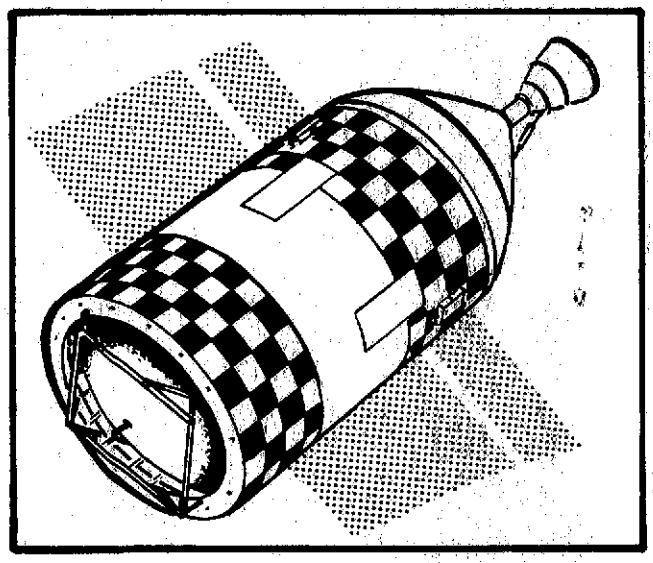
MCR-74-145
Contract NAS8-29670

25

Catalogue

April 1974

Space Tug Thermal Control Equipment Thermal Requirements, Characteristics, and Constraints



MARTIN MARIETTA

MCR-74-145

SPACE TUG THERMAL CONTROL EQUIPMENT THERMAL REQUIREMENTS CHARACTERISTICS, AND CONSTRAINTS CATALOGUE

April 1974

Prepared for

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

by

Terry L. Ward
Program Manager

Martin Marietta Corporation
P. O. Box 179
Denver, Colorado 80201

FOREWORD

This document contains the Equipment Thermal Requirements Characteristics and Constraints Catalogues developed by Martin Marietta Corporation, Denver Division under Contract NAS8-29670.

The catalogues contained herein were developed under the above contract titled Space Tug Thermal Control for the National Aeronautics and Space Administration, George C. Marshall Space Flight Center with Mr. Jack D. Loose of the Astronautics Laboratory, Propulsion and Thermal Branch serving as the Technical Monitor.

The major contributor to the completion of the data is acknowledged: Solomon H. Eichenbaum.

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INTRODUCTION AND SUMMARY

The Space Tug Thermal Control Study contained two tasks associated with the cataloging of equipment thermal requirements, physical characteristics and constraints. In satisfaction of these tasks a Data Bank program was developed to provide a means of standardizing the method of cataloging while using the computer to handle the data and format the data into the desired catalogues.

During the course of the study 109 components were catalogued and included in the Data Bank. A standardized method was selected for describing each component as shown in Section 1. Each subsystem of the Avionics System is described on a subsystem header page which describes the types of components included within the subsystem, the quantity requirements, target weights, target power and relative comments. The individual components listed within each subsystem are not necessarily a complete list of candidate items but do represent several of the presently available components for consideration in a Tug application.

Section 1 does summarize all of the data obtained during the study which was complete enough to fill the input requirements of the Data Bank program.

Section 2 the Thermal Requirements catalogue summarizes the data from Section 1 in a form which emphasizes the Tug mission

modes and the temperature requirements of each component as they would relate to the mission modes.

Section 3 the Physical Characteristics and Constraints Catalogue summarizes the data from Section 1 in a form for use by the thermal designer.

The data bank is a dynamic program in that additions or deletions to the list of components will not alter its use. A further description of the program and input requirements is contained in Reference 1.

REFERENCES

1. T. L. Ward, "Space Tug Thermal Control Equipment Thermal Requirements Characteristics and Constraints Catalogue User's Guide." MCR-74-144, Martin Marietta Corporation, April 1974.

I.

SPACE TUG THERMAL CONTROL EQUIPMENT DATA BANK

SPACE TUG EQUIPMENT DATA BANK

THE SPACE TUG EQUIPMENT DATA BANK HAS BEEN PREPARED FOR NASA/MSFC UNDER CONTRACT NUMBER NAS 8-29670.

THIS DOCUMENT CONTAINS THE RAW DATA OF ALL EQUIPMENT ITEMS IDENTIFIED FOR POTENTIAL APPLICATION TO THE SPACE TUG SYSTEM.

THE FOLLOWING DATA IS INCLUDED IN THIS DOCUMENT

EQUIPMENT THERMAL REQUIREMENTS

EQUIPMENT PHYSICAL CHARACTERISTICS

EQUIPMENT CONSTRAINTS

THIS DOCUMENT WAS PREPARED BY THE MARTIN MARIETTA AEROSPACE CORPORATION AND WAS SUBMITTED TO NASA/MSFC ON 1 MAY 1974.

QUESTIONS CONCERNING THE DATA CONTAINED HEREIN SHOULD BE DIRECTED TO
MR. TERRY L. WARD
PHONE 303-794-5211
EXTENSION 4702

THE SYSTEMS AND SUBSYSTEMS DESCRIBED HEREIN ARE DEFINED BY AND IN ACCORDANCE WITH
BASELINE TUG DEFINITION DOCUMENT
REVISION A
DATED JUNE 26, 1972
RELEASED BY
PRELIMINARY DESIGN OFFICE
PROGRAM DEVELOPMENT
GEORGE C. MARSHALL SPACE FLIGHT CENTER
NATIONAL AERONAUTICS AND SPACE ADMINSTRATION

THE DATA CONTAINED IN THE AVIONICS SYSTEM SECTION PRETAINS TO THOSE CANDIDATE EQUIPMENT ITEMS WHICH HAVE BEEN IDENTIFIED FOR APPLICATION TO THE FOLLOWING SUBSYSTEMS

GUIDANCE, NAVIGATION AND CONTROL

DATA MANAGEMENT

COMMUNICATIONS

INSTRUMENTATION

ELECTRICAL POWER

EQUIPMENT ITEM	QUANTITY	WEIGHT (POUNDS)	POWER (WATTS)	REMARKS
IMU	2	80.	40.	MOUNTED AT POSITION 1 WITH STAR TRACKER.
STAR TRACKER	2	50.	18.	POSITION 1
ELECTRONICS	2	24.		
HORIZON SCANNER	2	70.	38.	POSITION 3, POSSIBLY
ELECTRONICS	2	10.		DEPLOYED.
LASER RADAR (A)	2	70.	155.	POSITION 2, W/3 POSITION
ELECTRONICS (A)	2	20.		MIRROR YAG
TELEVISION (A)	2	20.	10.	POSITION 2, FORWARD LOOKING , ZOOM, ONE GIMBAL.
ACS ELECTRONICS	2	28.	18.5	
SUN SENSOR	2	0.8	0.0	MOUNTED ON EXTERIOR AT POSITION 2 AND 4
TOTALS		372.8	279.5	

NOTES (A) INCLUDED IN RENDEZVOUS AND DOCKING CATEGORY OF MASS PROPERTIES.

TIMELINES

CONTINUOUS OPERATION
IMU
ACS

HORIZON SCANNER*						
STAR TRACKER *						
SUN SENSOR *						
	15.31 TO	16.06,	18.45 TO	19.20,	23.40 TO	24.25
	36.60 TO	37.35,	60.60 TO	61.35,	82.28 TO	83.03
	87.54 TO	88.29,	90.59 TO	91.34		
LASER RADAR *	60.35 TO	61.35				
TELEVISION *	60.85 TO	61.35				

AUTOCOLLIMATOR WAS EXCLUDED FROM CATALOG SINCE IT APPEARS THAT HORIZON SCANNER CAN BE ATTACHED DIRECTLY TO IMU THERE BY AVOIDING THE NEED FOR THE AUTOCOLLIMATOR.

RATE GYROS WHERE INCLUDED IN CATALOG HOWEVER NO FIRM REQUIREMENT HAS BEEN ESTABLISHED.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

IMU 1 CAROUSEL 5B DELCO ELECTRONICS P/N 7886091-011

DESIGN OPERATING CASE TEMPERATURE	289. TO 319. DEG. K (60. TO 115. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 344. DEG. K (-35. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	287. TO 319. DEG. K (57. TO 115. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	286. TO 321. DEG. K (56. TO 118. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 57.7 * WIDTH 27.9 * HEIGHT	30.5 CENTIMETERS
LENGTH 22.7 * WIDTH 11.0 * HEIGHT	12.0 INCHES
PACKAGE AREA	8440.0 SQ. CENTIMETERS * 1308.2 SQ. INCHES
PACKAGE VOLUME	49102.2 CU. CENTIMETERS * 2996.4 CU. INCHES
CASE MATERIAL	ALUMINIUM
CASE WEIGHT	9.1 KILOGRAMS * 20.0 POUNDS
TOTAL WEIGHT	36.3 KILOGRAMS * 80.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.900 * EMISSIVITY = 0.900
INPUT STEADY STATE POWER	95. WATTS **
21.0 AT 297. DEG,	94.0 AT 211. DEG (WATTS AT DEG. KELVIN)
21.0 AT 75. DEG,	94.0 AT -80. DEG (WATTS AT DEG. FAHRENHEIT)
OUTPUT POWER	0. WATTS ** MILLI-WATT OUTPUT
THERMAL DESIGN	ACTIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
MARRIED WITH MAGIC 352 COMPUTER
MOUNT WITH Z-AXIS ALONG LONGITUDNIAL AXIS
MAX CABLE LENGTH 1.8 METERS (6.0 FEET)
QUALIFIED FOR 9 HOUR MISSION
OPERATIONAL IN 8 HOURS

THE CAROUSEL 5B IMU IS DESIGNED AND BUILT BY
DELCO ELECTRONICS DIVISION OF GENERAL MOTORS CORPORATION
6767 HOLISTER AVE. GOLTA, CALIFORNIA 93017
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. BILL CATTOI PHONE 805-968-1011 EXTENSION 623
THIS IMU IS CURRENTLY IN A PRODUCTION PHASE AND IS BEING PROCURED BY SAMSO FOR USE ON THE TITAN 3C TRANSTAGE AS THE SINGLE GUIDANCE SENSOR FOR THIS SYSTEM IT IS MARRIED TO THE MAGIC 352 COMPUTER ALSO BUILT BY DELCO AND SUPPLIED AS A TWO PACKAGE SYSTEM. THE IMU IS A 4 GIMBAL SYSTEM AND IS QUALIFIED FOR A 9 HOUR MISSION THIS IMU IS SCHEDULED TO FLY FOR THE FIRST TIME IN 1973. A SINGLE 28 VDC SOURCE IS REQUIRED INTERCONNECTING CABLE WITH THE COMPUTER IS LIMITED TO 1.8 M (6 FT). THE GIMBAL SET IS INTERNALLY SHOCK MOUNTED. THE CASE IS PRESSURIZED TO 11.7 N/CM SQ (17 PSIA) AND THE UNIT IS DESIGNED WITH AN INTERNAL ACTIVE THERMAL CONTROL SYSTEM COMPRISED OF A FAN AND THERMOSTATICLY CONTROLLED HEATERS. THE UNIT IS DESIGNED TO FUNCTION WITHIN A MAXIMUM POWER BUGET OF 205 WATTS. APPROXIMATELY 8 HOURS ARE REQUIRED FROM POWER ON TO GO-INERTIAL.

REF. BROCHURE, UNIVERSAL SPACE GUIDANCE SYSTEM, DELCO ELECTRONICS

AVIONICS SYSTEMS
GUIDANCE NAVIGATION AND CONTROL

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IMU 2 NIS 200 NORTHOP CORP ELEC DIV

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	219. TO 347. DEG. K (-65. TO 165. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
PACKAGE SHAPE	CYLINDRICAL
PACKAGE SIZE * LENGTH 30.5 * WIDTH 9.7 * HEIGHT	0.0 CENTIMETERS
LENGTH 12.0 * WIDTH 3.8 * HEIGHT	0.0 INCHES
PACKAGE AREA	2433.8 SQ. CENTIMETERS * 377.2 SQ. INCHES
PACKAGE VOLUME	8920.7 CU. CENTIMETERS * 544.4 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.4 KILOGRAMS * 3.0 POUNDS
TOTAL WEIGHT	7.7 KILOGRAMS * 17.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	70. WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	ACTIVE * PASSIVE

****

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
UNIT IS DESIGN FOR AIRCRAFT USE WITH COOLING ACHIEVED BY AIRCRAFT AIRFLOW AND HEAT EXCHANGER
FAST START IN 17 SECONDS, NORMAL START 3 MINUTES,UNIT IS THERMAL STABILIZED IN 15 MINUTES UNIT IS PAINTED GRAY COLOR STD MIL SPEC
HEAT EXCHANGER IS 5 IN BY 7 IN BY 0.5 IN THICK.
UNIT IS MARRIED TO AIRCRAFT COMPUTER

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THE NIS 200 IMU IS DESIGNED AND BUILT BY
NORTHROP CORPORATION ELECTRONICS DIVISION
NORWOOD, MASSACHUSETTS 02062

THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR LEO SPIEGEL PHONE 617-762-5300 EXTENSION 337

THE NIS-200 IS BASICALLY AN AIRCRAFT IMU AND REQUIRES EXTENSIVE REDESIGN IN ORDER FOR IT TO QUALIFY FOR A SPACE ENVIRONMENT. THE UNIT HAS BEEN SELECTED TO BE USED ON THE NORTH AMERICAN ROCKWELL B1 ATTACK BOMBER.THE UNIT IS A 3-AXIS / 4 GIMBAL PLATFORM. UNIT WILL BE PAINTED PER CUSTOMER THERMAL REQUIREMENTS.

REF. NORTHOP BROCHURE NIS-200 FAMILY OF INERTIAL PLATFORMS.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

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IMU 3 VIKING IRU HAMILTON STANDARD SC736300

DESIGN OPERATING CASE TEMPERATURE	325. TO 330. DEG. K (125. TO 135. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 325. DEG. K (-35. TO 125. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 297. DEG. K (0. TO 75. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	241. TO 300. DEG. K (-25. TO 80. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 29.0 * WIDTH 25.4 * HEIGHT 19.0 CENTIMETERS	
LENGTH 11.4 * WIDTH 10.0 * HEIGHT 7.5 INCHES	
PACKAGE AREA	3541.9 SQ. CENTIMETERS * 549.0 SQ. INCHES
PACKAGE VOLUME	14010.9 CU. CENTIMETERS * 855.0 CU. INCHES
CASE MATERIAL	BERYLLIUM
CASE WEIGHT	6.8 KILOGRAMS * 15.0 POUNDS
TOTAL WEIGHT	13.8 KILOGRAMS * 30.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.85 * EMISSIVITY = 0.85
INPUT STEADY STATE POWER	45. WATTS ** WARMUP IS TEMP DEPENDENT
5.0 AT 311. DEG, 50.0 AT 241. DEG	(WATTS AT DEG. KELVIN)
5.0 AT 100. DEG, 50.0 AT -25. DEG	(WATTS AT DEG. FAHRENHEIT)
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * PASSIVE

****

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE UNIT IS MARRIED TO HDC-402 COMPUTER.CABLE LENGTH 5. FT BETWEEN IMU AND COMPUTER.UNIT IS MOUTED WITH ITS X-AXIS ALONG LONGITIDUAL AXIS OF VEHICLE.UNIT IS ENVIRONMENTS TEMPERATURE DEPENDENT AT-30 DEG.C OPERATIONAL IN 121 MINUTES,AT 24 DEG. C OPERATIONAL IN 45 MINUTES. UNIT WAS BUILT FOR VIKING PROGRAM AND IS POWERED UP 3HRS PRIOR TO MARS REENTRY.

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THE INERTIAL REFERENCE UNIT IS DESIGNED AND BUILT BY
HAMILTON STANDARD SYSTEM CENTER
1690 NEW BRITAIN AVE.FARMINGTON CONN.06032
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR KEN BILLYERD PHONE 303-794-5211 EXTENSION 4632
THIS UNIT IS DESIGNED FOR THE VIKING PROGRAM WHICH REQUIRES A REDUNDANT SYSTEM CAPABILITY THAT THIS UNIT HAS. UNIT POWER IS SUPPLIED BY A SINGLE CABLE CONNECTION,ITS INPUT VOLTAGE IS 28 VOLT UNREGULATED.UNIT HAS A REDUNDANT POWER SUPPLY IN PACKAGE AND IS CAPABLE OF OPERATING OF EITHER POWER SUPPLY.
UNIT IS MARRIED TO THE HONEYWELL HDC-402 COMPUTER IN THE VIKING PROGRAM.

REF. INERTIAL REFERENCE UNIT PART NUMBER SC736300 HAMILTON STANDARD SYSTEM CENTER.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

IMU 4 MICRON ESG AUTONETICS RI

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K (-80. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 20.3 * WIDTH 17.8 * HEIGHT	9.1 CENTIMETERS
LENGTH 8.0 * WIDTH 7.0 * HEIGHT	3.6 INCHES
PACKAGE AREA	1419.4 SQ. CENTIMETERS * 220.0 SQ. INCHES
PACKAGE VOLUME	3303.6 CU. CENTIMETERS * 201.6 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.8 KILOGRAMS * 4.0 POUNDS
TOTAL WEIGHT	4.5 KILOGRAMS * 10.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	50.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE MICRON IS IN THE DEVELOPMENT STAGE AT PRESENT TIME FOR WRIGHT PATTERSON AIR FORCE AVIONICS. THE PROGRAM WILL GO INTO PHASE 2 AT END OF YEAR WITH EXPECTED PRODUCTION IN 1977. UNIT IS DESIGN FOR AIRCRAFT AND STRATEGIC CRUISE MISSILES. UNIT AT PRESENT IS DESIGN WITH AN ACTIVE COOLING SYSTEM USING FORCED COOL AIR AND COLD PLATE. UNIT CAN BE MODIFIED FOR SPACE ENVIRONMENT AND USE OF A PASSIVE THERMAL DESIGN. ALL DATA IS PRELIMINARY INFORMATION

THE MICRON ESG NAVIGATION IS DESIGN AND BUILT BY THE
AUTONETICS DIVISION OF ROCKWELL INTERNATIONAL
3370 MIRALOMA AVENUE ANAHEIM, CALIFORNIA 92803
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR ROBERT D. FAGALY PHONE 216-647-5058 EXTENSION
THE MICRON ESG NAVIGATION IS A TOTAL NAVIGATION SYSTEM BEING DEVEL OPED FOR WRIGHT PATTERSON AIR FORCE AVIONICS LABRATORY. THE UNIT INCLUDES A STRAPDOWN INERTIAL NAVIGATION UNIT, AN ELECTRONIC UNIT, AND A DEDICATED PROCESSOR THAT HAS 3K WORDS OF 2 MIL PLATED WIRE/ SOLID STATE MEMORY A CONVENTIONAL MOS CPU AND AN I/O UNIT. THE MICRON INTERFACE WILL BE PURELY DIGITAL. THE PROGRAM AT THIS STAGE IS COMPLETING PHASE 1B WITH A FUNCTIONAL BRASSBOARD FABRI CATED AND TESTED. PROGRAM IS GOING INTO PHASE 2 WITH COMPLETION IN LATE 1976 AND PRODUCTION IN 1977. UNIT IS DESIGN FOR USE IN AIRCRAFT AND CRUISE MISSILES, AT PRESENT TIME UNIT HAS AN ACTIVE COOLING SYSTEM UTILIZING FORCED AIR AND A COLD PLATE SYSTEM. INDICATION ARE THAT UNIT COULD BE MODIFIED FOR USE IN SPACE WITH A PASSIVE THERMAL CONTROL. UNIT WILL MEET MIL-E-5400 CLASS 2X. REF. MICRON ESG NAVIGATION BR73-560/201 APRIL 1973 BY AUTONETICS DIVISION ROCKWELL INTERNATIONAL.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

IMU 5 H478 STRAPDOWN IMU HONEYWELL

DESIGN OPERATING CASE TEMPERATURE	236. TO 336. DEG. K (-34. TO 145. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	225. TO 366. DEG. K (-55. TO 200. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	236. TO 328. DEG. K (-34. TO 131. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	229. TO 328. DEG. K (-48. TO 131. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 24.4 * WIDTH 9.9 * HEIGHT 10.2	CENTIMETERS
LENGTH 9.6 * WIDTH 3.9 * HEIGHT 4.0	INCHES
PACKAGE AREA	1179.9 SQ. CENTIMETERS * 182.9 SQ. INCHES
PACKAGE VOLUME	2454.1 CU. CENTIMETERS * 149.8 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.9 KILOGRAMS * 1.9 POUNDS
TOTAL WEIGHT	2.7 KILOGRAMS * 6.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.80 * EMISSIVITY = 0.80
INPUT STEADY STATE POWER	30.0 WATTS ** UNIT REQUIRE HEATER POWER
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE UNIT HAS INTERNAL HEATERS THAT MAINTAIN THE UNIT WITHIN OPERATING TEMPERATURE. THE UNIT THERMAL DESIGN IS PASSIVE WITH CONDUCTION TO THE MOUNTING SURFACE. UNIT REQUIRE 200 WATTS FOR FAST WARM UP. UNIT HAS A BLUE ANODIZED FINISH BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. UNIT WAS QUALIFIED ON THE SHAG PROGRAM.

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THE H-478 SHAG TRRAPDOWN IMU IS DESIGN AND BUILT BY HONEYWELL INC., AEROSPACE DIVISION,
13350 U.S. HIGHWAY 19, ST. PETERSBURG, FLORIDA 33733
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HARVEY H. WHELESS PHONE 813-531-4611 EXTENSION 3378
THE H-478 SHAG STRAPDOWN IMU IS AN OFF THE SHELF UNIT, IT WAS QUALIFIED FOR THE SHAG PROGRAM. UNIT POWER SUPPLY IS 28 VDC SOURCE. UNIT DESIGN TO MEET MIL-STD-801A(USAF) CLASS 1 .

REF. HONEYWELL LETTER OF 23 AUGUST 1973 AND BROCHURE 0373-11567 HONEYWELL SPACE TUG PROGRAM CAPABILITY (GUIDANCE, NAVIGATION AND CONTROL) 4 APRIL 1973.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

IMU 6 H-448 AGENA IMU HONEYWELL

DESIGN OPERATING CASE TEMPERATURE	269. TO 322. DEG. K (25. TO 120. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	255. TO 344. DEG. K (0. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	269. TO 322. DEG. K (25. TO 120. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	269. TO 322. DEG. K (25. TO 120. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 30.7 * WIDTH 16.0 * HEIGHT 41.9 CENTIMETERS	
LENGTH 12.1 * WIDTH 6.3 * HEIGHT 16.5 INCHES	
PACKAGE AREA	4901.0 SQ. CENTIMETERS * 759.7 SQ. INCHES
PACKAGE VOLUME	20611.6 CU. CENTIMETERS * 1257.8 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	4.5 KILOGRAMS * 10.0 POUNDS
TOTAL WEIGHT	17.0 KILOGRAMS * 37.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.25 * EMISSIVITY = 0.85
INPUT STEADY STATE POWER	135.0 WATTS **HEATERS POWER IS VARIABLE
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON

THE H-448 AGENA STRAPDOWN IMU HAS AN ACTIVE THERMAL SYSTEM IT USES A COLD PLATE WITH PLATE TEMPERATURE OF 10.6 TO 60 DEG. C(60 TO 140 DEG. F). UNIT IS PAINTED WITH A WHITE POLYURETHANE PAINT,HOWEVER UNIT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS MARRIED TO THE AGENA COMPUTER HDC-501 DIGITAL COMPUTER. THE H-448 IMU HAS BEEN SPACE QUALIFIED ON THE AGENA PROGRAM. THE UNIT HAS AN INTERNAL HEATERS THAT MAINTAIN UNIT WITHIN OPERATING TEMP.

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THE H-448 (AGENA) STRAPDOWN IMU IS DESIGN AND BUILT BY
HONEYWELL INC., AEROSPACE DIVISION
13350 U.S. HIGHWAY 19, ST. PETERSBURG, FLORIDA 33733
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HARVEY A. WHELESS PHONE 813-531-4611 EXTENSION 3378
THE H-448 STRAPDOWN IMU IS AN OFF THE SHELF, PRODUCTION UNIT THAT IS BEING USED AS THE BOOST GUIDANCE SYSTEM FOR THE AGENA VEHICLE. THE UNIT IS MARRIED TO THE AGENA COMPUTER,THE HDC-501 DIGITAL COMPUTER. THE H-448 IMU HAS QUALIFIED TO LEVELS EXCEEDING THE SPACE SHUTTLE REQUIREMENTS.
THE UNIT REQUIRES A 28 VDC SOURCE.

REF. MR HARVEY H. WHELESS LETTER OF THE 23 AUGUST 1973. AND BROCHURE 0373-11567 HONEYWELL SPACE TUG PROGRAM CAPABILITY (GUIDANCE, NAVIGATION AND CONTROLL) 4 APRIL 1973.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

IMU 7 HEXAD IMU HONEYWELL

DESIGN OPERATING CASE TEMPERATURE	289. TO 333. DEG. K	
	(60. TO 140. DEG. F)	
NON-OPERATING AND STORAGE CASE TEMPERATURE	264. TO 344. DEG. K	
	(15. TO 160. DEG. F)	
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	264. TO 333. DEG. K	
	(15. TO 140. DEG. F)	
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	264. TO 333. DEG. K	
	(15. TO 140. DEG. F)	
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH	68.6 * WIDTH 52.1 * HEIGHT	26.7 CENTIMETERS
LENGTH	27.0 * WIDTH 20.5 * HEIGHT	10.5 INCHES
PACKAGE AREA	13577.4 SQ. CENTIMETERS *	2104.5 SQ. INCHES
PACKAGE VOLUME	95237.5 CU. CENTIMETERS *	5811.7 CU. INCHES
CASE MATERIAL	ALUMINUM	
CASE WEIGHT	18.1 KILOGRAMS *	40.0 POUNDS
TOTAL WEIGHT	60.9 KILOGRAMS *	134.2 POUNDS
SURFACE PROPERTIES	ALPHA = 0.25 * EMISSIVITY = 0.85	
INPUT STEADY STATE POWER	198.0 WATTS **HEATERS POWER IS VARIABLE	
OUTPUT POWER	0.0 WATTS **	
THERMAL DESIGN	ACTIVE * ACTIVE	

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE HEXAD IMU IS IN DEVELOPMENT IT HAS INTERNAL HEATERS THAT HAVE VARIABLE POWER AND MAINTAIN THE UNIT WITHIN OPERATING TEMPERATURE. THE UNIT THERMAL DESIGN IS ACTIVE WITH A COLD PLATE UTILIZED TO MAINTAIN THE UNIT TEMPERATURE REQUIREMENTS. THE HEXAD IMU IS PAINTED WITH A WHITE POLYURETHANE PAINT, HOWEVER UNIT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.

THE HEXAD IMU IS BEING DEVELOP AND BUILT BY
HONEYWELL INC., AEROSPACE DIVISION
13350 U.S. HIGHWAY 19, ST. PETERSBURG, FLORIDA 33733
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HARVEY H. WHELESS PHONE 813-531-4611 EXTENSION 3378
THE HEXAD IMU IS AT PRESENT IN DEVELOPMENT. THE HEXAD IMU IS A GIMBALLED SYSTEM WHICH HAS SIX SINGLE AXIS SENSOR ASSEMBLIES MOUNTED IN A DODERAHEDRAL ORIENTATION. EACH OF THE SENSOR ASSEMBLIES CONTAIN ONE GYRO, ONE ACCELEROMETER, REBALANCE ELECTRONICS, INTERFACE CIRCUITRY AND A COMPLETE POWER CONDITIONER. THE GYRO AND ACCELEROMETER ARE IDENTICAL TO THOSE USED IN H-448 IMU. THE HEXAD CONFIGURATION HAS NOT BEEN SPACE QUALIFIED, HOWEVER COMPONENTS USED IN THE HEXAD IMU HAVE BEEN SPACE QULAIFIED IN OTHER PROGRAMS. UNIT HAS SPECIAL FEATURES CAPABILITIES TO INTERFACE WITH THE HDC-601 COMPUTER.

REF. MR HARVEY H. WHELESS LETTER OF 23 AUGUST 1973. AND BROCHURE 0373-11567 HONEYWELL SPACE TUG PROGRAM CAPABILITY (GUIDANCE, NAVIGATION AND CONTROL) 4 APRI 1973.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

IMU 8 BLOCK 5D STRAPDOWN HONEYWELL DGG8088A1

DESIGN OPERATING CASE TEMPERATURE	304. TO 308. DEG. K (88. TO 95. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	272. TO 344. DEG. K (30. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	268. TO 328. DEG. K (23. TO 131. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	268. TO 318. DEG. K (23. TO 113. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 27.9 * WIDTH 22.9 * HEIGHT 17.8 CENTIMETERS	
LENGTH 11.0 * WIDTH 9.0 * HEIGHT 7.0 INCHES	
PACKAGE AREA	3083.9 SQ. CENTIMETERS * 478.0 SQ. INCHES
PACKAGE VOLUME	11356.2 CU. CENTIMETERS * 693.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	2.0 KILOGRAMS * 4.5 POUNDS
TOTAL WEIGHT	9.9 KILOGRAMS * 21.9 POUNDS
SURFACE PROPERTIES	ALPHA = 0.25 * EMISSIVITY = 0.85
INPUT STEADY STATE POWER	36.0 WATTS **HAS VARIABLE HEATER POWER
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON

THE BLOCK 5D STRAPDOWN IMU IS IN DEVELOPMENT, AND HAS A PASSIVE COOLING SYSTEM OF RADIATION OUT TO SPACE. THE UNIT IS THERMALLY ISOLATED FROM ITS MOUNTING SURFACE. UNIT REQUIRE 24.2 WATTS OF HEATER POWER AT ASCENT AND 7.7 WATTS FOR IN ORBIT OPERATION. THE UNIT IS PAINTED WITH A WHITE POLYURETHANE PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.

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THE DGG8088A1 BLOCK 5D STRAPDOWN IMU IS DESIGN AND BUILT BY HONEYWELL INC., AEROSPACE DIVISION
13350 U.S. HIGHWAY 19, ST. PETERSBURG, FLORIDA 33733
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HARVEY H. WHELESS PHONE 813-531-4611 EXTENSION 3378
THE BLOCK 5D STRAPDOWN IMU IS BEING DEVELOPED AS A PART OF A PRIMARY ATTITUDE DETERMINATION SUBSYSTEM (PADS). UNIT HAS FOUR GYROS R-ED 21429, THREE ORTHOGONAL, AND ONE SKEWED. THE SKEWED GYRO PROVIDES REDUNDANCY IF ANY ORTHOGONAL GYRO FAILS. THE UNIT HAS A BUILT-IN TEST EQUIPMENT, A REDUNDANT AC AND DC POWER SUPPLIE AND A REDUNDANT LOGIC AND DATA PROCESSING CHANNELS. IN ADDITION UNIT IS THERMALLY ISOLATED FROM ITS MOUNTING SURFACE. THE UNIT QUALIFICATION TEST WERE SCHEDULE TO BEGIN IN JULY 1973.

REF. MR HARVEY H. WHELESS LETTER OF 23 AUGUST 1973. AND BROCHURE 0373-11567 HONEYWELL SPACE TUG PROGRAM CAPABILITY (GUIDANCE, NAVIGATION AND CONTROL) 4 APRIL 1973.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

IMU 9 H-319 CENTAUR IRU HONEYWELL		GIMBALED
DESIGN OPERATING CASE TEMPERATURE		278. TO 322. DEG. K
		(40. TO 120. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE		239. TO 344. DEG. K
		(-30. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS		273. TO 322. DEG. K
		(32. TO 120. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS		266. TO 322. DEG. K
		(20. TO 120. DEG. F)
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH	35.3 * WIDTH 44.7	* HEIGHT 45.7 CENTIMETERS
LENGTH	13.9 * WIDTH 17.6	* HEIGHT 18.0 INCHES
PACKAGE AREA	10472.8 SQ. CENTIMETERS	* 1623.3 SQ. INCHES
PACKAGE VOLUME	72160.8 CU. CENTIMETERS	* 4403.5 CU. INCHES
CASE MATERIAL	MAGNESIUM	
CASE WEIGHT	7.5 KILOGRAMS	* 16.6 POUNDS
TOTAL WEIGHT	28.3 KILOGRAMS	* 62.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.25	* EMISSIVITY = 0.85
INPUT STEADY STATE POWER	90.0 WATTS **	
OUTPUT POWER	0.0 WATTS **	
THERMAL DESIGN	PASSIVE	* PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE CENTAUR INERTIAL REFERENCE UNIT (IRU) IS MARRIED TO THE CENTAUR SYSTEM ELECTRONICS UNIT (SEU). THE IRU IS A GIMBALED SYSTEM, IT HAS A PASSIVE THERMAL DESIGN OF RADIATION TO SPACE. THE UNIT IS PAINTED WITH A WHITE POLYURETHANE PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT HAS INTERNAL HEATERS WHICH MAINTAIN THE UNIT WITHIN OPERATING TEMPERATURE. THE IRU CASE WEIGHT INCLUDES 4 KG (8.8LB) OF ALUMINUM.

THE H-319 CENTAUR GIMBALED IMU IS DESIGN AND BUILT BY
HONEYWELL INC., AEROSPACE DIVISION
13350 U.S. HIGHWAY 19, ST. PETERSBURG, FLORIDA 33733
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HARVEY H. WHELESS PHONE 813-531-4611 EXTENSION 3378
THE H-319 CENTAUR IMU IS A GIMBALED SYSTEM. THE UNIT IS OFF THE SHELF AND HAS EXTENSIVE FLIGHT TEST HISTORY. THE IMU IS COMPOSED OF TWO SEPERATE PACKAGES, THE INERTIAL REFERENCE UNIT (IRU) AND THE SYSTEM ELECTRONICS UNIT (SEU). THE UNIT HAS QUALIFIED FOR SPACE ENVIRONMENT ON SEVERAL CENTAUR FLIGHTS. THE IRU IS THE GIMBAL INERTIAL SENSOR, THE SEU SUPPLY THE ELECTRONICS AND POWER TO THE IRU.

REF. MR HARVEY H. WHELESS LETTER OF 23 AUGUST 1973. AND BROCHURE 0373-11567 HONEYWELL SPACE TUG PROGRAM CAPABILITY (GUIDANCE, NAVIGATION AND CONTROL) 4 APRIL 1973.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

IMU 9 H-319 CENTAUR SEU HONEYWELL

DESIGN OPERATING CASE TEMPERATURE	278. TO 322. DEG. K
	(40. TO 120. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	239. TO 344. DEG. K
	(-30. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	273. TO 322. DEG. K
	(32. TO 120. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	248. TO 332. DEG. K
	(-14. TO 138. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	35.1 * WIDTH 26.7 * HEIGHT 15.0 CENTIMETERS
LENGTH	13.8 * WIDTH 10.5 * HEIGHT 5.9 INCHES
PACKAGE AREA	3719.6 SQ. CENTIMETERS * 576.5 SQ. INCHES
PACKAGE VOLUME	14009.5 CU. CENTIMETERS * 854.9 CU. INCHES
CASE MATERIAL	MAGNESIUM
CASE WEIGHT	4.7 KILOGRAMS * 10.4 POUNDS
TOTAL WEIGHT	11.3 KILOGRAMS * 25.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.25 * EMISSIVITY = 0.85
INPUT STEADY STATE POWER	60. WATTS ** + OR - 10
OUTPUT POWER	30.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE CENTAUR SYSTEM ELECTRONICS UNIT (SEU) IS MARRIED TO THE INERTIAL REFERENCE UNIT(IRU). THE SEU UTILIZES RADIATION TO SPACE AS THE UNIT PASSIVE THERMAL CONTROL. THE SEU IS PAINTED WITH A WHITE POLYURETHANE PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.

THE H-319 CENTAUR GIMBALED IMU IS DESIGN AND BUILT BY
HONEYWELL INC., AEROSPACE DIVISION
13350 U.S. HIGHWAY 19, ST. PETERSBURG, FLORIDA 33733
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HARVEY H. WHELESS PHONE 813-531-4611 EXTENSION 3378
THE H-319 CENTAUR IMU IS A GIMBALED SYSTEM. THE SYSTEM IS COMPOSE OF TWO SEPERATE PACKAGES THE INERTIAL REFERENCE UNIT (IRU) AND THE SYSTEM ELECTRONICS UNIT (SEU). THE SYSTEM IS AN OFF THE SHELF PRODUCTION STATUS AND HAS EXTENSIVE FLIGHT TEST HISTORY. THE UNIT HAS QUALIFIED FOR SPACE ENVIRONMENT ON SEVERAL CENTAUR FLIGHTS. THE SEU IS THE ELECTRONICS AND POWER SUPPLY FOR THE IRU WHICH IS THE GIMBAL INERTIAL MEASURING UNIT.

REF. MR HARVEY H. WHELESS LETTER OF 23 AUGUST 1973. AND BROCHURE 0373-11567 HONEYWELL SPACE TUG PROGRAM CAPABILITY (GUIDANCE, NAVIGATION AND CONTROL) 4 APRIL 1973.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

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IMU 10 DIGS IMU HAMILTON STANDARD

DESIGN OPERATING CASE TEMPERATURE	305. TO 333. DEG. K (90. TO 140. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	266. TO 344. DEG. K (20. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	305. TO 333. DEG. K (90. TO 140. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	305. TO 333. DEG. K (90. TO 140. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 33.0 * WIDTH 27.9 * HEIGHT 20.3 CENTIMETERS	
LENGTH 13.0 * WIDTH 11.0 * HEIGHT 8.0 INCHES	
PACKAGE AREA	4322.6 SQ. CENTIMETERS * 670.0 SQ. INCHES
PACKAGE VOLUME	18746.8 CU. CENTIMETERS * 1144.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	8.2 KILOGRAMS * 18.0 POUNDS
TOTAL WEIGHT	18.1 KILOGRAMS * 40.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.9 * EMISSIVITY = 0.9
INPUT STEADY STATE POWER	55.0 WATTS ** 550 WARM UP FROM 75DEG F
45.0 AT 344. DEG, 140.0 AT 200. DEG	(WATTS AT DEG. KELVIN)
45.0 AT 160. DEG, 140.0 AT-100. DEG	(WATTS AT DEG. FAHRENHEIT)
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON

THE DIGS USES A PHASE-CHANGE (WAX) HEAT SINK AND INTERNAL HEATERS FOR A TEMPERATURE CONTROL. UNIT INTERNAL GYROS ARE DESIGN TO OPERATE AT 71.1 + OR- 0.6 DEG.C(160 +OR-1 DEG.F). UNIT REQUIRES 620 WATTS INCLUDING 425 WATTS GROUND POWER FOR FAST WARM UP. UNIT NEED 60 MINUTES OF WARM UP PRIOR TO BEING OPERATIONAL. THE DIGS SURFACES ARE PAINTED WITH ALUMINIZED PAINT. ABOVE DATA INCLUDES THE DIGS AND ITS SUPPORTING CRADLE. UNIT IS THERMALLY ISOLATED.

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THE DELTA INERTIAL GUIDANCE SYSTEM (DIGS) IMU IS DESIGN AND BUILT BY HAMILTON STANDARD SYSTEM CENTER
1690 NEW BRITAIN AVENUE FARMINGTON, CONN. 06032
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HAL. TAYLOR PHONE 203-623-1621 EXTENSION 2748
THE DIGS IMU IS A STRAPDOWN IMU THAT IS IN PRODUCTION AND HAS HAD 8 FLIGHTS ON THE DELTA. THE UNIT IS COUPLED TO THE DELTA COMPUTER THE TDY-300. THE UNIT IS DESIGN FOR SPACE ENVIRONMENT. UNIT HAS A PHASE CHANGE WAX HEAT SINK, AN INTERNAL HEATERS-FINE TEMPERATURE CONTROL AND SHOCK MOUNTS THAT ARE THERMAL ISOLATORS TO MAINTAIN THE UNIT WITHIN ITS OPERATING TEMPERATURE. UNIT MISSION DURATION ON THE DELTA VEHICLE IS 90 MINUTES. UNIT WILL REQUIRE SOME MODIFICATIONS TO EXTEND ITS MISSION TIME.

REF. SUMMARY SHEETS ON THE DIGS THERMAL DESIGN FROM HSSC.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

IMU 11 RSD IMU HAMILTON STANDARD

DESIGN OPERATING CASE TEMPERATURE	305. TO 333. DEG. K (90. TO 140. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	305. TO 333. DEG. K (90. TO 140. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	305. TO 333. DEG. K (90. TO 140. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	35.6 * WIDTH 36.1 * HEIGHT 19.8 CENTIMETERS
LENGTH	14.0 * WIDTH 14.2 * HEIGHT 7.8 INCHES
PACKAGE AREA	5403.3 SQ. CENTIMETERS * 837.5 SQ. INCHES
PACKAGE VOLUME	25410.4 CU. CENTIMETERS * 1550.6 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	10.4 KILOGRAMS * 23.0 POUNDS
TOTAL WEIGHT	29.2 KILOGRAMS * 64.4 POUNDS
SURFACE PROPERTIES	ALPHA = 0.9 * EMISSIVITY = 0.9
INPUT STEADY STATE POWER	144.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE REDUNDANT STRAPDOWN IMU IS IN DEVELOPMENT AT PRESENT, IT IS BASED ON 2 DIGS IMU COUPLED TOGETHER. UNIT IS EXPECTED TO BE THERMALLY ISOLATED AND HAVE INTERNAL HEATERS TO MAINTAIN OPERATING TEMPERATURE. ABOVE DATA IS BASED ON DIGS TEMPERATURE RANGE NO FUTHER INFORMATION IS AVAILABLE AT PRESENT TIME. SURFACE PROPERTIES ARE BASED ON DIGS WHICH HAS ALUMINIZED PAINT BUT UNIT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.

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THE REDUNDANT STRAPDOWN INERTIAL MEASUREMENT SYSTEMS IS BEING DESIGN BY HAMILTON STANDARD SYSTEM CENTER
1690 NEW BRITAIN AVENUE FARMINGTON, CONN. 06032
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HAL TAYLOR PHONE 203-677-4081 EXTENSION 2748
THE REDUNDANT STRAPDOWN IMU IS PRESENTLY IN DEVELOPMENT STAGE. THE UNIT WILL USE A DODECAHEDRON STRAPDOWN INERTIAL SYSTEM. AN INTERIM UNIT IS PRESENTLY BEING CONSIDERED COMPOSED OF TWO DIGS IMU COUPLED TOGETHER. AT THE PRESENT TIME THERE ARE NO ADDITIONAL DETAIL INFORMATION ON THE RSDIMU THE UNIT WILL BE DESIGN FOR A SPACE ENVIRONMENT.

REF. HAMILTON STANDARD DOCUMENT HSER 5421 REDUNDANT STRAPDOWN INERTIAL MEASUREMENT SYSTEMS.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

IMU 12 SKN-2400 INU SINGER COMPANY

DESIGN OPERATING CASE TEMPERATURE	218. TO 344. DEG. K (-67. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K (-80. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	218. TO 344. DEG. K (-67. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	218. TO 344. DEG. K (-67. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	34.3 * WIDTH 19.6 * HEIGHT 18.5 CENTIMETERS
LENGTH	13.5 * WIDTH 7.7 * HEIGHT 7.3 INCHES
PACKAGE AREA	3338.2 SQ. CENTIMETERS * 517.4 SQ. INCHES
PACKAGE VOLUME	12435.1 CU. CENTIMETERS * 758.8 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	2.7 KILOGRAMS * 6.0 POUNDS
TOTAL WEIGHT	10.9 KILOGRAMS * 24.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	150.0 WATTS **
300.0 AT 219. DEG,	10.0 AT 297. DEG (WATTS AT DEG. KELVIN)
300.0 AT -65. DEG,	10.0 AT 75. DEG (WATTS AT DEG. FAHRENHEIT)
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE INU CONTAINS A FAN AND IS AIR COOLED BY FORCED AIR AND CONDUCTION. UNIT IS DESIGN FOR ARIFRACT USE BUT CAN BE MODEFIED FOR SPACE ENVIRONMENT. UNIT INCLUDES THE SKC-3000 COMPUTER BUT CAN BE FUNCTIONAL WITHOUT COMPUTER. UNIT REQUIRED 2.5 MINUTES TO WARM-UP HOWEVER IT IS A FUNCTION OF AVAILABLE POWER FOR HEATERS AND TEMPERATURE THAT SETS THE WARM-UP PERIOD. UNIT IS PAINTED BLACK BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.

THE SKN-2400 INERTIAL NAVIGATION UNIT IS DESIGN AND BUILT BY THE SINGER COMPANY KEARFOFF DIVISION
1150 MCBRIDE AVENUE, LITTLE FALLS NEW JERSEY 07424
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR T.R. MAHONEY PHONE 214-252-7423 EXTENSION
THE SKN-2400 INERTIAL NAVIGATION UNIT(INU) CONSISTS OF THE FOLLOWING FUNCTIONAL MODULES A 4 GIMBAL INERTIAL PLATFORM, PLATFORM ELECTRONICS, DC/DC POWER SUPPLY, I/O, ADAPTER, BATTERY, CPU AND MEMORY. THE CPU AND MEMORY IS THE SKC-3000 COMPUTER. THE INU CAN BE MODIFIED TO EXCLUDE THE COMPUTER AND OPERATE AS AN INERTIAL MEASURING SYSTEM. UNIT IS IN PRODUCTION AND TESTED TO MIL-F-5400 CLASS 2X. UNIT REQUIRE 2 SOURCES OF POWER A 115 V, 400 HZ PRIME POWER AND 26 V, 400 HZ SYNCHRO EXCITATION. THE ABOVE VARIABLE POWER IS BASED ON 2.5 MINUTES WARM-UP FROM -50 DEG C (-65 DEG.F) FOR USE IN AIRCRAFT, FOR SPACE USE LOWER POWER OF 280 WATTS FOR LONGER PERIOD OF APPROXIMATLY 15 MINUTES WILL BE REQUIRED FOR WARM UP. A DERIVATIVE OF THIS IMU HAS BEEN SELECTED FOR THE SPACE SHUTTLE ORBITER PROGRAM.

