | |

REPORT DATE 2/26/88 C-487

ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-520 NASA FMEA #: 05-6L-2083-1 NASA DATA: BASELINE [] NEW [X] SUBSYSTEM: OMS ____ 520 MDAC ID: RESISTOR, 1.2K 1/4W ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: CRITICALITY REDUNDANCY SCREENS CIL ITEM FLIGHT С В HDW/FUNC A NASA [2/1R] [P] [P] [P] IOA [3/2R] [F] [P] [P] [X] * ĭχ] COMPARE [N/N] [N] [] [] []**RECOMMENDATIONS:** (If different from NASA) [D] [3/2R] [P] [P] [P] (ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) ADEQUATE [INADEQUATE [1 **REMARKS:** IOA RECOMMENDS THAT BELLOWS FAILURE SHOULD NOT BE CONSIDERED AND CRITICALITY THUS REDUCED, SINCE IT CONSTITUTES A "MULTIPLE UNRELATED FAILURE" WHICH IS BEYOND THE SCOPE OF IOA'S INTERPRETATION OF NSTS 22206. NASA IS RIGHT THAT THIS FAILURE COULD CAUSE CONTINUOUS POWER ON THE ASSOCIATED VALVE(S), SINCE THE SIGNAL THROUGH THIS ITEM WOULD INHIBIT CLOSING OR OPENING WHEN THE VALVES REACH FULL CLOSED OR OPEN. HOWEVER, NASA'S SCENARIO WITH ANOTHER FAILURE CONSISTING OF BELLOWS RUPTURE IS IRRELEVANT. A BELLOWS RUPTURE ANYTIME EXPOSING ELECTRICAL COMPONENTS AND VALVE MOTOR TO PROPELLANT IS SERIOUS, NOT JUST WHEN THE VALVE MOTOR IS CONTINUOUSLY ON AND HOT. THAT IS, THIS FAILURE DOES NOT SIGNIFICANTLY CONTRIBUTE TO THE BELLOWS RUPTURE FAILURE. FURTHERMORE, THE VALVES ARE PROTECTED FROM CONTINUOUS POWER BY AN ELECTRICAL THERMAL SHUTOFF DEVICE WITHIN THE VALVE MOTOR AT NO MORE THAN 352 F, AND, ACCORDING TO THE SPECS, "THE MOTOR AND ACTUATION MECHANISM SHALL NOT FAIL AS A RESULT OF PROLONGED POWER APPLICATION." SEE AC MOTOR VALVE SPEC MC284-0430 SECT. 3.1, 3.2.1.2.9, 3.2.1.2.11.

REPORT DATE 2/26/88

| ASSESSME ASSESSME NASA FME | NT NT A | D/ I) #: | ATE: D: | 1/0 OMS NON | | NASA DATA BASELINE NEW | | | | |]] | | | |
|--|-----------------|----------------|------------------------|-------------------|--------------------------------|------------------------------|--------|------|------------------|----------------|--------------|----------|-----------|-----|
| SUBSYSTE MDAC ID: ITEM: | M: | | | OMS 521 RES | OMS 521 RESISTOR, 1.2K 1 | | | | | | | · | | |
| LEAD ANALYST: W.A. HAUFLER | | | | | | | | | | | | | | |
| ASSESSMENT: | | | | | | | | | | | | | | |
| CRITICAL | | | ITY REDUNDANCY SCREENS | | | | | | | | CIL | | | |
| | FLIGH HDW/FU | | r NC A | | | В | В | | с | | LIEM | | | |
| NASA IOA | [[| 3 | / /3 |]] | [[|]] | [[|] | [[|] | | [[|]] | * |
| COMPARE | [| N | /N |] | [|] | [|] | [|] | | [|] | |
| RECOMMENDATIONS: (If different from NASA) | | | | | | | | | | | | | | |
| | [| | / |] | Ţ |] | [|] | [|] | (AI | [DD/ |] DELE | TE) |
| * CIL RE | TE | NT | ION | RATI | ONALE: | (If | appl | icat | ole) / IN/ | ADEQI ADEQI | JATE JATE | [[|]] | |
| NO ISSUE. IOA IDENTIFIED A NONCREDIBLE FAILURE MODE. | | | | | | | | | | | | | | |

REPORT DATE 2/26/88

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NASA DATA: BASELINE [] ASSESSMENT DATE: 1/01/88 ASSESSMENT ID: OMS-522 NEW [X] NASA FMEA #: 05-6L-2091-1 SUBSYSTEM: OMS 522 MDAC ID: RESISTOR, 12K 1/4W ITEM: LEAD ANALYST: W.A. HAUFLER ASSESSMENT: REDUNDANCY SCREENS CIL CRITICALITY ITEM FLIGHT В С Α HDW/FUNC NASA [3 /3] IOA [3 /3]]] [[] [[[1 1 * 1 1 COMPARE [/]]] Г 1 . RECOMMENDATIONS: (If different from NASA) 1 [(ADD/DELETE) * CIL RETENTION RATIONALE: (If applicable) -ADEQUATE [1 INADEQUATE [1 **REMARKS:** NO DIFFERENCES.

REPORT DATE 2/26/88

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