REF. MR T.R.MAHONEY LETTER, AND DATA SHEETS OF 3 OCTOBER 1973 AND SKN-2400 INERTIAL NAVIGATION UNIT ET@-1137 SINGER.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

IMU 13 KT-70 IMU SINGER COMPANY

DESIGN OPERATING CASE TEMPERATURE	218. TO 344. DEG. K (-67. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	218. TO 344. DEG. K (-67. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	218. TO 344. DEG. K (-67. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	218. TO 344. DEG. K (-67. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	55.9 * WIDTH 27.9 * HEIGHT 25.4 CENTIMETERS
LENGTH	22.0 * WIDTH 11.0 * HEIGHT 10.0 INCHES
PACKAGE AREA	7380.6 SQ. CENTIMETERS * 1144.0 SQ. INCHES
PACKAGE VOLUME	39656.7 CU. CENTIMETERS * 2420.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	7.3 KILOGRAMS * 16.0 POUNDS
TOTAL WEIGHT	26.9 KILOGRAMS * 59.4 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	112.0 WATTS ** AT 28 VDC AT 10 AMPS MAX
280.0 AT 218. DEG,	8.0 AT 297. DEG (WATTS AT DEG. KELVIN)
280.0 AT -67. DEG,	8.0 AT 75. DEG (WATTS AT DEG. FAHRENHEIT)
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE KT-70 IMU IS A 4 GIMBAL SYSTEM IT HAS AN ACTIVE COOLING SYSTEM OF HEAT TRANSFER THROUGH COLD PLATE. THE BASIC KT-70 IMU WAS BUILT FOR SEVERAL AIRCRAFT PROGRAMS INCLUDING THE A7D/E, F105 AND P3C IN ADDITION UNIT IS USED ON THE SRAM MISSILE AND IS UNDER EVALUATION FOR THE SPACE SHUTTLE. UNIT HAS INTERNAL HEATERS THAT WARM UP UNIT TO OPERATING TEMPERATURE. UNIT REQUIRE 14 MINUTES FOR WARM UP FOR SHUTTLE CONFIGURATION. UNIT IS PAINTED BLACK.

THE KT-70 IMU IS DESIGN AND BUILT BY
THE SINGER COMPANY KEARFOFF DIVISION
1150 MCBRIDE AVENUE, LITTLE FALLS, NEW JERSEY 07424
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. T. H. MAHONEY AND PHONE 214-252-7423 EXTENSION
MR. M. GUBERMAN PHONE 201-256-4000 EXTENSION 5377
THE KT-70 IMU IS AN OFF-THE SHELF AND IN PRODUCTION UNIT. IT HAS BEEN BUILT IN BOTH A 3 GIMBAL AND A 4 GIMBAL SYSTEM. THE ABOVE UNIT IS A 4 GIMBALLED IMU. UNIT HAS BEEN PROPOSED FOR AND IS UNDER EVOLUTION AT PRESENT FOR THE SPACE SHUTTLE. UNIT HAS BEEN BUILT FOR BOTH AIRCRAFT USE SUCH AS A7D/E,F105 AND P3C AND MISSILE USE SUCH AS THE SRAM. THE KT-70 UTILIZES FORCED AIR COOLING AND COLD PLATE CONDUCTION, HOWEVER IT COULD BE MODIFIED FOR A SPACE ENVIRONMENT USING ONLY A PASSIVE THERMAL CONTROL. THE ABOVE DATA IS BASED ON CONFIGURATION FOR THE SPACE SHUTTLE PROPOSAL. UNIT HAS INTERNAL HEATERS FOR USE IN WARMING UP UNIT FROM COLD START AND TO MAINTAIN OPERATING TEMPERATURES. THE UNIT WARM UP TIME IS BASICLY A FUNCTION OF AVAILABLE POWER AND TEMPERATURE. ABOVE CONFIGURATION LIMITS IS 28 VDC AT 10 AMPS OR 280 WATTS OF POWER. REF. BROCHURE PD-365-A KT-70 EQUIPMENT AND SYSTEM CONSIDERATIONS FOR NASA APPLICATIONS AND MR.T.R.MAHONEY LETTER OF 3 OCTOBER 1973

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

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RG 1 ATM RATE GYROS MARTIN MARIETTA CO. P/N 50M3770-13

DESIGN OPERATING CASE TEMPERATURE	233. TO 316. DEG. K (-40. TO 109. DEG. F)
NON-OPERATING AND STORAGE CASE TERMPERATURE	233. TO 347. DEG. K (-40. TO 165. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	233. TO 316. DEG. K (-40. TO 109. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	233. TO 316. DEG. K (-40. TO 109. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 30.5 * WIDTH 22.4 * HEIGHT 14.0 CENTIMETERS	
LENGTH 12.0 * WIDTH 8.8 * HEIGHT 5.5 INCHES	
PACKAGE AREA	2838.7 SQ. CENTIMETERS * 440.0 SQ. INCHES
PACKAGE VOLUME	9517.6 CU. CENTIMETERS * 580.8 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	2.3 KILOGRAMS * 5.0 POUNDS
TOTAL WEIGHT	5.2 KILOGRAMS * 11.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.85 * EMISSIVITY = 0.85
INPUT STEADY STATE POWER	23.1 WATTS **
10.4 AT 340. DEG.	21.9 AT 316. DEG (WATTS AT DEG. KELVIN)
10.4 AT 152. DEG.	21.9 AT 110. DEG (WATTS AT DEG. FAHRENHEIT)
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON

THE ATM RATE GYRO HAS AN INTERNAL PROPORTIONAL HEATER THAT MAINTAIN THE UNIT AT 67.8 + OR - 1 DEG.C(154 + OR -1 DEG. F). THE UNIT THERMAL DESIGN IS PASSIVE WITH RADIATION AND CONDUCTION TO THE SURROUNDING ENVIRONMENT AND MOUNTING STRACTURE. THE UNIT HAS A BLACK ANODIZED FINISH BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SPACE QUALIFIED AND PRESENTLY OPERATING ONBOARD THE SKYLAB.

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THE ATM RATE GYROS ARE BUILT BY
MARTIN MARIETTA AEROSPACE ORLANDO DIVISION
P.O. BOX 5837 ORLANDO FLORIDA 32805
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR JAMES WISE PHONE 205-453-3826 EXTENSION

THE ATM RATE GYRO IS A ONE AXIS RATE GYRO, THREE UNITS ARE REQUIRED TO HAVE COMPLETE ROTATION CAPABILITIES. EACH UNIT IS PACKAGED IN A SEPERATE INDIVIDUAL BOX. EACH UNIT IS CONTROLLED TO ITS OWN OPERATING TEMPERATURE RANGE BY AN INTERNAL PROPORTIONAL HEATER. THE GYROS ARE PRESENTLY OPERATING ONBOARD THE SKYLAB.

REF. ATM EQUIPMENT LIST DOCUMENT NUMBER 50M72900

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

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ST 1 CT-401 SENSOR BBRC

DESIGN OPERATING CASE TEMPERATURE	263. TO 323. DEG. K (14. TO 122. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	243. TO 333. DEG. K (-22. TO 140. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	263. TO 323. DEG. K (14. TO 122. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	253. TO 333. DEG. K (-4. TO 140. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 30.5 * WIDTH 13.5 * HEIGHT 15.2 CENTIMETERS	
LENGTH 12.0 * WIDTH 5.3 * HEIGHT 6.0 INCHES	
PACKAGE AREA	2160.0 SQ. CENTIMETERS * 334.8 SQ. INCHES
PACKAGE VOLUME	6253.3 CU. CENTIMETERS * 381.6 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.4 KILOGRAMS * 3.0 POUNDS
TOTAL WEIGHT	5.0 KILOGRAMS * 11.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.85 * EMISSIVITY = 0.9
INPUT STEADY STATE POWER	5.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
UNIT HAS NO PREFERRED ORIENTATION BUT REQUIRES ITS BRIGHT OBJECT SENSOR TO BE LOCATED NEAR BY TO PROTECT TRACKER FROM BRIGHT LIGHT.
POWER IS UNDER 3 WATTS FOR REGULATED +,-10 VDC AND +5 VDC AND 5 WATTS FOR 28 VOLTS UNREGULATED.
UNIT IS OPERATIONAL IN 15 MINUTES.

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THE CT-401 STELLAR ASPECT SENSOR IS DESIGNED AND BUILT BY
BALL BROTHERS RESEARCH CORPORATION
P.O BOX 1062 BOULDER,COLORADO 80302
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR DON VANLANDINGHAM PHONE 303-441-4000 EXTENSION4383
UNIT IS IN PRODUCTION IT IS USED ON THE SMALL ASTRONOMY SATELLITE C EXPECTED FLIGHT 1975 PRUCHASED BY NASA GODDARD.
UNIT IS BEING PROPOSED FOR SPACE SHUTTLE.
UNIT FIELD OF VIEW IS 8 DEG BY 8 DEG WITH BRIGHT OBJECT SENSOR PROTECTION ANGLE OF 20 DEGREES OFF AXIS. THIS UNIT IS A STRAPDOWN ALL ELECTRONICS DEVICE.

REF.STELLAR ASPECT SENSOR CT-401 BBRC SENSORS NEW PRODUCT INFORMATION DATA SHEETS.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

ST 2 STAR TRACKER HONEYWELL

DESIGN OPERATING CASE TEMPERATURE	263. TO 283. DEG. K (14. TO 50. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	255. TO 303. DEG. K (0. TO 85. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	263. TO 283. DEG. K (14. TO 50. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	263. TO 283. DEG. K (14. TO 50. DEG. F)
PACKAGE SHAPE	CYLINDRICAL
PACKAGE SIZE	* LENGTH 50.8 * WIDTH 12.7 * HEIGHT 0.0 CENTIMETERS LENGTH 20.0 * WIDTH 5.0 * HEIGHT 0.0 INCHES
PACKAGE AREA	5067.1 SQ. CENTIMETERS * 785.4 SQ. INCHES
PACKAGE VOLUME	25740.7 CU. CENTIMETERS * 1570.8 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.5 KILOGRAMS * 1.0 POUNDS
TOTAL WEIGHT	3.2 KILOGRAMS * 7.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	3.0 WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
UNIT WILL HAVE A MODULAR COMPONENT DESIGN, AND WILL INCOPORATE A PASSIVE THERMAL DESIGN. SURFACE PROPERTIES WILL DEPEND ON CUSTOMER THERMAL REQUIREMENTS.
EXPECTED THERMAL QUALIFICATION TEST IS 1975.
ALL DATA INDICATED ABOVE IS PRELIMINARY ENGINEERING DATA.

THE DIGITAL STAR TRACKER IS DESIGNED AND BUILT BY
HONEYWELL RADIATION CENTER
2 FORBES ROAD,LEXINGTON,MASS 02173
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR IRVING CHABINSKY PHONE 617-562-6222 EXTENSION
THE DIGITAL STAR TRACKER IS BEING PROPOSED FOR THE SHUTTLE PROGRAM
UNIT IS IN ENGINEERING DEVELOPMENT AND NO ADDITIONAL INFORMATION WERE SUPPLIED DUE TO PROPRIETERY REASONS.

REF. NON AVAILABLE

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

ST 3 MMOS ITT GILFILLAN

DESIGN OPERATING CASE TEMPERATURE	293. TO 323. DEG. K (68. TO 122. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	289. TO 323. DEG. K (60. TO 122. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	289. TO 300. DEG. K (60. TO 80. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	293. TO 323. DEG. K (68. TO 122. DEG. F)
PACKAGE SHAPE	CYLINDRICAL
PACKAGE SIZE * LENGTH 38.1 * WIDTH 7.6 * HEIGHT	0.0 CENTIMETERS
LENGTH 15.0 * WIDTH 3.0 * HEIGHT	0.0 INCHES
PACKAGE AREA	2189.0 SQ. CENTIMETERS * 339.3 SQ. INCHES
PACKAGE VOLUME	6950.0 CU. CENTIMETERS * 424.1 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	3.2 KILOGRAMS * 7.0 POUNDS
TOTAL WEIGHT	6.8 KILOGRAMS * 15.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	20. WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
UNIT IS COLD PLATED WITH APPROX. 75 PERCENT OF COOLING ACHIEVED THRU MOUNTING FLANGE. UNIT SHOULD BE MOUNTED LOOKING OUT TO SPACE. IT HAS SEVERAL MODES OF OPERATION WITH 20 WATTS STEADY STATE POWER MAX POWER FOR ALL MODES AND 13 WATTS MIN POWER FOR ONE MODE. UNIT SHOULD BE COUPLED TO A COMPUTER.UNIT IS IN PROTOTYPE STAGE. UNIT HAS NOT BEEN QUAL TESTED. EXPECTED COLD PLATE IS 15.6 TO 37.8 DEG C (60 TO 100 DEG F) WITH QUAL TEST EXCEEDING VALUES.

THE MULTI-MODE OPTICAL SENSOR IS DESIGNED AND BUILT BY
ITT GILFILLAN DEFENSE SPACE GROUP
7821 ORION AVE P.O.BOX 7713 VAN NUYS, CALIFORNIA 91409
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR BERNARD GRABOIS PHONE 213-988-2600 EXTENSION 422
THIS UNIT IS A MULTI-MODE OPTICAL SENSOR IT IS DESIGNED TO HAVE SEVERAL MODES OF OPERATION SUCH AS A STAR TRACKER,A UV RADIOMETER, A BEACON TRACKER,AND SEVERAL OTHER MODES.IN ADDITION IT IS BEING DESIGNED TO BE COUPLED TO THE SCANNING LASER RADAR AND USED AS A RENDEZOUS SYSTEM. THE UNIT IS BEING PROPOSED IN IT SEVERAL MODES OF OPERATION FOR THE SHUTTLE PROGRAM.BUT AT THIS TIME THERE IS NO INDICATION AS TO WHAT MODES THE SHUTTLE IS CONSIDERING.

REF. ITT GILFILLAN DATA SHEETS ON MMOS.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

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ST 4 569B STAR TRACKER EMR PHOTOELECTRIC

DESIGN OPERATING CASE TEMPERATURE	243. TO 318. DEG. K
	(-22. TO 113. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	218. TO 348. DEG. K
	(-67. TO 167. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	243. TO 318. DEG. K
	(-22. TO 113. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 318. DEG. K
	(-22. TO 113. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	11.4 * WIDTH 15.7 * HEIGHT 9.1 CENTIMETERS
LENGTH	4.5 * WIDTH 6.2 * HEIGHT 3.6 INCHES
PACKAGE AREA	857.0 SQ. CENTIMETERS * 132.8 SQ. INCHES
PACKAGE VOLUME	1645.9 CU. CENTIMETERS * 100.4 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.4 KILOGRAMS * .8 POUNDS
TOTAL WEIGHT	1.8 KILOGRAMS * 4.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	3.0 WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
THE 569B STAR TRACKER DIMENSIONS DO NOT INCLUDE THE OPTICS. THE UNIT IS BLACK ANODIZED. REQUIRES APPROX 30 MINUTES TO BE OPERATIONAL. UNIT HAS NO LIMITATIONS ON MOUNTING LOCATIONS.
THE 569B USES THE ASCOP 571E-01-14 QUADRANT MULTIPLIER PHOTOTUBE WHICH IS 180 GRAMS,(.12 LBS) 3.5 CM O.D X 10.8 CM LENGTH (1.37 IN O.D.X 4.25 LENGTH) AND HAS A STAINLESS STEEL HOUSING.
UNIT IS SPACE QUALIFIED. COOLING BY CONDUCTION AND RADIATION.

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THE 569B STAR-TRACKING SENSOR IS DESIGNED AND BUILT BY
EMR PHOTOELECTRIC
BOX 44 PRINCETON, NEW JERSEY 08540
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR ROBERT WISNER PHONE 213-822-1441 EXTENSION
THE 569B STAR TRACKING SENSOR ASSEMBLY IS DESIGNED FOR SPACE USE. IT FEATURES THE USE OF ASCOP MODEL 571E-01-14 QUADRANT MULTIPLIER PHOTOTUBE. THE 571E PERFORMS THE FUNCTION OF FOUR LIGHT SENSING DEVICES IN 4 SINGLE TUBE. THE STAR TRACKER OPERATES FROM VOLTAGE OF +20 VDC AND -20 VDC. UNIT IS COMPLETELY SELF-CONTAINED AND INCLUDES A SILICON SENSISTOR FOR TEMPERATURE INDICATIONS.
UNIT IS SPACE QUALIFIED BUT HAS NOT FLOWN.

REF. ASPECT SENSORS FOR FINE GUIDANCE AND TRACKING SYSTEMS BY EMR PHOTOELECTRIC

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

ST 5 574 STAR CAMERA EMR PHOTOELECTRIC

DESIGN OPERATING CASE TEMPERATURE	263. TO 313. DEG. K (13. TO 104. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	218. TO 343. DEG. K (-67. TO 158. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	263. TO 313. DEG. K (13. TO 104. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	263. TO 313. DEG. K (13. TO 104. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE	* LENGTH 10.2 * WIDTH 15.2 * HEIGHT 30.5 CENTIMETERS LENGTH 4.0 * WIDTH 6.0 * HEIGHT 12.0 INCHES
PACKAGE AREA	1858.1 SQ. CENTIMETERS * 288.0 SQ. INCHES
PACKAGE VOLUME	4719.5 CU. CENTIMETERS * 288.0 CU. INCHES
CASE MATERIAL	MAGNESIUM
CASE WEIGHT	1.0 KILOGRAMS * 2.1 POUNDS
TOTAL WEIGHT	5.3 KILOGRAMS * 11.7 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	4.4 WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
THE 574 STAR CAMERA DIMENSIONS DO NOT INCLUDE THE OPTICS. THE UNIT SURFACE IS IRIDITE 15. UNIT REQUIRE APPROX 30 MINUTES TO BE OPERATIONAL. UNIT HAS NO LIMITATIONS ON MOUNTING ORIENTATION IN VEHICLE UNIT IS DESIGN FOR SPACE ENVIRONMENT AND IS THERMALLY CONTROLED BY RADIATION AND CONDUCTION OF THE HEAT TO THE ENVIRONMENT AND THE MOUNTING LOCATIONS. UNIT FINISH IS CUSTOMER DEPENDENT.

THE 574 STAR CAMERA IS DESIGNED AND BUILT BY
EMR PHOTOELECTRIC
BOX 44 PRINCETON, NEW JERSEY 08540
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR ROBERT WISNER PHONE 213-822-1441 EXTENSION
THE 574 STAR CAMERA HAS AN ELECTROSTATIC IMAGE DISSECTOR TUBE. IT HAS BEEN DESIGNED AND DEVELOPED AS A SENSOR COMPONENT FOR STAR TRACKER SYSTEMS INTENDED TO OPERATE IN BOTH SEARCH AND TRACK MODES UNIT IS DESIGN FOR SPACE ENVIRONMENT, AND REQUIRES THREE SOURCES OF POWER, A 16 V UNREGULATED 10 V REGULATED AND A -10 V REGULATED VOLTAGE. UNIT HAS A DIGITAL OUTPUT AND SHOULD BE COUPLED TO THE VEHICLE COMPUTER.

REF. BROCHURE,EMR PHOTOELECTRIC STAR CAMERA A DETAILED DESCRIPTION OF THE PROPOSAL AS PRESENTED TO MARTIN MARIETTA CORP. BY EMR PHOTOELECTRIC

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

ST 6 OAO STAR TRACKER BENDIX CORPORATION P/N 2126798-1 STRAPDOWN

DESIGN OPERATING CASE TEMPERATURE	244. TO 311. DEG. K	
	(-20. TO 100. DEG. F)	
NON-OPERATING AND STORAGE CASE TEMPERATURE	239. TO 328. DEG. K	
	(-30. TO 130. DEG. F)	
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	244. TO 311. DEG. K	
	(-20. TO 100. DEG. F)	
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	244. TO 311. DEG. K	
	(-20. TO 100. DEG. F)	
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH 31.7 * WIDTH 20.3 * HEIGHT	15.2 CENTIMETERS	
LENGTH 12.5 * WIDTH 8.0 * HEIGHT	6.0 INCHES	
PACKAGE AREA	2877.4 SQ. CENTIMETERS *	446.0 SQ. INCHES
PACKAGE VOLUME	9832.2 CU. CENTIMETERS *	600.0 CU. INCHES
CASE MATERIAL	ALUMINUM	
CASE WEIGHT	.9 KILOGRAMS *	2.0 POUNDS
TOTAL WEIGHT	7.3 KILOGRAMS *	16.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.70 * EMISSIVITY = 0.85	
INPUT STEADY STATE POWER	6. WATTS **	
OUTPUT POWER	0.0 WATTS **	
THERMAL DESIGN	PASSIVE * PASSIVE	

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
THE OAO-IV STRAPDOWN STAR TRACKER HAS A PASSIVE THERMAL CONTROL HEAT IS REJECTED BY CONDUCTION TO A RADIATION SHIELD HAVING A PERMISSIBLE TEMPERATURE EXCURSION OF -29 TO 38 DEG.C(-20 TO 100 DEG F). NO HEATERS ARE REQUIRED WITHIN THIS RANGE. UNIT IS HARD MOUNTED TO VEHICLE MOUNTING FLANGE. UNIT REQUIRE CLEAR UNOBSTRACTED VIEW TO OPERATE PROPERLY

THE ORBITING ASTRONOMICAL OBSERVATORY (OAO-IV) STRAPDOWN STAR TRACKER IS DESIGN AND BUILT BY THE BENDIX CORP. NAVIGATION AND CONTROL DIVISION TETERBORO, NEW JERSEY 07608.
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JIM TONGE PHONE 201-288-2000 EXTENSION 6111
THE OAO-IV STAR TRACKER HAS BEEN DEVELOPED UNDER A CONTRACT WITH THE GODDARD SPACE FLIGHT CENTER AND IS PRESENTLY OPERATING ABOARD THE FOURTH FLIGHT OF THE ORBITING ASTRONOMICAL OBSERVATORY. ITS MAJOR SUBASSEMBLIES CONSIST OF REFRACTIVE OPTICS, AND IMAGE DISECTOR PHOTOMULTIPLIER TUBE (FW 143) AND ASSOCIATED PROCESSING ELECTRONICS. THE UNIT IS A STRAPDOWN STAR TRACKER WITH THE ENTIRE SYSTEM IN ONE PACKAGE MOUNTED TO THE VEHICLE MOUNTING FLANGE. UNIT HAS SENSORS WHICH ACTIVATE A SHUTTER WHEN THE SUN IS WITHIN 60 DEGREES OR THE EARTHS EDGE IS WITHIN 25 DEGREES OF THE OPTICAL AXIS. UNIT IS SPACE QUALIFIED.

REF. OPTICAL STELLAR PLANET AND SOLAR TRACKING SENSING DEVICES BY THE BENDIX CORP NAVIGATION AND CONTROL DIVISION. APRIL 1973

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

ST 7 OMA ATM STAR TRKR. BENDIX CORPORATION P/N-2125000-3 GIMBAL

DESIGN OPERATING CASE TEMPERATURE	247. TO 305. DEG. K (-15. TO 90. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 328. DEG. K (-40. TO 130. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 305. DEG. K (0. TO 90. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	255. TO 305. DEG. K (0. TO 90. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 43.4 * WIDTH 32.0 * HEIGHT	55.9 CENTIMETERS
LENGTH 17.1 * WIDTH 12.6 * HEIGHT	22.0 INCHES
PACKAGE AREA	11211.1 SQ. CENTIMETERS * 1737.7 SQ. INCHES
PACKAGE VOLUME	77676.6 CU. CENTIMETERS * 4740.1 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	2.7 KILOGRAMS * 6.0 POUNDS
TOTAL WEIGHT	18.1 KILOGRAMS * 40.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.250 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	8.6 WATTS ** THE ARE 3 HEATERS
10.0 AT 258. DEG.	20.0 AT 261. DEG (WATTS AT DEG. KELVIN)
10.0 AT 5. DEG.	20.0 AT 10. DEG (WATTS AT DEG. FAHRENHEIT)
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
THE OMA ATM STAR TRACKER IS A GIMBALLED UNIT. THE ABOVE DIMENSIONS ARE EXTERIOR LIMITS SEE REF FOR MORE DETAIL DESCRIPTION. UNIT IS MARRIED TO ATM STAR TRACKER ELECTRONICS UNIT. UNIT HAS 3 INTERNAL HEATERS OF 10 WATTS EACH TWO OF THE HEATERS HAVE SET POINTS OF -23 .3 TO -15.0 (-9.9 TO 5.0 DEG.F) AND THE THIRD HEATER HAS SET POIN OF -15.3 TO -6.7 DEG C (5.5 TO 22.5 DEG.F). UNIT IS THERMALLY ISO LATED, PAINTED WHITE, AND HAS A SUPERINSULATION BLANKET COVERING .

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THE SKYLAB ATM OMA GIMBALLED STAR TRACKER IS DESIGN AND BUILT BY THE BENDIX CORPORATION NAVIGATION AND CONTROL DIVISION TETERBORO, NEW JERSEY 07608.
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JIM TONGE PHONE 201-288-2000 EXTENSION 6111
THE APOLLO TELESCOPE MOUNT (ATM) STAR TRACKER SYSTEM CONSISTS OF THE OPTICAL MECHANICAL ASSEMBLY (OMA) AND A STAR TRACKER ELECTRONICS (STE). THE OMA CONSISTS OF A REFRACTIVE TELESCOPE MOUNTED IN A DOUBLE GIMBAL SUSPENSION. EACH GIMBAL IS DRIVEN BY A DIRECT DRIVE D.C. TORQUER, WITH GIMBAL RATE CONTROL PROVIDED BY D.C. TACH OMETERS. THE TELESCOPE HAS A SCANNED FIELD-OF-VIEW OF 1 DEG SQUARE AND AN INSTANTANEOUS FIELD-OF-VIEW OF 10 ARC MINUTE SQUARE. A COMBINATION SUN AND EARTH ALBEDO SHADE IS PROVIDED ALLOWING TRACKING OF STARS WITHIN 45 DEG OF THE SUN AND 5 DEG OF THE EARTH. THE STAR TRACKER ELECTRONICS, SEE STE 1, PROVIDES OTHER FUNCTIONS IN SUPPORT OF THE OMA. THE ATM STAR TRACKER IS CAPABLE OF 3 MODES OF OPERATION, MANUAL, SEARCH, AND TRACK.

REF. OPTICAL STELLAR PLANET AND SOLAR TRACKING SENSING DEVICES BY THE BENDIX CORP. NAVIGATION AND CONTROL DIVISION. APRIL 1973.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

ST 8 KS-199 STAR TRKR	KOLLSMAN INSTR.	GIMBAL UNIT
DESIGN OPERATING CASE TEMPERATURE		261. TO 294. DEG. K
		(10. TO 70. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE		272. TO 311. DEG. K
		(30. TO 100. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS		261. TO 294. DEG. K
		(10. TO 70. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS		244. TO 311. DEG. K
		(-20. TO 100. DEG. F)
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH	38.1 * WIDTH 24.1	* HEIGHT 24.1 CENTIMETERS
LENGTH	15.0 * WIDTH 9.5	* HEIGHT 9.5 INCHES
PACKAGE AREA	4841.9 SQ. CENTIMETERS	* 750.5 SQ. INCHES
PACKAGE VOLUME	22184.0 CU. CENTIMETERS	* 1353.7 CU. INCHES
CASE MATERIAL	ALUMINUM	
CASE WEIGHT	5.4 KILOGRAMS	* 12.0 POUNDS
TOTAL WEIGHT	9.1 KILOGRAMS	* 20.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.20	* EMISSIVITY = 0.75
INPUT STEADY STATE POWER	8.7 WATTS **	
OUTPUT POWER	0.0 WATTS **	
THERMAL DESIGN	PASSIVE	* PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
THE KS-199 STAR TRACKER WAS BUILT FOR THE MOL PROGRAM. ONE ENGINEERING MODEL WAS BUILT AND FUNCTIONAL TESTED. THE GIMBAL SENSOR IS COUPLED TO AN ELECTRONIC UNIT. THE TRACKER HAS INTERNAL HEATERS TOTALING 10 WATTS AND ARE USED FOR FAST WARM UP WHEN UNIT IS BELOW -11.8 DEG C(10 DEG. F). THE UNIT THERMAL DESIGN IS PASSIVE WITH UNIT THERMALLY ISOLATED FROM MOUNTING, AND COVERED BY SUPER-INSULATION BLANKET TO MAINTAIN PROPER OPERATING TEMPERATURE.

THE KS-199 GIMBALLED STAR TRACKER IS DESIGN AND BUILT BY
KOLLSMAN INSTRUMENT CORPORATION
575 UNDERHILL BOULEVARD, SYOSSET, NEW YORK 11791
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JAMES CARVELLA PHONE 516-921-4300 EXTENSION 2122
THE KS-199 STAR TRACKER IS A GIMBALLED TWO AXIS STAR TRACKER. IT WAS BUILT FOR THE MANNED ORBITING LABORATORY (MOL) PROGRAM AND AT THE TIME THE PROGRAM WAS CANCELLED AN ENGINEERING UNIT HAD BEEN COMPLETED AND FUNCTIONALLY TESTED. THIS EQUIPMENT HAS SINCE BEEN DELIVERED TO MR JOE PARKER, S AND E-ASTR-GDA AT MSFC. THE UNIT WAS DESIGNED FOR THE APPLICABLE ENVIRONMENTAL SPECIFICATIONS BUT HAS NEVER BEEN TESTED. THE KS-199 STAR TRACKER CONSIST OF TWO PACKAGES THE OPTICAL GIMBAL STAR TRACKER AND THE STAR TRACKER ELECTRONICS UNIT. THE UNIT HAS A SILICON SOLID STATE DETECTOR A FIELD OF VIEW OF 1 DEGREE AND A GIMBAL-FREEDOM OF + TO - 30 DEGREES ABOUT EACH AXIS. UNIT ACQUISITION TIME IS LESS THAN 1 SECOND. THE KS-199 STAR TRACKER CAN BE IMPROVED FROM ITS PRESENT MOL CONFIGURATION WITH A SAVING IN WEIGHT SIZE AND POWER.
REF. TELEPHONE CONVERSATION WITH MR JAMES CARVELLA OF KOLLSMAN, AND DATA SUMMARY OF THE KS-199 STAR TRACKER DATED MAY 15, 1973

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

STE 1 ATM STE BENDIX CORPORATION P/N 21258-1 (STE)

DESIGN OPERATING CASE TEMPERATURE	247. TO 329. DEG. K
	(-15. TO 132. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	218. TO 343. DEG. K
	(-67. TO 158. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 305. DEG. K
	(0. TO 90. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	247. TO 329. DEG. K
	(-15. TO 132. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 47.0 * WIDTH 34.3 * HEIGHT	15.7 CENTIMETERS
LENGTH 18.5 * WIDTH 13.5 * HEIGHT	6.2 INCHES
PACKAGE AREA	5782.6 SQ. CENTIMETERS * 896.3 SQ. INCHES
PACKAGE VOLUME	25374.5 CU. CENTIMETERS * 1548.4 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.8 KILOGRAMS * 4.0 POUNDS
TOTAL WEIGHT	14.5 KILOGRAMS * 32.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.70 * EMISSIVITY = 0.85
INPUT STEADY STATE POWER	15.1 WATTS **
OUTPUT POWER	8.6 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
THE ATM STAR TRACKER ELECTRONICS (STE) UNIT IS MARRIED TO THE ATM OMA GIMBAL STAR TRACKER THE STE IS PAINTED BLACK AND IS DESIGN FOR RADIATION AND CONDUCTION COOLING. THE STE UNIT SUPPLIES THE STEADY STATE POWER TO THE OMA THE OMA HEATER POWER IS SUPPLIED DIRECTLY OF THE ATM 28 VDC BUS. UNIT IS MOUNTED ON THE ATM RACK THERE ARE NO MOUNTING LIMITATIONS OF CABLE LENGTH REQUIREMENTS.

THE ATM STAR TRACKER ELECTRONICS UNIT IS DESIGN AND BUILT BY THE BENDIX CORPORATION NAVIGATION AND CONTROL DIVISION TETERBORO, NEW JERSEY 07608
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JIM TONGE PHONE 201-288-2000 EXTENSION 6111
THE ATM STAR TRACKER ELECTRONICS UNIT IS PART OF THE ATM STAR TRACKER SYSTEM THAT WAS BUILT FOR NASA MSFC AND IS ONBOARD THE SKYLAB. THE ATM STAR TRACKER SYSTEM CONSIST OF TWO PACKAGES A OMA - OPTICAL MECHANICAL ASSEMBLY AND A STE-STAR TRACKER ELECTRONICS. THE OMA CONSIST OF A REFRACTIVE TELESCOPE MOUNTED IN A DOUBLE GIMBAL SUSPENSION. THE STE UNIT INCLUDES THE 28 VDC POWER SUPPLY, SERVO AMPLIFIERS, DIGITAL LOGIC UNIT, ENCODER PROCESSING ELECTRONICS, TELEMTRY AND OTHER FUNCTIONS. THE STE SUPPLIES THE POWER TO THE OMA IT DOES NOT SUPPLY THE POWER TO THE THREE OMA HEATERS, THE THREE HEATERS RECEIVE THEIR POWER TO MAINTAIN THE OMA IN ITS TEMPERATURE RANGE DIRECTLY FROM THE ATM POWER SUPPLY BUS.

REF. OPTICAL STELLAR PLANET AND SOLAR TRACKING SENSING DEVICES BY THE BENDIX CORP., NAVIGATION AND CONTROL DIVISION. APRIL 1973.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

STE 2 KS-199 STAR TRKR KOLLSMAN INSTR. ELECTRONIC UNIT

DESIGN OPERATING CASE TEMPERATURE	261. TO 294. DEG. K (10. TO 70. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	272. TO 311. DEG. K (30. TO 100. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	261. TO 294. DEG. K (10. TO 70. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	244. TO 311. DEG. K (-20. TO 100. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 21.8 * WIDTH 17.8 * HEIGHT	20.3 CENTIMETERS
LENGTH 8.6 * WIDTH 7.0 * HEIGHT	8.0 INCHES
PACKAGE AREA	2387.1 SQ. CENTIMETERS * 370.0 SQ. INCHES
PACKAGE VOLUME	7892.0 CU. CENTIMETERS * 481.6 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	2.3 KILOGRAMS * 5.0 POUNDS
TOTAL WEIGHT	4.5 KILOGRAMS * 10.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.20 * EMISSIVITY = 0.75
INPUT STEADY STATE POWER	14.3 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
THE KS-199 STAR TRACKER WAS BUILT FOR THE MOL PROGRAM, ONE ENGINEERING MODEL WAS BUILT AND FUNCTIONALY TESTED. THE ELECTRONIC UNIT IS COUPLED TO THE STAR TRACKER OPTICS. THE UNIT IS DESIGNED FOR SPACE ENVIRONMENT BUT THE ABOVE TEMPERATURE IS BASED ON THE OPTICS UNIT. THE ELECTRONIC UNIT WAS PLACED INSIDE THE MOL. THE UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION TO THE VEHICLE ENVIRONMENT.

THE KS-199 STAR TRACKER ELECTRONICS IS DESIGN AND BUILT BY
KOLLSMAN INSTRUMENT CORPORATION
575 UNDERHILL BOULEVARD, SYOSSET, NEW YORK 11791
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JAMES CARVELLA PHONE 516-921-4300 EXTENSION 2122
THE KS-199 STAR TRACKER IS A GIMBALLED TWO AXIS STAR TRACKER. THE UNIT WAS BUILT FOR THE MANNED ORBITING LABORATORY (MOL) PROGRAM, AND AT THE TIME THE PROGRAM WAS CANCELLED AN ENGINEERING UNIT HAD BEEN COMPLETED AND FUNCTIONALLY TESTED. THIS EQUIPMENT HAS SINCE BEEN DELIVERED TO MSFC. THE UNIT WAS DESIGNED FOR THE APPLICABLE ENVIRONMENT SPECIFICATIONS BUT HAS NEVER BEEN TESTED. THE KS-199 STAR TRACKER CONSIST OF A GIMBAL OPTICAL STAR TRACKER AND A STAR TRACKER ELECTRONICS UNIT. THE ELECTRONIC UNIT IS MOUNTED INTERNAL TO THE VEHICLE AND IS NOT EXPOSED TO THE SAME EVNIRONMENT THAT THE OPTICS UNIT IS EXPOSED TO. THE TEMPERATURE RANGE INDICATED ABOVE ARE THE OPTICS LIMITS. THE ELECTRONICS UNIT HAS A DIGITAL OUTPUT. THE KS-199 STAR TRACKER CAN BE IMPROVED FROM ITS PRESENT MOL CONFI GURATION WITH A SAVING IN WEIGHT, SIZE AND POWER.
REF. TELEPHONE CONVERSATION WITH MR JAMES CARVELLA OF KOLLSMAN AND DATA SUMMARY OF THE KS-199 STAR TRACKER DATED MAY 15, 1973.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

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HS 1 HORIZON SENSOR QUANTIC INDUSTRIES MODEL 5079

DESIGN OPERATING CASE TEMPERATURE	255. TO 339. DEG. K (0. TO 150. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 339. DEG. K (-40. TO 150. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	275. TO 339. DEG. K (35. TO 150. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	255. TO 339. DEG. K (0. TO 150. DEG. F)
PACKAGE SHAPE	CYLINDRICAL
PACKAGE SIZE * LENGTH	20.1 * WIDTH 10.2 * HEIGHT 0.0 CENTIMETERS
LENGTH	7.9 * WIDTH 4.0 * HEIGHT 0.0 INCHES
PACKAGE AREA	1929.5 SQ. CENTIMETERS * 299.1 SQ. INCHES
PACKAGE VOLUME	6507.3 CU. CENTIMETERS * 397.1 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.4 KILOGRAMS * 3.0 POUNDS
TOTAL WEIGHT	3.2 KILOGRAMS * 7.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.20 * EMISSIVITY = 0.05
INPUT STEADY STATE POWER	1.6 WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
THE 5079 MODEL IS THERMALLY ISOLATED FROM CONDUCTION AND RADIATION IT HAS AN NCR-2 MULTILAYERS SUPER INSULATION ALUMINIZED MYLAR BLANKET WHICH COVERS THE TOTAL UNIT WITH THE EXCEPTION OF THE OPTICS.UNIT HAS NO CABLE LIMITATION,UNIT SHOULD BE MOUNTED IN THE VEHICLE WHERE THERE ARE NO STRUCTURAL INTERFERENCE WITH THE OPTICS VIEW.THIS UNIT IS SPACE QUALIFIED AND HAS FLOWN ON SEVERAL SPACE VEHICLES. CONTRACT AGENCY IS SAMSO.

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THE SYNCHRONOUS ALTITUDE,STATIC INFRARED HORIZON SENSOR MODEL 5079 IS DESIGN AND BUILT BY QUANTIC INDUSTRIES, INC.
999 COMMERCIAL ST., SAN CARLOS ,CALIFORNIA 94070
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR SCOTT V. SWETNAM PHONE 415-591-9411 EXTENSION
THE 5079 HORIZON SENSOR IS A COMPLETELY STATIC SYSTEM THAT OPERATES ON THE RADIATION-BALANCE PRINCIPLE. THE UNIT IS DESIGNED FOR EARTH-ORBITING SATELLITES OPERATING AT SYNCHRONOUS AND NEAR SYNCHRONOUS ALTITUDE. THIS SENSOR HAS BEEN QUALIFIED FOR SPACE ENVIRONMENT AND HAS FLOWN ON SEVERAL SAMSO VEHICLES. UNIT IS IN PRODUCTION AND CAN BE MODIFIED TO ALLOW OPERATION IN A SMALL ALTITUDE RANGE AROUND ANY SELECTED NOMINAL ALTITUDE FROM 279 TO 112000 KM (150 TO 60000 NMI). THE ENTIRE SENSOR , INCLUDING POWER SUPPLY, ELECTRONICS, AND FULL EMI PROTECTION, IS CONTAINED IN ONE COMPACT PACKAGE. THE SENSOR INPUT POWER IS BY A SINGLE CABLE AND A 29 VDC SOURCE.

REF.ETD-225L TECHNICAL DESCRIPTION OF A HIGH-ACCURACY, SYNCHRONOUS ALTITUDE, STATIC,INFRARED HORIZON SENSOR 1 DEC. 1972.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

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HS 2 HORIZON SENSOR BARNES ENGR. CO. MODEL 13-159

DESIGN OPERATING CASE TEMPERATURE	255. TO 333. DEG. K
	(0. TO 140. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	239. TO 347. DEG. K
	(-30. TO 165. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 333. DEG. K
	(0. TO 140. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	255. TO 333. DEG. K
	(0. TO 140. DEG. F)
PACKAGE SHAPE	CYLINDRICAL
PACKAGE SIZE * LENGTH	15.0 * WIDTH 9.1 * HEIGHT 0.0 CENTIMETERS
LENGTH	5.9 * WIDTH 3.6 * HEIGHT 0.0 INCHES
PACKAGE AREA	1386.4 SQ. CENTIMETERS * 214.9 SQ. INCHES
PACKAGE VOLUME	3936.5 CU. CENTIMETERS * 240.2 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.8 KILOGRAMS * 1.8 POUNDS
TOTAL WEIGHT	3.4 KILOGRAMS * 7.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.35 * EMISSIVITY = 0.50
INPUT STEADY STATE POWER	6.0 WATTS ** PER UNIT
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
FOR TUG TWO HORIZON SENSORS ARE REQUIRED TO ENABLE PITCH AND ROLL SENSING THE 2 SENSORS ARE IDENTICAL AND ARE COUPLED TO A COMMON POWER SUPPLY UNIT.CONDUCTION IS THRU BOTTOM FLANGE.
THE TWO SENSORS ARE REQUIRED TO BE POSITIONED SUCH THAT THEIR SCAN CONES INTERSECT AT THE EARTH DISC CENTER WITH A HALF CONES ANGLE OF 55 DEGREES.
UNIT IS OPERATIONAL IN 2 MINUTES FROM POWER ON.

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THE MODEL 13-159 HORIZON SENSOR IS DESIGNED AND BUILT BY
BARNES ENGINEERING COMPANY
30 COMMERCE ROAD STANFORD CONNECTICUT 06904
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR SY SPIELBERGER PHONE 203-348-5381 EXTENSION
THIS HORIZON SENSOR IS AN OFF-THE-SHELF INSTRUMENT THE SENSOR WAS DEVELOPED AND QUALIFIED FOR ENGINS MATRA FOR ESRO ON THE TD1/A SATELLITE PROGRAM IT WAS SUCCESSFULLY LAUNCHED MARCH 1972 FROM VANDENBERG ON A ONE YEAR ORBITAL MISSION.THE 13-159 SENSOR IS A CONICAL SCAN INSTRUMENT WITH A FULL SCALE CONE OF 110 DEGREES. THE UNIT CONSIST OF 2 SENSORS UNITS AND A SEPARATE POWER SUPPLY, THAT IS CONNECTED TO THE SENSORS BY MEANS OF CABLE. THE POWER SUPPLY CONVERTS 16 VDC TO VARIOUS AC AND DC VOLTAGES REQUIRED BY THE SENSORS. THE POWER SUPPLY HAS A 15 WATTS INPUT POWER SORCE. UNIT CASE IS IRIDITED ALUMINUM BUT CAN BE PAINTED PER CUSTOMER THERMAL REQUIREMENTS.

REF.BEC-3855-DR-01 DESIGN REPORT AND DESCRIPTION OF THE MODEL 13-159 HORIZON SCANNER ASSEMBLY (HSA) MARCH 1969.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

HS 3 LAHS LASC

DESIGN OPERATING CASE TEMPERATURE	244. TO 336. DEG. K (-20. TO 145. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	228. TO 339. DEG. K (-50. TO 150. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	244. TO 336. DEG. K (-20. TO 145. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	244. TO 336. DEG. K (-20. TO 145. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE	* LENGTH 15.2 * WIDTH 15.2 * HEIGHT 10.2 CENTIMETERS LENGTH 6.0 * WIDTH 6.0 * HEIGHT 4.0 INCHES
PACKAGE AREA	1083.9 SQ. CENTIMETERS * 168.0 SQ. INCHES
PACKAGE VOLUME	2359.7 CU. CENTIMETERS * 144.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.2 KILOGRAMS * .5 POUNDS
TOTAL WEIGHT	1.5 KILOGRAMS * 3.3 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	3.1 WATTS **PER HEAD
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
UNIT IS CONTAINED IN A SINGLE PACKAGE PER AXIS. FOR TWO AXIS SENSING TWO HEADS ARE REQUIRED.
THE UNIT IS PAINTED BLACK ANODIZED ALUMINUM,BUT CAN BE PAINTED PER CUSTOMER THERMAL REQUIREMENTS.
NO LIMITATIONS ON UNIT MOUNTING LOCATION OR CABLE LENGTH.

THE LOW ALTITUDE HORIZON SENSOR IS DESIGNED AND BUILT BY
LOCKHEED MISSILES AND SPACE COMPANY
SUNNYVALE, CALIFORNIA 94088
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR RICHARD H.ANDERSON PHONE 408-742-6362 EXTENSION
THE LAHS IS A LOW ALTITUDE HORIZON SENSOR WITH THE NOMINAL ALTITUDE OF 835 KILOMETER PER OPTICAL SYSTEM SET UP. EACH UNIT IS CONTAINED IN A SINGLE PACKAGE . SINGLE UNIT WILL DETERMINE VEHICLE ATTITUDE IN ONE AXIS.FOR TWO AXIS SENSING,2 HEADS ARE REQUIRED AND FOR FULL REDUNDANCY A THIRD HEAD,AND SWITCHING CIRCUITRY IS REQUIRED. THIS UNIT IS SPACE QUALIFIED. IT IS A 3-AXIS STRAPDOWN OFF-THE-SHELF HORIZON SENSOR.

REF. DATA SHEETS (LAHS) LOW ALTITUDE HORIZON SENSOR BY LOCKHEED MISSILES AND SPACE COMPANY.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS
AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

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HS 4 NOHS LMSC

DESIGN OPERATING CASE TEMPERATURE	244. TO 336. DEG. K (-20. TO 145. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	228. TO 339. DEG. K (-50. TO 150. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	244. TO 336. DEG. K (-20. TO 145. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	244. TO 336. DEG. K (-20. TO 145. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 10.2 * WIDTH 10.2 * HEIGHT 25.4 CENTIMETERS	
LENGTH 4.0 * WIDTH 4.0 * HEIGHT 10.0 INCHES	
PACKAGE AREA	1238.7 SQ. CENTIMETERS * 192.0 SQ. INCHES
PACKAGE VOLUME	2621.9 CU. CENTIMETERS * 160.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.2 KILOGRAMS * .5 POUNDS
TOTAL WEIGHT	1.8 KILOGRAMS * 4.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	3.5 WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
UNIT IS BLACK ANODIZED BUT CAN BE PAINTED PER CUSTOMER THERMAL REQUIREMENTS. MAJORITY OF COOLING IS BY RADIATOON WITH VERY LITTLE THRU CONDUCTION. NO LIMITATIONS ON MOUNTING LOCATION OR CABLE LENGTH.

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THE NULL OPERATING HORIZON SENSOR (NOHS) IS DESIGNED AND BUILT BY LOCKHEED MISSILES AND SPACE COMPANY
SUNNYVALE, CALIFORNIA 94088
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR RICHARD H ANDERSON PHONE 408-742-6362 EXTENSION
THE NOHS IS DESIGNED FOR CONTROL OF SATELLITE IN SYNCHRONOUS ORBIT
UNIT IS COUPLED TO A DIGITAL COMPUTER. INPUT POWER IS FROM A 28VDC UNREGULATED SOURCE. THE UNIT IS SPACE QUALIFIED.
IT IS AN OFF-THE-SHELF HORIZON SENSOR FOR 3 AXIS STABILZED SYNCHRONOUS ORBIT SATELLITES.

REF. DATA SHEETS (NOHS) NULL OPERATING HORIZON SENSOR BY LOCKHEED MISSILES AND SPACE COMPANY.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

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HS 5 DSHS LMSC

DESIGN OPERATING CASE TEMPERATURE			244. TO 336. DEG. K
			(-20. TO 145. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE			228. TO 339. DEG. K
			(-50. TO 150. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS			244. TO 336. DEG. K
			(-20. TO 145. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS			244. TO 336. DEG. K
			(-20. TO 145. DEG. F)
PACKAGE SHAPE	RECTANGULAR		
PACKAGE SIZE * LENGTH	24.1 * WIDTH	23.6 * HEIGHT	8.9 CENTIMETERS
LENGTH	9.5 * WIDTH	9.3 * HEIGHT	3.5 INCHES
PACKAGE AREA	1989.0 SQ. CENTIMETERS	*	308.3 SQ. INCHES
PACKAGE VOLUME	5067.3 CU. CENTIMETERS	*	309.2 CU. INCHES
CASE MATERIAL	ALUMINUM		
CASE WEIGHT	.5 KILOGRAMS	*	1.0 POUNDS
TOTAL WEIGHT	4.1 KILOGRAMS	*	9.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90	* EMISSIVITY = 0.90	
INPUT STEADY STATE POWER	14. WATTS **		
OUTPUT POWER	0. WATTS **		
THERMAL DESIGN	PASSIVE	* PASSIVE	

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
UNIT IS BLACK ANODIZED BUT CAN BE PAINTED PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS DESIGNED FOR COOLING BY RADIATION AND CONDUCTION.
NO LIMITATIONS ON MOUNTING LOCATIONS OR CABLE LENGTH.

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THE DUAL SCAN HORIZON SENSOR IS DESIGNED AND BUILT BY
LOCKHEED MISSILES AND SPACE COMPANY
SUNNYVALE, CALIFORNIA 94088
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR RICHARD H ANDERSON PHONE 408-742-6362 EXTENSION
THE DUAL SCAN HORIZON SENSOR (DSHS) IS AN INFRARED SCANNING HORIZON SENSOR FOR USE ON 3-AXIS STABILIZED SYCHRONOUS ORBIT SATELLITE. THE DSAS COVERS AN ALTITUDE RANGE FROM 28800 TO 42500 KILOMETERS. THE DSAS HAS BOTH ANALOG AND DIGITAL OUTPUTS. INPUT POWER IS FROM A 28 VOLTS UNREGULATED SOURCE. THE DSAS IS FULLY QUALIFIED AND IS IN FLIGHT UNIT PRODUCTION.

REF. DATA SHEETS DUAL SCAN HORIZON SENSOR (DS4S) BY LOCKHEED MISSILES AND SPACE COMPANY.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

HS 6 MOD.IV HORIZON SYS QUANTIC INDUSTRIES

DESIGN OPERATING CASE TEMPERATURE	255. TO 339. DEG. K (0. TO 150. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 339. DEG. K (-35. TO 150. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 328. DEG. K (0. TO 130. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	255. TO 328. DEG. K (0. TO 130. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 19.3 * WIDTH 19.8 * HEIGHT 18.0 CENTIMETERS	
LENGTH 7.6 * WIDTH 7.8 * HEIGHT 7.1 INCHES	
PACKAGE AREA	2175.7 SQ. CENTIMETERS * 337.2 SQ. INCHES
PACKAGE VOLUME	6897.1 CU. CENTIMETERS * 420.9 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.6 KILOGRAMS * 3.5 POUNDS
TOTAL WEIGHT	3.4 KILOGRAMS * 7.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	10.0 WATTS **4TRKS 2.5
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
THE MOD IV SENSOR IS COMPOSED OF 4 TRACKERS AND 1 ELECTRONIC UNIT EACH OF THE TRACKERS IS FINISHED WITH BLACK ANODIZE ALUMINUM.EACH TRACKER APPROX POWER STEADY STATE IS 2.5 WATTS, TOTAL AVERAGE POWER CONSUMPTION IS 25 WATTS. ALLOWABLE CABLE LENGTH IS AT LEAST 6.25 METERS (20 FT). THE ABOVE UNIT IS A REDESIGNED AND REPACKAGED MOD IV HORIZON SENSOR THAT WAS SPACE FLOWN ON A SAMSO VEHICLE IN 1970. THE NEW MODIFIED MOD IV IS BUILT FOR SAMSO.

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THE MOD IV HORIZON SENSOR IS DESIGN AND BUILT BY
QUANTIC INDUSTRIES INC.
999 COMMERCIAL ST., SAN CARLOS, CALIFORNIA 94070
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR SHELDON KNIGHT PHONE 415-591-9411 EXTENSION
THE MOD IV HORIZON SENSOR IS A STATIC, HIGH-ACCURACY, HIGH RELIABILITY FULLY REDUNDANT HORIZON SENSOR SYSTEM. THE UNIT COMPOSED OF 4 HORIZON TRACKER AND 1 CENTRAL ELECTRONIC UNIT. THIS UNIT WAS DEVELOPED FOR SAMSO PROGRAM AND WAS SPACE FLOWN IN JULY 1970. THE ABOVE DATA IS ON A NEW REDESIGNED MOD IV HORIZON SENSOR. THIS NEW MOD IV UNIT IS BEING DEVELOP AND BUILT FOR SAMSO AND WILL BE SPACE FLOWN IN THE SPRING OF 1974. THE UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF INSULATION BLANKET FOR THE CEU AND CONDUCTION / RADIATION FOR THE TRACKERS. THIS UNIT CAN BE MODIFIED TO USE LESS THAN 4 TRACKERS BUT REDUNDANT CAPABILITY WOULD NOT BE AVAILABLE.

REF.ETD-3218 QUANTIC INDUSTRIES MOD IV HORIZON SENSOR SYSTEM DATED 30 APRIL 1970 AND DATA SHEET ON NEW MOD IV HORIZON SENSOR.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

HSE 1 POWER SUPPLY H.S. BARNES ENGR. CO.	MODEL 13-159	
DESIGN OPERATING CASE TEMPERATURE	255. TO 333. DEG. K	
	(0. TO 140. DEG. F)	
NON-OPERATING AND STORAGE CASE TEMPERATURE	239. TO 347. DEG. K	
	(-30. TO 165. DEG. F)	
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 333. DEG. K	
	(0. TO 140. DEG. F)	
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	255. TO 333. DEG. K	
	(0. TO 140. DEG. F)	
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH 15.2 * WIDTH 7.6 * HEIGHT	10.2 CENTIMETERS	
LENGTH 6.0 * WIDTH 3.0 * HEIGHT	4.0 INCHES	
PACKAGE AREA	696.8 SQ. CENTIMETERS	* 108.0 SQ. INCHES
PACKAGE VOLUME	1179.9 CU. CENTIMETERS	* 72.0 CU. INCHES
CASE MATERIAL	ALUMINUM	
CASE WEIGHT	.4 KILOGRAMS	* .9 POUNDS
TOTAL WEIGHT	1.3 KILOGRAMS	* 2.8 POUNDS
SURFACE PROPERTIES	ALPHA = 0.350	* EMISSIVITY = 0.500
INPUT STEADY STATE POWER	15.0 WATTS	**FOR TWO SENSORS
OUTPUT POWER	12. WATTS	**
THERMAL DESIGN	PASSIVE	* PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
UNIT IS MARRIED TO THE HORIZON SENSOR MODEL 13-159.
POWER SUPPLY UNIT WILL REQUIRE MODIFICATION TO BE COUPLED TO TWO SENSORS. UNIT INPUT POWER LEVEL IS BASED ON DOUBLING THE POWER SUPPLY UNIT ASSOCIATED WITH ONE HORIZON SENSOR POWER SUPPLY THE SINGLE SENSOR POWER SUPPLY HAS A 7.5 WATTS INPUT STEADY STATE POWER.
CONDUCTION IS THRU BOTTOM MOUNTING PLATE.

THE MODEL 13-159 HORIZON SCANNER ASSEMBLY IS DESIGNED AND BUILT BY BARNES ENGINEERING COMPANY.
30 COMMERCE ROAD STAMFORD CONNECTICUT 06904
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR SY.C.SPIELBERGER PHONE 203-348-5381 EXTENSION
THE POWER SUPPLY UNIT IS OFF-THE-SELF INSTRUMENT THAT WAS DEVELOPED AND QUALIFIED FOR ENGINS MATRA FOR ESRO ON THE TD1/A SATELLITE PROGRAM.IT WAS SUCCESSFULLY LAUNCHED MARCH 1972 FROM VANDENBERG ON A ONE YEAR ORBITAL MISSION. SOME REDESIGN WILL BE REQUIRED FOR POWER SUPPLY UNIT TO ACCOMADATE THE TWO UNIT SENSORS. THE POWER SUPPLY CONVERTS 16 VDC INPUT INTO THE VARIOUS AC AND DC VOLTAGES REQUIRED BY THE SENSORS.UNIT IS CONNECTED TO THE SENSORS BY MEANS OF CABLES. UNIT CASE IS IRIDETE ALUMINUM BUT CAN BE PAINTED PER CUSTOMER THERMAL REQUIREMENTS. IF UNIT REQUIRE ACTUAL PITCH AND ROLL COMPUTATION CIRCUITS TO BE PROVIDED INTERNAL TO INCHES AND WEIGHT INCREASED TO 8 POUNDS.
PACKAGE UNIT SIZE WILL BE INCREASED TO APPROXIMATELY 10 BY 4 BY 3

REF.BEC-3855-DR-01 DESIGN REPORT AND DESCRIPTION OF THE MODEL 13-159 HORIZON SCANNER ASSEMBLY (HSA) MARCH 1969

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

HSE 2 MOD IV HORIZON CEU QUANTIC INDUSTRIES

DESIGN OPERATING CASE TEMPERATURE	255. TO 339. DEG. K (0. TO 150. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 339. DEG. K (-35. TO 150. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 328. DEG. K (0. TO 130. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	255. TO 328. DEG. K (0. TO 130. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE	* LENGTH 45.7 * WIDTH 21.6 * HEIGHT 19.0 CENTIMETERS LENGTH 18.0 * WIDTH 8.5 * HEIGHT 7.5 INCHES
PACKAGE AREA	4538.7 SQ. CENTIMETERS * 703.5 SQ. INCHES
PACKAGE VOLUME	18804.2 CU. CENTIMETERS * 1147.5 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	2.3 KILOGRAMS * 5.0 POUNDS
TOTAL WEIGHT	15.9 KILOGRAMS * 35.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.20 * EMISSIVITY = 0.05
INPUT STEADY STATE POWER	15.0 WATTS **DEPEND ON NUMBER OF SENSOR
OUTPUT POWER	10.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT INT* TUG/PAY INT
THE CEU HAS A PASSIVE THERMAL CONTROL DESIGN IT USES A MULTI-LAYER ALUMINIZED MYLAR INSULATION BLANKET. THE CEU IS COUPLED TO THE 4 TRACKERS OF THE MOD IV HORIZON SENSOR. UNIT TOTAL AVERAGE POWER CONSUMPTION IS 25 WATTS OF WHICH 10 WATTS IS DISSIPATED IN THE TRACKERS. CABLE LENGTH IS AT LEAST 6.25 METERS (20 FT).

THE CENTRAL ELECTRONICS UNIT OF THE MOD IV HORIZON SENSOR IS DESIGN AND BUILT BY QUANTIC INDUSTRIES INC.
999 COMMERCIAL ST., SAN CARLOS, CALIFORNIA 94070
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR SHELDON KNIGHT PHONE 415-591-9411 EXTENSION
THE CENTRAL ELECTRONICS UNIT (CEU) IS A FULLY REDUNDANT ELECTRONIC UNIT FOR THE MOD IV HORIZON SENSOR. THIS IS A NEW CONFIGURATION OF THE MOD IV HORIZON SENSOR THAT WAS DEVELOPED BUILT AND SPACE FLOWN FOR A SAMSO PROGRAM. THE NEW UNIT IS BEING BUILT FOR A SAMSO PROGRAM AND WILL BE LAUNCH SOMETIME IN THE SPRING OF 1974. THE CEU IS COUPLED TO THE MOD IV TRACKERS BY CABLES. THE UNIT IS DESIGN FOR SPACE ENVIRONMENT AND HAS A PASSIVE THERMAL CONTROL SYSTEM IN THE FORM OF A MULTI-LAYER ALUMINIZED MYLAR NCR/2 INSULATION BLANKET. THE MOD IV HORIZON SENSOR SYSTEM IS A STATIC, HIGH-ACCURACY, HIGH-RELIABILITY FULLY REDUNDANT HORIZON SENSOR SYSTEM. THE SYSTEM IS COMPOSED OF 4 TRACKER AND 1 CENTERAL ELECTRONICS UNIT. THE UNIT CAN BE MODIFIED TO USE LESS THAN 4 TRACKERS BUT REDUNDANCY WOULD NOT BE AVAILABLE.
REF. ETD-321B QUANTIC INDUSTRIES MOD IV HORIZON SENSOR SYSTEM DATED 30 APRIL 1970 AND DATA SHEETS ON NEW MOD IV HORIZON SENSOR.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

SS 1 REFRACTOSYN SUN H H CONTROLS CO. MODEL S-4

DESIGN OPERATING CASE TEMPERATURE	253. TO 358. DEG. K (-4. TO 185. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	253. TO 358. DEG. K (-4. TO 185. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	253. TO 358. DEG. K (-4. TO 185. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	253. TO 358. DEG. K (-4. TO 185. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	1.5 * WIDTH 1.0 * HEIGHT 1.0 CENTIMETERS
LENGTH	.6 * WIDTH .4 * HEIGHT .4 INCHES
PACKAGE AREA	8.3 SQ. CENTIMETERS * 1.3 SQ. INCHES
PACKAGE VOLUME	1.6 CU. CENTIMETERS * .1 CU. INCHES
CASE MATERIAL	EPOXY BLACK HYSOL 111C
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	.0 KILOGRAMS * .1 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT ON* TUG/PAY ON
UNIT IS APPROXIMATELY 1 GRAM IN WEIGHT HAS NO POWER INPUT AND NO MOUTING LIMITATIONS. UNIT HAS FLOWN ON AGENA B.
UNIT IS COVERED BY A BLACK EPOSY HYSO TYPE 111C.
NO LIMITATION ON CONNECTING CABLE LENGTH.

THE REFRACTOSYN SUN SENSOR MODEL S-4 IS DESIGN AND BUILT BY H.H.CONTROLS CO. INC.
16 FROST STREET ARLINGTON MASSACHUSETTS 02174
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HAROLD H. SEWARD PHONE 617-646-2626 EXTENSION
THE REFRACTOSYN PRISM SENSOR CONSISTS OF TWO PHOTOCELLS AND AN ISOCLES PRISM CUT AT CRITICAL ANGLE OF 41.5 DEGREES.
TWO SENSORS MOUTED AT OPPOSITE SIDE OF VEHICLE WILL PROVIDE SUN SENSOR SYSTEM FOR 360 DEGREES OF FIELD AQUISITION ABOUT ONE AXIS.
UNIT IS OFF-THE-SHELF ITEM AND HAS FLOWN ON LOCKHEED AGENA B.

REF.DATA SHEETS ON REFRACTOSYN SUNSENSOR S-4 FROM H.H CONTROLS CO INC.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

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SS 2 FINE SUN SENSOR AS BBRS — SS-100 SERIES

DESIGN OPERATING CASE TEMPERATURE	253. TO 358. DEG. K (-4. TO 185. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 373. DEG. K (-40. TO 212. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	253. TO 358. DEG. K (-4. TO 185. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 368. DEG. K (-22. TO 203. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	7.1 * WIDTH 4.8 * HEIGHT 4.3 CENTIMETERS
LENGTH	2.8 * WIDTH 1.9 * HEIGHT 1.7 INCHES
PACKAGE AREA	171.7 SQ. CENTIMETERS * 26.6 SQ. INCHES
PACKAGE VOLUME	148.2 CU. CENTIMETERS * 9.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.1 KILOGRAMS * .3 POUNDS
TOTAL WEIGHT	.2 KILOGRAMS * .4 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	0. WATTS **
OUTPUT POWER	. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT ON* TUG/PAY ON

THE UNIT WEIGHT IS APPROX 170 GRAMS.
NO LIMITATION ON MOUTING LOCATION.
INDIVIDUAL SENSORS ARE CHROMICOATED ALUMINUM.SENSOR BLOCK IS ALUMINUM WITH ANODIZED MOUNTING PADS.RETAINERS ARE ALUMINUM BLACK ANODIZED.

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THE FINE SUN SENSOR ASSEMBLIES SS-100 SERIES IS DESIGNED AND BUILT BY BALL BROTHERS RESEARCH CORPORATION
P.O. BOX 1062 BOULDER COLORADO 80302
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. DON VANLANDINGHAM PHONE 303-441-4000 EXTENSION 4383
THE SS-100 FINE SUN SENSOR ASSEMBLY IS A 2-AXIS SENSOR THAT GENERATES ELECTRICAL SIGNALS WHEN POINTED AT OR NEAR THE SUN. THE SS-100 SERIES IS COMPRISED OF AN ARRAY OF FINE SOLAR DETECTORS WHICH ARE ARRANGED IN PAIRS AND ALIGNED TO PROVIDE ERROR SIGNALS IN TWO ORTHOGONAL AXES.THE UNIT IS USUALLY EMPLOYED IN CONJUNCTION WITH COARSE SOLAR DETECTORS OR INERTIAL REFERENCE SYSTEM.
THE SS-100 SERIES IS QUALIFIIED FOR ROCKET AND SATELLITE APPLICATIONS, AND VARIATIONS HAVE BEEN FLOWN ON AEROBEE ROCKETS AND ON ORBITING SOLAR OBSERVATORIES AS WELL AS OTHER SATELLITES.

REF.BALL BROTHERS RESEARCH CORP. SS-100 DATA SHEETS.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

SS 3 DIGITAL SUN SENSOR ADCOLE CORPORATION MODEL 15564

DESIGN OPERATING CASE TEMPERATURE	253. TO 318. DEG. K (-4. TO 113. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	208. TO 358. DEG. K (-85. TO 185. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	253. TO 318. DEG. K (-4. TO 113. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	253. TO 318. DEG. K (-4. TO 113. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	6.6 * WIDTH 4.3 * HEIGHT 3.3 CENTIMETERS
LENGTH	2.6 * WIDTH 1.7 * HEIGHT 1.3 INCHES
PACKAGE AREA	129.2 SQ. CENTIMETERS * 20.0 SQ. INCHES
PACKAGE VOLUME	94.2 CU. CENTIMETERS * 5.7 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.0 KILOGRAMS * .1 POUNDS
TOTAL WEIGHT	.1 KILOGRAMS * .3 POUNDS
SURFACE PROPERTIES	ALPHA = 0.86 * EMISSIVITY = 0.86
INPUT STEADY STATE POWER	0.05WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT ON* TUG/PAY ON
THE 15564 SUN SENSOR IS A DIGITAL SUN SENSOR WITH SENSOR AND ELECT RONICS IN 1 UNIT. THE UNIT DISSIPATE HEAT BY CONDUCTION TO THE MOUNTINGS FLANGE. THE UNIT IS PAINTED WITH BLACK EPOXY PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT HAS A 0.048 WATTS DISSIPATED POWER. THE 15564 SUN SENSOR HAS BEEN SPACE QUALI FIED AND FLOWN ON THE ESRO IV EUROPEAN SATELLITE.

THE 15564 DIGITAL ASPECT SUN SENSOR IS DESIGN AND BUILT BY
ADCOLE CORPORATION
330 BEAR HILL ROAD, WALTHAM, MASS. 02154
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. H. N. LOWELL PHONE 617-890-3400 EXTENSION 56
THE 15564 SUN SENSOR IS A DIGITAL ASPECT SUN SENSOR FOR A SPINNING VEHICLE. THE UNIT IS COMPOSED OF A SENSOR UNIT AND AN ELECTRONICS UNIT THAT ARE INCLOSED IN 1 PACKAGE. THE UNIT HAS A 128 DEGREE FIELD OF VIEW A RESOLUTION OF 1 DEGREE AND AN ACCURACY OF 30 MINUTES. THE 15564 SUNSENSOR HAS BEEN QUALIFIED FOR SPACE ENVIR- ONMENT ON THE ESRO IV EUROPEAN SATELLITE.

REF. CONVERSATION WITH MR H.N. LOWELL. AND SUMMARY OF ADCOLE CORP. SUN SENSORS SPECIFICATIONS AND CHARACTERISTICS.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

SS 4 DIGITAL SUNSENSOR ADCOLE CORPORATION MODEL 16765

DESIGN OPERATING CASE TEMPERATURE	253. TO 333. DEG. K (-4. TO 140. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	208. TO 358. DEG. K (-85. TO 185. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	253. TO 333. DEG. K (-4. TO 140. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 343. DEG. K (-22. TO 158. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	7.4 * WIDTH 6.6 * HEIGHT 9.7 CENTIMETERS
LENGTH	2.9 * WIDTH 2.6 * HEIGHT 3.8 INCHES
PACKAGE AREA	367.0 SQ. CENTIMETERS * 56.9 SQ. INCHES
PACKAGE VOLUME	469.5 CU. CENTIMETERS * 28.7 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.1 KILOGRAMS * .3 POUNDS
TOTAL WEIGHT	.4 KILOGRAMS * .9 POUNDS
SURFACE PROPERTIES	ALPHA = 0.34 * EMISSIVITY = 0.1
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT ON* TUG/PAY ON
THE 16765 SUN SENSOR IS A DIGITAL SUN SENSOR WITH THE SENSOR AND ELECTRONICS IN 1 UNIT. THE UNIT DISSIPATE HEAT BY CONDUCTION TO THE MOUNTINGS. THE UNIT SURFACE IS IRIDITE ALUMINUM, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT HAS A 0.028 WATTS DISSIPATED POWER. THE 16765 SUN SENSOR HAS BEEN SPACE FLOWN ON ONE OF THE NAVY RESEARCH LABORATORY SATELLITES.

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THE 16765 DIGITAL ASPECT SUN SENSOR IS DESIGN AND BUILT BY ADCOLE CORPORATION
330 BEAR HILL ROAD, WALTHAM, MASS. 02154
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. H. N. LOWELL PHONE 617-890-3400 EXTENSION 56
THE 16765 SUN SENSOR IS A DIGITAL ASPECT SUN SENSOR FOR A SPINNING VEHICLE. THE UNIT IS INCLOSED IN 1 PACKAGE AND CONTAIN BOTH THE SENSOR AND THE ELECTRONICS. THE UNIT HAS 180 DEGREES FIELD OF VIEW, A RESOLUTION OF 0.5 DEGREES AND AN ACCURACY OF 15 MINUTES. THE UNIT HAS ONE SENSOR AND THE ELECTRONICS USES OMOS CIRCUITRY. THE 16765 SUN SENSOR HAS BEEN SPACE QUALIFIED, AND USED BY THE NAVY RESEARCH LABORATORY ON THEIR SATELLITES.

REF. CONVERSATION WITH MR. H. N. LOWELL AND SUMMARY OF ADCOLE CORP SUN SENSORS SPECIFICATIONS AND CHARACTERISTICS.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

LR 1 SCAN LASAR RADAR ITT GILFILLAN

DESIGN OPERATING CASE TEMPERATURE	293. TO 323. DEG. K (68. TO 122. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	289. TO 323. DEG. K (60. TO 122. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	289. TO 300. DEG. K (60. TO 80. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	293. TO 323. DEG. K (68. TO 122. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 30.5 * WIDTH 22.9 * HEIGHT 61.0 CENTIMETERS	
LENGTH 12.0 * WIDTH 9.0 * HEIGHT 24.0 INCHES	
PACKAGE AREA	7896.8 SQ. CENTIMETERS * 1224.0 SQ. INCHES
PACKAGE VOLUME	42475.3 CU. CENTIMETERS * 2592.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	4.5 KILOGRAMS * 10.0 POUNDS
TOTAL WEIGHT	27.2 KILOGRAMS * 60.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	30. WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT OFF* TUG/PAY INT
UNIT IS IN ENGINEERING STAGE AND IS NOT COMPLETED.
UNIT IS MARRIED TO AN ELECTRONICS PACKAGE WHICH IS 9 BY 12 BY 12 INCHS WEIGHT 15 LBS AND POWER LEVEL OF 20 WATTS.
DATA ABOVE IS PRELIMINARY INFORMATION.
NO COOLING REQUIRED UNIT IS COLD PLATED.
SYSTEM TOTAL POWER IS 50 WATTS. SURFACE PROPERTIES WILL DEPEND ON CUSTOMER THERMAL REQUIREMENTS.

THE SCANNING LASER RADAR IS DESIGNED AND BUILT BY
ITT GILFILLAN
7821 ORION AVE. P.O.BOX 7713 VAN NUYS, CALIFORNIA 91409
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. BERNARD GRABOIS PHONE 213-988-2600 EXTENSION 422
THE SCANNING LASER RADAR FOR LOW POWER SYSTEM IS A GA AS SEMI-CONDUCTOR LASER BEING DEVELOPED FOR POSSIBLE USE IN THE SPACE SHUTTLE PROGRAM.THE UNIT IS IN DEVELOPMENT WITH A PROTOTYPE BUILT. THE UNIT IS PART OF A LOW POWER SYSTEM WITH THE TOTAL SYSTEM POWER OF 50 WATTS. UNIT ACQUISITION RANGE IS 110 MILES FOR A PASSIVE CO-OPERATIVE TARGET AND 0.1 MILE FOR A NON-COOPERATIVE TARGET.

REF.PRELIMINARY TECHNICAL REPORT ITT 7760 SCANNING LASER RADAR FOR THE SPACE SHUTTLE, APRIL 1972.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

LR 2 SCAN LASAR RADAR ITT GILFILLAN

DESIGN OPERATING CASE TEMPERATURE	293. TO 323. DEG. K (68. TO 122. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	289. TO 323. DEG. K (60. TO 122. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	289. TO 300. DEG. K (60. TO 80. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	293. TO 323. DEG. K (68. TO 122. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 30.5 * WIDTH 25.4 * HEIGHT 61.0 CENTIMETERS	
LENGTH 12.0 * WIDTH 10.0 * HEIGHT 24.0 INCHES	
PACKAGE AREA	8361.3 SQ. CENTIMETERS * 1296.0 SQ. INCHES
PACKAGE VOLUME	47194.7 CU. CENTIMETERS * 2880.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	3.2 KILOGRAMS * 7.0 POUNDS
TOTAL WEIGHT	31.8 KILOGRAMS * 70.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	70. WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT OFF* TUG/PAY INT
UNIT IS IN CONCEPTUAL DESIGN STAGE AND ABOVE DATA ARE PRELIMINARY INFORMATION. UNIT IS COUPLED TO AN ELECTRONICS UNIT WHICH IS ALSO IN DESIGN STAGE. THIS UNIT IS EXPECTED TO BE THERMOELECTRICLY COOLED.

THE DIODE PUMPED YAG LASER RADAR IS BEING DESIGNED BY
ITT GILFILLAN
7821 ORION AVE. P.O BOX 7713 VAN NUYS, CALIFORNIA 91409
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. BERNARD GRABOIS PHONE 213-988-2600 EXTENSION 422
THIS UNIT IS IN THE DESIGN STAGES IT IS BEING PROPOSED FOR THE SPACE SHUTTLE PROGRAM AS A POSSIBLE CANDIDATE FOR THE SHUTTLE LASER RADAR. THIS UNIT IS THE MEDIUM POWER LASER RADAR. ITS TOTAL POWER IS 100 WATTS WITH 70 WATTS IN TRANSMITTER/RECEIVER UNIT AND 30 WATTS IN THE ELECTRONIC PACKAGE THAT THE UNIT IS COUPLED. THE UNIT MAX RANGE IS 300 MILES FOR A PASSIVE COOPERATIVE TARGET AND 1.5 MILES FOR A PASSIVE NON-COOPERATIVE TARGET. THE ABOVE DATA IS PRELIMINARY INFORMATION ON THIS UNIT.

REF.PRELIMINARY TECHNICAL REPORT ITT.7760 SCANNING LASER RADAR FOR THE SPACE SHUTTLE APRIL 1972.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

LR 3 SCAN LASER RADAR ITT GILFILLAN

DESIGN OPERATING CASE TEMPERATURE	293. TO 323. DEG. K	
	(68. TO 122. DEG. F)	
NON-OPERATING AND STORAGE CASE TEMPERATURE	289. TO 323. DEG. K	
	(60. TO 122. DEG. F)	
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	289. TO 300. DEG. K	
	(60. TO 80. DEG. F)	
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	293. TO 323. DEG. K	
	(68. TO 122. DEG. F)	
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH 30.5 * WIDTH 30.5 * HEIGHT	76.2 CENTIMETERS	
LENGTH 12.0 * WIDTH 12.0 * HEIGHT	30.0 INCHES	
PACKAGE AREA	11148.4 SQ. CENTIMETERS * 1728.0 SQ. INCHES	
PACKAGE VOLUME	70792.1 CU. CENTIMETERS * 4320.0 CU. INCHES	
CASE MATERIAL	ALUMINUM	
CASE WEIGHT	9.1 KILOGRAMS * 20.0 POUNDS	
TOTAL WEIGHT	45.4 KILOGRAMS * 100.0 POUNDS	
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90	
INPUT STEADY STATE POWER	600. WATTS **	
OUTPUT POWER	0. WATTS **	
THERMAL DESIGN	ACTIVE * ACTIVE	

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT OFF* TUG/PAY INT
UNIT IS A PRE-DESIGN STAGE AND ALL ABOVE DATA IS PRELIMINARY INFO. THIS UNIT IS DESIGNED TO HAVE AN ACTIVE COOLING SYSTEM. UNIT IS COUPLED TO AN ELECTRONICS UNIT WHICH IS ALSO IN DESIGN STAGE.

THE LAMP PUMP YAG LASER RADAR IS BEING DESIGNED BY
ITT GILFILLAN
7821 ORION AVE. P.O BOX 7713 VAN NUYS, CALIFORNIA 91409
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. BERNARD GRABOIS PHONE 213-988-2600 EXTENSION 422
THIS UNIT IS IN THE DESIGN STAGE. IT IS BEING PROPOSED FOR USE IN THE SPACE SHUTTLE. THIS UNIT IS A HIGH POWER LASER RADAR SYSTEM, WITH THE TOTAL POWER OF 750 WATTS OF WHICH 600 WATTS IS IN THE TRANSMITTER/RECEIVER PACKAGE AND 150 WATTS IN THE ELECTRONICS UNIT. THE UNIT POWER CAN BE INCREASED TO APPROXIMATELY 10K WATTS INPUT POWER BUT IT DEPENDS ON THE DESIRED RADAR RANGE. IN THE 750 WATTS POWER LEVEL THE UNIT HAS A 300 MILES TARGET RANGE FOR A PASSIVE COOPERATIVE TARGET AND A 10 MILES TARGET RANGE FOR A NON-COOPERATIVE TARGET.
THE ABOVE DATA IS PRELIMINARY INFORMATION ON THIS UNIT.

REF.PRELIMINARY TECHNICAL REPORT ITT 7760 SCANNING LASER RADAR FOR THE SPACE SHUTTLE, APRIL 1972

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

LRE 1 ELEC.LASER RADAR ITT GILFILLAN

DESIGN OPERATING CASE TEMPERATURE	293. TO 323. DEG. K (68. TO 122. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	289. TO 323. DEG. K (60. TO 122. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	289. TO 300. DEG. K (60. TO 80. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	293. TO 323. DEG. K (68. TO 122. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 30.5 * WIDTH 30.5 * HEIGHT 22.9 CENTIMETERS	
LENGTH 12.0 * WIDTH 12.0 * HEIGHT 9.0 INCHES	
PACKAGE AREA	4645.2 SQ. CENTIMETERS * 720.0 SQ. INCHES
PACKAGE VOLUME	21237.6 CU. CENTIMETERS * 1296.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.4 KILOGRAMS * 3.0 POUNDS
TOTAL WEIGHT	6.8 KILOGRAMS * 15.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	20.0 WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT OFF* TUG/PAY INT
UNIT MARRIED TO THE SCANNING LASER RADAR TRANSMITTER-RECEIVER.
UNIT IS IN DEVELOPEMENT AND ABOVE DATA IS PRELINIMARY INFORMATION
UNIT IS EXPECTED TO BE PASSIVE THERMAL CONTROL WITH NO ACTIVE COOL
ING REQUIRED.

THE ELECTRONICS FOR SCANNING LASER RADAR IS DESIGNED AND BUILT BY ITT GILFILLAN
7821 ORION AVE. P.O.BOX 7713 VAN NUYS, CALIFORNIA 91409
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. BERNARD GRABOIS PHONE 213-988-2600 EXTENSION 422
THE ELECTRONIC PACKAGE OF THE SCANNING LASER RADAR IS MARRIED TO THE LASER RADAR TRANSMITTER/RECEIVER.THE UNIT IS IN DEVELOPEMEN FOR POSSIBLE USE IN THE SPACE SHUTTLE PROGRAM A PROTOTYPE UNIT IS BUILT. THIS UNIT IS PART OF THE LOW POWER LASER RADAR SYSTEM,WITH TOTAL POWER OF 50 WATTS OF WHICH 20 WATTS IS IN THE ELECTRONICS. THE ABOVE DATA IS PRELIMINARY INFORMATION ON THIS UNIT.

REF.PRELIMINARY TECHNICAL REPORT ITT 7760 SCANNING LASER RADAR FOR THE SPACE SHUTTLE, APRIL 1972.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

LRE 2 ELEC LASER RADAR ITT GILFILLAN

DESIGN OPERATING CASE TEMPERATURE	293. TO 323. DEG. K	
	(68. TO 122. DEG. F)	
NON-OPERATING AND STORAGE CASE TEMPERATURE	289. TO 323. DEG. K	
	(60. TO 122. DEG. F)	
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	289. TO 300. DEG. K	
	(60. TO 80. DEG. F)	
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	293. TO 323. DEG. K	
	(68. TO 122. DEG. F)	
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH 30.5 * WIDTH 30.5 * HEIGHT 30.5	CENTIMETERS	
LENGTH 12.0 * WIDTH 12.0 * HEIGHT 12.0	INCHES	
PACKAGE AREA	5574.2 SQ. CENTIMETERS *	864.0 SQ. INCHES
PACKAGE VOLUME	28316.8 CU. CENTIMETERS *	1728.0 CU. INCHES
CASE MATERIAL	ALUMINUM	
CASE WEIGHT	2.3 KILOGRAMS *	5.0 POUNDS
TOTAL WEIGHT	9.1 KILOGRAMS *	20.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90	
INPUT STEADY STATE POWER	30.0 WATTS **	
OUTPUT POWER	0. WATTS **	
THERMAL DESIGN	ACTIVE * ACTIVE	

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT OFF* TUG/PAY INT
UNIT IS IN DESIGN STAGE AND ALL ABOVE DATA IS PRELIMINARY INFORMATION. UNIT IS COUPLED TO A TRANSMITTER/RECEIVER UNIT OF THE SCANNING LASER RADAR.
UNIT IS DESIGNED TO HAVE A THERMOELECTRIC COOLING SYSTEM.

THE ELECTRONICS FOR DIODE PUMPED YAG, SCANNING LASER RADAR IS DESIGNED BY ITT GILFILLAN
7821 ORION AVE. P.O. BOX 7713 VAN NUYS, CALIFORNIA 91409
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. BERNARD GRABOIS PHONE 213-988-2600 EXTENSION 422
THE ELECTRONICS UNIT FOR THE SCANNING LASER RADAR IS IN DESIGN STAGE. IT IS COUPLED TO THE TRANSMITTER/RECEIVER UNIT OF THE RADAR. UNIT IS BEING PROPOSED FOR THE SPACE SHUTTLE PROGRAM AS POSSIBLE CANDIDATE FOR THE SHUTTLE LASER RADAR SYSTEM. THIS UNIT IS PART OF THE MEDIUM POWER LASER RADAR SYSTEM,WITH TOTAL POWER OF 100 WATTS OF WHICH 30 WATTS IS IN THE ELECTRONICS.
THE ABOVE DATA IS PRELIMINARY INFORMATION ON THIS UNIT.

REF.PRELIMINARY TECHNICAL REPORT ITT 7760 SCANNING LASER RADAR FOR THE SPACE SHUTTLE, APRIL 1972.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

LRE 3 ELEC LASER RADAR ITT GILFILLAN

DESIGN OPERATING CASE TEMPERATURE	293. TO 323. DEG. K (68. TO 122. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	289. TO 323. DEG. K (60. TO 122. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	289. TO 300. DEG. K (60. TO 80. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	293. TO 323. DEG. K (68. TO 122. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 30.5 * WIDTH 30.5 * HEIGHT 61.0 CENTIMETERS	
LENGTH 12.0 * WIDTH 12.0 * HEIGHT 24.0 INCHES	
PACKAGE AREA	9290.3 SQ. CENTIMETERS * 1440.0 SQ. INCHES
PACKAGE VOLUME	56633.7 CU. CENTIMETERS * 3456.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	31.8 KILOGRAMS * 70.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	150. WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT OFF* TUG/PAY INT
THIS UNIT IS MARRIED TO THE TRANSMITTER/RECEIVER OF THE HIGH POWER SCANNING LASER RADAR. THIS UNIT IS IN DESIGN STAGE, AND ALL ABOVE DATA IS PRELIMINARY INFORMATION.
UNIT IS DESIGNED WITH AN ACTIVE COOLING SYSTEM.

THE ELECTRONICS FOR LAMP PUMPED YAG LASER RADAR IS DESIGNED BY
ITT GILFILLAN
7821 ORION AVE P.O BOX 7713 VAN NUYS, CALIFORNIA 91409
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. BERNARD GRABOIS PHONE 213-988-2600 EXTENSION 422
THE ELECTRONICS UNIT FOR THE SCANNING LASER RADAR IS IN DESIGN STAGE. IT IS COUPLED TO THE TRANSMITTER/RECEIVER UNIT OF THE LASER RADAR. UNIT IS BEING PROPOSED FOR THE SPACE SHUTTLE PROGRAM AS POSSIBLE CANDIDATE FOR THE SHUTTLE LASER RADAR SYSTEM. THIS ELECTRONICS UNIT IS PART OF THE HIGH POWER LASER RADAR SYSTEM,WHICH HAS A TOTAL POWER OF 750 WATTS OF WHICH 150 WATTS IS IN THE ELECTRONICS.
THE ABOVE DATA IS PRELIMINARY INFORMATION ON THIS UNIT.

REF.PRELIMINARY TECHNICAL REPORT ITT 7760 SCANNING LASER RADAR FOR THE SPACE SHUTTLE, APRIL 1972.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

TV 1 COLOR TELEVISION WESTINGHOUSE P/N 2RD2800

DESIGN OPERATING CASE TEMPERATURE	253. TO 338. DEG. K
	(-4. TO 149. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	219. TO 373. DEG. K
	(-65. TO 212. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 338. DEG. K
	(-65. TO 149. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 338. DEG. K
	(-65. TO 149. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	28.7 * WIDTH 11.4 * HEIGHT 16.5 CENTIMETERS
LENGTH	11.3 * WIDTH 4.5 * HEIGHT 6.5 INCHES
PACKAGE AREA	1981.3 SQ. CENTIMETERS * 307.1 SQ. INCHES
PACKAGE VOLUME	5416.3 CU. CENTIMETERS * 330.5 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.1 KILOGRAMS * 2.5 POUNDS
TOTAL WEIGHT	5.7 KILOGRAMS * 12.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.20 * EMISSIVITY = 0.86
INPUT STEADY STATE POWER	28.0 WATTS **AT 28 VDC
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT OFF* TUG/PAY INT
THE SKYLAB COLOR T.V. CAMERA WAS DESIGN WITH A PASSIVE THERMAL CONTROL OF RADIATION FROM THE SURFACES. THE UNIT IS PAINTED WITH A WHITE CAT-A-LAC PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. CAMERA IS DESIGN FOR SPACE ENVIRONMENT AND WAS TO BE USED AS THE T.V.CAMERA FOR THE T-027 EXPIREMENT ONBOARD SKYLAB. DIMENSIONS OF CAMERA DOES NOT INCLUDE LENS WHICH IS 16.5 CM (6.5 IN) LONG NOR THE HANDLE WHICH IS 14 CM (5.5 IN) LONG.

THE SKYLAB COLOR TV CAMERA IS DESING AND BUILT BY WESTINGHOUSE ELECTRIC CORP. AEROSPACE AND ELECTRONICS SYSTEMS DIV. BALTIMORE P.O. BOX 746 BALTIMORE, MARYLAND 21203
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HERB HAWLK PHONE 303-794-5211 EXTENSION 4119
THE SKYLAB COLOR TV CAMERA WAS BUILT FOR NASA JSC UNDER CONTRACT NUMBER NAS9-11801. THE CAMERA IS DESIGN FOR SPACE ENVIRONMENT AND IS AT PRESENT IN USE ONBOARD THE SKYLAB SIMILAR UNITS HAVE BEEN USED ONBOARD APOLLO 10 THRU 14. IN ADDITION FOR THE CAMERA USE ONBOARD SKYLAB IT WAS DESIGN TO BE ATTACHED TO A BOOM AND PLACED OUTSIDE THE OWS AIR LOCK AS PART OF THE T-027 EXPIREMENT. THE CAMERA LENS AND HANDLE LENGTH ARE NOT INCLUDED IN THE ABOVE UNIT DIMENSIONS. SINCE UNIT MAY REQUIRE SOME MODIFICATION IN MOUNTING FOR SPACE TUG AND POSSIBLY DIFFERENT LENS THEN THE ONE USED ON SKYLAB.

REF. CRITICAL DESIGN REVIEW OF THE UPGRADED SKYLAB COLOR TELEVISION SYSTEM DATED AUGUST 9, 1972.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM
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TV 2 LUNAR T.V. SYSTEM RCA

DESIGN OPERATING CASE TEMPERATURE	263. TO 323. DEG. K (14. TO 122. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	263. TO 323. DEG. K (14. TO 122. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	273. TO 313. DEG. K (32. TO 104. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	248. TO 323. DEG. K (-14. TO 122. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 45.7 * WIDTH 16.5 * HEIGHT 10.2 CENTIMETERS	
LENGTH 18.0 * WIDTH 6.5 * HEIGHT 4.0 INCHES	
PACKAGE AREA	2774.2 SQ. CENTIMETERS * 430.0 SQ. INCHES
PACKAGE VOLUME	7669.1 CU. CENTIMETERS * 468.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.4 KILOGRAMS * 3.0 POUNDS
TOTAL WEIGHT	5.8 KILOGRAMS * 12.8 POUNDS
SURFACE PROPERTIES	ALPHA = 0.25 * EMISSIVITY = 0.05
INPUT STEADY STATE POWER	14.8 WATTS **AT 28 V INPUT
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG OFF* TUG/ORBIT OFF* TUG/PAY INT
THERMAL CONTROL OF THE CTV IS ACHIEVED BY THE INTERACTION OF A SEC OND-SURFACE MIRROR ON THE TOP OF THE CAMERA WITH THE LUNAR SURFACE AND WITH DEEP SPACE. THF CTV REJECTS HEAT THROUGH RADIATION AND RECEIVES HEAT BY INTERNAL HEAT DISSIPATION, SOLAR RADIATION INCI-DENT TO THE MIRROR RADIATOR, AND LUNAR SURFACE RADIATION WHEN THE RADIATOR IS TILTED TOWARD THE LUNAR SURFACE. A THERMAL INSULATION BLANKET COVERS THE REMAINING SURFACES OF THE CAMERA.

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THE COLOR TELEVISION CAMERA IS DESIGN AND BUILT BY
RCA GOVERNMENT AND COMMERCIAL SYSTEMS ASTRO-ELECTRONICS DIVISION
P.O. BOX 800 PRINCETON, NEW JERSEY 08540
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. SAMUEL RUSSELL PHONE 609-448-3400 EXTENSION 3247
THE COLOR TELEVISION CAMERA IS PART OF THE GROUND-COMMANDED TELE-VISION ASSEMBLY AND COLOR TELEVISION CAMERA SYSTEM DESIGNED TO OP-ERATE ON THE LUNAR SURFACE. UNIT WAS USED ON THE APOLLO LUNAR ROVER VEHICLE(LRV). THE TELEVISION ASSEMBLY CONSIST OF THE COLOR TV CAMERA AND A TV CONTROL UNIT. THE TV CONTROL UNIT PERMIT GROUND-COMMANDED POSITIONING AND OPERATION OF THE CAMERA. THE CAMERA OPERATES ON 28 VDC POWER SOURCE. IT HAS AN F/2.2 ANGENIEUX LENS WITH A ZOOM RATIO OF 6:1. THE CAMERA BODY CONTAINS THE SIT TUBE, COLOR-WHEEL ASSEMBLY, AND ALL SYNCHRONIZATION, DEFLECTION, AND VIDEO COMPONENTS REQUIRED TO PROVIDE A STANDARD 525-LINE COM-POSITE VIDEO FROMAT AT THE CTV OUTPUT. UNIT IS OFF-THE-SHELF AND HAS BEEN SPACE QUALIFIED AND SPACE FLOWN ONBOARD THE APOLLO PROGRAM.

REF. TECHNICAL DATA SHEETS ON THE LUNAR COLOR TELEVISION CAMERA BY RCA.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

ACSE -1 VALVE DRIVE AMP. MARTIN MARIETTA CO P/N 837G5000000

DESIGN OPERATING CASE TEMPERATURE	236. TO 366. DEG. K (-35. TO 200. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 398. DEG. K (-35. TO 257. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	236. TO 366. DEG. K (-35. TO 200. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	236. TO 366. DEG. K (-35. TO 200. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 26.7 * WIDTH 17.8 * HEIGHT 19.8 CENTIMETERS	
LENGTH 10.5 * WIDTH 7.0 * HEIGHT 7.8 INCHES	
PACKAGE AREA	2709.7 SQ. CENTIMETERS * 420.0 SQ. INCHES
PACKAGE VOLUME	9394.7 CU. CENTIMETERS * 573.3 CU. INCHES
CASE MATERIAL	MAGNESIUM
CASE WEIGHT	1.1 KILOGRAMS * 2.5 POUNDS
TOTAL WEIGHT	5.4 KILOGRAMS * 12.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	38.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE VALVE DRIVE AMPLIFIER ELECTRONIC COMPONENT IS DESIGN FOR THE VIKING LANDER CAPSULE. UNIT IS DESIGN TO WITHSTAND SPACE ENVIRONMENT AND THE MARTIAN ATMOSPHERE. UNIT HAS A PASSIVE THERMAL DESIGN OF RADIATION TO SPACE AND CONDUCTION TO MOUNTINGS. UNIT IS FINISH PER CUSTOMER REQUIREMENTS. UNIT IS DESIGN TO BE ABLE TO BE EXPOSED TO 125 DEG.C.(257 DEG.F) STERILIZATION TEMPERATURE.

THE VALVE DRIVE AMPLIFIER ELECTRONIC COMPONENT IS DESIGN AND BUILT BY MARTIN MARIETTA AEROSPACE DENVER DIVISION.
P.O. BOX 179 DENVER, COLORADO 80201
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. B. HARMEL PHONE 303-794-5211 EXTENSION 2103
THE VALVE DRIVE AMPLIFIER IS DESIGNED AND BUILT FOR THE VIKING LANDER CAPSULE. UNIT IS THE CONTROLLER OF THE VIKING LANDER ACS. THE UNIT IS DESIGN FOR SPACE ENVIRONMENT AND WILL BE ONBOARD VIKING FIRST FLIGHT IN THE SUMMER OF 1975. UNIT HAS HAD ITS QUAL TEST AND STERILIZATION AT PRESENT TIME.

REF. THERMAL ANALYSIS FOR VALVE DRIVE AMPLIFIER ELECTRONIC COMPONENT, MMC VIKING PROGRAM NAS1-9000, OCTOBER 9, 1972.

EQUIPMENT ITEM		QUANTITY	WEIGHT (POUNDS) UNIT	WEIGHT (POUNDS) TOTAL	POWER (WATTS)	VOLUME (CU FT.)
COMPUTER	*	2	21.6	42.	60.	.60
TAPE RECORDER		1	10.	10.	20.	.20
DATA ACQUISITION UNIT	*	10	4.	40.	26.	.26
TELEMETRY FORMATTER	*	2	6.	12.	14.	.25
DATA BUS CONTROLLER	*	2	6.	12.	15.	.20
TOTALS				116.	136.	1.50

NOTES * DENOTE REDUNDANT UNITS

TIMELINES

CONTINUOUS OPERATION OF SUBSYSTEM FROM PRELAUNCH TO LANDING.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 1 MAGIC 352 DELCO ELECTRONICS P/N 7888760-031

DESIGN OPERATING CASE TEMPERATURE	305. TO 328. DEG. K
	(90. TO 130. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 344. DEG. K
	(-35. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	299. TO 340. DEG. K
	(79. TO 152. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	298. TO 342. DEG. K
	(77. TO 156. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 50.8 * WIDTH 40.6 * HEIGHT	22.9 CENTIMETERS
LENGTH 20.0 * WIDTH 16.0 * HEIGHT	9.0 INCHES
PACKAGE AREA	8309.7 SQ. CENTIMETERS * 1288.0 SQ. INCHES
PACKAGE VOLUME	47194.7 CU. CENTIMETERS * 2880.0 CU. INCHES
CASE MATERIAL	ALUMINIUM
CASE WEIGHT	9.1 KILOGRAMS * 20.0 POUNDS
TOTAL WEIGHT	36.1 KILOGRAMS * 79.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	208. WATTS ** 215MAX
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	ACTIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
MARRIED TO CAROUSEL 5B IMU
QUALIFIED FOR A 9 HOUR MISSION
FUNCTION IN LESS THAN ONE MINUTE AFTER POWER-ON

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THE MAGIC 352 COMPUTER IS DESIGNED AND BUILT BY
DELCO ELECTRONICS DIVISION OF GENERAL MOTOR CORPORATION
6767 HOLISTER AVE. GOLTA, CALIFORNIA 93017
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JOHN MICHELS PHONE 805-968-1011 EXTENSION 623
THIS COMPUTER IS CURRENTLY IN A PRODUCTION PHASE AND IS BEING PROCURED BY SAMSO FOR USE ON THE TITAN 3C TRANSTAGE AS THE SINGLE GUIDANCE AND CONTROL COMPUTER. FOR THIS SYSTEM IT IS MARRIED TO CAROUSEL 5B IMU. THIS UNIT IS SCHEDULED TO FLY FOR THE FIRST TIME IN 1973. A SINGLE 28 VDC SOURCE IS REQUIRED. THE INTERNAL THERM AL DESIGN IS CONDUCTION. THE BOX IS DESIGNED TO MAINTAIN A 3.45 N/ CM SQ (5 PSIA) PRESSURE ABOVE THE LOCAL AMBIENT. NITROGEN IS THE PRESSURANT GAS BUT IS NOT REQUIRED FOR THERMAL DESIGN. THE COMPUTER IS DESIGNED WITH 16K WORDS OF MEMORY. THE MAX POWER ALLOWABLE IS 215 WATTS.

REF. MAGIC 352 COMPUTER TECHNICAL DESCRIPTION, DELCO ELECTRONICS.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 2 MAGIC 352 DIGS DELCO ELECTRONICS P/N 7554180-011

DESIGN OPERATING CASE TEMPERATURE	253. TO 343. DEG. K (-4. TO 158. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	208. TO 423. DEG. K (-85. TO 302. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	263. TO 333. DEG. K (14. TO 140. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	253. TO 343. DEG. K (-4. TO 158. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 48.3 * WIDTH 27.9 * HEIGHT 19.8 CENTIMETERS	
LENGTH 19.0 * WIDTH 11.0 * HEIGHT 7.8 INCHES	
PACKAGE AREA	5716.1 SQ. CENTIMETERS * 886.0 SQ. INCHES
PACKAGE VOLUME	26714.2 CU. CENTIMETERS * 1630.2 CU. INCHES
CASE MATERIAL	ALUMINIUM
CASE WEIGHT	5.7 KILOGRAMS * 12.5 POUNDS
TOTAL WEIGHT	22.7 KILOGRAMS * 50.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.900 * EMISSIVITY = 0.900
INPUT STEADY STATE POWER	175. WATTS ** 21 WATTS DISCRETE POWER
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	ACTIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
BOX DESIGN INCLUDES EXTERNAL CASE AIR HEAT EXCHANGER
THERMAL MASS AND RADIATION IN FLIGHT
90 MINUTE MISSION LIFETIME

THE MAGIC 352 DIGS COMPUTER IS DESIGNED AND BUILT BY
DELCO ELECTRONICS DIVISION OF GENERAL MOTORS CORPORATION
6767 HOLISTER AVE. GOLTA, CALIFORNIA 93017
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JOHN MICHELS PHONE 805-968-1011 EXTENSION 623
THIS COMPUTER IS CURRENTLY IN A PROTOTYPE DEVELOPMENT PHASE FOR MACDONALD DOUGLAS CORP. THE CASE IS PRESSURIZED WITH NITROGEN AND HAS A 3.45 N/CM SQ (5 PSIG) RELIEF VALVE. THIS COMPUTER HAS POTENTIAL APPLICATION FOR THE DELTA LAUNCH VEHICLE. THE CASE IS DESIGNED WITH EXTERNAL AIR PASSAGES ON THE TOP, BOTTOM AND BACK FOR GROUND AIR CONDITIONING. QUAL TEST INCLUDES 71 DEG C (160 DEG F) FOR 90 MIN. AND 0 DEG C (32 DEG F) FOR 30 MIN. THE QUAL REQUIRES 4 CYCLES.

REF. CONVERSATION WITH MR. JOHN MICHELS OF DELCO ELECTRONICS.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 3 469 COMPUTER CONTROL DATA CORP.

DESIGN OPERATING CASE TEMPERATURE	253. TO 338. DEG. K (-4. TO 149. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	218. TO 368. DEG. K (-67. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	253. TO 338. DEG. K (-4. TO 149. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	253. TO 338. DEG. K (-4. TO 149. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	10.7 * WIDTH 10.7 * HEIGHT 21.3 CENTIMETERS
LENGTH	4.2 * WIDTH 4.2 * HEIGHT 8.4 INCHES
PACKAGE AREA	1138.1 SQ. CENTIMETERS * 176.4 SQ. INCHES
PACKAGE VOLUME	2428.2 CU. CENTIMETERS * 148.2 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.5 KILOGRAMS * 1.0 POUNDS
TOTAL WEIGHT	4.5 KILOGRAMS * 10.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	20.0 WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE 469 COMPUTER IS DESIGNED WITH A COLD PLATE. THE PLATE IS 12.7 X 11.9 X 2.1 CENTIMETERS (5. X 4.7 X .82 IN) AND COUPLES AS A MOUNTING PLATE AND FLANGE. SURFACE FINISH PER CUSTOMER REQUIREMENTS. CABLE LENGTH IS LIMITED TO 1.8 METERS (6 FT).
MICRO-SECOND TIME DELAY FROM POWER ON.
UNIT IS SPACE QUALIFIED.
BASEPLATE MUST CONDUCT 12 TO 15 WATTS TO MOUNTING FRAMEWORK.

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THE 469 CLASS-A PLATED WIRE COMPUTER IS DESIGNED AND BUILT BY CONTROL DATA CORPORATION, MINNEAPOLIS MILITARY PRODUCTS DIVISION 3101 EAST 80TH STREET MINNEAPOLIS, MINNESOTA 55440
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. CARROLL SKIBA PHONE 612-853-3126 EXTENSION
THE 469 CLASS A COMPUTER HAS CAPABILITIES FOR VARIOUS MEMORY SIZES RANGING FROM 8K TO 32K. THIS UNIT WOULD CONSIST OF FOUR 8K MEMORIES COUPLED TOGETHER TO ATTAIN THE 32K SIZE. THE UNIT CAN BE DESIGNED AS A REDUNDENT OR A CROSS OVER STRAP DOWN SYSTEM. THE UNIT HAS BEEN SPACE QUALIFIED HOWEVER HAS NOT FLOWN IN A SPACECRAFT SYSTEM. THE UNIT CURRENTLY USED ON THE ITT TALOS AND MMC PERSHING MISSILE SYSTEMS. THE 469 WAS CONSIDERED FOR USE ON HEAO AND IS BEING CONSIDERED FOR THE SHUTTLE ZERO-G FUEL GAUGING SYSTEM. THE NAP SPACE DIV. BASELINED THE 469 IN THEIR OOS STUDY FOR SAMSO. THE UNIT ULTILIZES A P-MOS PLATED WIRE MEMORY AND IS IN A PRODUCTION STATUS. THE 469 MEETS MIL-I-5400 CLASS 2 TEST REQUIREMENTS.

REF. CDC DESIGN AND QULAIFICATION POLICY 5 JUNE 1972.
469 COMPUTER AND SUPPORT EQUIPMENT BROCHURE-G020464.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 4 469 DOUBLE DENSITY CONTROL DATA CORP.

DESIGN OPERATING CASE TEMPERATURE	253. TO 338. DEG. K (-4. TO 149. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	218. TO 368. DEG. K (-67. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	253. TO 338. DEG. K (-4. TO 149. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	253. TO 338. DEG. K (-4. TO 149. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	10.7 * WIDTH 10.7 * HEIGHT 12.2 CENTIMETERS
LENGTH	4.2 * WIDTH 4.2 * HEIGHT 4.8 INCHES
PACKAGE AREA	747.9 SQ. CENTIMETERS * 115.9 SQ. INCHES
PACKAGE VOLUME	1387.5 CU. CENTIMETERS * 84.7 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	2.7 KILOGRAMS * 6.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	16.0 WATTS **
OUTPUT POWER	0. WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON

THE 469 COMPUTER IS DESIGNED WITH A COLDPLATE AND MUST CONDUCT 12 TO 15 WATTS TO MOUNTING FRAMEWORK. THE PLATE IS 12.7 X 11.9 X 2.1 CENTIMETERS (5. X 4.7 X .82 IN). SURFACE FINISH PER CUSTOMER REQUIREMENTS. CABLE LENGTH IS LIMITED TO 1.8 METERS (6 FT). MICRO-SECOND TIME DELAY FROM POWER ON. THE UNIT IS SPACE QUALIFIED.

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THE 469 CLASS A DOUBLE DENSITY PLATED WIRE COMPUTER IS BUILT BY CONTROL DATA COMPORATION MINNEAPOLIS MILITARY PRODUCTS DIVISION 3101 EAST 80TH STREET MINNEAPOLIS, MINNESOTA 55440
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. CARROLL SKIBA PHONE 612-853-3126 EXTENSION
THE 469 DOUBLE DENSITY COMPUTER IS PART OF THE FAMILY OF THE 469 COMPUTERS . THIS UNIT HAS A DOUBLE DENSITY MEMORY PER MEMORY BANK TWO 16K BANKS ARE USED TO ACHIEVE THE 32K REQ. THE 469 CAN BE BUILT FOR A REDUNDANT OR CROSS-OVER STRAPDOWN SYSTEM. THE UNIT IS SPACE QUALIFIED BUT HAS NOT FLOWN IN A SPACECRAFT SYSTEM. THE 469 HAS BEEN USED IN THE ITT TALOS AND MMC PERSHING MISSLE SYSTEMS. THE NAR SPACE DIV. BASELINED THE 469 IN THE SAMSO OOS STUDY AND IS UNDER CONSIDERATION FOR SHUTTLE ZERO-G FUEL GAUGE SYSTEM. THE 469 IS A P-MOS PLATED WIRE MEMORY AND IS IN A PRODUCTION STATUS. THE UNIT MEETS MIL-E-5400 CLASS 2 REQUIREMENTS.

REF. 469 COMPUTER AND SUPPORT EQUIPMENT BROCHURE, G02046A
CDC 469 DESIGN AND QULAIFICATION POLICY 5 JUNE 1972

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 5 LS-52 COMPUTER LEAR SIEGLER INC

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K	
	(-65. TO 160. DEG. F)	
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K	
	(-80. TO 203. DEG. F)	
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K	
	(-65. TO 160. DEG. F)	
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K	
	(-65. TO 160. DEG. F)	
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH	19.3 * WIDTH 27.9 * HEIGHT	30.5 CENTIMETERS
LENGTH	7.6 * WIDTH 11.0 * HEIGHT	12.0 INCHES
PACKAGE AREA	3958.7 SQ. CENTIMETERS *	613.6 SQ. INCHES
PACKAGE VOLUME	16439.5 CU. CENTIMETERS *	1003.2 CU. INCHES
CASE MATERIAL	ALUMINUM	
CASE WEIGHT	4.5 KILOGRAMS *	10.0 POUNDS
TOTAL WEIGHT	15.0 KILOGRAMS *	33.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90	
INPUT STEADY STATE POWER	205.0 WATTS **	
OUTPUT POWER	0. WATTS **	
THERMAL DESIGN	ACTIVE * ACTIVE	

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
PRESENTLY DESIGNED FOR FORCED AIR COOLING AND CAN BE MODIFIED FOR COLD PLATE. SURFACE PROPERTIES PER CUSTOMER REQUIREMENT. CABLE LENGTHS UP TO 15 METERS (50 FT) DEPENDING ON COMPONENTS. OPERATION WITHIN A FEW SECONDS OF POWER ON.

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THE LS-52 COMPUTER IS DESIGNED AND BUILT BY
LEAR SIEGLER INSTRUMENT DIVISION
4141 EASTERN AVENUE, S.E. GRAND RAPIDS, MICHIGAN 49508
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JOHN DELISIO PHONE 213-670-0643 EXTENSION
THE LS-52 COMPUTER WAS DEVELOPED AND BUILT FOR THE USAF F-4 FIGHTER BOMBER. IT IS IN PRODUCTION FOR THE AN/ARN-101 NAVIGATION WEAPON DELIVERY SYSTEM. THE LS-52 IS A 32K MACHINE EXPANDABLE TO 64K. THE COMPUTER HAS NOT BE USED IN A SPACE APPLICATION. MEETS MIL-E-5400 CLASS 2X AIRCRAFT REQUIREMENTS.

REF. CONVERSATION WITH MR JOHN DELISIO OF LEAR SIEGLER.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 6 BR-1018M COMPUTER BUNKER RAMO

DESIGN OPERATING CASE TEMPERATURE	218. TO 358. DEG. K (-67. TO 185. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	218. TO 398. DEG. K (-67. TO 257. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	218. TO 358. DEG. K (-67. TO 185. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	218. TO 358. DEG. K (-67. TO 185. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 30.5 * WIDTH 10.2 * HEIGHT 15.2 CENTIMETERS	
LENGTH 12.0 * WIDTH 4.0 * HEIGHT 6.0 INCHES	
PACKAGE AREA	1858.1 SQ. CENTIMETERS * 288.0 SQ. INCHES
PACKAGE VOLUME	4719.5 CU. CENTIMETERS * 288.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.9 KILOGRAMS * 2.0 POUNDS
TOTAL WEIGHT	5.9 KILOGRAMS * 13.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	14.5 WATTS **MEMORY UNIT IS TEMP DEPEND
12.5 AT 298. DEG,	30.0 AT1283. DEG (WATTS AT DEG. KELVIN)
12.5 AT 77. DEG,	30.0 AT1850. DEG (WATTS AT DEG. FAHRENHEIT)
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON

UNIT COMPONENTS ARE HEAT SUNK TO BASE PLATE. COOLING IS BY CONDUCTION. CABLE MAX LENGTH 1.52 METER (5 FT). UNIT IS DESIGN FOR AIRCRAFT, BUT CAN BE MODIFIED FOR SPACE APPLICATIONS. ABOVE UNIT IS SIZED FOR 16K WORD MEMORY AND POWER SUPPLY. A 32K WORD MEMORY UNIT WILL HAVE A SEPERATE MEMORY PACKAGE OF 15.3 X15.3 X10.2 CM (6.0X6.0X4.0 IN). UNIT SURFACES ARE BLACK ANODIZED, CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS.

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THE BR-1018M GENERAL PURPOSE DIGITAL COMPUTER IS DESIGNED AND BUILT BY BUNKER RAMO ELECTRONICS SYSTEMS DIVISION
31717 LA TIENDA DRIVE, WESTLAKE VILLAGE, CALIFORNIA 91361
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR GORDON OSBORN PHONE 213-889-2211 EXTENSION
THE BR-1018M WAS DEVELOPED FOR WRIGHT PATTERSON USAF 679H MISSILE PROGRAM. IT IS PRESENTLY BEING TESTED AT EAGLE USAF BASE FOR THE F4 LOW COST INERTIAL NAVIGATION SYSTEM. THE UNIT HAS QUALIFIED TO MIL-E-5400 CLASS 2. THE BR-1018M HAS A 16K WORD MEMORY THE UNIT CAN BE EXPANDED TO 131K WORD MEMORY. FOR A 32K WORD MEMORY COMPUTER THE MEMORY IS PACKAGED IN A SEPARATE BOX WITH THE DIMENSIONS OF 15.3 X15.3 X 10.2 CM(6.0 6.0 X4.0IN). THE UNIT WILL USE ADDITIONAL POWER AND HAVE ADDITIONAL WEIGHT. THE MEMORY TYPE IS A NDRO P-MOS PLATED WIRE,AND HAS AN 18 BITS WORD SIZE. THE UNIT CABLE LENGTH IS LIMITED TO 1.52 METERS (5.0 FEET).

REF. CONVERSATION WITH MR GORDON OSBORN OF BUNKER RAMO.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 7 CP-16A COMPUTER GENERAL ELECTRIC

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K (-80. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	32.0 * WIDTH 20.3 * HEIGHT 19.3 CENTIMETERS
LENGTH	12.6 * WIDTH 8.0 * HEIGHT 7.6 INCHES
PACKAGE AREA	3320.8 SQ. CENTIMETERS * 514.7 SQ. INCHES
PACKAGE VOLUME	12553.8 CU. CENTIMETERS * 766.1 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	3.1 KILOGRAMS * 6.8 POUNDS
TOTAL WEIGHT	11.3 KILOGRAMS * 24.9 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	242.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE CP-16 IS AN AIRCRAFT COMPUTER IT CAN BE MODIFIED FOR SPACE VEHICLE USE. IT IS FORCED AIR COOLED AND CAN BE CONVERTED TO CONDUCTION AND RADIATION.SURFACE PROPERTIES ARE PER CUSTOMER THERMAL REQUIREMENTS, UNIT IS PAINTED WITH GRAY EPOXY PAINT AT PRESENT USE UNIT AT STAND BY MODE WILL USE APPROX. 200 WATTS. MAXIMUM CABLE LENGTH IS 15 METERS (50 FEET). UNIT DOES NOT REQUIRE ANY SPECIAL ORIENTATION IN VEHICLE.

THE CP-16A GEMIC 1 COMPUTER IS DESIGN AND BUILT BY GENERAL ELECTRIC CO., AEROSPACE ELECTRONICS SYSTEMS DEPARTMENT FRENCH ROAD. UTICA, NEW YORK 13503
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR HOWARD ESTEY PHONE 315-797-1000 EXTENSION 7736
THE CP-16A DIGITAL COMPUTER IS AN OFF-THE-SHELF COMPUTER. IT IS DESIGN FOR AIRCRAFT USE BUT CAN BE MODIFIED FOR SPACE VEHICLE USE. UNIT HAS A 32K WORD CORE MEMORY AND IS EXPANDABLE TO 65K WORD MEMORY. UNIT POWER OF 242 WATTS INCLUDES-THE FOLLOWING CPU, I/O, (DMA). 32K X 18 CORE MEMORY,AND POWER SUPPLY. UNIT CAN HAVE EITHER 28 VDC OR 115 VAC 3 PHASE 400-HZ POWER SUPPLY. UNIT WITH EXPANDED MEMORY TO 64K WORD WILL HAVE LARGER SIZE,WEIGHT AND POWER CONSUMPTION. UNIT MEMORY CAN BE CONVERTED TO PLATE WIRE MEMORY WITH REDUCTION IN SIZE WEIGHT AND POWER CONSUMTPION. THE CP-16A IS QUALIFIED TO MIL-E-5400 CLASS 2X, AND MIL-E-16400 (EMI).

REF.DATA SHEETS FROM G.E. ON 8-17-73 AND CP-16 AND CP-32 GEMIC I COMPUTERS BROCHURE BY G.E.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP A CP-24A COMPUTER GENERAL ELECTRIC

DESIGN OPERATING CASE TEMPERATURE	233. TO 348. DEG. K (-40. TO 167. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	208. TO 388. DEG. K (-85. TO 239. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	233. TO 348. DEG. K (-40. TO 167. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 358. DEG. K (-65. TO 185. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 24.1 * WIDTH 26.7 * HEIGHT 31.2	CENTIMETERS
LENGTH 9.5 * WIDTH 10.5 * HEIGHT 12.3	INCHES
PACKAGE AREA 4461.3 SQ. CENTIMETERS *	691.5 SQ. INCHES
PACKAGE VOLUME 20105.7 CU. CENTIMETERS *	1226.9 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT 3.9 KILOGRAMS *	8.5 POUNDS
TOTAL WEIGHT 17.2 KILOGRAMS *	38.0 POUNDS
SURFACE PROPERTIES ALPHA = 0.90 * EMISSIVITY = 0.90	
INPUT STEADY STATE POWER 94.5 WATTS **	
OUTPUT POWER 0.0 WATTS **	
THERMAL DESIGN ACTIVE * ACTIVE	

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE CP-24A IS DESIGN TO MEET THE REQUIREMENTS OF SPACE MISSIONS. THE UNIT THERMAL CONTROL IS BY CONDUCTION TO COLD PLATE MOUNTING. UNIT IS PAINTED BLACK BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. IN STAND BY MODE UNIT DISSIPATE 75 WATTS. MAXIMUM CABLE LENGTH IS 15 METERS (50 FEET). UNIT HAS NO SPECIAL MOUNTING REQUIREMENTS TO THE VEHICLE. OPERATIONAL WITHIN 300 NANOSECONDS.

THE CP-24A GEMIC I COMPUTER IS DESIGNED AND BUILT BY GENERAL ELECTRIC CO., AEROSPACE ELECTRONICS SYSTEM DEPARTMENT FRENCH ROAD, UTICA, NEW YORK 13503
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR HOWARD ESTEY PHONE 315-797-1000 EXTENSION 7736
THE CP-24A DIGITAL COMPUTER IS AN OFF-THE-SHELF COMPUTER, IT IS DESIGN FOR SPACECRAFT USEAGE. THE CP-24A HAS A 32K PLATED WIRE NDRO MEMORY. ITS INPUT STEADY STATE POWER OF 94.5 WATTS INCLUDES THE FOLLOWING CPU, I/O, 32K X 25 PLATED WIRE MEMORY WITH POWER SWITCHING AND POWER SUPPLY. THE POWER SUPPLY FOR UNIT IS A 28 VDC POWER SUPPLY. THE CP-24 MEMORY IS A NON-DESTRUCTIVE READ-OUT (NDRO) PLATED WIRE USING BOTH LOW POWER METAL OXIDE SEMICONDUCTORS (MOS) AND TTL LOGIC CIRCUITS. THE CP-24A IS AVAILABLE IN SMALLER SIZE MEMORIES OF 16K AND 8K AT LOWER SIZE WEIGHT AND POWER. IT IS NOT AVAILABLE WITH LARGER MEMORIES THAN THE PRESENT 32K WORD MEMORY.

REF.DATA SHEETS FROM G.E. ON 8-17-73 AND CP-24A GEMIC I COMPUTER BROCHURE BY G.E.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 9 CP-32A COMPUTER GENERAL ELECTRIC

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K (-80. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 45.7 * WIDTH 25.7 * HEIGHT 19.3 CENTIMETERS	
LENGTH 18.0 * WIDTH 10.1 * HEIGHT 7.6 INCHES	
PACKAGE AREA	5101.4 SQ. CENTIMETERS * 790.7 SQ. INCHES
PACKAGE VOLUME	22641.7 CU. CENTIMETERS * 1381.7 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	4.0 KILOGRAMS * 8.9 POUNDS
TOTAL WEIGHT	18.9 KILOGRAMS * 41.7 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	365. WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE CP-32 IS DESIGNED FOR AIRCRAFT USE IT CAN BE MODIFIED FOR SPACECRAFT USE. IT HAS A FORCED AIR COOLING SYSTEM AND CAN BE CONVERTED TO CONDUCTION COOLING. UNIT IS PAINTED WITH A GRAY EPOXY PAINT AT PRESENT USAGE BUT IS APPLICATION DEPENDENT. IN STAND BY MODE UNIT DISSIPATE 293 WATTS. MAXIMUM CABLE LENGTH IS 15 METERS (50 FEET). NO SPECIAL ORIETATION IS REQUIRED FOR UNIT TO BE MOUNTED IN VEHICLE.

THE CP-32A GEMIC 1 COMPUTER IS DESIGNED AND BUILT BY GENERAL ELECTRIC CO., AEROSPACE ELECTRONICS SYSTEMS DEPARTMENT FRENCH ROAD, UTICA, NEW YORK 13503
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR HOWARD ESTEY PHONE 315-797-1000 EXTENSION 7736
THE CP-32A DIGITAL COMPUTER IS AN OFF-THE-SHELF UNIT THAT IS DESIGN FOR AIRCRAFT USE BUT CAN BE MODIFIED FOR SPACE VEHICLES. THE UNIT HAS 32K WORDS CORE MEMORY AND IS EXPANDABLE TO 1600K WORD MEMORY. THE UNIT STEADY STATE POWER OF 365 WATTS INCLUDES THE CPU WITH I/O. 32K X 36 BIT-WORDS CORE MEMORY AND POWER SUPPLY. THE POWER SUPPLY HAS THE OPTION OF EITHER 28 VDC OR 115 VAC 400 HZ 3 PHASE POWER SUPPLY. UNIT MEMORY CAN BE CONVERTED TO PLATED WIRE MEMORY WHICH WILL REDUCE UNIT WEIGHT, SIZE AND POWER. THE CP-32A IS QUALIFIED TO MIL-E-5400, CLASS 2X AND MIL-E-16400 (EMI).

REF. DATA SHEETS FROM G.E. ON 8-17-73 AND CP-16 AND CP-32 GEMIC 1 COMPUTER BROCHURE BY G.E.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 10 SCP-234 COMPUTER. RCA

DESIGN OPERATING CASE TEMPERATURE	263. TO 333. DEG. K (14. TO 140. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	253. TO 358. DEG. K (-4. TO 185. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	263. TO 333. DEG. K (14. TO 140. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	263. TO 333. DEG. K (14. TO 140. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 23.6 * WIDTH 22.6 * HEIGHT 14.5 CENTIMETERS	
LENGTH 9.3 * WIDTH 8.9 * HEIGHT 5.7 INCHES	
PACKAGE AREA	2406.6 SQ. CENTIMETERS * 373.0 SQ. INCHES
PACKAGE VOLUME	7731.2 CU. CENTIMETERS * 471.8 CU. INCHES
CASE MATERIAL	MAGNESIUM
CASE WEIGHT	.2 KILOGRAMS * .5 POUNDS
TOTAL WEIGHT	5.3 KILOGRAMS * 11.7 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	3.5 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE STANDARD CONTROL PROCESSOR IS A COMPUTER DESIGN FOR SPASE USAGE, IT IS DEVELOPED FOR A DOD PROGRAM THAT IS CLASSIFIED. UNIT WILL BE LAUNCH IN THE FUTURE. IT IS DESIGN FOR A PASSIVE COOLING BY RADIATION. UNIT IS PAINTED WITH BLACK PAINT. CABLE LENGTH DEPEND ON UNIT SPEED AND CABLE CAPACITANCE. UNIT STEADY STATE POWER IS INDEPENDENT OF MEMORY SIZE. UNIT POWER DOES NOT INCLUDE POWER CONVERTER FROM 28 VDC TO +10 VDC, -10 VDC.

THE SCP-234 STANDARD CONTROL PROCESSOR COMPUTER IS DESIGN AND BUILT BY RCA ASTRO-ELECTRONICS DIVISION
P.O. BOX 800 PRINCETON, NEW JERSEY 08540
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR SAM RUSSELL PHONE 609-448-3400 EXTENSION 3247
THE SCP-234 STANDARD CONTROL PROCESSOR COMPUTER IS DESIGNED FOR SPACE VEHICLE USE. THE UNIT IS BEING DEVELOP FOR A DOD CLASSIFIED PROGRAM AND WILL BE USED IN SOME FUTURE LAUNCH. THE UNIT HAS A 32K X 16 BITS CMOS MEMORY. UNIT SIZE IS EXPANDABLE TO 65K WORD MEMORY. UNIT POWER INCLUDE CPU,32K X 16 BITS CMOS MEMORY,READ OUT ONLY,READ RATE AND I/O CONTROLLER,IT DOES NOT INCLUDE POWER CONVERTER. UNIT OPERATES ON +10 VDC,-10 VDC AND NEED POWER CONVERTER FOR 28 VDC INPUT SOURCE. UNIT IS BASICALLY DESIGN FOR RADIATION THERMAL CONTROL. NO FURTHER INFORMATION IS AVAILABLE.

REF. TELEPHONE CONVERSATION WITH MR SAM RUSSELL OF RCA ASTRO ELECTRONICS DIVISION ON 8-24-73.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 11 RAC-261 COMPUTER RAYTHEON COMPANY.

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K	
	(-65. TO 160. DEG. F)	
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K	
	(-80. TO 203. DEG. F)	
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K	
	(-65. TO 160. DEG. F)	
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K	
	(-65. TO 160. DEG. F)	
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH	49.8 * WIDTH 12.2 * HEIGHT	15.2 CENTIMETERS
LENGTH	19.6 * WIDTH 4.8 * HEIGHT	6.0 INCHES
PACKAGE AREA	3103.0 SQ. CENTIMETERS *	481.0 SQ. INCHES
PACKAGE VOLUME	9250.2 CU. CENTIMETERS *	564.5 CU. INCHES
CASE MATERIAL	ALUMINUM	
CASE WEIGHT	2.0 KILOGRAMS *	4.5 POUNDS
TOTAL WEIGHT	13.6 KILOGRAMS *	30.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90	
INPUT STEADY STATE POWER	200. WATTS **	
OUTPUT POWER	0.0 WATTS **	
THERMAL DESIGN	PASSIVE * PASSIVE	

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE RAC-261 IECM CMPUTER IS DESIGN FOR AN AIRCRAFT USE IT HAS A PASSIVE THERMAL CONTROL OF CONDUCTION THRU SIDE WALLS OF UNIT. SURFACE IS IRIDITED BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT CAN BE MODIFIED FOR SPACE USE WITHOUT CHANGING ITS BASIC MODE.

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THERAC-261 IECM COMPUTER IS DESIGN AND BUILT BY
RAYTHEON COMPANY EQUIPMENT DIVISION
528 BOSTON POST ROAD SUDBURY, MASSACHUSETTS 01776
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR K.A. JENSEN PHONE 617-443-9521 EXTENSION 2881
THE RAC-261 IECM COMPUTER IS A PART OF THE RAC-261 COMPUTER FAMILY THE RAC-261 COMPUTER IS A MODULAR UNIT THAT IS DESIGN FOR MILITARY AIRCRAFT AND SPACE ENVIRONMENTS, AND CAPABLE OF OPERATING IN MIL-E 5400 AND MIL-E-8189 ENVIRONMENTS. COOLING IS PROVIDED DEPENDING ON APPLICATION BY CONDUCTION (COLD PLATE), FORCED AIR OR LIQUID. THE RAC-261 IECM COMPUTER IS BUILT FOR THE F4 INTERNAL ELECTRONICS COUNTER MEASURE SYSTEM AT ITS PRESENT FORM IT USES A 16K X16 BITS ERASEABLE CORE MEMORY BY EMI. THE ABOVE DATA IS BASED ON A 32K X 16 BITS CORE MEMORY, UNIT IS EXPANDABLE UP TO 65K WORD MEMORY. THE RAC-261 CAN BE CHANGED TO USE MOS OR PLATED WIRE MEMORY WITH SOME REDUCTION IN UNIT WEIGHT POWER AND SIZE. THE RAC-261 POWER SOURCE IS 28 VDC. UNIT AS INDICATED ABOVE CONSIST OF THE FOLLOWING CPU WITH I/O, 32K X 16 CORE MEMORY AND 28 VDC POWER SUPPLY.

REF.CONVERSATION WITH MR K.A. JENSEN OF RAYTHEON ON 8-24-73 AND RAYTHEON AEROSPACE COMPUTER SYSTEM MODEL 261 BROCHURE.

AVIONICS SYSTEM
DATA MANAGEMENT

COMP 12 AP-101 COMPUTER IBM

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K (-80. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 71.1 * WIDTH 25.7 * HEIGHT 19.3 CENTIMETERS	
LENGTH 28.0 * WIDTH 10.1 * HEIGHT 7.6 INCHES	
PACKAGE AREA	7385.3 SQ. CENTIMETERS * 1144.7 SQ. INCHES
PACKAGE VOLUME	35220.4 CU. CENTIMETERS * 2149.3 CU. INCHES
CASE MATERIAL	MAGNESIUM
CASE WEIGHT	4.5 KILOGRAMS * 10.0 POUNDS
TOTAL WEIGHT	26.1 KILOGRAMS * 57.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	340. WATTS ** FULL PREFORMANCE
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE AP-101 COMPUTER IS DESIGN FOR ACTIVE COOLING BY MEANS OF FORCE AIR CIRCULATION. UNIT CAN BE MODIFIED TO PASSIVE THERMAL CONTROL. UNIT POWER CAN BE REDUCED TO 280 WATTS STEADY STATE BY REDUCING DUTY CYCLE TO 200 KOP/S FROM 500 KOP/S. UNIT CABLE LENGTH IS DEPENDENT ON DESIGN CONSIDERATIONS. SURFACE PROPERTIES ARE GOLD MYLAR BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS.

THE ADVANCED SYSTEM/4 PI MODEL AP-101 COMPUTER IS DESIGN AND BUILT BY IBM FEDERAL SYSTEMS DIVISION, ELECTRONICS SYSTEMS CENTER OWEGO, NEW YORK 13827
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR DICK WALKER AND C.L.MARTIN PHONE 205-837-4000 EXTENSION
THE MODEL AP-101 COMPUTER IS MEMBER OF THE IBM ADVANCED SYSTEM/4, PI GENERAL-PURPOSE COMPUTERS THAT ARE BASED ON COMMON TECHNOLOGY. THE AP-101 COMPUTER HAS A 32K X 36 BIT FERRITE MAGNETIC CORE, NON-VOLATILE, RANDOM ACCESS, DESTRUCTIVE READOUT MEMORY. THE UNIT IS A MODULAR DESIGN COMPUTER THAT CONSISTS OF A CPU, A PARALLEL I/O CHANNEL, A 28 VDC POWER SUPPLY, AND UP TO A 32K WORD MEMORY ALL IN A SINGLE AIR TRANSPORT RACK (ATR). THE AP-101 MEMORY IS IN PLUGGABLE MODULES WITH EACH 8K INCREMENT CONSISTS OF TWO COMPLETELY INTER-CHANGEABLE PLUGGABLE MODULES. THE MAIN STORAGE MODULE OF 32K, IN CONJUNCTION WITH A PLUG-IN EXTERNAL MEMORY UNIT CAN EXPAND THE MAIN STORAGE TO 262K WORD MEMORY. THE AP-101 COMPUTER IS DESIGNED TO MEET MIL-E-5400, CLASS 2X REQUIREMENTS. UNIT IS BEING CONSIDER FOR THE SPACE SHUTTLE AND HAS THE CAPABILITY TO INTERCHANGE MEMORY MODULE FROM CORE TO PLATED WIRE. THE AP-101 IS AN OFF-THE-SHELF, AND IN PRODUCTION COMPUTER, VARIOUS OPTIONS ARE AVAILABLE DEPEND-ING ON APPLICATION AND NEEDS.
REF.ADVANCED SYSTEM/4 PI MODEL AP-101 BROCHURE BY IBM.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 13 ADVANCE TECH COMP IBM — CMOS LSI MONDLITIC

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K (-80. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 12.2 * WIDTH 25.7 * HEIGHT 19.3 CENTIMETERS	
LENGTH 4.8 * WIDTH 10.1 * HEIGHT 7.6 INCHES	
PACKAGE AREA	2086.7 SQ. CENTIMETERS * 323.4 SQ. INCHES
PACKAGE VOLUME	6037.8 CU. CENTIMETERS * 368.4 CU. INCHES
CASE MATERIAL	MAGNESIUM
CASE WEIGHT	1.8 KILOGRAMS * 4.0 POUNDS
TOTAL WEIGHT	9.1 KILOGRAMS * 20.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	80.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE ABOVE DATA IS FOR A PROJECTED ADVANCED TECHNOLOGY COMPUTER IN THE 1977 TIME PERIOD. THE COMPUTER IS ASSUMED TO BE A 64K WORDS MEMORY, AND USING A CMOS LSI / MONOLITHIC NONVOLATILITY MEMORY. PHYSICAL PARAMETERS ARE BASED ON EXPECTED TECHNOLOGY OF 1977. DIMENSION IS BASED ON UNIT VOLUME OF 5950 CC, (363 CUBIC INCHES) UNIT IS ASSUMED TO BE DESIGN TO MEET MIL-E-5400 CLASS 2, AND HAVE A PASSIVE THERMAL CONTROL IN THE FORM OF RADIATION AND CONDUCTION

THE CMOS LSI /MONOLITHIC MEMORY ADVANCE TECHNOLOGY COMPUTER IS DESIGN BY IBM FEDERAL SYSTEMS DIVISION, ELECTRONICS SYSTEMS CENTER, OWEGO, NEW YORK 13827
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR DICK WALKER AND C.L MARTIN PHONE 205-837-4000 EXTENSION2424
THE CMOS LSI / MONOLITHIC NONVOLATILE COMPUTER IS AN ADVANCE TECHNOLOGY COMPUTER THAT IS BEING DEVELOPED FOR THE 1977 TIME PERIOD. THE UNIT USES CMOS LSI LOGIC AND MEMORY CIRCUITS. THIS TECHNOLOGY REPRESENTS A SIGNIFICANT BREAKTHROUGH IN POWER, WEIGHT, VOLUME, AND COST. THE ABOVE DATA IS BASED ON A 64K WORD CMOS LSI MONOLITHIC NONVOLATILE MEMORY COMPUTER. DATA IS BASED ON ASSUMPTION THAT UNIT WILL BE ABLE TO MEET MIL-E-5400 CLASS 2 AND HAVE A PASSIVE THERMAL CONTROL. SINCE UNIT IS ONLY IN CONCEPTUAL STAGE THERE ARE NO OTHER INFORMATION AVAILABLE AT THIS TIME.

REF. DATA SHEETS FROM IBM AND CONVERSATION WITH MR DICK WALKER OF IBM.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 14 MILLICOMPUTLER WESTINGHOUSE

DESIGN OPERATING CASE TEMPERATURE	218. TO 398. DEG. K (-67. TO 257. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 423. DEG. K (-80. TO 302. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	218. TO 398. DEG. K (-67. TO 257. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	218. TO 398. DEG. K (-67. TO 257. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	24.1 * WIDTH 14.0 * HEIGHT 15.2 CENTIMETERS
LENGTH	9.5 * WIDTH 5.5 * HEIGHT 6.0 INCHES
PACKAGE AREA	1835.5 SQ. CENTIMETERS * 284.5 SQ. INCHES
PACKAGE VOLUME	5137.3 CU. CENTIMETERS * 313.5 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.5 KILOGRAMS * 1.0 POUNDS
TOTAL WEIGHT	4.5 KILOGRAMS * 10.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.85 * EMISSIVITY = 0.85
INPUT STEADY STATE POWER	8.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE MILLICOMPUTER IS DESIGN FOR BOTH AIRCRAFT AND SPACE ENVIRONMENT. IT IS COOLED BY CONDUCTION AND ITS SURFACES ARE BLACK IRIDITE BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. ABOVE DATA IS BASED ON A MILLICOMPUTER WITH CPU ROM 32K WORD SEMICONDUCTOR MEMORY AND A GENERAL PURPOSE I/O IT DOES NOT INCLUDE THE 28 VDC POWER SUPPLY. THE ADDITION OF THE POWER SUPPLY WILL INCREASE THE UNIT HEIGHT BY APPROX. 5.1 CM (2 IN).

THE MILLICOMPUTER IS DESIGN AND BUILT BY WESTINGHOUSE ELECTRIC CORP., AEROSPACE AND ELECTRONIC SYSTEMS DIVISION BOX 746 BALTIMORE, MARYLAND 21203
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JIM H. BROWN PHONE 301-765-3660 EXTENSION
THE MILLICOMPUTER IS PART OF A FAMILY OF FAST, LIGHTWEIGHT,MILITARY DIGITAL COMPUTERS OF MODULAR DESIGN. THE ABOVE DATA IS FOR A MILLICOMPUTER WITH A 32K WORDS ROM MEMORY DEVELOPED FOR THE BLOC FIVE DOD PROGRAM. THE UNIT INCLUDES THE FOLLOWING A TTL MSI CPU, A 32K X 16 BIT-WORDS SEMICONDUCTOR ROM MEMORY. A GENERAL PURPOSE I O AND A POWER SWITCHING. IT DOES NOT INCLUDE A POWER SUPPLY. THE UNIT MEMORY CAN BE CHANGED DEPENDING ON APPLICATION TO CORE OR PLATED WIRE MEMORY AND IS EXPANDABLE TO 64K WORDS. THE ADDITION OF A POWER SUPPLY WILL INCREASE UNIT BY APPROX. 5.1 CM(2 IN). THE MILLICOMPUTER PERFORMS THE COMPUTATIONS AND DATA HANDLING FUNCTION FOR A SPECTRUM OF AVIONICS AND AEROSPACE APPLICATIONS, INCLUDING FIRE CONTROL WEAPON DELIVERY. ECM, ELINT, RECONNAISSAICE AND NAVIGATION. AT PRESENT THE COMPUTER IS USED IN AN AIRCRAFT AS PRIME FIRE CONTROL SYSTEM AND OTHER MEMBERS OF FAMILY ARE USED IN THE B-57G,SADRAM, AW6-14 AND AWAC SYSTEM. THE COMPUTER IS DESIGNED TO THE SPECIFICATIONS OF MIL-E-5400 CLASS 4 AND MIL-E 16400.
REF. WESTINGHOUSE MILLICOMPUTER BRUCHURE.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 15 MAGIC IV COMPUTER DELCO ELECTRONICS

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K (-80. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 19.0 * WIDTH 16.5 * HEIGHT 13.0 CENTIMETERS	
LENGTH 7.5 * WIDTH 6.5 * HEIGHT 5.1 INCHES	
PACKAGE AREA	1550.3 SQ. CENTIMETERS * 240.3 SQ. INCHES
PACKAGE VOLUME	4074.2 CU. CENTIMETERS * 248.6 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.9 KILOGRAMS * 4.1 POUNDS
TOTAL WEIGHT	4.9 KILOGRAMS * 10.8 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	39.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE UNIT IS COOLED BY HEAT CONDUCTION TO AN EXTERNAL HEAT SINK (COLD PLATE). COLD PLATE MAXIMUM TEMPERATURE IS 71 DEGREES C (160 DEGREES F). THE MAGIC IV IS IN DEVELOPMENT AT PRESENT WITH PROTOTYPE COMPUTER SCHEDULED TO BE AVAILABLE IN MID- 1974 AND PRODUCTION PLANNED FOR LATE 1974. THE UNIT SURFACE PROPERTIES AT PRESENT IS BLACK PAINT BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS BEING DESIGN FOR SPACE ENVIRONMENT

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THE MAGIC IV COMPUTER IS DESIGNED AND BUILT BY
DELCO ELECTRONICS DIV. OF GENERAL MOTORS CORPORATION
6767 HOLISTER AVENUE. GOLTA, CALIFORNIA 93017
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JACK TONEY PHONE 805-968-1011 EXTENSION 301
THE MAGIC IV IS A SECOND GENERATION LARGE SCALE INTEGRATION (LSI) COMPUTER THAT IS CURRENTLY UNDER DEVELOPMENT ON IRAD FUNDS. A PROTOTYPE UNIT IS EXPECTED TO BE AVAILABLE DURING MID-1974, AND PRODUCTION CAPABILITY IS PLANNED FOR LATE 1974. THE MAGIC IV IS A 32K X 16 BITS SEMICONDUCTOR LSI MEMORY. IT IS DESIGN TO MEET A SPACE ENVIRONMENT AND TO QUALIFY TO MIL-E-5400 CLASS 2. UNIT IS EXPANDABLE FROM 8K TO 65K WORD MEMORY AND CAN BE CONVERTED TO CORE OR PLATED WIRE MEMORY. THE MAGIC IV THAT IS DESCRIBED ABOVE CONSISTS OF THE FOLLOWING: A CPU, A 32K X 16 BITS LSI MEMORY, I/O CONTROLLER AND A 28 VDC POWER SUPPLY. THE 32K MEMORY CONSIST OF 24K WORDS ROM AND 8K WORDS RAM HOWEVER MEMORY CAN BE MODIFIED PER CUSTOMER NEED AND APPLICATION.

REF. SPACE QUALIFIED COMPUTER, DELCO ELECTRONICS P73-02A
APRIL 1973

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 16 MAGIC 362 COMPUTER DELCO ELECTRONICS

DESIGN OPERATING CASE TEMPERATURE	218. TO 344. DEG. K (-67. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	218. TO 398. DEG. K (-67. TO 257. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	218. TO 344. DEG. K (-67. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	218. TO 344. DEG. K (-67. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	18.8 * WIDTH 17.8 * HEIGHT 13.0 CENTIMETERS
LENGTH	7.4 * WIDTH 7.0 * HEIGHT 5.1 INCHES
PACKAGE AREA	1616.0 SQ. CENTIMETERS * 250.5 SQ. INCHES
PACKAGE VOLUME	4329.1 CU. CENTIMETERS * 264.2 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	2.0 KILOGRAMS * 4.5 POUNDS
TOTAL WEIGHT	5.2 KILOGRAMS * 11.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	58.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
UNIT IS COOLED BY HEAT CONDUCTION TO A COLD PLATE. THE MAGIC 362 IS DESIGN TO QUALIFY FOR SPACE ENVIRONMENT. THE UNIT IS PAINTED BLACK BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. THE MAGIC 362 IS AN OFF-THE-SHELF COMPUTER THAT IS IN PRODUCTION. UNIT HAS NO MOUNTING LIMITATION ON VEHICLE AND HAS NO SPECIFIED CABLE LENGTH REQUIREMENTS. CABLE LENGTH WILL DEPEND ON COMPONENTS.

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THE MAGIC 362 COMPUTER IS DESIGNED AND BUILT BY
DELCO ELECTRONICS DIVISION OF GENERAL MOTORS CORPORATION
6767 HOLISTER AVE. GOLTA, CALIFORNIA 93017
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JACK TONEY PHONE 805-968-1011 EXTENSION 301
THE MAGIC 362 IS A MEMBER OF THE MAGIC III FAMILY OF COMPUTERS. THE MAGIC 362 COMPUTER IS IN PRODUCTION WITH PROTOTYPE OF THE UNIT BEING READIED FOR THE ADVANCE TACTICAL NAVIGATION SYSTEM. THE ABOVE DATA CORRESPOND TO A MAGIC 362 COMPUTER WITH THE FOLLOWING:A CPU, A 32K X16 BITS SEMI-CONDUCTOR MEMORY OF WHICH 24K ARE ROM AND 8K ARE RAM,AN I/O CONTROLLER AND A 28 VDC POWER SUPPLY. UNIT MEMORY CAN BE EXPANDED TO 65K WORDS AND THE MEMORY CAN BE INTER-CHANGED WITH CORE OR PLATED WIRE MEMORY MODULES. UNIT IS DESIGN TO COMPLY WITH MIL-E-5400, MIL-STD-704, AND MIL-STD-461.

REF. SPACE QUALAIFIED COMPUTER DELCO ELECTRONICS P73-02A APRIL 1973, AND MAGIC 362 SERIES AEROSPACE DIGITAL COMPUTERS TECHNICAL DESCRIPTION, DELCO ELECTRONICS S73-49 JULY 1973.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 17 MICRO-D 1808 ARMA DIV. OF AMBAC

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 398. DEG. K (-80. TO 257. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 59.7 * WIDTH 18.5 * HEIGHT 13.5 CENTIMETERS	
LENGTH 23.5 * WIDTH 7.3 * HEIGHT 5.3 INCHES	
PACKAGE AREA	4319.9 SQ. CENTIMETERS * 669.6 SQ. INCHES
PACKAGE VOLUME	14899.4 CU. CENTIMETERS * 909.2 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.8 KILOGRAMS * 4.0 POUNDS
TOTAL WEIGHT	16.3 KILOGRAMS * 36.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	106. WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE MICRO D COMPUTER IS AN AIRCRAFT DESIGN COMPUTER THAT USES THE AIRCRAFT FORCED AIR AS THE UNIT COOLING SYSTEM. CABLE LENGTH IS LIMITED TO APPROX. 2.5 METERS (8 FT). THERE IS NO INDICATION WHETHER UNIT CAN BE MODIFIED FOR A SPACE ENVIRONMENT. SURFACES ARE PAINTED BLACK BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIRE MENTS. THE ABOVE DATA IS FOR A 32K X 18 BIT WORD CORE MEMORY IT DOES NOT INCLUDE A POWER SUPPLY.

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THE MICRO-D 1808 COMPUTER IS DESIGNED AND BUILT BY
ARMA DIVISION OF AMBAC INDUSTRIES
ROOSEVELT FIELD, GARDEN CITY, NEW YORK 11530
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. L. C. BERKE AND MR R. ROGERS PHONE 516-742-2000 EXTENSION 231
THE MICRO-D 1808 COMPUTER IS AN AIRCRAFT COMPUTER IT IS USED ON COMMERICAL AIRCRAFT AND THE GRUMMAN EC2 AIRCRAFT. THE UNIT IS OFF THE SHELF, PRODUCTION ITEM. THE MICRO-D 1808 MEMORY IS EXPANDABLE FROM 4K TO 32K WORDS MEMORY. THE UNIT IS DESIGN TO MEET MIL-E-5400 CLASS 1,AND MIL-E-5400 CLASS 2X. THE MICRO-D 1808 DESCRIBED ABOVE HAS THE FOLLOWING A CPU, A 32K X 18 BITS CORE MEMORY, AND THE I/O CONTROLLER IT DOES NOT INCLUDE THE POWER SUPPLY UNIT. THE ADDITION OF THE POWER SUPPLY WILL INCREASE THE LENGTH BY APPROX. 17.8 CM(7 IN), THE WEIGHT BY 10 KILOGRAMS(22 LBS), AND THE POWER BY 45 WATTS.

REF. DETAILED EQUIPMENT SPECIFICATION COMPUTER, GENERAL PURPOSE MICRO-D TYPE 1808 ARMA DIV. MD-1829 REV. B 4 JANUARY 1972.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 18 AOP COMPUTER WESTINGHOUSE

DESIGN OPERATING CASE TEMPERATURE	253. TO 353. DEG. K (-4. TO 176. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	218. TO 398. DEG. K (-67. TO 257. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	253. TO 353. DEG. K (-4. TO 176. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	253. TO 353. DEG. K (-4. TO 176. DEG. F)
PACKAGE SHAPE	RECTAGULAR
PACKAGE SIZE * LENGTH 22.9 * WIDTH 17.8 * HEIGHT 55.9 CENTIMETERS	
LENGTH 9.0 * WIDTH 7.0 * HEIGHT 22.0 INCHES	
PACKAGE AREA	5354.8 SQ. CENTIMETERS * 830.0 SQ. INCHES
PACKAGE VOLUME	22712.5 CU. CENTIMETERS * 1386.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.4 KILOGRAMS * 3.0 POUNDS
TOTAL WEIGHT	14.1 KILOGRAMS * 31.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.85 * EMISSIVITY = 0.85
INPUT STEADY STATE POWER	13.6 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE ADVANCE ONBOARD PROCESSOR IS A PROTOTYPE UNIT THAT IS BEING DEVELOPED FOR NASA GODDARD SPACE FLIGHT CENTER FOR USE ON SPACE SATELLITES. UNIT HAS A COMPLETE PASSIVE THERMAL DESIGN WITH COOLING ACHIEVED BY RADIATION AND CONDUCTION. UNIT SURFACE IS BLACK IRIDITE. THE AOP DESCRIBED ABOVE INCLUDES A CPU, A 32K PLATED WIRE MEMORY A COMPLETE I/O AND A 28 VDC POWER SUPPLY. UNIT IS DESIGN FOR SPACE ENVIRONMENT AND IS BEING QUAL TESTED AT PRESENT.

THE ADVANCE ONBORAD PROCESSOR COMPUTER IS DESIGN AND BUILT BY WESTINGHOUSE ELECTRIC CORP. AEROSPACE AND ELECTRONICS SYSTEM DIVISION BOX 746 BALTIMORE, MARYLAND 21203
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JIM H. BROWN PHONE 301-765-3660 EXTENSION
THE ADVANCE ONBOARD PROCESSOR,AOP COMPUTER IS BEING BUILT FOR NASA GSFC,IT IS IN TESTING AT THE PRESENT TIME WITH EXPECTED LAUNCH IN LATE 1974. THE AOP HAS A 4K PLATED WIRE OR 8K CORE MEMORY THAT IS EXPANDABLE TO 64K WORDS MEMORY. THE UNIT DESCRIBED ABOVE IS A 32K PLATED WIRE MEMORY UNIT WITH A CPU,FIXED I/O AND 28 VDC POWER SUPPLY. THE AOP IN AN 8K PLATED WIRE IS 22.9 CM LONG BY 17.8 CM WIDE BY 21.6 CM HIGH (9.0 X 7.0 X 8.5 IN),IS 3.18 KG IN WEIGHT (7 LBS),AND DISSIPATE 12 WATTS. EACH ADDITIONAL 4K PLATED WIRE MEMORY ADD 5.7 CM (2.25 IN) TO THE HEIGHT, 1.8 KG (4LBS) TO WEIGHT AND .2 WATTS TO THE POWER. THE 32K AOP DATA IS BASED ON THE ABOVE 8K AOP EXPANDED BY THE VARIOUS PARAMETERS TO 32K AOP. THE AOP PLATED WIRE MEMORY CAN BE INTERCHANGE WITH CORE MEMORY BUT THERE WILL BE AN INCREASE POWER CONSUMPTION. THE UNIT IS DESIGN FOR SPACE ENVIRONMENT AND A PREDECSSOR TO THE AOP. THE OBP- ONBOARD PROCESSOR HAS BEEN USED ON THE OAO-C SATELLITE.

REF. TELECON WITH MR JIM H. BROWN OF WESTINGHOUSE

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 19 HDC-301 COMPUTER HONEYWELL

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K	
	(-65. TO 160. DEG. F)	
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K	
	(-79. TO 203. DEG. F)	
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K	
	(-65. TO 160. DEG. F)	
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K	
	(-65. TO 160. DEG. F)	
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH	16.3 * WIDTH 16.0 * HEIGHT	3.8 CENTIMETERS
LENGTH	6.4 * WIDTH 6.3 * HEIGHT	1.5 INCHES
PACKAGE AREA	766.1 SQ. CENTIMETERS *	118.7 SQ. INCHES
PACKAGE VOLUME	991.1 CU. CENTIMETERS *	60.5 CU. INCHES
CASE MATERIAL	ALUMINUM	
CASE WEIGHT	.1 KILOGRAMS *	.3 POUNDS
TOTAL WEIGHT	.7 KILOGRAMS *	1.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90	
INPUT STEADY STATE POWER	16.0 WATTS **	
OUTPUT POWER	0.0 WATTS **	
THERMAL DESIGN	PASSIVE * PASSIVE	

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE HDC-301 COMPUTER HAS A PASSIVE THERMAL CONTROL HEAT IS CONDUCTED TO THE MOUNTING EDGES. THE ABOVE UNIT SIZE IS BASED ON A 4K WORD MEMORY. UNIT IS EXPANDABLE TO 32K WORD MEMORY. UNIT HAS CONFORMAL COATING.

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THE HDC-301 DIGITAL COMPUTER IS DESIGN AND BUILT BY
HONEYWELL INC., AEROSPACE DIVISION
13350 U.S. HIGHWAY 19, ST. PETERSBURG, FLORIDA 33733
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HARVEY H. WHELESS PHONE 813-531-4611 EXTENSION 3378
THE HDC-301 COMPUTER IS IN PRODUCTION AND AS OF MARCH 1973, 16 PROCESSORS HAVE BEEN DELIVERED FOR A VARIETY OF PROGRAMS. IT IS DESIGNED TO MEET MIL-E-5400 CLASS II, AND TESTING TO THIS SPECIFICATION WILL BE ACCOMPLISHED UNDER THE F-14 HSS PROGRAM. THE ENTIRE HDC-301 PROCESSOR IS CONTAINED ON ONE 16.2 X 15.9 X 1.3 CM(6.35X 6.25X0.5 IN) PRINTED CIRCUIT BOARD WEIGHING 0.44 KG (0.50 LB). THE STD I/O BOARD AND MEMORY BOARDS ARE THE SAME SIZE. UNIT CIRCUIT IS MOS/LSI AND MEMORY WORD SIZE IS 16 BIT. BECAUSE OF THE SMALL SIZE AND WEIGHT, THE HDC-301 BOARDS ARE INTEGRATED DIRECTLY INTO SYSTEM ELECTRONICS, THEREBY AVOIDING A SEPARATE POWER SUPPLY AND CHASSIS. UNIT INPUT VOLTAGE IS +5, -2, -9, AND -13 VDC.

REF. MR HARVEY H WHELESS LETTER OF 23 AUGUST 1973. AND BROCHURE 0373-11567 HONEYWELL SPACE TUG PROGRAM CAPABILITY (GUIDANCE, NAVIGATION AND CONTROL) 4 APRIL 1973.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 20 HDC-402 COMPUTER HONEYWELL

DESIGN OPERATING CASE TEMPERATURE	241. TO 325. DEG. K (-25. TO 125. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	241. TO 325. DEG. K (-25. TO 125. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 311. DEG. K (0. TO 100. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	241. TO 333. DEG. K (-25. TO 140. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 40.6 * WIDTH 26.7 * HEIGHT 27.4 CENTIMETERS	
LENGTH 16.0 * WIDTH 10.5 * HEIGHT 10.8 INCHES	
PACKAGE AREA	5860.6 SQ. CENTIMETERS * 908.4 SQ. INCHES
PACKAGE VOLUME	29732.7 CU. CENTIMETERS * 1814.4 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	4.5 KILOGRAMS * 10.0 POUNDS
TOTAL WEIGHT	21.3 KILOGRAMS * 47.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	25.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE HDC-402 COMPUTER IS DESIGN FOR THE VIKING PROGRAM. IT HAS A PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION. THE UNIT IS PAINTED WITH BLACK PAINT. THE UNIT IS QUAL. TESTED TO 60 DEG.C (140 DEG F) FOR SHORT TIME DURING ENTRY, AND TO 40.6 DEG.C(115 DEG F) FOR MARS OPERATION. UNIT AT ENTRY DISSIPATE 40 WATTS OF POWER WHILE CONTROLLING VEHICLE MARS ENTRY. THE ABOVE DATA IS FOR THE DUAL REDUNDANT SYSTEM WITH 18K X 25 BIT PLATED WIRE MEMORY.

THE HDC-402 COMPUTER IS DESIGN AND BUILT BY
HONEYWELL INC., AEROSPACE DIVISION
13350 U.S. HIGHWAY 19, ST. PETERSBURG, FLORIDA 33733
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HARVEY H. WHELESS PHONE 813-531-4611 EXTENSION 3378
MR. JOHN MYERS PHONE 303-794-5211 EXTENSION 4149
THE HDC-402 IS A DUAL REDUNDANT COMPUTER SYSTEM BUILT FOR THE VIKING PROGRAM. BOTH COMPUTER ARE PACKAGED WITHIN THE ONE ENVELOPE. AS OF MARCH 1973 THE PROCESSOR, I/O, DRIVER RECEIVER AND POWER SUPPLY HAVE COMPLETED ENGINEERING DEVELOPMENT AND ARE CONSIDERED OFF-THE-SHELF. EACH COMPUTER HAS AN 18K X 25 BITS, 2 MIL PLATED WIRE MEMORY, AND A POWER SWITCHING IN THE EVENT OF FAILURE IN THE OPERATING STRING. UNIT COULD BE EXPANDED TO 32K WORD MEMORY WITH SOME MODIFICATIONS. IN THE PRESENT MODE OF OPERATION ON THE VIKING PROGRAM ONLY ONE COMPUTER IS ON AT ANY ONE TIME AND ITS OPERATING POWER IS 25 WATTS.

REF. BROCHURE 0373-11567 HONEYWELL SPACE TUG PROGRAM CAPABILITY (GUIDANCE, NAVIGATION AND CONTROL) 4 APRIL 1973. AND CONVERSATION WITH MR JOHN MYERS OF MMC VIKING PROGRAM.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 21 HDC-601C COMPUTER HONEYWELL

DESIGN OPERATING CASE TEMPERATURE	218. TO 344. DEG. K	
	(-67. TO 160. DEG. F)	
NON-OPERATING AND STORAGE CASE TEMPERATURE	208. TO 398. DEG. K	
	(-85. TO 257. DEG. F)	
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	244. TO 322. DEG. K	
	(-20. TO 120. DEG. F)	
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	218. TO 344. DEG. K	
	(-67. TO 160. DEG. F)	
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH 49.8 * WIDTH 21.1 * HEIGHT	19.3 CENTIMETERS	
LENGTH 19.6 * WIDTH 8.3 * HEIGHT	7.6 INCHES	
PACKAGE AREA	4835.1 SQ. CENTIMETERS *	749.4 SQ. INCHES
PACKAGE VOLUME	20260.4 CU. CENTIMETERS *	1236.4 CU. INCHES
CASE MATERIAL	ALUMINUM	
CASE WEIGHT	7.0 KILOGRAMS *	15.4 POUNDS
TOTAL WEIGHT	15.9 KILOGRAMS *	35.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90	
INPUT STEADY STATE POWER	160. WATTS ** 115 VAC 400 HZ	
OUTPUT POWER	0.0 WATTS **	
THERMAL DESIGN	ACTIVE * ACTIVE	

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE HDC-601C IS AN 8K X 16 BIT CORE MEMORY COMPUTER. IT IS DESIGN WITH AN ACTIVE COLD PLATE COOLING SYSTEM UTILIZING FORCED AIR. UNIT CAN BE MODIFIED TO USE A PASSIVE THERMAL CONTROL FOR SPACE APPLICATIONS. THE HDC-601C IS PAINTED WITH A GRAY ENAMEL PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS EXPANDABLE TO 32K WORD MEMORY WITH THE ADDITIONAL MEMORY HOUSED WITHIN THE COMPUTER MAINFRAME.

THE HDC-601C DIGITAL COMPUTER IS DESIGN AND BUILT BY
HONEYWELL INC., AEROSPACE DIVISION
13350 U.S. HIGHWAY 19, ST. PETERSBURG, FLORIDA 33733
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HARVEY H. WHELESS PHONE 813-531-4611 EXTENSION 3378
THE HDC-601C COMPUTER IS A PRODUCTION OFF-THE-SHELF UNIT. UNIT IN ABOVE FORM CONSIST OF THE FOLLOWING A CPU, 8K X 16 BITS CORE MEMORY, I/O CONTROLLER AND A 115 VAC, 400 HZ, SINGLE PHASE POWER SUPPLY. THE UNIT CAN BE EXPANDED TO 32K WORDS MEMORY WITHIN THE EXISTING COMPUTER MAINFRAME. IN ADDITION AN EXPANDED MEMORY UNIT OF UP TO 32K WORDS MEMORY CAN BE COUPLED TO THE MAIN COMPUTER. FURTHERMORE UNIT HAS SPACE FOR UP TO 12 ADDITIONAL PRINTED CIRCUIT BOARD SLOTS FOR CUSTOM I/O. THE HDC-601C DIGITAL COMPUTER IS DESIGN SPECIFICALLY FOR USE IN AEROSPACE AND DEFENSE APPLICATIONS, UNIT IS QUALIFIED TO MIL-E-5400 CLASS II, MIL-STD-704A, AND MIL-STD-461.

REF. MR HARVEY H. WHELESS LETTER OF 23 AUGUST 1973. AND BROCHURE 0373-11567 HONEYWELL SPACE TUG PROGRAM CAPABILITY (GUIDANCE, NAVIGATION AND CONTROL) 4 APRIL 1973.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 22 HDC-601P COMPUTER HONEYWELL

DESIGN OPERATING CASE TEMPERATURE	218. TO 344. DEG. K (-67. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	218. TO 398. DEG. K (-67. TO 257. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	244. TO 322. DEG. K (-20. TO 120. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	218. TO 344. DEG. K (-67. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	49.8 * WIDTH 21.1 * HEIGHT 19.3 CENTIMETERS
LENGTH	19.6 * WIDTH 8.3 * HEIGHT 7.6 INCHES
PACKAGE AREA	4835.1 SQ. CENTIMETERS * 749.4 SQ. INCHES
PACKAGE VOLUME	20260.4 CU. CENTIMETERS * 1236.4 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	7.0 KILOGRAMS * 15.4 POUNDS
TOTAL WEIGHT	16.8 KILOGRAMS * 37.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	120.0 WATTS ** 28 VDC
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE HDC-601P IS AN 8K X 16 BIT PLATED WIRE MEMORY COMPUTER. IT IS DESIGN WITH AN ACTIVE COLD PLATE COOLING SYSTEM UTILIZING FORCED AIR. UNIT CAN BE MODIFIED TO USE A PASSIVE THERMAL CONTROL FOR SPACE APPLICATIONS. THE HDC-601P IS PAINTED WITH A GRAY ENAMEL PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS EXPANDABLE TO 32K WORDS MEMORY WITH UP TO 16K PLATED WIRE MEMORY HOUSED IN THE COMPUTER MAINFRAME.AND REST IN AUXILARY MEMORY.

THE HDC-601P DIGITAL COMPUTER IS DESIGN AND BUILT BY
HONEYWELL INC.. AEROSPACE DIVISION
13350 U.S. HIGHWAY 19, ST. PETERSBURG, FLORIDA 33733
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HARVEY H. WHELESS PHONE 813-531-4611 EXTENSION 3378
THE HDC-601P COMPUTER IS AN OFF THE SHELF IN PRODUCTION UNIT. THE DATA ABOVE DESCRIBE A HD6-601P COMPUTER THAT HAS THE FOLLOWING CPU, 8K X 16 BIT PLATED WIRE MEMORY, PROGRAM CONTROLLER, DMA DATA CHANNELS. I/O CONTROLLER AND 28 VDC POWER SUPPLY. UNIT IS CAPABLE OF EXPANDING ITS MEMORY TO 32K WORDS, AND HAS UP TO 3 ADDITIONAL PRINTED CIRCUIT BOARDS SLOTS FOR CUSTOM I/O. THE HDC-601P DIGITAL COMPUTER IS DESIGN SPECIFICALLY FOR USE IN AEROSPACE AND DEFENSE APPLICATIONS, AND IS QUALIFIED TO MIL-E-5400 CLASS II, MIL-STD-704 A, AND MIL-STD-461.

REF. MR HARVEY H. WHELESS LETTER OF 23 AUGUST 1973. AND BROCHURE 0373-11567 HONEYWELL SPACE TUG PROGRAM CAPABILITY (GUIDANCE, NAVIGATION AND CONTROL) 4 APRIL 1973.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 23 HDC-602 COMPUTER HONEYWELL

DESIGN OPERATING CASE TEMPERATURE	219. TO 366. DEG. K (-65. TO 199. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	219. TO 347. DEG. K (-65. TO 165. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 361. DEG. K (-65. TO 190. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 361. DEG. K (-65. TO 190. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 61.0 * WIDTH 30.2 * HEIGHT 27.9	CENTIMETERS
LENGTH 24.0 * WIDTH 11.9 * HEIGHT 11.0	INCHES
PACKAGE AREA	8780.6 SQ. CENTIMETERS * 1361.0 SQ. INCHES
PACKAGE VOLUME	51481.6 CU. CENTIMETERS * 3141.6 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	4.1 KILOGRAMS * 9.0 POUNDS
TOTAL WEIGHT	20.4 KILOGRAMS * 45.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.25 * EMISSIVITY = 0.85
INPUT STEADY STATE POWER	170.0 WATTS ** +28VDC
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON

THE HDC-602 DIGITAL COMPUTER IS DESIGN WITH A PASSIVE RADIANT COOL ED THERMAL SYSTEM. THE UNIT IS PRESENTLY IN DEVELOPMENT STAGE AND WILL BE USED IN THE SPACE SHUTTLE MAIN ENGINE CONTROLLER. THE HDC -602 IS AN HERMETICAL SEALED UNIT AND IS PAINTED WITH A WHITE POLY URETHANE PAINT. BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENT THE HDC-602 DESCRIBED ABOVE HAS A 16K X 17 BIT WORDS PLATED WIRE MEMORY, UNIT IS EXPANDABLE TO 32K WORDS MEMORY.

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THE HDC-602 DIGITAL COMPUTER IS DESIGN AND BUILT BY
HONEYWELL INC., AEROSPACE DIVISION
13350 U.S. HIGHWAY 19, ST. PETERSBURG, FLORIDA 33733
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. HARVEY H. WHELESS PHONE 813-531-4611 EXTENSION 3378
THE HDC-602 DIGITAL COMPUTER IS IN DEVELOPMENT STAGE FOR THE SPACE SHUTTLE PROGRAM. IT WILL BE USED IN THE SPACE SHUTTLE AS THE MAIN ENGINE CONTROLLER. THE HDC-602 DESCRIBED ABOVE CONSIST OF THE FOLLOWING CPU, 16K X 17 BIT PLATED WIRE MEMORY, PROGRAM CONTROLL-ER, DMA DATA CHANNELS, I/O CONTROLLER AND A 28 VDC POWER SUPPLY. UNIT IS EXPANDABLE TO 32K WORDS PLATED WIRE MEMORY. UNIT IS DE-SIGN TO MEET MIL-STD-461/462 AND MIL-STD-704, AND TO WITHSTAND 24G VIBRATION.

REF. MR HARVEY H. WHELESS LETTER OF 23 AUGUST 1973. AND BROCHURE 0373-11567 HONEYWELL SPACE TUG PROGRAM CAPABILITY (GUIDANCE, NAVIGATION AND CONTROL) 4 APRIL 1973.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 24 D216 COMPUTER AUTONETICS R.I.

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K (-80. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 27.9 * WIDTH 17.8 * HEIGHT 15.2 CENTIMETERS	
LENGTH 11.0 * WIDTH 7.0 * HEIGHT 6.0 INCHES	
PACKAGE AREA	2387.1 SQ. CENTIMETERS * 370.0 SQ. INCHES
PACKAGE VOLUME	7570.8 CU. CENTIMETERS * 462.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.4 KILOGRAMS * 3.0 POUNDS
TOTAL WEIGHT	7.3 KILOGRAMS * 16.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	65. WATTS ** 28 VDC POWER SUPPLY
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE D216 DIGITAL COMPUTER IS DESIGN FOR USE FOR BOTH AIRCRAFT AND MISSILES. THE UNIT THERMAL CONTROL IS BY MEANS OF CONDUCTIVE COOLING TO A COLDPLATE. UNIT HAS A IRIDITE ALUMINUM FINISH BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. THE ABOVE D216 DIGITAL COMPUTER IS A 7 MODULE UNIT INCLUDING THE 28 VDC POWER SUPPLY ALL PACKAGED IN ONE BOX. THE D216 HAS A 32K X 16 BIT WORDS PLATED WIRE MEMORY AND MEMORY SIZE CAN VARY FROM 8K TO 65K WORDS.

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THE D216 GENERAL PURPOSE DIGITAL COMPUTER IS DESIGN AND BUILT BY AUTONETICS DIVISION, ROCKWELL INTERNATIONAL
3370 MIRALOMA AVENUE ANAHEIM, CALIFORNIA 92803
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. VINCE MAREK PHONE 714-632-3374 EXTENSION
THE D216 COMPUTER IS A MEMBER OF THE ADVANCED D200 FAMILY OF MOS / LSI GENERAL-PURPOSE COMPUTERS. THE D216 COMPUTER IS CURRENTLY IN PRODUCTION. IT HAS BEEN CONFIGURED FOR AN UNMANNED SPACE APPLICATION AND IS CURRENTLY BEING QUALIFIED FOR THIS ENVIRONMENT. LAUNCH IS SCHEDULED NEAR THE END OF THIS YEAR 1973. THE D216 DIGITAL COMPUTER DESCRIBED ABOVE CONSIST OF A MODULAR COMPUTER WITH THE FOLLOWING COMPONENTS A PMOS LSI PROCESSOR, A 32K X 16 BIT WORDS PLATE WIRE,RANDOM ACCESS, NDRO,NONVOLATILE MEMORY,AN INPUT/ OUTPUT WITH BOTH DIRECT MEMORY ACCESS (DMA) AND A PROGRAM CONTROL TRANSFER CAPABILITY, AND A 28 VDC POWER SUPPLY. THE D216 MEMORY IS EXPANDABLE TO 65K WORDS WHICH ARE DIRECTLY ADDRESSABLE. THE D216 IS DESIGN TO MEET MIL-E-5400 CLASS 2 AND 2X. THIS UNIT IS THE FORERUNNER OF THE DI216 DIGITAL COMPUTER. THE D200 FAMILY COMPUTER HAVE BEEN USED ON SEVERAL PROGRAMS INCLUDING THE F-1110 NAVIGATION SYSTEM.
REF. BROCHURE. AUTONETICS ADVANCED D200 FAMILY OF MOS/LSI GENERAL-PURPOSE COMPUTERS PUB. NO P71-828/401

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 25 DI216 COMPUTER AUTONETICS R.I.

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K (-80. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 27.9 * WIDTH 17.8 * HEIGHT 15.2 CENTIMETERS	
LENGTH 11.0 * WIDTH 7.0 * HEIGHT 6.0 INCHES	
PACKAGE AREA	2387.1 SQ. CENTIMETERS * 370.0 SQ. INCHES
PACKAGE VOLUME	7570.8 CU. CENTIMETERS * 462.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.4 KILOGRAMS * 3.0 POUNDS
TOTAL WEIGHT	7.3 KILOGRAMS * 16.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	75.0 WATTS **28 VDC POWER SUPPLY
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE DI216 COMPUTER IS IN THE FINAL STAGE OF DEVELOPMENT WITH ANTICIPATED QUALIFICATIONS TESTS COMPLITION DURING 1974. THE UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF HEAT CONDUCTION TO A COLD PLATE. UNIT SURFACE IS IRIDITED ALUMINUM BUT COULD BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. THE DI216 IS A MODULAR UNIT WITH 32K WORDS MEMORY.

THE DI216 GENERAL PURPOSE COMPUTER IS DESIGN AND BUILT BY AUTONETICS DIVISION, ROCKWELL INTERNATIONAL
3370 MIRALOMA AVENUE, ANAHEIM, CALIFORNIA 92803
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. VINCE MAREK PHONE 714-632-3374 EXTENSION
THE DI216 COMPUTER IS A MEMBER OF THE ADVANCED D200 FAMILY OF MOS/LSI GENERAL PURPOSE COMPUTERS. THE DI216 IS MUCH LIKE ITS FORERUNNER THE D216 COMPUTER BUT WITH A FASTER PROCESSOR. THE DI216 IS IN THE FINAL STAGE OF DEVELOPMENT. IT IS EXPECTED TO BE QUAL TESTED DURING 1974 FOR SPACE ENVIRONMENT. THE DI216 COMPUTER DESCRIBED ABOVE IS BUILT IN MODULAR FORM IT INCLUDES THE FOLLOWING A PMOS LSI PROCESSOR, A 32K X 16 BIT WORDS PLATED WIRE, RANDOM ACCESS, NDRO, NONVOLITE MEMORY, AN INPUT/OUTPUT WITH BOTH DIRECT MEMORY ACCESS (DMA) AND A PROGRAM CONTROL TRANSFER CAPABILITY AND A 28 VDC POWER SUPPLY. THE DI216 MEMORY IS EXPANDABLE TO 65K X 16 BIT WORDS MEMORY. THE DI216 IS DESIGN TO MEET MIL-E-5400 CLASS 2 AND 2X. THE DI216 IS EXPECTED TO BE FULLY DEVELOPED IN TIME FOR THE SPACE TUG INITIAL OPERATIONAL CAPABILITY (IOC) SYSTEM.

REF. SUMMARY OF DI216 COMPUTER CHARACTERISTICS.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 26 D232 COMPUTER AUTONETICS R.I

DESIGN OPERATING CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 368. DEG. K (-80. TO 203. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 344. DEG. K (-65. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 27.9 * WIDTH 17.8 * HEIGHT 30.5 CENTIMETERS	
LENGTH 11.0 * WIDTH 7.0 * HEIGHT 12.0 INCHES	
PACKAGE AREA	3780.6 SQ. CENTIMETERS * 586.0 SQ. INCHES
PACKAGE VOLUME	15141.6 CU. CENTIMETERS * 924.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	2.7 KILOGRAMS * 6.0 POUNDS
TOTAL WEIGHT	13.6 KILOGRAMS * 30.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	140.0 WATTS ** 28 VDC POWER SUPPLY
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE D232 COMPUTER IS IN FINAL STAGE OF DEVELOPMENT AND IS SCHEDULE TO BE OPERATIONAL NEAR THE END OF 1973. THE D232 COMPUTER IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION TO A COLDPLATE. THE UNIT SURFACE IS IRIDITE ALUMINUM BUT FINISH IS APPLICATION DEPENDENT. THE D232 COMPUTER IS SIMILAR TO THE DI216 COMPUTER BUT HAS A 65K X 16 BIT WORDS PLATED WIRE MEMORY AND REQUIRES HIGHER POWER.

THE D232 GENERAL PURPOSE COMPUTER IS DESIGN AND BUILT BY
AUTONETICS DIVISION, ROCKWELL INTERNATIONAL
3370 MIRALOMA AVENUE ANAHEIM, CALIFORNIA 92803
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. VINCE MAREK PHONE 714-632-3374 EXTENSION
THE D232 COMPUTER IS A MEMBER OF THE D200 FAMILY OF MOS/LSI COMPUTERS. IT IS VERY SIMILAR TO THE DI216 COMPUTER EXCEPT THAT ITS WORD LENGTH IS 32 BITS RATHER THEN 16 BITS. IT USES THE SAME MOS/LSI COMPONENTS AND HAS THE SAME BASIC ARCHITECTURE AS THE DI216 COMPUTER. THE D232 IS A MODULAR COMPUTER AND INCLUDES THE FOLLOWING A PMOS LSI PROCESSOR, A 65K X 32 BIT WORDS PLATED WIRE, RANDOM ACCESS, NDRO, NONVOLATILE MEMORY, A GENERAL I/O WITH BOTH (DMA)-DIRECT MEMORY ACCESS AND A PROGRAM CONTROLLER, AND A 28 VDC POWER SUPPLY. THE UNIT IS DESIGN TO MEET MIL-E-5400 CLASS 2. THE D232 IS DESIGN TO OPERATE WITH BOTH PLATED WIRE AND SEMICONDUCTOR MEMORIES. THE D232 IS EXPECTED TO BE FULLY DEVELOPED IN TIME FOR THE SPACE TUG INITIAL OPERATIONAL CAPABILITY (IOC) SYSTEM.

REF. SUMMARY OF D232 COMPUTER CHARACTERISTICS.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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COMP 27 TDY-300 COMPUTER TELEDYNE P/N 1882218-1

DESIGN OPERATING CASE TEMPERATURE	253. TO 344. DEG. K (-4. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	219. TO 344. DEG. K (-65. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	243. TO 344. DEG. K (-22. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 344. DEG. K (-22. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 41.9 * WIDTH 33.8 * HEIGHT	30.5 CENTIMETERS
LENGTH 16.5 * WIDTH 13.3 * HEIGHT	12.0 INCHES
PACKAGE AREA	7445.8 SQ. CENTIMETERS * 1154.1 SQ. INCHES
PACKAGE VOLUME	43153.7 CU. CENTIMETERS * 2633.4 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	6.4 KILOGRAMS * 14.0 POUNDS
TOTAL WEIGHT	21.5 KILOGRAMS * 47.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.26 * EMISSIVITY = 0.26
INPUT STEADY STATE POWER	143.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE TDY-300 IS DESIGN FOR SPACE ENVIRONMENT IT IS THE COMPUTER FOR THE DELTA LAUNCH VEHICLE. UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL IN SPACE BY MEANS OF RADIATION AND CONDUCTION. UNIT REQUIR ES AIR CONDITION AIR FOR PRELAUNCH OPERATION WITH THE COMPARTMENT AIR TEMPERATURE BETWEEN 22.2 AND 29.9 DEG C (72 TO 85 DEG.F) AND WITH AN AVERAGE CONVECTIVE HEAT TRANSFER COEFFICIENT BETWEEN 0.5 AND 2.0 BTU/HR-FT SQ-DEG F. UNIT IS PAINTED WITH ALUMINIZED PAINT.

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THE TDY-300 DIGITAL COMPUTER IS DESIGN AND BUILT BY
TELEDYNE SYSTEMS COMPANY
19601 NORDHOFF ST. NORTHRIDGE, CALIFORNIA 91324
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JAMES E. FITHIAN PHONE 213-886-2211 EXTENSION 2544
THE DIGS COMPUTER IS A 4K X 24 BIT WORDS CORE MEMORY COMPUTER. UNIT CAN BE EXPANDED TO 32K X 24 BIT CORE MEMORY BUT THAT WILL REQ UIRE PACKAGING THE POWER SUPPLY IN A SEPARATE CASE AND MOUNTING IT ALONGSIDE THE DCU. THERE WILL BE NO SIGNIFICANT MODIFICATION IN THE POWER SUPPLY TO CARRY THE POWER DRAIN OF THE ADDED MEMORY, SINCE THE MEMORY WILL BE MODIFIED TO 2 16K X 24 BITS MEMORIES AND ONE WILL ALWAYS BE IN STANDBY. THE DIGS COMPUTER IS OFF-THE-SHELF PRODUCTION COMPUTER THAT IS BEING USED ON THE DELTA LAUNCH VEHICLE IT HAS TO PRESENT 8 SUCCESSFUL FLIGHTS. THE COMPUTER MEMORY IS RANDOM ACCESS NON-VOLATILE MAGNETIC CORES. UNIT PRESENT MISSION LIFE ONBOARD THE DELTA IS 90 MINUTES. UNIT REQUIRES CONDITIONED COOLED AIR DURING PRELAUNCH OPERATIONS. UNIT IS THE MAIN COMPUTER ONBOARD THE DELTA, IT IS COUPLED TO THE DELTA IMU, AND PREFORMS ALL OF THE GUIDANCE NAVIGATION AND CONTROL COMPUTATIONS FUNCTIONS DURING FLIGHT.
REF. MDAC SPECIFICATION DOCUMENT 1882218 GUIDANCE COMPUTER, DIGS AND LETTER OF SEPTEMBER 20 1973. FROM MR. JAMES E. FITHIAN.

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

COMP 28 TDY-310 CENTAUR TELEDYNE P/N 7516288

DESIGN OPERATING CASE TEMPERATURE	253. TO 333. DEG. K
	(-4. TO 140. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	219. TO 344. DEG. K
	(-65. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	243. TO 343. DEG. K
	(-22. TO 158. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 343. DEG. K
	(-22. TO 158. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	38.9 * WIDTH 35.3 * HEIGHT 24.9 CENTIMETERS
LENGTH	15.3 * WIDTH 13.9 * HEIGHT 9.8 INCHES
PACKAGE AREA	6436.5 SQ. CENTIMETERS * 997.7 SQ. INCHES
PACKAGE VOLUME	34153.4 CU. CENTIMETERS * 2084.2 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	8.1 KILOGRAMS * 17.8 POUNDS
TOTAL WEIGHT	28.1 KILOGRAMS * 62.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.25 * EMISSIVITY = 0.92
INPUT STEADY STATE POWER	235.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE TDY-310 IS THE GUIDANCE COMPUTER ONBOARD THE CENTAUR LAUNCH VEHICLE. UNIT IS DESIGN FOR A PASSIVE THERMAL CONTROL IN SPACE BY DISSIPATING HEAT BY RADIATION AND CONDUCTION AND AN ACTIVE CONTROL ON THE GROUND BY REQUIRING AIR CONDITION AIR FOR CONVECTIVE COOLING. UNIT IS PAINTED WITH A WHITE PAINT S-13G, BUT CAN BE FIN ISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS COUPLED TO THE CENTAUR IMU. ABOVE UNIT IS A 16K X 24 BITS CORE MEMORY COMPUTER.

THE TDY-310 CENTARU COMPUTER IS DESIGN AND BUILT BY
TELEDYNE SYSTEMS COMPANY
19601 NORDHOFF ST. NORTHRIDGE, CALIFORNIA 91324
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR JAMES E. FITHIAN PHONE 213-886-2211 EXTENSION 2544
THE TDY-310 CENTAUR COMPUTER IS A 16K X 24 BIT WORDS CORE MEMORY COMPUTER. THE UNIT CAN BE EXPANDED TO 32K BY REMOVING THE POWER SUPPLY AND ADDING ANOTHER 16K MEMORY MODULE IN ITS PLACE. THE POW ER SUPPLY WOULD THEN BE MOUNTED WITHIN A SEPERATE CHASSIS ALONG-SIDE THE DCU. THERE IS NO SIGNIFICANT MODIFICATION TO THE POWER SUPPLY NEEDED TO CARRY THE POWER DRAIN OF THE ADDED MEMORY, SINCE ONE OF THE TWO MEMORIES WILL ALWAYS BE IN STANDBY. UNIT IS AN OFF-THE-SHELF, AND IN PRODUCTION AND HAD SEVERAL FLIGHTS ONBOARD THE CENTAUR. THE COMPUTER CONTAIN 16K X24 BITS RANDOM ACCESS MEMORY, ARITHMETIC SECTION, TIMING AND CONTROL SECTION, I/O SECTION AND POWER SUPPLY. THE CENTAUR COMPUTER IS COUPLED TO THE CENTAUR IMU AND PREFORM ALL THE GUIDANCE NAVIGATION AND CONTROL COMPUTATION ONBOARD THE CENTAUR. UNIT REQUIRES AIR CONDITIONED AIR DURING GROUND OPERATIONS. UNIT PRESENT LIFE MISSION ONBOARD CENTAUR IS 7 HRS POST THERMAL STABILIZATION.
REF. TELEDYNE INTERFACE CONTROL DOCUMENT 7516289, CENTAUR COMPUTER UNIT, AND LETTER OF SEPTEMBER 20 1973 FROM MR JAMES E. FITHIAN.

AVIONICS SYSTEM

DATA MANAGEMENT SUBSYSTEM

COMP 29 SKC2000 COMPUTER SINGER COMPANY

DESIGN OPERATING CASE TEMPERATURE	218. TO 344. DEG. K (-67. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	211. TO 373. DEG. K (-80. TO 212. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	218. TO 344. DEG. K (-67. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	218. TO 344. DEG. K (-67. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 55.9 * WIDTH 25.4 * HEIGHT 17.8	CENTIMETERS
LENGTH 22.0 * WIDTH 10.0 * HEIGHT 7.0	INCHES
PACKAGE AREA	5729.0 SQ. CENTIMETERS * 888.0 SQ. INCHES
PACKAGE VOLUME	25236.1 CU. CENTIMETERS * 1540.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	4.5 KILOGRAMS * 10.0 POUNDS
TOTAL WEIGHT	45.4 KILOGRAMS * 100.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	800.0 WATTS ** 28 VDC AND 115 VAC 400 HZ
OUTPUT POWER	10.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON

THE SKC-2000 IS DESIGN FOR AIRCRAFT USE IT HAS AN ACTIVE THERMAL CONTROL OF CONDUCTION AND FORCED AIR COOLING, UNIT COULD BE MODIFIED FOR A PASSIVE COOLING SYSTEM. ABOVE POWER IS BASED ON THE B1 COMPUTER APPLICATIONS AND IT INCLUDES SPECIAL B1 TYPE I/O WHICH IS APPROX. 100 WATTS OF DISSIPATED POWER. UNIT IS A 32K WORD CORE MEMORY COMPUTER. UNIT SURFACES ARE ANODIZED ALUMINUM THAT ARE PAINTED BLACK, OR PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS IN 2 BOXES

THE SKC-2000 ADVANCED DIGITAL COMPUTER IS DESIGN AND BUILT BY THE SINGER COMPANY, KEARFOTT DIVISION
1150 MCBRIDE AVENUE, LITTLE FALLS, NEW JERSEY 07424
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. T. R. MAHONEY AND PHONE 214-252-7423 EXTENSION
MR. M. GUBERMAN PHONE 201 256-4000 EXTENSION 5377
THE SKC-2000 COMPUTER IS A GENERAL PURPOSE AIRBORNE DIGITAL COMPUTER. UNIT IS MODULAR IN DESIGN AND CAN VARY IN MEMORY SIZE FROM 8K TO 131K WORDS MEMORY. THE ABOVE DATA IS BASED ON A SKC-2000 COMPUTER WITH THE FOLLOWING COMPONENTS, A CPU,DATA CONTROL BUS, 32K X 32 BIT LSI CORE MEMORY UNIT, 115V 400 HZ AND 28 VDC POWER SUPPLY AND SPECIAL B1 I/O. THE UNIT IS PACKAGED IN 2 BOXES. THE SKC-2000 IS DESIGN TO MEET MIL-E-5400 CLASS 2X. UNIT IS BEING USED ON SEVERAL PROGRAMS INCLUDING THE USAF B-1 ASIC PROGRAM-CENTRAL AVIONICS SYSTEM PROCESSOR, THE USAF/INT/U.S. (AN/AYK-13) ADVANCED NAVIGATION SYSTEMS PROGRAM AND NASA JSC- MULTI-COMPUTER SYSTEMS FUTURE SPACE PROGRAMS .

REF. SINGER BROCHURE PD-408-A SKC-2000 ADVANCED DIGITAL COMPUTER AND LETTER AND DATA SHEETS OF 3 OCTOBER 1973 FROM MR. T.R. MAHONEY

AVIONICS SYSTEM
DATA MANAGEMENT SUBSYSTEM

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TR 1 EREP TAPE RECORDER MARTIN MARIETTA P/N PD8300140-010

DESIGN OPERATING CASE TEMPERATURE	289. TO 314. DEG. K (60. TO 105. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	278. TO 314. DEG. K (40. TO 105. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	278. TO 305. DEG. K (40. TO 90. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	278. TO 305. DEG. K (40. TO 90. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 47.0 * WIDTH 38.1 * HEIGHT 30.5 CENTIMETERS	
LENGTH 18.5 * WIDTH 15.0 * HEIGHT 12.0 INCHES	
PACKAGE AREA	8767.7 SQ. CENTIMETERS * 1359.0 SQ. INCHES
PACKAGE VOLUME	54568.9 CU. CENTIMETERS * 3330.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	10.2 KILOGRAMS * 22.5 POUNDS
TOTAL WEIGHT	40.8 KILOGRAMS * 90.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.85 * EMISSIVITY = 0.50
INPUT STEADY STATE POWER	187.0 WATTS ** 28 VDC POWER SOURCE
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE EREP TAPE RECORDER WAS BUILT FOR THE SKYLAB PROGRAM. THE UNIT IS ONBOARD THE SKYLAB AND UTILIZES THE EREP COOLANT LOOP FOR ITS THERMAL CONTROL. THE UNIT IS PAINTED WITH A GRAY PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT HAS A POWER DISSIPATION OF 35 WATTS IN STANDBY MODE,173 WATTS IN SLOW SPEED RECORD, AND 187 WATTS FOR HIGH SPEED RECORD.

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THE EREP DATA TAPE RECORDER IS DESIGN AND BUILT BY
MARTIN MARIETTA CORPORATION DENVER DIVISION
P.O. BOX 179 DENVER COLORADO 80201
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. PAUL BUTTLER PHONE 303-794-5211 EXTENSION 4593
THE EREP TAPE RECORDER IS A 28 TRACK MACHINE WITH 1.2 MEGA-BITS OF DATA PER CHANNEL. THE UNIT IS FLYING ONBOARD THE SKYLAB AND IS THE MAIN DATA RECORDER FOR EREP ONBOARD SKYLAB. THE UNIT HAS A TWO SPEED RECORDING CAPABILITY SLOW SPEED 17.8 CM/SEC (7 IN/SEC) AND HIGH SPEED OF 152.4 CM/SEC (60 IN/SEC). THE RECORDER ELECTRONICS IS BUILT BY AMPEX COMPANY AND THE UNIT IS PACKAGED FOR SKYLAB BY MARTIN MARIETTA CORP. DENVER DIVISION. THE RECORDER ITSELF CAN WITHSTAND TEMPERATURE OF 70 DEG C (160 DEG F),ITS THE MAGNETIC TAPE THAT LIMITS THE OPERATING TEMPERATURE TO 40.6 DEG C(105 DEG. F).

REF. PD8300140 EREP MAGNETIC TAPE RECORDER.

EQUIPMENT ITEM		QUANITY	WEIGHT (POUNDS) UNIT	WEIGHT (POUNDS) TOTAL	POWER (WATTS)	VOLUME (CU FT.)
TRANSPONDER,PM	*	2	16.	32.	36.	.70
TRANSMITTER,FM	*	2	23.	46.	60.	.70
POWER AMPLIFIER	*	2	12.	24.	127.	.50
HYBRID JUNCTION		1	4.	4.	0.	.02
RF MULTIPLEXER		1	4.	4.	0.	.01
FILTER		1	4.	4.	0.	.01
DECODER	*	2	1.5	3.	2.	.54
MODULATION PROCESSER		2	14.	28.	15.	.30
OMNI ANTENNAS		4	2.5	10.	0.	
TOTAL				155.	239.	2.78

NOTES * REDUNDANT

TIMELINES

CONTINUOUS OPERATION OF SUBSYSTEM FROM 3.91 HOURS TO 98.60 HOURS.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

TPM 1 S-BAND TRANSPONDER PHILCO FORD CORP P/N PD6400439-040

DESIGN OPERATING CASE TEMPERATURE	241. TO 325. DEG. K (-25. TO 125. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 396. DEG. K (-35. TO 254. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 311. DEG. K (0. TO 100. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	241. TO 325. DEG. K (-25. TO 125. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 27.4 * WIDTH 6.3 * HEIGHT 12.7 CENTIMETERS	
LENGTH 10.8 * WIDTH 2.5 * HEIGHT 5.0 INCHES	
PACKAGE AREA	1206.4 SQ. CENTIMETERS * 187.0 SQ. INCHES
PACKAGE VOLUME	2212.3 CU. CENTIMETERS * 135.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.9 KILOGRAMS * 1.9 POUNDS
TOTAL WEIGHT	1.7 KILOGRAMS * 3.8 POUNDS
SURFACE PROPERTIES	ALPHA = 0.85 * EMISSIVITY = 0.85
INPUT STEADY STATE POWER	6.4 WATTS **
OUTPUT POWER	0.2 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE S-BAND TRANSPONDER IS DESIGN FOR THE VIKING PROGRAM. IT HAS A PASSIVE THERMAL DESIGN OF CONDUCTION TO MOUNTING SURFACES AND RADIATION TO THE ENVIRONMENT. UNIT IS ASSUMED TO BE PAINTED BLACK FOR SPACE TUG ALTHOUGH FOR VIKING IT IS VACUUM GOLD PLATED. THERE ARE NO CABLE LIMITATIONS ON THIS UNIT, AND UNIT HAS NO WARM UP REQ IREMENTS.

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THE STDN S-BAND TRANSPONDER IS DESIGN AND BUILT BY PHILCO-FORD CORPORATION WESTERN DEVELOPMENT LABORATORIES DIVISION 3939 FABIAN WAY PALO ALTO, CALIFORNIA 94303
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. T.E. WATSON AND PHONE 303-794-5211 EXTENSION 4841
MR. B.HARNEL PHONE 303-794 5211 EXTENSION 2103
THE STDN S-BAND TRANSPONDER IS BUILT FOR THE VIKING PROGRAM AND WILL BE USED ON THE VIKING LANDER. UNIT IS COUPLED TO AN S-BAND AMPLIFIER BY CABLES, AND IS MOUNTED ON THE EQUIPMENT RACK IN THE VIKING LANDER. UNIT FIRST FLIGHT IS EXPECTED IN OCTOBER OF 1975.

REF. VIKING COMMUNICATION DOCUMENT PD6400439

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

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TPM 2 S-BAND SGLS TRANSP MOTOROLA INC. MSR-101/MST-201

DESIGN OPERATING CASE TEMPERATURE	243. TO 353. DEG. K (-22. TO 176. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 363. DEG. K (-40. TO 194. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 10.9 * WIDTH 7.4 * HEIGHT	7.9 CENTIMETERS
LENGTH 4.3 * WIDTH 2.9 * HEIGHT	3.1 INCHES
PACKAGE AREA	448.9 SQ. CENTIMETERS * 69.6 SQ. INCHES
PACKAGE VOLUME	633.5 CU. CENTIMETERS * 38.7 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.4 KILOGRAMS * .8 POUNDS
TOTAL WEIGHT	1.4 KILOGRAMS * 3.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	2.8 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE MSR-101 S-BAND RECEIVER IS PART OF S-BAND SGLS TRANSPONDER. UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION TO MOUNTING POINTS AND RADIATION FROM CASE SURFACES. UNIT IS PAINTED WITH BLACK PAINT. BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT HAS A STANDBY INPUT POWER MODE OF 0.9 WATT. THE MSR-101 IS THE RECEIVER/DEMODULATOR UNIT OF THE TRANSPONDER AND THE MST-201 OR MST-501 ARE THE TRANSMITTER/BASEBAND UNIT OF THE TRANSP

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THE MSR-101/MST-201 SIMPLIFIED S-BAND SGLS TRANSPONDER IS DESIGN AND BUILT BY MOTOROLA INC. GOVERNMENT ELECTRONICS DIVISION 8201 E. MCDOWELL ROAD. SCOTTSDALE, ARIZONA 85252
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. C.L. MAVITY PHONE 602-949-2471 EXTENSION
THE MSR-101 IS A RECEIVER/DEMODULATOR THAT IS PART OF EITHER THE MSR-101/MST-201 OR MSR-101/MST-501 S-BAND SGLS TRANSPONDER. THE TRANSPONDER RECEIVER/DEMODULATOR IS PACKAGED IN ONE UNIT. THE RECEIVER/DEMODULATOR UNIT IS AN S-BAND, DUAL-CONVERSION, PM RECEIVER DESIGNED TO DEMODULATE UP-LINK COMMANDS AND PRN RANGING CODE. THE RECEIVER HAS A THREE-LINE DIGITAL OUTPUT AND A READ-SYNC PULSE OUTPUT. THE RECEIVER RF INPUT FREQUENCY IS 1750 TO 1850 MHZ WITH A RANGE OF +100 TO -100 KHZ FROM ASSIGNED FREQUENCY. THE POWER INPUT FOR THE RECEIVER IS 22 TO 32 VDC. THE TRASPONDER COMBINED WEIGHT OF BOTH RECEIVER AND TRANSMITTER IS 2.7 KG (6.1 LB). UNIT IS DESIGNED FOR USE FOR USE IN EARTH-ORBITING SPACE MISSIONS. UNIT IS DESIGN WITH A REVERSE POLARITY PROTECTION OF 35 VDC MAX, DC POWER RETURN ISOLATION FROM CASE AND THE UNIT IS HERMETICLY SEALED.

REF. DATA SHEETS ON MSR-101/MST-201 SIMPLIFIED S-BAND SGLS TRANSPONDER BY MOTOROLA GOVERNMENT ELEVTRONICS DIVISION.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

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TPM 3 S-BAND SGLS TRANSP MOTOROLA INC. MSR-101/MST-201

DESIGN OPERATING CASE TEMPERATURE	243. TO 353. DEG. K (-22. TO 176. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 363. DEG. K (-40. TO 194. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 11.4 * WIDTH 8.4 * HEIGHT	8.4 CENTIMETERS
LENGTH 4.5 * WIDTH 3.3 * HEIGHT	3.3 INCHES
PACKAGE AREA	523.7 SQ. CENTIMETERS * 81.2 SQ. INCHES
PACKAGE VOLUME	803.0 CU. CENTIMETERS * 49.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.4 KILOGRAMS * .8 POUNDS
TOTAL WEIGHT	1.4 KILOGRAMS * 3.1 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	33.6 WATTS **AT 28 VDC AND 1.2 AMP,MAX
OUTPUT POWER	2.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON

THE MST-201 S-BAND TRANSMITTER IS PART OF THE S-BAND SGLS TRANSPON DER. UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION THE MOUNTING POINTS AND RADIATION FROM CASE SURFACES. UNIT IS PAIN ED WITH BLACK PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIR EMENTS. UNIT IS DESIGN FOR SPACE ENVIRONMENT. ITS INPUT POWER REQUIREMENTS IS 22 TO 32 VDC AND 1.2 AMP.,MAXIMUM INPUT CURRENT. UNIT IS COUPLED TO THE MSR-101 RECEIVER.

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THE MSR-101/MST-201 SIMPLIFIED S-BAND SGLS TRANSPONDER IS DE- SIGN AND BUILT BY MOTOROLA INC. GOVERNMENT ELECTRONICS DIVISION 8201 E. MCDOWELL ROAD, SCOTTSDALE, ARIZONA 85252
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. C. L. MAVITY PHONE 602-949-2471 EXTENSION
THE MST-201 TRANSMITTER/BASEBAND UNIT IS COMPRISED OF A BASEBAND ASSEMBLY AND A TRANSMITTER ASSEMBLY. THE BASEBAND ASSEMBLY IS A MEDIUM-FREQUENCY, LOW POWER PROCESSOR CAPABLE OF ACCEPTING 2 PCM SIGNALS ONE PCM SIGNAL BI-PHASE MODULATES A 1.024 MHZ SUBCARRIER THE SECOND (OPTIONAL) PCM SIGNAL BI-PHASE MODULATES A 1.7 MHZ SUB- CARRIER. THE PRN RANGING SIGNAL IS SUMMED WITH THE MODULATED SUB- CARRIER TO PRODUCE A COMPOSITE SIGNAL WHICH IS USED TO MODULATE THE TRANSMITTER. THE TRANSMITTER ASSEMBLY IS A PM-TYPE TRANSMIT- TER THAT ACCEPTS A 100 HZ TO 2MHZ COMPOSITE SIGNAL FROM THE BASE- BAND ASSEMBLY AND PHASE MODULATES AN S-BAND CARRIER FOR DOWN-LINK DATA TRANSMISSION. TRANSMITTER FREQUENCY IS 2200 TO 2300 MHZ. UNIT IS AN HERMETICLY SEALED UNIT AND IS DESIGN WITH REVERSE POLAR ITY PROTECTION OF 35 VDC MAX, ISOLATION OF DR POWER RETURN FROM CASE AND LOAD ISOLATION OF TRANSMITTER OUTPUT TO PREVENT DAMAGE FROM OPEN,OR SHORT CIRCUIT CONDITIONS.
REF. DATA SHEET ON MSR-101/MST-201 SIMPLIFIED S-BAND SGLS TRANS- PONDER BY MOTOROLA GOVERNMENT ELECTRONICS DIVISION.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

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TPM 4 S-BAND SGLS TRANSP MOTOROLA INC. MSR-101/MST-501

DESIGN OPERATING CASE TEMPERATURE	243. TO 353. DEG. K (-22. TO 176. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 363. DEG. K (-40. TO 194. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 11.4 * WIDTH 8.4 * HEIGHT 8.4 CENTIMETERS	
LENGTH 4.5 * WIDTH 3.3 * HEIGHT 3.3 INCHES	
PACKAGE AREA	523.7 SQ. CENTIMETERS * 81.2 SQ. INCHES
PACKAGE VOLUME	803.0 CU. CENTIMETERS * 49.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.4 KILOGRAMS * .8 POUNDS
TOTAL WEIGHT	1.4 KILOGRAMS * 3.1 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	56. WATTS **AT 28 VDC AND 2.0 AMP,MAX
OUTPUT POWER	5.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON

THE MST-501 S-BAND TRANSMITTER IS PART OF THE S-BAND SGLS TRANSPONDER. UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION TO MOUNTING POINTS AND RADIATION FROM CASE SURFACES. UNIT IS PAINTED WITH BLACK PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS DESIGN FOR SPACE ENVIRONMENT. ITS INPUT POWER REQUIREMENTS IS 22 TO 32 VDC AND 2.0 AMP., MAXIMUM INPUT CURRENT. UNIT IS COUPLED TO THE MSR-101 RECEIVER.

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THE MSR-101/MST-501 SIMPLIFIED S-BAND SGLS TRANSPONDER IS DESIGN AND BUILT BY MOTOROLA INC. GOVERNMENT ELECTRONICS DIVISION 8201 E. MCDOWELL ROAD, SCOTTSDALE, ARIZONA 85252
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. C.L. MAVITY PHONE 602-949-2471 EXTENSION
THE MST-501 TRANSMITTER/BASEBAND UNIT IS AN IDENTICAL UNIT TO THE MST-201 TRANSMITTER THE ONLY DIFFERANCE IN THE UNITS IS THE MST-501 HAS A 5 WATTS RF POWER OUTPUT AND THE MST-201 HAS A 2 WATTS RF POWER OUTPUT, FOR MORE DETAILED DISCUSSION REFER TO MST-201 TRANSMITTER.

REF. DATA SHEET ON MSR-101/MIT-501 SIMPLIFIED S-BAND SGLS TRANSPONDER BY MOTOROLA GOVERNMENT ELECTRONICS DIVISION.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

TPM 5 MSX-201S S-BAND MOTOROLA INC. SGLS TRANSPONDER

DESIGN OPERATING CASE TEMPERATURE	243. TO 353. DEG. K (-22. TO 176. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 363. DEG. K (-40. TO 194. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	10.9 * WIDTH 14.7 * HEIGHT 8.4 CENTIMETERS
LENGTH	4.3 * WIDTH 5.8 * HEIGHT 3.3 INCHES
PACKAGE AREA	751.9 SQ. CENTIMETERS * 116.5 SQ. INCHES
PACKAGE VOLUME	1348.7 CU. CENTIMETERS * 82.3 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.5 KILOGRAMS * 1.2 POUNDS
TOTAL WEIGHT	2.2 KILOGRAMS * 4.9 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	36.4 WATTS **AT 28 VDC
OUTPUT POWER	2.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE MSX-201S TRANSPONDER IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION TO THE BOTTOM SURFACE AND MOUNITNGS, AND RADIATION FROM THE OTHER SURFACES. UNIT IS PAINTED WITH A BLACK PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS IN ENGINEERING STAGE AND WILL REQUIRE SOME FURTHER WORK BEFORE IT IS READY FOR PRODUCTION. UNIT IS A SINGLE PACKAGE OF THE MSR-101/MST-201 TRANSPONDER. THE MSX-201S IS PACKAGED IN A SEALED CASE.

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THE MSX-201S SIMPLIFIED S-BAND SGLS TRANPONDER IS DESIGN AND BUILT BY MOTOROLA INC. GOVERNMENT ELECTRONICS DIVISION
8201 E. MCDOWELL ROAD, SCOTTSDALE, ARIZONA 85252
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. C.L. MAVITY PHONE 602-949-2471 EXTENSION
THE MSX-201S TRANSPONDER IS BASICLLY THE MSR-101/MST-201 TRANSPONDER PACKAGED IN A SINGLE CASE RATHER THEN TWO CASES. UNIT IS IN ENGINEERING DEVELOPMENT AND WOULD REQUIRE SOME ENGINEERING PRIOR TO BE MANUFACTURED. THE PACKAGE CONFIGURATION IS NOW BEING USED FOR OTHER EQUIPMENT WITH SIMILAR FUNCTIONAL CHARACTERISTICS. UNIT INPUT POWER IS THE SUMMATION OF THE RECEIVER OPERATING INPUT POWER OF 2.8 WATTS AND THE TRANSMITTER INPUT POWER OF 33.6 WATTS AT 28 VDC AND 1.2 AMPS MAXIMUM. FOR FURTHER INFORMATION SEE DATA ON MSR-101/MST-201 THE MSX-201S S-BAND TRANSPONDER IS IDENTICAL TO THE MSR-101/MST-201 TRANSPONDER THE ONLY DIFFERANCE IS THE MSX-201 IS A SINGLE PACKAGE UNIT WHERE THE MSR-101/MST-201 TRANSPONDER HAS TWO PACKAGES SEPERATING THE RECEIVER AND TRANSMITTER.

REF. DATA SHEET BY MOTOROLA INC. ON MSX-201S SIMPLIFIED S-BAND SGLS TRANSPONDER- E1038

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

TPM 6 MSX-501S S-BAND MOTOROLA INC. SGLS TRANPSONDER

DESIGN OPERATING CASE TEMPERATURE	243. TO 353. DEG. K (-22. TO 176. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 363. DEG. K (-40. TO 194. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 10.9 * WIDTH 14.7 * HEIGHT	8.4 CENTIMETERS
LENGTH 4.3 * WIDTH 5.8 * HEIGHT	3.3 INCHES
PACKAGE AREA	751.9 SQ. CENTIMETERS * 116.5 SQ. INCHES
PACKAGE VOLUME	1348.7 CU. CENTIMETERS * 82.3 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.5 KILOGRAMS * 1.2 POUNDS
TOTAL WEIGHT	2.2 KILOGRAMS * 4.9 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	58.8 WATTS **AT 28 VDC
OUTPUT POWER	5.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE MSX-501S TRANSPONDER IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION TO THE BOTTOM SURFACE AND MOUNTINGS, AND RADIATION FROM THE OTHER SURFACES. UNIT IS PAINTED WITH A BLACK PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS IN ENGIN EERING STAGE AND WILL REQUIRE SOME FURTHER WORK BEFORE UNIT IS READY FOR PRODUCTION. THE MSX-501S IS PACKAGED IN A SEALED UNIT.

THE MSX-501S SIMPLIFIED S-BAND SGLS TRANPONDER IS DESIGN AND BUILT BY MOTOROLA INC. GOVERNMENT ELECTRONICS DIVISION
8201 E. MCDOWELL ROAD, SCOTTSDALE, ARIZONA 85252
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. C.L. MAVITY PHONE 602-949-2471 EXTENSION
THE MSX-5013 TRANSPONDER IS IDENTICAL TO THE MSX-201S TRANSPONDER THE ONLY EXCEPTION IS THE MSX-501S HAS A 5 WATTS RF POWER OUTPUT WHERE AS THE MSX-201S HAS A 2 WATTS RF POWER OUTPUT. UNIT IS IN ENGINEERING STAGE AND WILL REQUIRE SOME FUTHER ENGINEERING WORK BEFORE ACHIEVING PRODUCTION STATUS. THE UNIT INPUT POWER IS THE SUMMATION OF THE RECFIVER INPUT POWER OF 2.8 WATTS AND THE TRANSMITTER INPUT POWER OF 56 WATTS AT 25 VDC AND 2.0 AMPS MAXIMUM CURRENT. THIS UNIT IS IDENTICAL TO THE MSR-101/MST-501 TRANSPOND- ER ONLY DIFFERENCE IS THAT THIS UNIT WILL BE PACKAGED IN A SINGLE CASE WHERE THE MSR-101/MST-501 HAS INDIVIDUAL CASES FOR THE RECEIV ER AND TRANSMITTER. FOR FURTHER INFORMATION ON THE MSX-501S SEE THE MSR-101/MST-501 S-BAND TRANSPONDER.

REF. DATA SHEET BY MOTOROLA INC. ON MSX-201S SIMPLIFIED S-BAND SGLS TRANSPONDER-103B

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

TPM 7 TR-36 TRANSPONDER CUBIC CORPORATION RECEIVER

DESIGN OPERATING CASE TEMPERATURE	239. TO 344. DEG. K (-30. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 344. DEG. K (-40. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	250. TO 333. DEG. K (-10. TO 140. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	239. TO 344. DEG. K (-30. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	16.0 * WIDTH 26.4 * HEIGHT 5.6 CENTIMETERS
LENGTH	6.3 * WIDTH 10.4 * HEIGHT 2.2 INCHES
PACKAGE AREA	1319.5 SQ. CENTIMETERS * 204.5 SQ. INCHES
PACKAGE VOLUME	2362.1 CU. CENTIMETERS * 144.1 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.5 KILOGRAMS * 1.0 POUNDS
TOTAL WEIGHT	2.3 KILOGRAMS * 5.1 POUNDS
SURFACE PROPERTIES	ALPHA = 0.900 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	6.5 WATTS ** 28 VDC AND 225 MA
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE TR-36 S-BAND SGLS TRANPSONDER IS BUILT FROM 4 SEPARATE UNITS RECEIVER, TRANSMITTER, MULTICOUPLER AND BASEBAND ASSEMBLY. THE RECEIVER HAS PASSIVE COOLING BY CONDUCTION THRU MOUNTING SURFACE, AND RADIATION FROM REST OF SURFACES. UNIT IS BUILT IN A SEALED CASE AND IS PAINTED BLACK BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SPACE QUALIFIED AND IS USED ON USAF PROGRAM.

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THE TR-36 SGLS TRANSPONDER (RECEIVER) IS DESIGN AND BUILT BY CUBIC CORPORATION
9233 BALBOA AVENUE, SAN DIEGO, CALIFORNIA 92123
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. R. M. TEMPELTON PHONE 714-277-6780 EXTENSION
THE TR-36 TRANSPONDER SET CONSISTS OF FOUR INDEPENDENT UNITS INTER CONNECTED TO PROVIDE FULL CAPABILITY FOR A USAF SPACE GROUND LINK SYSTEM (SGLS) CONCEPT. THE UNITS ARE A RECEIVER, TRANSMITTER, BASEBAND ASSEMBLY AND MULTICOUPLER. UNIT INPUT POWER IS 22 TO 33 VDC AND A NOMINAL CURRENT OF 225 MA. UNIT MEETS MIL-STD 826A. THE RECIEVER IS TUNED TO 1750-1850 MHZ BAND WITH PHASE LOCKED LOOP THRESHOLD OF -124DBM. IT PROVIDES CROSS STRAPPED COHERENT DRIVE OUTPUTS WHICH SWITCHES TRANSMITTER FROM NON-COHERENT TO COHERENT MODE OF OPERATION. AT INPUT SIGNALS OF -90 DBM AND ABOVE DIGITAL COMMAND SIGNALS ARE PROVIDED WITH BIT ERROR RATE OF 1 IN 10E6 SYMBOLS. THESE ARE PRESENT IN THE RECIEVED SIGNAL AS FSK-MODULATED 65 76,95, KHZ SUBCARRIERS. THE SUBCARRIERS ARE AM MODULATED BY THE CLOCK FREQ. AND RECOVERED IN THE OUTPUT AS READ PULSES. CROSS STRAPPED PRN OUTPUTS ARE PROVIDED WHICH ACCOMODATE A 500 KHZ RANGING DATA CLOCK. THE PRN DATA IS ROUTED FROM THE RECIEVER, THROUGH THE BASEBAND TO THE TRANSMITTER PHASE MODULATOR.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM
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TPM 7 TR-36 TRANSPONDER CUBIC CORPORATION TRANSMITTER

DESIGN OPERATING CASE TEMPERATURE	239. TO 344. DEG. K (-30. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 344. DEG. K (-40. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	250. TO 333. DEG. K (-10. TO 140. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	239. TO 344. DEG. K (-30. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 21.8 * WIDTH 13.0 * HEIGHT	5.1 CENTIMETERS
LENGTH 8.6 * WIDTH 5.1 * HEIGHT	2.0 INCHES
PACKAGE AREA	919.5 SQ. CENTIMETERS * 142.5 SQ. INCHES
PACKAGE VOLUME	1437.5 CU. CENTIMETERS * 87.7 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.2 KILOGRAMS * .5 POUNDS
TOTAL WEIGHT	1.8 KILOGRAMS * 4.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.900 * EMISSIVITY = 0.900
INPUT STEADY STATE POWER	28.0 WATTS ** 900 MA AT 28 VDC.
OUTPUT POWER	3.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE TRANSMITTER OF THE TR-36 TRANSPONDER IS DESIGN WITH A PASSIVE THERMAL CONTROL. COOLING IS BY CONDUCTION THROUGH BASE PLATE AND RADIATION FROM OTHER SURFACES. UNIT IS BUILT IN A SEALED CASE AND IS PAINTED BLACK, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SPACE QUALIFIED AND IS USED ON A USAF PROGRAM

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THE TR-36 SGLS TRANSPONDER (TRANSMITTER) IS DESIGN AND BUILT BY CUBIC CORPORATION
9233 BALBOA AVENUE, SAN DEIGO, CALIFORNIA 92123
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. R. M. TEMPLETON PHONE 714-277-6780 EXTENSION
THE TR-36 TRANSPONDER SET CONSIST OF FOUR INDEPENDENT UNITS INTERCONNECTED TO PROVIDE FULL CAPABILITY OF THE USAF SPACE GROUND LINK SYSTEM(SGLS) CONCEPT. THE TR-36 TRANSPONDER INCLUDES A RECEIVER, TRANSMITTER,BASEBAND ASSEMBLY, AND MULTICOUPLER. TRANSMITTER HAS AN INPUT POWER OF 22 TO 33 VDC AND 900 MA NOMINAL CURRENT. UNIT HAS A NOMINAL OUTPUT POWER OF 3 WATTS. UNIT IS PROTECTED FROM DAMAGE AT ANY VOLTAGE BELOW 22 VDC. THE TRANSMITTER PHASE MODULATES THE COMPOSITE SIGNAL ON A CARRIER IN THE 2200-2300MHZ BAND. THE OUTPUT OF THE TRANSMITTER IS A NOMINAL 3 WATTS WITH A MINIMUM OF 2 WATTS UNDER WORST POSSIBLE CONDITIONS. TWO COHERENT DRIVE INPUTS ARE PROVIDED FOR CROSS STRAPPING BETWEEN TRANSPONDER SETS.
REF. TECHNICAL DATA SHEETS ON MODEL TR-36 SGLS TRANSPONDER BY CUBIC CORPORATION.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

TPM 7 TR-36 TRANSPONDER CUBIC CORPORATION BASEBAND ASSEMBLY

DESIGN OPERATING CASE TEMPERATURE	239. TO 344. DEG. K (-30. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 344. DEG. K (-40. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	250. TO 333. DEG. K (-10. TO 140. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	239. TO 344. DEG. K (-30. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 23.1 * WIDTH 10.2 * HEIGHT	6.3 CENTIMETERS
LENGTH 9.1 * WIDTH 4.0 * HEIGHT	2.5 INCHES
PACKAGE AREA	892.3 SQ. CENTIMETERS * 138.3 SQ. INCHES
PACKAGE VOLUME	1491.2 CU. CENTIMETERS * 91.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.2 KILOGRAMS * .5 POUNDS
TOTAL WEIGHT	1.3 KILOGRAMS * 2.8 POUNDS
SURFACE PROPERTIES	ALPHA = 0.900 * EMISSIVITY = 0.900
INPUT STEADY STATE POWER	4.5 WATTS **150 MA AT 28 VDC
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE BASEBAND ASSEBLY OF THE TR-36 TRANSPONDER IS DESIGN WITH A PAS SIVE THERMAL CONTROL. UNIT IS COOLED BY CONDUCTION THROUGH MOUNTING SURFACE AND RADIATION FROM REMAINING SURFACES. UNIT IS BUILT WITH A SEALED PACKAGE AND IS PAINTED BLACK BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SAPCE QUALIFIED AND IS USED ON A USAF PROGRAM.

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THE TR-36 SGLS TRANSPONDER (BASEBAND) IS DESIGN AND BUILT BY CUBIC CORPORATION
9233 BALBOA AVENUE, SAN DEIGO, CALIFORNIA 92123
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR R. M. TEMPELTON PHONE 714-277-6780 EXTENSION
THE BASEBAND ASSEMBLY IS PART OF THE TR-36 TRANSPONDER SET WHICH CONSIST OF FOUR INDEPENDENT UNITS INTERCONNECTED TO FORM A SGLS TRANSPONDER. THE OTHER UNITS THAT ARE PART OF THE SYSTEM ARE RECEI VER,TRANSMITTER,AND MULTICOUPLER. THE BASEBAND ASSEMBLY UNIT HAS AN INPUT OF 500 KHZ CLOCK SIGNAL PHASE MODULATED BY A PSEUDO-RANDOM NOISE (PRN) CODE SEQUENCE. ITS OUTPUT SIGNAL IS A COMPOSITE RANGING WITH TWO PCM SUBCARRIER CHANNELS OF 1.024 AND 1.700 MHZ. THE BAEBAND INPUT POWER IS A 22 TO 33 VDC AND 150 MA NOMINAL CURRENT. THE BASEBAND RECIEVES PCM DATA TRAINS AND BI-PHASE MODULATES 1.024 AND 1.700 MHZ INTERNALLY GENERATED SUBCARRIER FREQUENCIES. THESE TWO SIGNALS ARE COMBINED WITH THE PRN RANGING SIGNAL AND ROUTED TO THE TRANSMITTER AS A COMPOSITE MODULATION SIGNAL. THE BASEBAND PRN INPUTS ARE PROVIDED TO ACCEPT CROSS STRAPPING BETWEEN TRANSPONDER SETS.

REF. TECHNICAL DATA SHEETS ON MODEL TR-36 SGLS TRANSPONDER BY CUBIC CORPORATION.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

TPM 7 TR-36 TRANSPONDER CUBIC CORPORATION MULTICOUPLER

DESIGN OPERATING CASE TEMPERATURE	239. TO 344. DEG. K (-30. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 344. DEG. K (-40. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	250. TO 333. DEG. K (-10. TO 140. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	239. TO 344. DEG. K (-30. TO 160. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 17.8 * WIDTH 6.1 * HEIGHT	4.8 CENTIMETERS
LENGTH 7.0 * WIDTH 2.4 * HEIGHT	1.9 INCHES
PACKAGE AREA	447.2 SQ. CENTIMETERS * 69.3 SQ. INCHES
PACKAGE VOLUME	523.1 CU. CENTIMETERS * 31.9 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.1 KILOGRAMS * .3 POUNDS
TOTAL WEIGHT	.4 KILOGRAMS * .8 POUNDS
SURFACE PROPERTIES	ALPHA = 0.900 * EMISSIVITY = 0.900
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE MULTICOUPLER OF THE TR-36 TRANSPONDER IS DESIGN WITH A PASSIVE THERMAL CONTROL. UNIT IS COOLED BY CONDUCTION THROUGH MOUNTING SUR FACE AND RADIATION FROM REMAINING SURFACES. UNIT IS BUILT WITH A SEALED CASE AND IS PAINTED BLACK BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SPACE QUALIFIED AND IS USED ON A USAF PROGRAM. UNIT IS BASICALLY A PASSIVE UNIT WITH NO HEAT DISSI- PATION.

THE TR-36 SGLS TRANSPONDER (MULTICOUPLER) IS DESIGN AND BUILT BY CUBIC CORPORATION
9233 BALBOA AVENUE, SAN DEIGO, CALIFORNIA 92123
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. R. M. TEMPELTON PHONE 714-277-6780 EXTENSION
THE MULTICOUPLER IS PART OF THE TR-36 TRANSPONDER SET WHICH CON- SIST OF FOUR INDEPENDENT UNITS THAT ARE INTERCONNECTED. THE MULTICOUPLER IS A PASSIVE UNIT THAT ENABLES TRANSPONDER TO RECEIVE AND TRANSMIT FROM THE SAME ANTENNA. UNIT IS FIXED TUNED TO 1750 TO 1850 MHZ FREQUENCY BAND TO RECEIVE FROM ANTENNA AND IT IS FIXED TUNED TO 2200 TO 2300 MHZ FREQUENCY BAND TO TRANSMIT TO ANTENNA. UNIT IS SPACE QUALIFIED FOR A USAF PROGRAM. FOR FURTHER INFORMAT- ION SEE REFERENCE DOCUMENT.

REF. TECHNICAL DATA SHEETS ON MODEL TR-36 SGLS TRANSPONDER BY CUBIC CORPORATION

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

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ITEM 1 TWTA S-BAND WATKINS- JOHNSON P/N PD6400439-070

DESIGN OPERATING CASE TEMPERATURE	241. TO 325. DEG. K	
	(-25. TO 125. DEG. F)	
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 396. DEG. K	
	(-35. TO 254. DEG. F)	
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 311. DEG. K	
	(0. TO 100. DEG. F)	
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	241. TO 328. DEG. K	
	(-25. TO 130. DEG. F)	
PACKAGE SHAPE	RECTANGULAR	
PACKAGE SIZE * LENGTH 30.5 * WIDTH 11.2 * HEIGHT	15.5 CENTIMETERS	
LENGTH 12.0 * WIDTH 4.4 * HEIGHT	6.1 INCHES	
PACKAGE AREA	1972.1 SQ. CENTIMETERS *	305.7 SQ. INCHES
PACKAGE VOLUME	5277.9 CU. CENTIMETERS *	322.1 CU. INCHES
CASE MATERIAL	ALUMINUM	
CASE WEIGHT	1.8 KILOGRAMS *	4.0 POUNDS
TOTAL WEIGHT	4.4 KILOGRAMS *	9.6 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.85	
INPUT STEADY STATE POWER	82.5 WATTS **	
OUTPUT POWER	22.0 WATTS **	
THERMAL DESIGN	PASSIVE * PASSIVE	

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON

THE TRAVELING WAVE TUBE AMPLIFIER IS AN S-BAND AMPLIFIER USED ON THE VIKING PROGRAM. IT HAS A PASSIVE THERMAL DESIGN OF CONDUCTION TO THE BOTTOM SURFACE AND MOUNTING POINTS AND SOME RADIATION TO SURROUNDING SURFACES AND ENVIRONMENT. UNIT IS PAINTED WITH A BLACK ENAMEL PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT REQUIRE A MAXIMUM OF 2 MINUTES FOR WARM UP PRIOR TO BEING OPERATIONAL.

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THE TRAVELING WAVE TURE AMPLIFIER IS DESIN AND BUILT BY
WATKINS-JOHNSON COMPANY
3333 HILLVIEW AVENUE PALO ALTO, CALIFORNIA 94303
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. T.E. WATSON AND 303-794-5211 EXTENSION 4841
MR.B. HARMEL PHONE 303 794 5211 EXTNESION 2103
THE TWTA IS AN S-BAND AMPLIFIER BUILT FOR THE VIKING PROGRAM AND WILL BE USED ON THE VIKING LANDER. UNIT ANTICIPATED FLIGHT IS OCTOBER 1975. UNIT IS COUPLED TO THE S-BAND TRANSPONDER BY CABLE.

REF. VIKING COMMUNICATION DOCUMENT PD6400439

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

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TFM 2 MTT-201 S-BAND FM MOTOROLA INC.

DESIGN OPERATING CASE TEMPERATURE	243. TO 353. DEG. K (-22. TO 176. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 363. DEG. K (-40. TO 194. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 10.9 * WIDTH 7.4 * HEIGHT	6.6 CENTIMETERS
LENGTH 4.3 * WIDTH 2.9 * HEIGHT	2.6 INCHES
PACKAGE AREA	402.5 SQ. CENTIMETERS * 62.4 SQ. INCHES
PACKAGE VOLUME	531.3 CU. CENTIMETERS * 32.4 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.5 KILOGRAMS * 1.0 POUNDS
TOTAL WEIGHT	1.0 KILOGRAMS * 2.3 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	28.0 WATTS **28 +OR- 4 VDC POWER SUPPLY
OUTPUT POWER	2.8 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON

THE MTT-201 S-BAND TRANSMITTER IS DESIGN WITH A PASSIVE THERMAL DESIGN OF CONDUCTION TO THE BOTTOM SURFACE AND MOUNTINGS, AND RADIATION FROM OTHER SURFACES. THE UNIT IS PAINTED WITH A BLACK PAINT. BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS PACKAGED IN A HERMETICLY SEALED CASE.

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THE MTT-201 S-BAND FM TELEMETRY TRANSMITTER IS DESIGN AND BUILT BY MOTOROLA INC GOVERNMENT ELECTRONICS DIVISION
8201 E. MCDOWELL ROAD, SCOTTSDALE, ARIZONA 85252
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. C. L. MAVITY PHONE 602-949-2471 EXTENSION
THE MTT-201 TRANSMITTER WAS DEVELOPED FOR USE IN MISSILE AND SPACE TELEMETRY APPLICATIONS. UNIT OUTPUT POWER IS 2.8 WATTS NOMINAL WITH 2 WATTS MINIMUM. UNIT INPUT SUPPLY VOLTAGE IS 28 VDC + OR- 4 VDC. AND AN INPUT CURRENT OF 1.0 AMPS MAXIMUM. UNIT IS DESIGN WITH A TRUE FM DC TO 1 MHZ FREQUENCY RESPONSE, A BUILT-IN FERRITE ISOLATOR TO PREVENT DAMAGE BY HIGH VSWR LOADS, A DC ISOLATION OF ALL INPUTS FROM EACH OTHER AND THE CASE, AND A REVERSE POLARITY PROTECTION BY A SERIES OF DIODES TO PROTECT AGAINST REVERSAL OF INPUT VOLTAGE POLARITY. UNIT MEETS ELECTROMAGNETIC COMPATIBILITY MIL-STD-461.

REF. DATA SHEETS MTT-201 S-BAND FM TELEMETRY TRANSMITTER.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

TFM 3 MTT-501 S-BAND FM MOTOROLA INC.

DESIGN OPERATING CASE TEMPERATURE	243. TO 353. DEG. K (-22. TO 176. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 363. DEG. K (-40. TO 194. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	243. TO 353. DEG. K (-22. TO 176. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	12.4 * WIDTH 7.4 * HEIGHT 6.6 CENTIMETERS
LENGTH	4.9 * WIDTH 2.9 * HEIGHT 2.6 INCHES
PACKAGE AREA	445.0 SQ. CENTIMETERS * 69.0 SQ. INCHES
PACKAGE VOLUME	605.4 CU. CENTIMETERS * 36.9 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.5 KILOGRAMS * 1.0 POUNDS
TOTAL WEIGHT	1.0 KILOGRAMS * 2.3 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	67.0 WATTS **28 +OR- 4 VDC POWER SUPPLY
OUTPUT POWER	7.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE MTT-501 S-BAND TRANSMITTER IS DESIGN WITH A PASSIVE THERMAL DESIGN OF CONDUCTION TO THE BOTTOM SURFACE AND MOUNTINGS, AND RADIATION FROM THE REMAINING SURFACES. UNIT IS PAINTED WITH A BLACK PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS PACKAGED IN A HERMETICLY SEALED CASE.

THE MTT-501 S-BAND FM TELEMETRY TRANSMITTER IS DESIGN AND BUILT BY MOTOROLA INC. GOVERMENT ELECTRONICS DIVISION
8201 E. MCDOWELL ROAD, SCOTTSDALE, ARIZONA 85252
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. C.L. MAVITY PHONE 602-949-2471 EXTENSION
THE MTT-501 TRANSMITTER WAS DEVELOPED FOR USE IN MISSILE AND SPACE TELEMETRY APPLICATIONS. UNIT OUTPUT POWER IS 7 WATTS NOMINAL AND 5 WATTS MINIMUM. UNIT INPUT SUPPLY VOLTAGE IS 28 VDC + OR - 4 VDC AND AN INPUT CURRENT OF 2.4 AMPS MAXIMUM. UNIT IS DESIGN WITH THE FOLLOWING A TRUE FM DC TO 1 MHZ FREQUENCY RESPONSE, A BUILT-IN FERRITE ISOLATOR TO PREVENT DAMAGE BY HIGH VSWR LOADS, A DC ISOLATION OF ALL INPUTS FROM EACH OTHER AND THE CASE, AND A REVERSE POLARITY PROTECTION BY MEAN OF A SERIES OF DIODES TO PROTECT AGAINST REVERSAL OF INPUT VOLTAGE POLARITY. UNIT MEETS ELECTROMAGNETIC COMPATIBILITY MIL-STD-461.

REF. DATA SHEET MTT-501 S-BAND FM TELEMETRY TRANSMITTER.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

TFM 4 S-BAND TRANSMITTER EMR P/N PD6400418-079

DESIGN OPERATING CASE TEMPERATURE	269. TO 368. DEG. K (25. TO 202. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 344. DEG. K (-35. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	269. TO 311. DEG. K (25. TO 100. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	265. TO 383. DEG. K (18. TO 229. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 30.5 * WIDTH 19.0 * HEIGHT	12.7 CENTIMETERS
LENGTH 12.0 * WIDTH 7.5 * HEIGHT	5.0 INCHES
PACKAGE AREA	2419.3 SQ. CENTIMETERS * 375.0 SQ. INCHES
PACKAGE VOLUME	7374.2 CU. CENTIMETERS * 450.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.1 KILOGRAMS * 2.5 POUNDS
TOTAL WEIGHT	6.5 KILOGRAMS * 14.4 POUNDS
SURFACE PROPERTIES	ALPHA = 0.900 * EMISSIVITY = 0.900
INPUT STEADY STATE POWER	235.0 WATTS **
OUTPUT POWER	30.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE S-BAND TRANSMITTER IS DESIGN WITH A PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION. UNIT IS PAINTED BLACK BUT CAN BE FIN ISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SPACE QUALIFIED AND HAS BEEN SPACE FLOWN ONBOARD THE TITAN III ON SEVERAL FLIGHTS. UNIT CASE IS HERMETICLY SEALED AND MAINTAINS ATMOSPHERIC PRESSURE FOR EXTENDED PERIODS. UNIT OPERATE ON AN INPUT VOLTAGE RANGE OF 25 TO 32 VDC.

THE S-BAND RADIO TELEMETRY TRANSMITTER IS DESIGN AND BUILT BY ELECTRO-MECHANICAL RESEARCH
P.O. BOX 3041 SARASOTA, FLORIDA 33578
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. PAUL A. CHRISTENSEN PHONE 303-794-5211 EXTENSION 2485
THE S-BAND TELEMETRY TRANSMITTER IS AN OFF-THE SHELF AND IN PRODUC TION UNIT. UNIT IS SPACE QUALIFIED AND HAS BEEN SPACE FLOWN NUMER OUS TIMES ONBOARD THE MARTIN MARIETTA TITAN III LAUNCH VEHICLES. UNIT IS DESIGN TO HAVE A TRUE FREQUENCY MODULATION, A SELF-PROTEC TION FROM REVERSING 28 VDC POWER WITH RF OUTPUT POWER AND ISOLA- TION OF POWER GROUND FROM CASE. TRANSMITTER IS BUILT WITH A HERMETICLY SEALED CASE.

REF. PD640041A S-BAND RADIO TELEMETRY TRANSMITTER, MARTIN MARIETTA CORPORATION DENVER DIVISION.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

PA 1 S-BAND POWER AMP RADIATION INC

DESIGN OPERATING CASE TEMPERATURE	248. TO 343. DEG. K (-13. TO 158. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 373. DEG. K (-40. TO 212. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	248. TO 343. DEG. K (-13. TO 158. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	233. TO 363. DEG. K (-40. TO 194. DEG. F)
PACKAGE SHAPE	TANGULAR
PACKAGE SIZE * LENGTH	9.7 * WIDTH 5.3 * HEIGHT 2.5 CENTIMETERS
LENGTH	3.8 * WIDTH 2.1 * HEIGHT 1.0 INCHES
PACKAGE AREA	179.1 SQ. CENTIMETERS * 27.8 SQ. INCHES
PACKAGE VOLUME	130.8 CU. CENTIMETERS * 8.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.1 KILOGRAMS * .2 POUNDS
TOTAL WEIGHT	.1 KILOGRAMS * .3 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	23.2 WATTS **28 VDC POWER SOURCE.
OUTPUT POWER	7.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE UNIT IS DESIGN WITH A HEAT SINK BASE PLATE FOR CONDUCTION COOLING. UNIT IS MOUNTED TO COLD PLATE FOR COOLING. THE UNIT SEMICONDUCTOR COMPONENTS ARE SOFT-SOLDERED TO THE HEAT SINK PLATE. UNIT HAS AN ALUMINUM ANODIZED FINISH BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENT. UNIT WAS TESTED TO PRESSURE ALTITUDE OF 1 X 10-7 TORR. AMPLIFIER WEIGHT IS LESS THAN 150 GRAMS (0.33 LBS).

THE S-BAND MICROCIRCUIT POWER AMPLIFIER IS DESIGN AND BUILT BY RADIATION INCORPORATED SYSTEMS DIVISION
MELBOURNE, FLORIDA 32901
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. J.PAUL REYNOLDS PHONE 305-727-5003 EXTENSION
THE S-BAND MICROCIRCUIT POWER AMPLIFIER WAS DEVELOPED FOR NASA GODDARD SPACE FLIGHT CENTER AND SOME TWENTY UNITS WERE BUILT. THE S-BAND AMPLIFIER IS A SOLID STATE SEMICONDUCTOR AMPLIFIER. UNIT IS DESIGN TO OPERATE WITH AN INPUT VOLTAGE OF 19 TO 28 VDC. AND WITH A MINIMUM EFFICIENCY OF 33 PERCENT AT THE MAXIMUM POWER OUTPUT. AMPLIFIER IS BUILT WITH A LOAD PROTECTOR AGAINST SHORT OR OPEN CIRCUITS AT THE OUTPUT. UNIT WAS DESIGN TO A SPACE ENVIRONMENT AND TO OPERATE IN A VACUUM OF 1 X 10-7 TORR WITH NO CORONA PROBLEMS.

REF. TECHNICAL BRIEF 1-A0-2022 S-BAND MICROCIRCUIT POWER AMPLIFIER

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

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PA 2 AMPLIFIERS MSC 91000 SERIES

DESIGN OPERATING CASE TEMPERATURE	253. TO 343. DEG. K
	(-4. TO 158. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 363. DEG. K
	(-40. TO 194. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	253. TO 343. DEG. K
	(-4. TO 158. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	253. TO 343. DEG. K
	(-4. TO 158. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 10.2 * WIDTH 6.3 * HEIGHT	1.3 CENTIMETERS
LENGTH 4.0 * WIDTH 2.5 * HEIGHT	.5 INCHES
PACKAGE AREA	171.0 SQ. CENTIMETERS * 26.5 SQ. INCHES
PACKAGE VOLUME	81.9 CU. CENTIMETERS * 5.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.1 KILOGRAMS * .3 POUNDS
TOTAL WEIGHT	.3 KILOGRAMS * .6 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	40.0 WATTS **
OUTPUT POWER	30.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON

THE 91000 SERIES S-BAND TELEMETRY AMPLIFIER IS A NON TUNABLE MICRO WAVE INTEGRATED CIRCUIT POWER AMPLIFIER SPECIFICALLY DESIGNED FOR USE IN S-BAND TELEMETRY SYSTEMS. THE UNIT IS DESIGN TO BE INCOPORA TED INTO A TOTAL SYSTEM PACKAGE. UNIT IS DESIGN WITH PASSIVE THER-MAL CONTROL OF RADIATION AND CONDUCTION TO SURFACES. UNIT HAS AN ANODIZED ALUMINUM FINISH BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. UNIT DESIGN FOR SPACE APPLICATION.

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THE S-BAND SOLID-STATE TELEMETRY AMPLIFIERS ARE DESIGN AND BUILT BY MICROWAVE SEMICONDUCTOR CORP.
100 SCHOOL HOUSE ROAD, SOMERSET, NEW JERSEY 08873
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. CARL J. LUMP PHONE 201-469-3311 EXTENSION
THE MSC-91000 SERIES TELEMETRY AMPLIFIERS ARE OFF-THE-SHELF AND IN PRODUCTION UNITS. THE 91000 SERIES CONSIST OF VARIOUS AMPLIFIERS WITH VARIOUS POWER LEVELS. THE 91000 SERIES OF AMPLIFIERS ARE DESIGNED FOR OPERATION AT OPTIONAL SUPPLY VOLTAGES RANGING FROM 20 VOLTS TO 28 VOLTS. AT EACH OPERATING SUPPLY VOLTAGE FIVE LEVELS OF MINIMUM POWER OUTPUT LEVELS ARE AVAILABLE RANGING FROM 4.5 TO 20 WATTS FOR THE 20 VOLT AMPLIFIERS AND 6.5 TO 30 WATTS FOR THE 28 VOLT AMPLIFIERS. THESE UNITS ARE OPERATED IN A CLASS C MODE. ALL UNITS ARE SOLID STATE TRANSISTORIZED UNITS THAT DELIVER A CON-TINUOUS WAVE AT 2.2 TO 2.3 GHZ. AMPLIFIERS HAVE BEEN TESTED PER MIL-E-5400 FOR HIGH RELIABILITY AND SPACE APPLICATIONS.

REF. PRELIMINARY DATA SHEET ON MICROWAVE INTEGRATED CIRCUIT 91000 SERIES S-BAND TELEMETRY AMPLIFIERS BY MSC DATED MAY, 15, 1973.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

RFM 1 RF MULTIPLEXER WAVECOM INC. P/N PD6400439-060

DESIGN OPERATING CASE TEMPERATURE	241. TO 325. DEG. K (-25. TO 125. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 396. DEG. K (-35. TO 254. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 311. DEG. K (0. TO 100. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	241. TO 325. DEG. K (-25. TO 125. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 30.5 * WIDTH 6.3 * HEIGHT 12.7 CENTIMETERS	
LENGTH 12.0 * WIDTH 2.5 * HEIGHT 5.0 INCHES	
PACKAGE AREA	1322.6 SQ. CENTIMETERS * 205.0 SQ. INCHES
PACKAGE VOLUME	2458.1 CU. CENTIMETERS * 150.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.4 KILOGRAMS * .8 POUNDS
TOTAL WEIGHT	1.6 KILOGRAMS * 3.5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.85
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE VIKING RF MULTIPLEXER IS DESIGN A BUILT FOR THE VIKING MARS LANDER. THE UNIT IS A PASSIVE DEVICE AND DOES NOT DISSIPATE ANY POWER. IT HAS A PASSIVE THERMAL CONTROL OF CONDUCTION TO THE BOTTOM SURFACES AND MOUNTINGS AND RADIATION FROM THE REMAINING SURFACES. UNIT IS PAINTED WITH A BLACK ENAMEL PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.

THE VIKING MULTIPLEXER IS DESIGN AND BUILT BY
WAVECOM INC.
9036 WINNETKA AVE. NORTHRIDGE, CALIFORNIA 91324
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. THOMAS F. WATSON PHONE 303-794-5211 EXTENSION 4841
THE VIKING RF MULTIPLEXER UNIT IS PART OF THE MICROWAVE COMPONENT ASSEMBLY. UNIT IS BUILT FOR THE VIKING LANDER AND IT HAS A TWO CHANNEL DIPLEX SYSTEM. ABOVE DATA IS BASED ON A UNIT WITHOUT THE EXTRA NEEDED EQUIPMENT THAT IS PACKAGED IN THE VIKING MCA.

REF. PD6400439 VIKING COMMUNICATION SYSTEM. MARTIN MARIETTA AEROSPACE DENVER DIVISION.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

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RFM 2 MULTIPLEXER EMERSON ELECTRIC P/N PD8500103-030

DESIGN OPERATING CASE TEMPERATURE	255. TO 325. DEG. K (0. TO 125. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 344. DEG. K (-35. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	255. TO 325. DEG. K (0. TO 125. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	255. TO 325. DEG. K (0. TO 125. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 17.8 * WIDTH 7.6 * HEIGHT	7.6 CENTIMETERS
LENGTH 7.0 * WIDTH 3.0 * HEIGHT	3.0 INCHES
PACKAGE AREA	658.1 SQ. CENTIMETERS * 102.0 SQ. INCHES
PACKAGE VOLUME	1032.4 CU. CENTIMETERS * 63.0 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.2 KILOGRAMS * .5 POUNDS
TOTAL WEIGHT	.9 KILOGRAMS * 2.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.900 * EMISSIVITY = 0.900
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE MULTIPLEXER IS A PASSIVE ELECTRONIC UNIT WITH NO POWER DISSIPATION. THE UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION FROM THE UNIT SURFACES. THE UNIT IS PAINTED BLACK BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT HAS A SEALED CASE AND HAS BEEN SPACE QUALIFIED ONBOARD THE TITAN III LAUNCH VEHICLE.

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THE TELEMETRY S-BAND MULTIPLEXER IS DESIGN AND BUILT BY
EMERSON ELECTRIC RANTEC DIVISION
CALABASAS, CALIFORNIA.
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JAMES E. BOATWRIGHT PHONE 303-794-5211 EXTENSION 3156
THE TELEMETRY S-BAND MULTIPLEXER IS AN OFF-THE-SHELF AND IN PRODUCTION UNIT. UNIT HAS BEEN SPACE QUALIFIED ON SEVERAL FLIGHTS ON TITAN III LAUNCH VEHICLE. UNIT OPERATE ON A FREQUENCY OF 2200 TO 2300 MHZ, AND IS A TWO CHANNEL TELEMETRY MULTIPLEXER. UNIT IS DESIGN TO HANDLE 30 WATTS CW APPLIED TO EACH CHANNEL, WHEN CHANNELS ARE OPERATING INDIVIDUALLY OR SIMULTANEOUSLY. UNIT IS AVAILABLE WITH A THREE CHANNEL SYSTEM BUT IT HAS A LARGER CASE AND HIGHER WEIGHT.

REF. PD8500103 MULTIPLEXERS-TELEMETRY, S-BAND MARTIN MARIETTA CORPORATION DENVER DIVISION.

AVIONICS SYSTEM
COMMUNICATION SUBSYSTEM

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DEC 1 MCR-904 DECODER MOTOROLA INC.

DESIGN OPERATING CASE TEMPERATURE	233. TO 348. DEG. K (-40. TO 167. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	223. TO 358. DEG. K (-58. TO 185. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	233. TO 348. DEG. K (-40. TO 167. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	233. TO 348. DEG. K (-40. TO 167. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	7.1 * WIDTH 15.2 * HEIGHT 8.4 CENTIMETERS
LENGTH	2.8 * WIDTH 6.0 * HEIGHT 3.3 INCHES
PACKAGE AREA	591.5 SQ. CENTIMETERS * 91.7 SQ. INCHES
PACKAGE VOLUME	908.5 CU. CENTIMETERS * 55.4 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	.5 KILOGRAMS * 1.0 POUNDS
TOTAL WEIGHT	1.4 KILOGRAMS * 3.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.90 * EMISSIVITY = 0.90
INPUT STEADY STATE POWER	2.8 WATTS **AT 28 VDC POWER SUPPLY
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON

THE MCR-904 COMMAND RECEIVER/DECODER IS DESIGN WITH A PASSIVE THERMAL DESIGN OF CONDUCTION TO THE BOTTOM MOUNTING SURFACE AND RADIATION FROM THE OTHER SURFACES. THE UNIT HAS AN IRIDITE ALUMINUM FINISH BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS PACKAGED IN AN HERMETICLY SEALED CASE. UNIT RESPOND TIME FOR COMMAND IS 15 MILLISECONDS MAXIMUM.

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THE MCR-904 COMMAND RECEIVER/DECODER IS DESIGN AND BUILT BY MOTOROLA INC. GOVERNMENT ELECTRONICS DIVISION
8201 E. MCDOWELL ROAD, SCOTTSDALE, ARIZONA 85252
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. C.L. MAVITY PHONE 602-949-2471 EXTENSION

THE MCR-904 COMMAND RECEIVER/DECODER IS AN FM FOUR-CHANNEL RECEIVER/ DECODER THAT WAS DEVELOPED FOR USE AS A RADIO LINK FOR MISSILE AND DRONE APPLICATIONS. THE MCR-904 RECEIVES AND DECODES COMMANDS TO PERFORM CRITICAL, REMOTELY CONTROLLED, SWITCH-CLOSURE FUNCTIONS SUCH AS ENGINE SHUT-DOWN, VEHICLE DESTRUCT, AND FUEL TURN-OFF. UNIT FREQUENCY RANGE IS 400 TO 450 MHZ WITH EXTENDED FREQUENCY AVAILABLE TO 550 MHZ. UNIT INPUT VOLTAGE IS FROM 24 TO 36 VDC AND STANDBY CURRENT OF 0.1 AMPERES AT NOMINAL VOLTAGE.

REF. DATA SHEET MCR-904 COMMAND RECEIVER/DECODER.

INSTRUMENTATION SUBSYSTEM
MEASUREMENT REQUIREMENTS

SUBSYSTEM	PRESS	TEMP	POSITION	VOLTAGE	CURRENT	FLOW	LIQUID LEVEL	DISCRETE
ELECTRICAL POWER	-	1	-	3	3	-	-	100
PROPELLANT FEED, FILL AND DRAIN	-	-	-	-	-	-	-	10
PROPELLANT MANAGEMENT	-	-	-	-	-	-	18	-
PRESSURIZATION	17	21	4	-	-	-	-	37
REACTION CONTROL	32	6	-	-	-	-	4	38
THRUST VECTOR CONTROL	2	2	3	-	-	-	-	-
FUEL CELL	2	10	-	-	-	1	-	-
TOTALS	53	40	7	3	3	1	22	185

TOTAL MEASUREMENTS 314

TIMELINES

CONTINUOUS OPERATION OF SUBSYSTEM FROM PRELAUNCH TO LANDING.

AVIONICS SYSTEM
INSTRUMENTATION SUBSYSTEM

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PRES 1 TRANSDUCER PRES. GULTON INDUSTRIES P/N PD7400081-010

DESIGN OPERATING CASE TEMPERATURE	233. TO 344. DEG. K (-40. TO 160. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	233. TO 344. DEG. K (-40. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	233. TO 344. DEG. K (-40. TO 160. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	233. TO 344. DEG. K (-40. TO 160. DEG. F)
PACKAGE SHAPE	NORICAL
PACKAGE SIZE * LENGTH	3.3 * WIDTH 1.3 * HEIGHT 0.0 CENTIMETERS
LENGTH	1.3 * WIDTH .5 * HEIGHT 0.0 INCHES
PACKAGE AREA	8.4 SQ. CENTIMETERS * 1.3 SQ. INCHES
PACKAGE VOLUME	0.0 CU. CENTIMETERS * 0.0 CU. INCHES
CASE MATERIAL	STAINLESS STEEL
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	.1 KILOGRAMS * .3 POUNDS
SURFACE PROPERTIES	ALPHA = 0.35 * EMISSIVITY = 0.20
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE PRESSURE TRANSDUCER IS A PASSIVE UNIT THAT MEASURED ABSOLUTE PRESSURE. UNIT HAS A PASSIVE THERMAL DESIGN OF CONDUCTION TO THE MOUNTING STRUCTURE, AND RADIATION TO ENVIRONMENT. UNIT IS MADE FROM STAINLESS STEEL AND HAS NO PAINT OR FINISH ON IT. UNIT IS SPACE QUALIFIED AND IS ONBOARD THE SKYLAB.

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THE ABSOLUTE PRESSURE TRANSDUCER IS DESIGN AND BUILT BY
GULTON INDUSTRIES SERVONIC DIVISION
164 WHITTIER AVENUE COSTA MESA, CALIFORNIA
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. C. W. MCANALLY PHONE 303-794-5211 EXTENSION 4618
THE PRESSURE TRANSDUCER IS AN OFF-THE-SHELF AND IN PRODUCTION ITEM UNIT IS DESIGN TO OPERATE OVER THE RANGE OF 0 TO 4.14 N/CM SQ (0 TO 6 PSIA). UNIT IS DESIGN TO WITHSTAND PRESURE UP TO 16.56 N/CM SQ (24 PSIA) FOR ANY PERIOD OF TIME UP TO ITS COMBINED OPERATING AND NON OPERATING LIFE WITH NO DAMAGE. THE UNIT CASE IS DESIGN TO WITHSTAND 552 N/CM SQ (800 PSIA) MINIMUM INTERNAL PRESSURE WITH OUT RUPTURE. TRANSDUCER HAS BEEN SPACE QUALIFIED AND IS AT PRESENT USED ONBOARD SKYLAB AS THE PRESSURE MEASUREMENT OF THE MULTIPUL DOCKING ADAPTOR (MDA).

REF. PD7400081 TRANSDUCER PRESSURE, ABSOLUTE MARTIN MARIETTA CORPORATION DENVER DIVISION.

AVIONICS SYSTEM
INSTRUMENTATION SUBSYSTEM

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PRES ? TRANSDUCER PRES. BALDWIN-LIMA P/N PD74S0041-011

DESIGN OPERATING CASE TEMPERATURE	236. TO 394. DEG. K
	(-35. TO 250. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 394. DEG. K
	(-35. TO 250. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	236. TO 394. DEG. K
	(-35. TO 250. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	236. TO 394. DEG. K
	(-35. TO 250. DEG. F)
PACKAGE SHAPE	CYLINDRICAL
PACKAGE SIZE * LENGTH	8.9 * WIDTH 1.3 * HEIGHT 0.0 CENTIMETERS
LENGTH	3.5 * WIDTH .5 * HEIGHT 0.0 INCHES
PACKAGE AREA	81.1 SQ. CENTIMETERS * 12.6 SQ. INCHES
PACKAGE VOLUME	45.0 CU. CENTIMETERS * 2.7 CU. INCHES
CASE MATERIAL	STAINLESS STEEL
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	.3 KILOGRAMS * .6 POUNDS
SURFACE PROPERTIES	ALPHA = 0.35 * EMISSIVITY = 0.20
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE PRESSURE TRANSDUCER IS A PASSIVE UNIT WITH NO POWER DISSIPATION. UNIT IS MAINTAINED WITHIN THE ABOVE TEMPERATURE RANGE BY RADIATION TO ENVIRONMENT AND CONDUCTION TO MOUNTING. UNIT HAS A STAINLESS STEEL CASE . TRANSDUCER IS SPACE QUALIFIED AND IS USED ON TITAN III LAUNCH VEHICLES PROGRAM. TRANSDUCER HAS VARIOUS TEMPERATURE LIMITS DEPENDING ON MEDIUM SUCH AS, AIR, UDMH, N2H4, AND N2O4.

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THE ABSOLUTE PRESSURE TRANSDUCER IS DESIGN AND BUILT BY
BALDWIN-LIMA HAMILTON
42 FOURTH AVENUE WALTHAM 54. MASS.
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR PAUL CHRISTENSEN PHONE 303-794-5211 EXTENSION 2485
THE ABSOLUTE PRESSURE TRANSDUCER IS AN-OFF-THE-SHELF AND IN PRODUCTION UNIT. UNIT IS DESIGN TO OPERATE OVER VARIOUS PRESSURE RANGES WITH THE MAXIMUM BEING 0 TO 345 N/CM SQ (0 TO 500 PSIA). TRANSDUCER IS SPACE QUALIFIED AND SEVERAL ARE USED ON THE VARIOUS MARTIN MARIETTA TITAN LAUNCH VEHICLES. TRANSDUCER IS QUALIFIED FOR USE IN SEVERAL MEDIUMS INCLUDING AIR, NITROGEN TETROXIDE, HYDRAZINE, AND UDMH. UNIT IS DESIGN TO WITHSTAND A PRESSURE OF 150 PRECENT OF ITS RATED FULL SCALE PRESSURE FOR 10 SECONDS WITH A LEAKAGE OF LESS THAN 3 X 10-10 SCC/SEC. OF HELIUM.

REF. PD74S0041 TRANSDUCERS, ABSOLUTE PRESSURE MARTIN MARIETTA CORP SPECIFICATION DOCUMENT.

AVIONICS SYSTEM
INSTRUMENTATION SUBSYSTEM

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PRES 3 TRANSDUCER PRES. GENISCO TECH CORP. P/N PD74S0048-003

DESIGN OPERATING CASE TEMPERATURE	144. TO 422. DEG. K (-200. TO 300. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	144. TO 422. DEG. K (-200. TO 300. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	144. TO 422. DEG. K (-200. TO 300. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	144. TO 422. DEG. K (-200. TO 300. DEG. F)
PACKAGE SHAPE	CYLINDRICAL
PACKAGE SIZE * LENGTH 6.6 * WIDTH 1.5 * HEIGHT 0.0 CENTIMETERS	
LENGTH 2.6 * WIDTH .6 * HEIGHT 0.0 INCHES	
PACKAGE AREA	77.8 SQ. CENTIMETERS * 12.1 SQ. INCHES
PACKAGE VOLUME	48.2 CU. CENTIMETERS * 2.9 CU. INCHES
CASE MATERIAL	STAINLESS STEEL
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	.2 KILOGRAMS * .5 POUNDS
SURFACE PROPERTIES	ALPHA = 0.35 * EMISSIVITY = 0.20
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE PRESSURE TRANSDUCER IS A PASSIVE COMPONENT WITH NO REAL POWER DISSIPATION. UNIT IS MAINTAINED IN ITS TEMPERATURE RANGE BY THERMAL RADIATION AND CONDUCTION TO ITS ENVIRONMENT. THE UNIT STAINLESS STEEL CASE IS NOT PAINTED OR FINISH IN ANY SPECIAL WAY OTHER THAN STANDARD STAINLESS STEEL FINISH.

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THE ABSOLUTE PRESSURE TRANSDUCER IS DESIGN AND BUILT BY
GENISCO TECHNOLOGY CORPORATION
COMPTON, CALIFORNIA
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. PAUL CHRISTENSEN PHONE 303-794-5211 EXTENSION 2485
THE PRESSURE TRANSDUCER IS AN OFF-THE-SHELF AND IN PRODUCTION UNIT THE TRANSDUCER IS DESIGN TO OPERATE OVER A PRESSURE RANGE OF 0 TO 207 N/CM SQ (0 TO 300 PSIA). UNIT IS DESIGN TO WITHSTAND A PRESSURE OF 150 PRECENT OF ITS RATED FULL SCALE PRESSURE FOR 10 SECONDS WITH LEAKAGE RATE OF LESS THAN 1 X 10-3 CC/MIN. OF HELIUM. UNIT IS SPACE QUALIFIED AND IS USED ONBOARD THE TITAN III LAUNCH VEHICLE.

REF. PD74S0048 TRANSDUCER, ABSOLUTE PRESSURE MARTIN MARIETTA CORP SPECIFICATION DOCUMENT.

AVIONICS SYSTEM
INSTRUMENTATION SUBSYSTEM

PRES 4 TRANSDUCER PRES. GULTON INDUS. INC. P/N PD7400085-010

DESIGN OPERATING CASE TEMPERATURE	269. TO 311. DEG. K (25. TO 100. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 344. DEG. K (-35. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	269. TO 311. DEG. K (25. TO 100. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	269. TO 311. DEG. K (25. TO 100. DEG. F)
PACKAGE SHAPE	CYLINDRICAL
PACKAGE SIZE * LENGTH	8.6 * WIDTH 1.5 * HEIGHT 0.0 CENTIMETERS
LENGTH	3.4 * WIDTH .6 * HEIGHT 0.0 INCHES
PACKAGE AREA	97.3 SQ. CENTIMETERS * 15.1 SQ. INCHES
PACKAGE VOLUME	63.0 CU. CENTIMETERS * 3.8 CU. INCHES
CASE MATERIAL	STAINLESS STEEL
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	.3 KILOGRAMS * .6 POUNDS
SURFACE PROPERTIES	ALPHA = 0.350 * EMISSIVITY = 0.200
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE DIFFERENTIAL PRESSURE TRANSDUCER IS A PASSIVE UNIT, IT IS DESIGN TO INDICATE A PRESSURE DIFFERENCE OF + TO - 3.45 N/CM SQ (+ TO -5.0 PSID). UNIT HAS NO REAL POWER DISSIPATION AND ITS TEMPERATURE IS MAINTAINED BY CONDUCTION AND RADIATION TO THE SURROUNDING. UNIT IS MADE FROM STAINLESS STEEL AND IS HERMETICLY SEALED. UNIT HAS NO FINISH. TRANSDUCER IS SPACE QUALIFIED AND IS USED ONBOARD TITAN IIIE LAUNCH VEHICLE.

THE DIFFERENTIAL PRESSURE TRANSDUCER IS DESIGN AND BUILT BY GULTON INDUSTRIES INC. SERVONIC/INSTRUMENTATION DIVISION
1644 WHITTIER AVENUE COSTA MESA, CALIFORNIA 92627
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. J. E. BOATWRIGHT PHONE 303-794-5211 EXTENSION 3156
THE PRESSURE TRANSDUCER IS AN OFF-THE-SHELF AND IN PRODUCTION ITEM IT MEASURES A PRESSURE DIFFERENCE BETWEEN ITS TWO PRESSURE PORTS. UNIT IS DESIGN TO OPERATE AT A PRESSURE RANGE OF -3.45 TO +3.45 N/CM SQ (-5.0 TO 5.0 PSID). UNIT CASE IS DESIGN TO WITHSTAND 414 N/CM SQ (600 PSIG) WITHOUT RUPTURE. THE PRESSURE TRANDUCER IS SPACE QUALIFIED, AND IS ONBOARD TITAN IIIE WHICH IS EXPECTED TO BE FLOWN SOMETIME DURING THE FIRST PART OF 1974.

REF. PD7400085 TRANDUCER PRESSURE, DIFFERENTIAL MARTIN MARIETTA CORP. SPECIFICATION DOCUMENT.

AVIONICS SYSTEM
INSTRUMENTATION SUBSYSTEM

TEMP 1 TRANSDUCER TEMP HY-CAL ENGINEERING P/N PD7400082-009

DESIGN OPERATING CASE TEMPERATURE	148. TO 423. DEG. K (-193. TO 302. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	155. TO 409. DEG. K (-180. TO 277. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	148. TO 423. DEG. K (-193. TO 302. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	148. TO 423. DEG. K (-193. TO 302. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE *°	LENGTH 2.0 * WIDTH 2.0 * HEIGHT .3 CENTIMETERS
	LENGTH .8 * WIDTH .8 * HEIGHT .1 INCHES
PACKAGE AREA	10.3 SQ. CENTIMETERS * 1.6 SQ. INCHES
PACKAGE VOLUME	1.0 CU. CENTIMETERS * .1 CU. INCHES
CASE MATERIAL	STAINLESS STEEL
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	.0 KILOGRAMS * .1 POUNDS
SURFACE PROPERTIES	ALPHA = 0.35 * EMISSIVITY = 0.20
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE TEMPERATURE TRANSDUCER IS A PLATINUM UNIT. IT IS A PASSIVE UNIT THAT HAS A MAXIMUM WEIGHT OF 6 GRAMS. TRANDUCER THERMAL CONTROL IS SIMPLY RADIATION AND CONDUCTION. UNIT CASE IS STAINLESS STEEL AND DOES NOT HAVE ANY PAINT OR FINISH ON IT. UNIT IS SPACE QUALIFIED AND SEVERAL DOZEN OF THIS UNIT ARE ONBOARD SKYLAB SUPPLING TEMPERATURE READINGS.

THE SURFACE TEMPERATURE TRANSDUCER IS DESIGN AND BUILT BY
HY-CAL ENGINEERING
12105 LOS NIETOS ROAD SANTA FE SPRINGS, CALIFORNIA
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. C. W. MCANALLY PHONE 303-794-5211 EXTENSION 4618
THE TEMPERATURE TRANSDUCER IS AN OFF-THE-SHELF AND IN PRODUCTION TRANSDUCER. UNIT HAS A PLATINUM RESISTANCE SENSOR ENCASED IN A THIN STAINLESS STEEL CASE. THE UNIT OPERATING TEMPERATURE RANGE IS FROM -125 TO 150 DEG.C (-193 TO 302 DEG.F). UNIT IS SPACE QUALIFIED AND SEVERAL DOZEN OF THIS TRANSDUCER ARE AT PRESENT IN USE ONBOARD THE MULTIPLE DOCKING ADAPTOR(MDA) OF SKYLAB.

REF. PD7400082 TRANSDUCER TEMPERATURE, SURFACE MARTIN MARIETTA SPECIFICATION DOCUMENT.

AVIONICS SYSTEM
INSTRUMENTATION SUBSYSTEM

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TEMP 2 TRANSDUCER TEMP. ROSEMOUNT ENGR. CO P/N PD74S0047-005

DESIGN OPERATING CASE TEMPERATURE	236. TO 422. DEG. K (-35. TO 300. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 422. DEG. K (-35. TO 300. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	236. TO 422. DEG. K (-35. TO 300. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	144. TO 311. DEG. K (-200. TO 100. DEG. F)
PACKAGE SHAPE	CYLINDRICAL
PACKAGE SIZE * LENGTH	2.0 * WIDTH .5 * HEIGHT 0.0 CENTIMETERS
LENGTH	.8 * WIDTH .2 * HEIGHT 0.0 INCHES
PACKAGE AREA	8.1 SQ. CENTIMETERS * 1.3 SQ. INCHES
PACKAGE VOLUME	1.6 CU. CENTIMETERS * .1 CU. INCHES
CASE MATERIAL	STAINLESS STEEL
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	.2 KILOGRAMS * .4 POUNDS
SURFACE PROPERTIES	ALPHA = 0.350 * EMISSIVITY = 0.200
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE SURFACE TEMPERATURE TRANSDUCER IS DESIGN TO MEASURE THE SURFACE TEMPERATURE OF THE PROPELLANT LINES WHICH FEED THE ATTITUDE CONTROL SYSTEM. UNIT IS A SEMI-CYLINDRICAL WITH A THICKNESS OF 0.254 CM (0.10 IN) AND AN INSIDE DIAMETER OF 0.32 CM (0.125 IN). TRANSDUCER IS A PASSIVE UNIT THAT CONDUCTS AND RADIATE TO THE SURROUNDING. UNIT HAS NO PAINT OR OTHER THAN STANDARD STAINLESS STEEL FINISH. UNIT IS SPACE QUALIFIED AND IS USED ON TITAN III.

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THE ATTITUDE CONTROL SYSTEM TEMPERATURE TRANSDUCER IS DESIGN AND BUILT BY ROSEMOUNT ENGINEERING COMPANY
4900 W. 78TH STREET MINNEAPOLIS, MINNESOTA 55435
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. J. E. BOATWRIGHT PHONE 303-794-5211 EXTENSION 3156
THE TEMPERATURE TRANSDUCER IS AN OFF-THE-SHELF AND IN PRODUCTION UNIT. THE TRANSDUCER IS A SEMI-CYLINDRICAL UNIT THAT IS MOUNTED ON PROPELLANT LINES TO MEASURE THE PROPELLANT TEMPERATURE. THERE ARE SEVERAL UNITS SIZE TO FIT THE VARIOUS PROPELLANT LINES SIZES. TRANSDUCER IS SPACE QUALIFIED AND HAS BEEN SPACE FLOWN ONBOARD MARTIN MARIETTA TITAN III LAUNCH VEHICLES.

REF. 74S0047 TRANSDUCERS,TEMPERATURE-ATTITUDE CONTROL SYSTEM
MARTIN MARIETTA CORP. SPECIFICATION DOCUMENT.

AVIONICS SYSTEM
INSTRUMENTATION SUBSYSTEM

TEMP 3 TRANSDUCER TEMP. ROSEMOUNT ENGR. CO P/N PD74S0030-503

DESIGN OPERATING CASE TEMPERATURE	266. TO 311. DEG. K (20. TO 100. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	236. TO 344. DEG. K (-35. TO 160. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	266. TO 311. DEG. K (20. TO 100. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUTREMENTS	266. TO 311. DEG. K (20. TO 100. DEG. F)
PACKAGE SHAPE	CYLINDRICAL
PACKAGE SIZE * LENGTH	5.8 * WIDTH .8 * HEIGHT 0.0 CENTIMETERS
LENGTH	2.3 * WIDTH .3 * HEIGHT 0.0 INCHES
PACKAGE AREA	31.6 SQ. CENTIMETERS * 4.9 SQ. INCHES
PACKAGE VOLUME	10.7 CU. CENTIMETERS * .7 CU. INCHES
CASE MATERIAL	STAINLESS STEEL
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	.3 KILOGRAMS * .6 POUNDS
SURFACE PROPERTIES	ALPHA = 0.35 * EMISSIVITY = 0.20
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE BULK PROPELLANT TEMPERATURE TRANSDUCER HAS A PROBE THAT IS 12.7 CM(5.0 IN) LONG AND IS .64 CM (0.25 IN) IN DIAMETER. THE PROBE IS EXTENDED ALL THE WAY INTO THE PROPELLANT TANK. THE SENSITIVE ELEMENT IS THERMALY ISOLATED FROM THE UNIT BODY. THE UNIT THERMAL DESIGN IS TO RADIATE AND CONDUCT TO THE SURROUNDING. TRANSDUCER IS BASICALLY A PASSIVE DEVICE WITH NO POWER DISSIPATION. UNIT IS SPACE QUALIFIED ON TITAN III PROGRAM.

THE BULK PROPELLANT TEMPERATURE TRANSDUCER IS DESIGN AND BUILT BY ROSEMOUNT ENGINEERING COMPANY
4900 W. 78TH STREET MINNEAPOLIS, MINNESOTA 55435
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. J. F. BOATWRIGHT PHONE 303-794-5211 EXTENSION 3156
THE TEMPERATURE TRANSDUCER IS AN OFF-THE-SHELF AND IN PRODUCTION UNIT. IT IS DESIGN TO MEASURE PROPELLANT TEMPERATURES. UNIT HAS A PROBE THAT IS A RESISTANCE TEMPERATURE SENSITIVE,THE PROBE IS PLACED INSIDE THE PROPELLANT TANK FOR MEASUREMENTS. UNIT IS SPACE QUALIFIED AND IS USED ONBOARD THE TITAN III LAUNCH VEHICLE. THE TRANSDUCER IS DESIGN TO MEASURE TEMPERATURES OF NITROGEN TETROXIDE HYDRAZINE AND UDMH- THE TITAN PROPELLANTS.

REF. PD74S0030 TRANSDUCERS-TEMPERATURE, BULK, PROPELLANT MARTIN MARIETTA CORP. SPECIFICATION DOCUMENT.

AVIONICS SYSTEM
INSTRUMENTATION SUBSYSTEM

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TEMP 4 TRANSDUCER TEMP. ROSEMOUNT ENGR. CO P/N PD74S0025-502

DESIGN OPERATING CASE TEMPERATURE	219. TO 355. DEG. K (-65. TO 180. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	219. TO 355. DEG. K (-65. TO 180. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	219. TO 355. DEG. K (-65. TO 180. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	219. TO 355. DEG. K (-65. TO 180. DEG. F)
PACKAGE SHAPE	CYLINDRICAL
PACKAGE SIZE * LENGTH	5.8 * WIDTH 1.0 * HEIGHT 0.0 CENTIMETERS
LENGTH	2.3 * WIDTH .4 * HEIGHT 0.0 INCHES
PACKAGE AREA	43.8 SQ. CENTIMETERS * 6.8 SQ. INCHES
PACKAGE VOLUME	18.9 CU. CENTIMETERS * 1.2 CU. INCHES
CASE MATERIAL	STAINLESS STEEL
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	.3 KILOGRAMS * .6 POUNDS
SURFACE PROPERTIES	ALPHA = 0.35 * EMISSIVITY = 0.20
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE TEMPERATURE TRANSDUCER IS A PASSIVE UNIT WITH NO REAL POWER DISSIPATION. UNIT HAS A PROBE THAT IS 4.6 CM(1.8 IN) LONG THAT IS PLACED INSIDE THE PROPELLANT TANK AND MEASURES THE PROPELLANT TEMPERATURE. THE TRANSDUCER THERMAL DESIGN IS TO CONDUCT AND RADIATE TO THE SURROUNDINGS. UNIT IS MADE FROM STAINLESS STEEL AND IS NOT PAINTED. TRANSDUCER IS SPACE QUALIFIED AND FLOWN ON SEVERAL TITAN VEHICLES

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THE PROPELLANT TEMPERATURE TRANDUCER IS DESIGN AND BUILT BY ROSEMOUNT ENGINEERING COMPANY
4900 W. 78TH STREET MINNEAPOLIS, MINNESOTA 55435
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. J. E. BOATWRIGHT PHONE 303-794-5211 EXTENSION 3165
THE TEMPERATURE TRANSDUCER IS AN OFF-THE-SHELF AND IN PRODUCTION UNIT, THE TRANDUCER IS DESIGN TO MEASURE PROPELLANT TEMPERATURE. THE UNIT HAS A PROTRUDING RESISTANCE TEMPERATURE SENSITIVE PROBE THAT IS EXTENDED INTO THE PROPELLANT TANK AND MEASURES THE PROPELLANT TEMPERATURE. TRANSDUCER IS SPACE QUALIFIED AND IS SPACE FLOWN ONBOARD THE TITAN LAUNCH VEHICLE. THE TRANSDUCER IS USED TO MEASURE THE TEMPERATURE OF THE TITAN PROPELLANT WHICH CONSIST OF THE OXIDIZER NITROGEN TETROXIDE AND FUEL A 50-50 MIXTURE OF HYDRAZINE AND UDMH.

REF. PD74S0025 TRANSDUCER -TEMPERATURE, PROPELLANT. MARTIN MARIETTA CORP. SPECIFICATION DOCUMENT.

AVIONICS SYSTEM
INSTRUMENTATION SUBSYSTEM

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CURR 1 SHUNTS-CURRENT MARTIN MARIETTA MMC STD. 92D18

DESIGN OPERATING CASE TEMPERATURE	223. TO 378. DEG. K
	(-58. TO 221. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	223. TO 378. DEG. K
	(-58. TO 221. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	223. TO 378. DEG. K
	(-58. TO 221. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	223. TO 378. DEG. K
	(-58. TO 221. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH	5.1 * WIDTH 3.3 * HEIGHT 4.3 CENTIMETERS
LENGTH	2.0 * WIDTH 1.3 * HEIGHT 1.7 INCHES
PACKAGE AREA	105.9 SQ. CENTIMETERS * 16.4 SQ. INCHES
PACKAGE VOLUME	72.4 CU. CENTIMETERS * 4.4 CU. INCHES
CASE MATERIAL	FIBERGLASS
CASE WEIGHT	0.0 KILOGRAMS * 0.0 POUNDS
TOTAL WEIGHT	.1 KILOGRAMS * .3 POUNDS
SURFACE PROPERTIES	ALPHA = 0.9 * EMISSIVITY = 0.9
INPUT STEADY STATE POWER	0.0 WATTS **
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

****

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES
MISSION ON-TIMES * SHUT/TUG INT* TUG/ORBIT ON* TUG/PAY ON
THE CURRENT SHUNT IS A PASSIVE DEVICE USED TO MEASURE CURRENT FLOW. THE SHUNT BASE IS MADE FROM A FIBERGLASS WITH THE ELEMENT ASSEMBLY MADE OUT OF NICKEL CHROME ALLOY. UNIT HAS NO REAL POWER DISSIPATION, AND CONTACT STUDS ARE ISOLATED FROM REST OF SHUNT BASE. UNIT IS NOT PAINTED AND IS SPACE QUALIFIED FOR TITAN.

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THE INSTRUMENT SHUNTS ARE DESIGN BY
MARTIN MARIETTA CORPORATION DENVER DIVISION
P. O. BOX 179 DENVER, COLORADO 80201
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. J. E. BOATWRIGHT PHONE 303-794-5211 EXTENSION 3165
THE INSTRUMENT CURRENT SHUNT IS AN OFF-THE-SHELF AND IN PRODUCTION UNIT. THERE ARE SEVERAL TYPE OF SHUNTS DEPENDING ON THE REQUIRED CURRENT RATING. FOR A 50 MILLIVOLT SHUNT THE CURRENT RATING VARIES FROM 2.5 AMPS TO 100 AMPS. THE UNIT IS SPACE QUALIFIED AND IS USED ONBOARD THE TITAN LAUNCH VEHICLE PROGRAM.

REF. MARTIN MARIETTA COROPRATION DENVER DIVISION-STANDARD SPECIFICATION CONTROL DRAWING 92D18 SHUNTS INSTRUMENT- REV 9 11,17 1972.

EQUIPMENT ITEM		QUANITY	WEIGHT (POUNDS)	POWER (WATTS)	VOLUME (CU FT.)
FUEL CELL POWER PLANT	*	1	36.	1500.	1.13
BATTERY SILVER ZINC	**	1	10.	560.	.12
POWER DISTRIBUTION UNIT		1	10.	0.	.11
HYDROGEN TANK		1			
OXYGEN TANK		1			
TOTAL					

NOTES * BASED UPON 1976 TECHNOLOGY. SHORT TERM PEAK CAPABILITY OF 4-KW.

** SIZED TO PROVIDE EMERGENCY POWER FOR 30 MINUTES. SIZED AS A 10-AH UNIT WITH 45 W-H/LB ENERGY DENSITY.

TIMELINES

CONTINUOUS OPERATION OF SUBSYSTEM FROM 3.877 HOURS TO 97.634 HOURS.

AVIONICS SYSTEM
ELECTRICAL POWER SUBSYSTEM

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FC 1 TUG FUEL CELLS PRATT AND WHITNEY

DESIGN OPERATING CASE TEMPERATURE	278. TO 355. DEG. K (40. TO 180. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	273. TO 394. DEG. K (32. TO 250. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	278. TO 355. DEG. K (40. TO 180. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	278. TO 355. DEG. K (40. TO 180. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 36.8 * WIDTH 16.0 * HEIGHT	30.7 CENTIMETERS
LENGTH 14.5 * WIDTH 6.3 * HEIGHT	12.1 INCHES
PACKAGE AREA	4426.2 SQ. CENTIMETERS * 686.1 SQ. INCHES
PACKAGE VOLUME	18113.2 CU. CENTIMETERS * 1105.3 CU. INCHES
CASE MATERIAL	ALUMINUM
CASE WEIGHT	1.5 KILOGRAMS * 3.3 POUNDS
TOTAL WEIGHT	15.0 KILOGRAMS * 33.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.20 * EMISSIVITY = 0.05
INPUT STEADY STATE POWER	88.0 WATTS **NO LOAD
732.5 AT 1.5 KW , 234.4 AT 0.5 KW	(WATTS AT KW .LOAD)
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON

THE FUEL CELLS FOR SPACE TUG ARE AT PRESENT IN DEVELOPMENT FOR NASA-LERC AND THE USAF. UNIT IS DESIGN TO USE A RADIATOR FOR ACTIVE COOLING SYSTEM. IN ADDITION UNIT HAS A MULTI-LAYER INSULATION BLANKET AROUND IT. ABOVE TEMPERATURES ARE THE FUEL CELL INTERNAL TEMPERATURES. WITH 82.2 DEG C(180 DEG.F) BEING THE NORMAL OPERATING TEMPERATURE. THE LIMITING FACTOR ON THE LOW END OF THE TEMPRATURE RANGE IS THE FREEZING POINT OF WATER.

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THE FUEL CELLS FOR SPACE TUG ARE BEING DESIGN AND BUILT BY
PRATT AND WHITNEY AIRCRAFT
EAST HARTFORD CONNECTICUT
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. L. M. HANDLEY PHONE 203-565-2764 EXTENSION
THE FUEL CELLS ARE AT PRESENT IN DEVELOPMENT BY PRATT AND WHITNEY FOR NASA LERC AND USAF. THE FUEL CELLS FOR THE SPACE TUG ARE ADVANCE TECHNOLOGY UNITS UTILIZING A PASSIVE WATER REMOVAL FROM THE FUEL CELLS. THESE FUEL CELLS WILL OPERATE AT 11.0 N/CM SQ. (16 PSIA) AND AT 82.2 DEG.C(180 DEG F). UNIT IS DESIGN WITH 32 PLATES IN A SERIES WHICH FORM A FUEL CELL STACK. UNDER NORMAL OPERATING CONDITION UNIT IS EXPECTED TO GENERATE 1 KW-STEADY STATE POWER AND UP TO 3 KW PEAK POWER AT 28 OR 56 VDC. UNIT IS SELF HEATING WITH APPROX 470 WATTS OF HEAT BEING REJECTED AT 1 KW STEADY STATE POWER BUT REQUIRES 88 WATTS TO MAINTAIN UNIT OPERATING WITH NO LOAD. THIS IS DO TO THE UNIT INTERNAL HEATER THAT DRAWS POWER TO KEEP UNIT IN OPERATING TEMPERATURE. THE UNIT STARTUP HEATER SIZE LIMITS WARM UP TO A MINIMUM OF 15 MINUTES. IN ADDITION TO THE CELL STACK AND STARTUP HEATER UNIT INCLUDES THE FOLLOWING: PURGE VALVES. COOLANT TEMP CONTROL VALVE AND PUMP. WATER VENT REGULATOR AND COUPLED READTANT PRESSURE REGULATOR.

AVIONICS SYSTEM
ELECTRICAL POWER SUBSYSTEM

FC 2 FUEL CELLS GENERAL ELECTRIC

DESIGN OPERATING CASE TEMPERATURE	273. TO 322. DEG. K (32. TO 120. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	273. TO 366. DEG. K (32. TO 200. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	273. TO 322. DEG. K (32. TO 120. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	273. TO 366. DEG. K (32. TO 200. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 36.8 * WIDTH 50.8 * HEIGHT 33.0 CENTIMETERS	
LENGTH 14.5 * WIDTH 20.0 * HEIGHT 13.0 INCHES	
PACKAGE AREA	9529.0 SQ. CENTIMETERS * 1477.0 SQ. INCHES
PACKAGE VOLUME	61779.2 CU. CENTIMETERS * 3770.0 CU. INCHES
CASE MATERIAL	STAINLESS STEEL
CASE WEIGHT	4.1 KILOGRAMS * 9.0 POUNDS
TOTAL WEIGHT	26.3 KILOGRAMS * 57.9 POUNDS
SURFACE PROPERTIES	ALPHA = 0.20 * EMISSIVITY = 0.05
INPUT STEADY STATE POWER	30.0 WATTS **
0.0 AT 0. DEG,	0.0 AT 0. DEG (WATTS AT DEG. FAHRENHEIT)
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	ACTIVE * ACTIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE FUEL CELLS FOR SPACE TUG ARE AT PRESENT IN THE DEVELOPMENT STAGE, THE DATA IS BASED ON A NASA TECHNOLOGY STUDY OF FUEL CELLS FOR SPACE SHUTTLE. THE UNIT HAS AN ACTIVE THERMAL CONTROL OF CIRCULATING COOLANT TO MAINTAIN THE FUEL CELL INTERNAL OPERATING TEMPERATURE AT 65 TO 82 DEG C (150 TO 180 DEG. F). IN ADDITION TO COOLANT SYSTEM THE UNIT IS COVERED WITH A MULTI-LAYER INSULATION BLANKET. FREEZING POINT OF WATER IS THE TEMPERATURE LIMIT ON UNIT.

THE SOLID POLYMER ELECTROLYTE FUEL CELL IS DESIGN AND BUILT BY GENERAL ELECTRIC COMPANY AIRCRAFT EQUIPMENT DIVISION DIRECT ENERGY CONVERSION PROGRAMS 930 WESTERN AVENUE, LYNN MASSACHUSETTS 01910
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. L. J. NUTTALL PHONE 617-594-0100 EXTENSION 2645
THE FUEL CELLS FOR SPACE TUG ARE AT PRESENT IN DEVELOPMENT STAGE. THE DATA IS BASED ON A NASA TECHNOLOGY STUDY OF FUEL CELLS FOR SPACE SHUTTLE. THE UNIT DESIGN IS BASED ON SOLID POLYMER ELECTROLYTE FUEL CELL. THE UNIT HAS A 32 STACK CELL AND USES OXYGEN AND HYDROGEN AS REACTANTS. UNIT REACTANTS ARE UNDER PRESSURE OF 41.4 N/CM SQ (60 PSIA) AND 82 DEG. C (180 DEG F) DURING NORMAL OPERATION. UNIT IS DESIGN TO GENERATE 1.5 KW AT 28 VDC STEADY STATE POWER. THE FUEL CELL HAS A CONSTANT LOAD OF 30 WATTS DISSIPATION IN THE COOLANT CIRCULATING PUMP. UNIT MAY BE OPERATED AT ANY LOAD FROM OPEN CIRCUIT TO THE MINIMUM SPECIFICATION VOLTAGE LEVEL FOR ANY PERIOD OF TIME CONTINUOUSLY. IN ADDITION TO THE STACK CELL THE UNIT INCLUDES THE FOLLOWING,PURGE VALVES, COOLANT PUMP AND ACCUMULATOR, PRESSURE REGULATORS, AND THERMAL CONTROL VALVE.

REF. SPECIFICATION SHEET ON SPACE TUG FUEL CELL OF APRIL 23,1973 AND CONVERSATION WITH MR. L.J. NUTTALL.

AVIONICS SYSTEM
ELECTRICAL POWER SUBSYSTEM

BAT 1 25 AH PRI. BATTERY ELECTRIC STORAGE P/N PD9450027-005

DESIGN OPERATING CASE TEMPERATURE	167. TO 300. DEG. K (-159. TO 80. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	283. TO 311. DEG. K (50. TO 100. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	167. TO 300. DEG. K (-159. TO 80. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	167. TO 300. DEG. K (-159. TO 80. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 34.3 * WIDTH 22.4 * HEIGHT 18.3 CENTIMETERS	
LENGTH 13.5 * WIDTH 8.8 * HEIGHT 7.2 INCHES	
PACKAGE AREA	3604.6 SQ. CENTIMETERS * 558.7 SQ. INCHES
PACKAGE VOLUME	14016.8 CU. CENTIMETERS * 855.4 CU. INCHES
CASE MATERIAL	TITANIUM
CASE WEIGHT	1.6 KILOGRAMS * 3.6 POUNDS
TOTAL WEIGHT	16.3 KILOGRAMS * 36.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.448 * EMISSIVITY = 0.129
INPUT STEADY STATE POWER	0.0 WATTS **AT 28 VDC
2.8 AT 1. AMP, 28. AT 10. AMP (WATTS AT AMPS-LOAD)	
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE 25 AH BATTERY IS DESIGN FOR PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION TO THE SURROUNDING ENVIRONMENT. UNIT HAS A POLISHED TITANIUM FINISH. THE BATTERY IS SPACE QUALIFIED AND HAS BEEN USED ONBOARD THE TITAN III FOR SEVERAL YEARS. THE BATTERY HAS AN APPROXIMATE 90 PRECENT EFFICIENCY, AND UNIT POWER DISSIPATION IS A FUNCTION OF THE UNIT LOADS. UNIT OPERATING VOLTAGE RANGE IS 25 TO 31 VDC.

THE PRIMARY WET BATTERY -28V 25 AMP HR IS DESIGN AND BUILT BY ELECTRIC STORAGE BATTERY CO.
2510 LOUISBURG ROAD, RALEIGHT, NORHT CAROLINA
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. PAUL CHRISTENSEN PHONE 303-794-5211 EXTENSION 2485
THE 25 AMPS-HOUR BATTERY IS SILVER-ZINC BATTERY. IT IS DESIGN FOR SPACE ENVIRONMENTS AND HAS BEEN SPACE QUALIFIED ONBOARD THE TITAN III. THE UNIT IS USED ON TITAN LAUNCH VEHICLE AS A TRANSIENT POWER SUPPLY WITH A NOMINAL 200 AMPS CURRENT AND A 25 AMP-HR CAPACITY. UNIT IS ELECTRICALLY ISOLATED FROM THE CASE AND HAS AN OPERATING VOLTAGE RANGE OF 25 TO 31 VDC.

REF. PD94S0027 BATTERY WET, PRIMARY-28V 25 AMP HR, MARTIN MARIETTA AEROSPACE DENVER DIVISION.

AVIONICS SYSTEM
ELECTRICAL POWER SUBSYSTEM

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BAT 2 165 AH PRI BATTERY EAGLE-PICHER INDUS P/N PD9400033-001

DESIGN OPERATING CASE TEMPERATURE	283. TO 300. DEG. K
	(50. TO 80. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	250. TO 272. DEG. K
	(-10. TO 30. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	283. TO 300. DEG. K
	(50. TO 80. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	257. TO 320. DEG. K
	(3. TO 117. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE * LENGTH 41.7 * WIDTH 22.1 * HEIGHT	21.3 CENTIMETERS
LENGTH 16.4 * WIDTH 8.7 * HEIGHT	8.4 INCHES
PACKAGE AREA	4561.5 SQ. CENTIMETERS * 707.0 SQ. INCHES
PACKAGE VOLUME	19640.1 CU. CENTIMETERS * 1198.5 CU. INCHES
CASE MATERIAL	MAGNESIUM
CASE WEIGHT	3.6 KILOGRAMS * 7.9 POUNDS
TOTAL WEIGHT	36.7 KILOGRAMS * 81.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.900 * EMISSIVITY = 0.900
INPUT STEADY STATE POWER	0.0 WATTS ** 28 VDC
45.0 AT 400. WATT 70.0 AT 700. WATTS	(WATTS AT WATTS LOAD)
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON

THE 165 AM-HR BATTERY HAS A PASSIVE THERMAL CONTROL OF CONDUCTION TO MOUNTING SURFACE AND RADIATION FROM THE OTHER SURFACES. UNIT IS PAINTED WITH A BLACK PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENT. THE BATTERY DISSIPATED POWER IS A FUNCTION OF THE BATTERY LOADS WITH THE UNIT BEING APPROXIMATELY 90 PERCENT EFFICIENT. UNIT IS SPACE QUALIFIED AND WILL BE USE ONBOARD THE TRANSTAGE IN UP-COMING LAUNCHES

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THE 165 AMP HOUR 28 V WET PRIMARY BATTERY IS DESIGN AND BUILT BY EAGLE- PITCHER INDUSTRIES, INC. ELECTRONICS DIVISION
P.O. BOX 47, JOPLIN, MISSOURI 64801
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. PAUL CHRISTENSEN PHONE 303-794-5211 EXTENSION 2485
THE 165 AMP-HR BATTERY IS A SILVER-ZINC BATTERY. IT IS DESIGN FOR SPACE ENVIRONMENT AND WILL HAVE ITS FIRST SPACE FLIGHT TOWARD THE END OF THE YEAR. BATTERY IS THE PRIMARY ELECTRICAL SOURCE ONBOARD THE TRANSTAGE- THE THIRD STAGE OF THE TITAN III LAUNCH VEHICLE. UNIT SUPPLIES A LOAD VOLTAGE OF FROM 26 TO 32 VDC.

REF. PD9400033 165 AMP HOUR 28 V NET PRIMARY BATTERY, MARTIN MARIETTA CORPORATION DENVER DIVISION.

AVIONICS SYSTEM
ELECTRICAL POWER SUBSYSTEM

BAT 3 15 AMP-HR BATTERY EAGLE PICHER P/N PD94S0028

DESIGN OPERATING CASE TEMPERATURE	283. TO 366. DEG. K (50. TO 200. DEG. F)
NON-OPERATING AND STORAGE CASE TEMPERATURE	239. TO 325. DEG. K (-30. TO 125. DEG. F)
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS	283. TO 366. DEG. K (50. TO 200. DEG. F)
QUALIFICATION TEST TEMPERATURE REQUIREMENTS	283. TO 366. DEG. K (50. TO 200. DEG. F)
PACKAGE SHAPE	RECTANGULAR
PACKAGE SIZE	* LENGTH 18.0 * WIDTH 16.0 * HEIGHT 10.7 CENTIMETERS
	LENGTH 7.1 * WIDTH 6.3 * HEIGHT 4.2 INCHES
PACKAGE AREA	1303.4 SQ. CENTIMETERS * 202.0 SQ. INCHES
PACKAGE VOLUME	3078.6 CU. CENTIMETERS * 187.9 CU. INCHES
CASE MATERIAL	STAINLESS STEEL
CASE WEIGHT	2.7 KILOGRAMS * 6.0 POUNDS
TOTAL WEIGHT	8.6 KILOGRAMS * 19.0 POUNDS
SURFACE PROPERTIES	ALPHA = 0.900 * EMISSIVITY = 0.900
INPUT STEADY STATE POWER	0.0 WATTS ** 25 TO 32 VDC
62.5 AT 625. LOAD	96.0 AT 960. LOAD(WATTS AT WATTS LOAD)
OUTPUT POWER	0.0 WATTS **
THERMAL DESIGN	PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY ON
THE ABOVE 15 AMP-HR BATTERY IS ONLY CAPABILITY DATA BASED ON AN EXISTING 4 AMP-HR BATTERY. THE UNIT WILL HAVE PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION. IN ADDITION UNIT WILL BE SEALED AND PAINTED BLACK OR PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS ASSUMED TO BE 90 PRECENT EFFICIENT WITH 10 PRECENT OF BATT ERY DISCHARGE POWER GENERATED AS INTERNAL HEAT. BATTERY TEMPERA- TURE RANGE IS BASED ON UNIT BEING USED ONCE.

THE 15 AMP-HR WET 28V BATTERY IS DESIGNED BY
EAGLE PITCHER INDUSTRIES INC. ELECTRONICS DIVISION
P.O. BOX 47, JOPLIN MISSOURI 64801
THE DATA CONTAINED HEREIN WAS OBTAINED FROM
MR. JEFF WILSON PHONE 417-623-8000 EXTENSION 369
THE 15 AMP-HOUR BATTERY IS BASED ON DISCUSSION OF POSSIBLE DEVEL- OPMENT OF A UNIT THAT DOES EXIST AT THE PRESENT TIME. IT IS A SIMILAR UNIT TO THE 4 AMP-HR, 28 V SILVER-ZINC BATTERY THAT IS ONBOARD TITAN III LAUNCH VEHICLES. THE UNIT IS A SILVER ZINC BATTERY WITH 15 AMP-HOUR CAPACITY AND A 25 TO 30 AMPS DISCHARGE RATE. THE BATTERY IS TEMPERATURE SENSITIVE, THE PREFERRED OPERAT- ING TEMPERATURE IS 26.7 DEG. C (80 DEG. F) AND SHOULD NOT EXCEED 60 DEG. C(140 DEG. F) IF IT IS A PRIMARY BATTERY THAT WILL BE RECHARGED AND USED AGAIN. IF THE BATTERY IS GOING TO BE USED ONLY ONCE AND NOT RECHARGE FOR SOME REUSE IT CAN TAKE TEMPERA TURE OF 93.3 DEG. C (200 DEG. F). FOR LONG BATTERY LIFE UNIT SHOULD BE MAINTAINED BELOW 52 DEG. C(125 DEG F) FOR OPERATING TEMPERATURE AND BETWEEN 1 AND 10 DEG. C (30 AND 50 DEG. F) DURING DRY STORAGE.

REF. EAGLE PITCHER TECHNICAL DATA SHEETS OF 26 APRIL 1973 EPP-0473 175/GMC AND PD94S0028 4 AMP-HR 28 V PRIMARY BATTERY MMC.

II.

SPACE TUG THERMAL CONTROL

EQUIPMENT THERMAL REQUIREMENTS CATALOGUE

PREPARED FOR

NATIONAL AERONAUTICS AND SPACE ADMINSTRATION

MARSHALL SPACE FLIGHT CENTER

UNDER CONTRACT NAS 8-29670

BY

MARTIN MARIETTA CORPORATION

DENVER DIVISION

YES PERTAINS TO THE REQUIREMENTS OF UNIT TO BE ON DURING THESE PERIODS OF FLIGHT.

INT PERTAINS TO THE REQUIREMENTS OF UNIT TO BE ON INTERMITTENTLY DURING THESE PERIODS OF FLIGHT.

THERMAL DESIGN GROUND ACTIVE ACTIVE COOLING FOR GROUND OPERATION MEANS A REQUIREMENT FOR FORCED CONVECTION.

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM INERTIAL MEASUREMENT UNITS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX						REMARKS
				PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
IMU 1	CAROUSEL 5R DELCO ELECTRONICS	ACTIVE PASSIVE	116/ 189	YES 288/319 (60/115)	YES 288/319 (60/115)	ON 288/319 (60/115)	ON 288/319 (60/115)	ON 288/319 (60/115)	OFF 235/344 (-35/160)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU 2	NIS 200 NORTHOP CORP ELEC	ACTIVE PASSIVE	70/ 70	YES 219/344 (-65/160)	YES 219/344 (-65/160)	ON 219/344 (-65/160)	ON 219/344 (-65/160)	ON 219/344 (-65/160)	OFF 219/347 (-65/165)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU 3	VIKING IRU HAMILTON STANDARD	ACTIVE PASSIVE	50/ 95	YES 324/330 (125/135)	YES 324/330 (125/135)	ON 324/330 (125/135)	ON 324/330 (125/135)	ON 324/330 (125/135)	OFF 235/324 (-35/125)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU 4	MICRON ESG AUTONETICS RI	ACTIVE ACTIVE	50/ 50	YES 219/344 (-65/160)	YES 219/344 (-65/160)	ON 219/344 (-65/160)	ON 219/344 (-65/160)	ON 219/344 (-65/160)	OFF 210/368 (-80/203)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU 5	H478 STRAPDOWN IMU HONEYWELL	PASSIVE PASSIVE	30/ 230	YES 236/335 (-34/145)	YES 236/335 (-34/145)	ON 236/335 (-34/145)	ON 236/335 (-34/145)	ON 236/335 (-34/145)	OFF 224/366 (-55/200)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU 6	H-448 AGENA IMU HONEYWELL	ACTIVE ACTIVE	135/ 275	YES 269/322 (25/120)	YES 269/322 (25/120)	ON 269/322 (25/120)	ON 269/322 (25/120)	ON 269/322 (25/120)	OFF 255/344 (0/160)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU 7	HEXAD IMU HONEYWELL	ACTIVE ACTIVE	198/ 306	YES 288/333 (60/140)	YES 288/333 (60/140)	ON 288/333 (60/140)	ON 288/333 (60/140)	ON 288/333 (60/140)	OFF 263/344 (15/160)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU 8	BLOCK 5D STRAPDOWN HONEYWELL	PASSIVE PASSIVE	36/ 43	YES 304/308 (88/ 95)	YES 304/308 (88/ 95)	ON 304/308 (88/ 95)	ON 304/308 (88/ 95)	ON 304/308 (88/ 95)	OFF 272/344 (30/160)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU 9	H-319 CENTAUR IRU HONEYWELL	PASSIVE PASSIVE	90/ 170	YES 277/322 (40/120)	YES 277/322 (40/120)	ON 277/322 (40/120)	ON 277/322 (40/120)	ON 277/322 (40/120)	OFF 238/344 (-30/160)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU 9	H-319 CENTAUR SEU HONEYWELL	PASSIVE PASSIVE	30/ 30	YES 277/322 (40/120)	YES 277/322 (40/120)	ON 277/322 (40/120)	ON 277/322 (40/120)	ON 277/322 (40/120)	OFF 238/344 (-30/160)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU10	DIGS IMU HAMILTON STANDARD	ACTIV PASSIVE	100/ 195	YES 305/333 (90/140)	YES 305/333 (90/140)	ON 305/333 (90/140)	ON 305/333 (90/140)	ON 305/333 (90/140)	OFF 266/344 (20/160)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU11	RSD IMU HAMILTON STANDARD	PASSIVE PASSIVE	144/ 144	YES 305/333 (90/140)	YES 305/333 (90/140)	ON 305/333 (90/140)	ON 305/333 (90/140)	ON 305/333 (90/140)	OFF 219/344 (-65/160)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU12	SKN-2400 INU SINGER COMPANY	ACTIVE ACTIVE	*50/ 160	YES 218/344 (-67/160)	YES 218/344 (-67/160)	ON 218/344 (-67/160)	ON 218/344 (-67/160)	ON 218/344 (-67/160)	OFF 210/368 (-80/203)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
IMU13	KT-70 IMU SINGER COMPANY	ACTIVE ACTIVE	392/ 120	YES 218/344 (-67/160)	YES 218/344 (-67/160)	ON 218/344 (-67/160)	ON 218/344 (-67/160)	ON 218/344 (-67/160)	OFF 218/344 (-67/160)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM RATE GYROS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX						REMARKS
				PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
RG 1	ATM RATE GYROS MARTIN MARIETTA CO	PASSIVE PASSIVE	33/ 45	YES 233/315 (-40/109)	OFF 233/347 (-40/165)	ON 233/315 (-40/109)	ON 233/315 (-40/109)	ON 233/315 (-40/109)	OFF 233/347 (-40/165)	ON DURING PRELAUNCH FOR CHECKOUT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM STAR TRACKERS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
ST 1	CT-401 SENSOR	PASSIVE	5/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	BARC	PASSIVE	5	263/323 (14/122)	243/333 (-22/140)	243/333 (-22/140)	243/122 (-40/122)	243/323 (-22/122)	243/333 (-22/140)	CHECKOUT
ST 2	STAR TRACKER	PASSIVE	3/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	HONEYWELL	PASSIVE	3	263/283 (14/ 50)	255/302 (0/ 85)	255/302 (0/ 85)	255/ 50 (-40/ 50)	255/283 (0/ 50)	255/302 (0/ 85)	CHECKOUT
ST 3	MMOS	PASSIVE	20/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	ITT GILFILLAN	PASSIVE	20	293/323 (68/122)	288/323 (60/122)	288/323 (60/122)	288/122 (-40/122)	288/323 (60/122)	288/323 (60/122)	CHECKOUT
ST 4	569B STAR TRACKER	PASSIVE	3/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	EMR PHOTOELECTRIC	PASSIVE	3	243/318 (-22/113)	218/348 (-67/167)	218/348 (-67/167)	218/113 (-40/113)	218/318 (-67/113)	218/348 (-67/167)	CHECKOUT
ST 5	574 STAR CAMERA	PASSIVE	4/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	EMR PHOTOELECTRIC	PASSIVE	4	262/313 (13/104)	218/343 (-67/158)	218/343 (-67/158)	218/104 (-40/104)	218/313 (-67/104)	218/343 (-67/158)	CHECKOUT
ST 6	OAO STAR TRACKER	PASSIVE	6/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	BENDIX CORPORATION	PASSIVE	6	244/310 (-20/100)	238/327 (-30/130)	238/327 (-30/130)	238/100 (-40/100)	238/310 (-30/100)	238/327 (-30/130)	CHECKOUT
ST 7	OMA ATM STAR TRKR.	PASSIVE	18/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	BENDIX CORPORATION	PASSIVE	28	247/305 (-15/ 90)	233/327 (-40/130)	233/327 (-40/130)	233/ 90 (-40/ 90)	233/305 (-40/ 90)	233/327 (-40/130)	CHECKOUT
ST 8	KS-199 STAR TRKR	PASSIVE	8/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	KOLLSMAN INSTR.	PASSIVE	18	260/294 (10/ 70)	272/310 (30/100)	272/310 (30/100)	272/ 70 (-40/ 70)	272/294 (30/ 70)	272/310 (30/100)	CHECKOUT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM STAR TRACKER ELECTRONICS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX						REMARKS
				PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
STE 1	ATM STE	PASSIVE	6/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	BENDIX CORPORATION	PASSIVE	6	247/328 (-15/132)	218/343 (-67/158)	218/343 (-67/158)	218/132 (-40/132)	218/328 (-67/132)	218/343 (-67/158)	CHECKOUT
STE 2	KS-199 STAR TRKR	PASSIVE	14/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	OLLSMAN INSTR.	PASSIVE	14	260/294 (10/ 70)	272/310 (30/100)	272/310 (30/100)	272/ 70 (-40/ 70)	272/294 (30/ 70)	272/310 (30/100)	CHECKOUT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM HORIZON SCANNERS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
HS 1	HORIZON SENSOR	PASSIVE	1/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	QUANTIC INDUSTRIES	PASSIVE	1	255/338 (0/150)	233/338 (-40/150)	233/338 (-40/150)	233/150 (-40/150)	233/338 (-40/150)	233/338 (-40/150)	CHECKOUT
HS 2	HORIZON SENSOR	PASSIVE	6/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	BARNES ENGR. CO.	PASSIVE	6	255/333 (0/140)	238/347 (-30/165)	238/347 (-30/165)	238/140 (-40/140)	238/333 (-30/140)	238/347 (-30/165)	CHECKOUT
HS 3	LAHS	PASSIVE	3/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	LASC	PASSIVE	3	244/335 (-20/145)	227/338 (-50/150)	227/338 (-50/150)	227/145 (-40/145)	227/335 (-50/145)	227/338 (-50/150)	CHECKOUT
HS 4	NOHS	PASSIVE	3/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	LMSC	PASSIVE	3	244/335 (-20/145)	227/338 (-50/150)	227/338 (-50/150)	227/145 (-40/145)	227/335 (-50/145)	227/338 (-50/150)	CHECKOUT
HS 5	OSHS	PASSIVE	14/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	LMSC	PASSIVE	14	244/335 (-20/145)	227/338 (-50/150)	227/338 (-50/150)	227/145 (-40/145)	227/335 (-50/145)	227/338 (-50/150)	CHECKOUT
HS 6	MOD.IV HORIZON SYS	PASSIVE	10/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	QUANTIC INDUSTRIES	PASSIVE	10	255/338 (0/150)	235/338 (-35/150)	235/338 (-35/150)	235/150 (-40/150)	235/338 (-35/150)	235/338 (-35/150)	CHECKOUT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM HORIZON SCANNER ELECTRONICS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
HSE 1	POWER SUPPLY H.S.	PASSIVE	3/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	BARNES ENGR. CO.	PASSIVE	3	255/333 (0/140)	238/347 (-30/165)	238/347 (-30/165)	238/140 (-40/140)	238/333 (-30/140)	238/347 (-30/165)	CHECKOUT
HSE 2	MOD IV HORIZON CEU	PASSIVE	5/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	QUANTIC INDUSTRIES	PASSIVE	5	255/338 (0/150)	235/338 (-35/150)	235/338 (-35/150)	235/150 (-40/150)	235/338 (-35/150)	235/338 (-35/150)	CHECKOUT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM SUN SENSOR

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
SS 1	REFRACTOSYN SUN H H CONTROLS CO.	PASSIVE PASSIVE	0/ 0	YES 253/358 (-4/185)	OFF 253/358 (-4/185)	OFF 253/358 (-4/185)	ON 253/358 (-4/185)	ON 253/358 (-4/185)	OFF 253/358 (-4/185)	ON DURING PRELAUNCH FOR CHECKOUT
SS 2	FINE SUN SENSOR AS RBRS	PASSIVE PASSIVE	0/ 0	YES 253/358 (-4/185)	OFF 233/373 (-40/212)	OFF 233/373 (-40/212)	ON 253/358 (-4/185)	ON 253/358 (-4/185)	OFF 233/373 (-40/212)	ON DURING PRELAUNCH FOR CHECKOUT
SS 3	DIGITAL SUN SENSOR ADCOLE CORPORATION	PASSIVE PASSIVE	0/ 0	YES 253/318 (-4/113)	OFF 208/358 (-85/185)	OFF 208/358 (-85/185)	ON 253/318 (-4/113)	ON 253/318 (-4/113)	OFF 208/358 (-85/185)	ON DURING PRELAUNCH FOR CHECKOUT
SS 4	DIGITAL SUNSENSOR ADCOLE CORPORATION	PASSIVE PASSIVE	0/ 0	YES 253/333 (-4/140)	OFF 208/358 (-85/185)	OFF 208/358 (-85/185)	ON 253/333 (-4/140)	ON 253/333 (-4/140)	OFF 208/358 (-85/185)	ON DURING PRELAUNCH FOR CHECKOUT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM LASER RADARS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX						REMARKS
				PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
LR 1	SCAN LASAR RADAR	ACTIVE	30/	YES	OFF	OFF	OFF	INT	OFF	ON DURING PRELAUNCH FOR
	ITT GILFILLAN	ACTIVE	30	293/323 (68/122)	288/323 (60/122)	288/323 (60/122)	288/323 (60/122)	288/323 (60/122)	288/323 (60/122)	CHECKOUT
LR 2	SCAN LASAR RADAR	ACTIVE	70/	YES	OFF	OFF	OFF	INT	OFF	ON DURING PRELAUNCH FOR
	ITT GILFILLAN	ACTIVE	70	293/323 (68/122)	288/323 (60/122)	288/323 (60/122)	288/323 (60/122)	288/323 (60/122)	288/323 (60/122)	CHECKOUT
LR 3	SCAN LASER RADAR	ACTIVE	600/	YES	OFF	OFF	OFF	INT	OFF	ON DURING PRELAUNCH FOR
	ITT GILFILLAN	ACTIVE	600	293/323 (68/122)	288/323 (60/122)	288/323 (60/122)	288/323 (60/122)	288/323 (60/122)	288/323 (60/122)	CHECKOUT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM LASER RADAR ELECTRONICS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
LRE 1	ELEC.LASER RADAR ITT GILFILLAN	PASSIVE PASSIVE	20/ 20	YES 293/323 (68/122)	OFF 288/323 (60/122)	OFF 288/323 (60/122)	OFF 288/323 (60/122)	INT 288/323 (60/122)	OFF 288/323 (60/122)	ON DURING PRELAUNCH FOR CHECKOUT
LRE 2	ELEC LASER RADAR ITT GILFILLAN	ACTIVE ACTIVE	30/ 30	YES 293/323 (68/122)	OFF 288/323 (60/122)	OFF 288/323 (60/122)	OFF 288/323 (60/122)	INT 288/323 (60/122)	OFF 288/323 (60/122)	ON DURING PRELAUNCH FOR CHECKOUT
LRE 3	ELEC LASER RADAR ITT GILFILLAN	ACTIVE ACTIVE	150/ 150	YES 293/323 (68/122)	OFF 288/323 (60/122)	OFF 288/323 (60/122)	OFF 288/323 (60/122)	INT 288/323 (60/122)	OFF 288/323 (60/122)	ON DURING PRELAUNCH FOR CHECKOUT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM TELEVISION

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
TV 1	COLOR TELEVISION WESTINGHOUSE	PASSIVE PASSIVE	28/ 28	YES 253/338 (-4/149)	OFF 219/373 (-65/212)	OFF 219/373 (-65/212)	OFF 219/373 (-65/212)	INT 219/338 (-65/149)	OFF 219/373 (-65/212)	ON DURING PRELAUNCH FOR CHECKOUT
TV 2	LUNAR T.V. SYSTEM RCA	PASSIVE PASSIVE	14/ 14	YES 263/323 (14/122)	OFF 263/323 (14/122)	OFF 263/323 (14/122)	OFF 263/323 (14/122)	INT 263/323 (14/122)	OFF 263/323 (14/122)	ON DURING PRELAUNCH FOR CHECKOUT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM ACS ELECTRONICS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX						REMARKS
				PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
ACSE 1	VALVE DRIVE AMP. MARTIN MARIETTA CO	PASSIVE PASSIVE	38/ 38	YES 235/366 (-35/200)	OFF 235/398 (-35/257)	ON 235/366 (-35/200)	ON 235/366 (-35/200)	ON 235/366 (-35/200)	OFF 235/398 (-35/257)	ON DURING PRELAUNCH FOR CHECKOUT

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM COMPUTERS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	MANEUVERS SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
COMP 1	MAGIC 352	ACTIVE	208/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	DELCO ELECTRONICS	PASSIVE	208	305/327 (90/130)	305/327 (90/130)	305/327 (90/130)	305/327 (90/130)	305/327 (90/130)	305/327 (90/130)	CHECKOUT AND STAB
COMP 2	MAGIC 352 DIGS	ACTIVE	175/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	DELCO ELECTRONICS	PASSIVE	196	253/343 (-4/158)	253/343 (-4/158)	253/343 (-4/158)	253/343 (-4/158)	253/343 (-4/158)	253/343 (-4/158)	CHECKOUT AND STAB
COMP 3	469 COMPUTER	PASSIVE	20/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	CONTROL DATA CORP.	PASSIVE	20	253/338 (-4/149)	253/338 (-4/149)	253/338 (-4/149)	253/338 (-4/149)	253/338 (-4/149)	253/338 (-4/149)	CHECKOUT AND STAB
COMP 4	469 DOUBLE DENSITY	PASSIVE	16/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	CONTROL DATA CORP.	PASSIVE	16	253/338 (-4/149)	253/338 (-4/149)	253/338 (-4/149)	253/338 (-4/149)	253/338 (-4/149)	253/338 (-4/149)	CHECKOUT AND STAB
COMP 5	LS-52 COMPUTER	ACTIVE	205/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	LEAR SIEGLER INC	ACTIVE	205	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP 6	BR-1018M COMPUTER	PASSIVE	27/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	BUNKER RAMO	PASSIVE	44	218/358 (-67/185)	218/358 (-67/185)	218/358 (-67/185)	218/358 (-67/185)	218/358 (-67/185)	218/358 (-67/185)	CHECKOUT AND STAB
COMP 7	CP-16A COMPUTER	ACTIVE	242/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	GENERAL ELECTRIC	ACTIVE	242	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP 8	CP-24A COMPUTER	ACTIVE	94/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	GENERAL ELECTRIC	ACTIVE	94	233/348 (-40/167)	233/348 (-40/167)	233/348 (-40/167)	233/348 (-40/167)	233/348 (-40/167)	233/348 (-40/167)	CHECKOUT AND STAB
COMP 9	CP-32A COMPUTER	ACTIVE	365/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	GENERAL ELECTRIC	ACTIVE	365	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP10	SCP-234 COMPUTER.	PASSIVE	3/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	RCA	PASSIVE	3	263/333 (14/140)	263/333 (14/140)	263/333 (14/140)	263/333 (14/140)	263/333 (14/140)	263/333 (14/140)	CHECKOUT AND STAB
COMP11	RAC-261 COMPUTER	PASSIVE	200/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	RAYTHEON COMPANY.	PASSIVE	200	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP12	AP-101 COMPUTER	ACTIVE	340/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	IBM	ACTIVE	340	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP13	ADVANCE TECH COMP	PASSIVE	80/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	IBM	PASSIVE	80	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP14	MILLICOMPUTLER	PASSIVE	8/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	WESTINGHOUSE	PASSIVE	8	218/398 (-67/257)	218/398 (-67/257)	218/398 (-67/257)	218/398 (-67/257)	218/398 (-67/257)	218/398 (-67/257)	CHECKOUT AND STAB

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM COMPUTERS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
COMP15	MAGIC IV COMPUTER	PASSIVE	39/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	DELCO ELECTRONICS	PASSIVE	39	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP16	MAGIC 362 COMPUTER	PASSIVE	58/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	DELCO ELECTRONICS	PASSIVE	58	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	CHECKOUT AND STAB
COMP17	MICRO-D 1808	ACTIVE	106/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	ARMA DIV. OF AMBAC	ACTIVE	106	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP18	AOP COMPUTER	PASSIVE	13/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	WESTINGHOUSE	PASSIVE	13	253/353 (-4/176)	253/353 (-4/176)	253/353 (-4/176)	253/353 (-4/176)	253/353 (-4/176)	253/353 (-4/176)	CHECKOUT AND STAB
COMP19	HDC-301 COMPUTER	PASSIVE	16/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	HONEYWELL	PASSIVE	16	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP20	HDC-402 COMPUTER	PASSIVE	25/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	HONEYWELL	PASSIVE	25	241/324 (-25/125)	241/324 (-25/125)	241/324 (-25/125)	241/324 (-25/125)	241/324 (-25/125)	241/324 (-25/125)	CHECKOUT AND STAB
COMP21	HDC-601C COMPUTER	ACTIVE	160/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	HONEYWELL	ACTIVE	160	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	CHECKOUT AND STAB
COMP22	HDC-601P COMPUTER	ACTIVE	120/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	HONEYWELL	ACTIVE	120	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	218/344 (-67/160)	CHECKOUT AND STAB
COMP23	HDC-602 COMPUTER	PASSIVE	170/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	HONEYWELL	PASSIVE	170	219/365 (-65/199)	219/365 (-65/199)	219/365 (-65/199)	219/365 (-65/199)	219/365 (-65/199)	219/365 (-65/199)	CHECKOUT AND STAB
COMP24	D216 COMPUTER	PASSIVE	65/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	AUTONETICS R.I.	PASSIVE	65	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP25	D1216 COMPUTER	PASSIVE	75/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	AUTONETICS R.I.	PASSIVE	75	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP26	D232 COMPUTER	PASSIVE	140/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	AUTONETICS R.I	PASSIVE	140	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	219/344 (-65/160)	CHECKOUT AND STAB
COMP27	TDY-300 COMPUTER	ACTIVE	143/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	LEDYNE	PASSIVE	143	253/344 (-4/160)	253/344 (-4/160)	253/344 (-4/160)	253/344 (-4/160)	253/344 (-4/160)	253/344 (-4/160)	CHECKOUT AND STAB
COMP28	TDY-310 CENTAUR	ACTIVE	235/	YES	YES	ON	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	TELEDYNE	PASSIVE	235	253/333 (-4/140)	253/333 (-4/140)	253/333 (-4/140)	253/333 (-4/140)	253/333 (-4/140)	253/333 (-4/140)	CHECKOUT AND STAB

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EQUIPMENT ITEM COMPUTERS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX						REMARKS
				PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
COMP29	SKC2000 COMPUTER SINGER COMPANY	ACTIVE ACTIVE	790/ 790	YES 218/344 (-67/160)	YES 218/344 (-67/160)	ON 218/344 (-67/160)	ON 218/344 (-67/160)	ON 218/344 (-67/160)	YES 218/344 (-67/160)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM TAPE RECORDERS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS - DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
TR 1	EREP TAPE RECORDER MARTIN MARIETTA	ACTIVE ACTIVE	187/ 187	YES 288/313 (60/105)	YES 288/313 (60/105)	ON 288/313 (60/105)	ON 288/313 (60/105)	ON 288/313 (60/105)	YES 288/313 (60/105)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM TRANSPONDERS, PM

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
TPM 1	S-BAND TRANSPONDER	PASSIVE	6/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	PHILCO FORD CORP	PASSIVE	6	241/324 (-25/125)	235/396 (-35/254)	235/324 (-35/125)	241/324 (-25/125)	241/324 (-25/125)	235/396 (-35/254)	CHECKOUT
TPM 2	S-BAND SGLS TRANSP	PASSIVE	2/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	MOTOROLA INC.	PASSIVE	2	243/353 (-22/176)	233/363 (-40/194)	233/353 (-40/176)	243/353 (-22/176)	243/353 (-22/176)	233/363 (-40/194)	CHECKOUT
TPM 3	S-BAND SGLS TRANSP	IVE	31/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	MOTOROLA INC.	PASSIVE	31	243/353 (-22/176)	233/363 (-40/194)	233/353 (-40/176)	243/353 (-22/176)	243/353 (-22/176)	233/363 (-40/194)	CHECKOUT
TPM 4	S-BAND SGLS TRANSP	PASSIVE	51/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	MOTOROLA INC.	PASSIVE	51	243/353 (-22/176)	233/363 (-40/194)	233/353 (-40/176)	243/353 (-22/176)	243/353 (-22/176)	233/363 (-40/194)	CHECKOUT
TPM 5	MSX-201S S-BAND	PASSIVE	34/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	MOTOROLA INC.	PASSIVE	34	243/353 (-22/176)	233/363 (-40/194)	233/353 (-40/176)	243/353 (-22/176)	243/353 (-22/176)	233/363 (-40/194)	CHECKOUT
TPM 6	MSX-501S S-BAND	PASSIVE	53/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	MOTOROLA INC.	PASSIVE	53	243/353 (-22/176)	233/363 (-40/194)	233/353 (-40/176)	243/353 (-22/176)	243/353 (-22/176)	233/363 (-40/194)	CHECKOUT
TPM 7	TR-36 TRANSPONDER	PASSIVE	6/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	CUBIC CORPORATION	PASSIVE	6	238/344 (-30/160)	233/344 (-40/160)	233/344 (-40/160)	238/344 (-30/160)	238/344 (-30/160)	233/344 (-40/160)	CHECKOUT
TPM 7	TR-36 TRANSPONDER	PASSIVE	25/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	CUBIC CORPORATION	PASSIVE	25	238/344 (-30/160)	233/344 (-40/160)	233/344 (-40/160)	238/344 (-30/160)	238/344 (-30/160)	233/344 (-40/160)	CHECKOUT
TPM 7	TR-36 TRANSPONDER	PASSIVE	4/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	CUBIC CORPORATION	PASSIVE	4	238/344 (-30/160)	233/344 (-40/160)	233/344 (-40/160)	238/344 (-30/160)	238/344 (-30/160)	233/344 (-40/160)	CHECKOUT
TPM 7	TR-36 TRANSPONDER	PASSIVE	0/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	CUBIC CORPORATION	PASSIVE	0	238/344 (-30/160)	233/344 (-40/160)	233/344 (-40/160)	238/344 (-30/160)	238/344 (-30/160)	233/344 (-40/160)	CHECKOUT

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM TRANSMITTERS, FM

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX						REMARKS
				PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
TFM 1	TWTA S-BAND WATKINS- JOHNSON	PASSIVE PASSIVE	60/ 60	YES 241/324 (-25/125)	OFF 235/396 (-35/254)	INT 235/324 (-35/125)	ON 241/324 (-25/125)	ON 241/324 (-25/125)	OFF 235/396 (-35/254)	ON DURING PRELAUNCH FOR CHECKOUT
TFM 2	MTT-201 S-BAND FM MOTOROLA INC.	PASSIVE PASSIVE	25/ 25	YES 243/353 (-22/176)	OFF 233/363 (-40/194)	INT 233/353 (-40/176)	ON 243/353 (-22/176)	ON 243/353 (-22/176)	OFF 233/363 (-40/194)	ON DURING PRELAUNCH FOR CHECKOUT
TFM 3	MTT-501 S-BAND FM MOTOROLA INC.	PASSIVE PASSIVE	60/ 60	YES 243/353 (-22/176)	OFF 233/363 (-40/194)	INT 233/353 (-40/176)	ON 243/353 (-22/176)	ON 243/353 (-22/176)	OFF 233/363 (-40/194)	ON DURING PRELAUNCH FOR CHECKOUT
TFM 4	S-BAND TRANSMITTER EMR	PASSIVE PASSIVE	205/ 205	YES 269/367 (25/202)	OFF 235/344 (-35/160)	INT 235/367 (-35/202)	ON 269/367 (25/202)	ON 269/367 (25/202)	OFF 235/344 (-35/160)	ON DURING PRELAUNCH FOR CHECKOUT

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM POWER AMPLIFIERS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX						REMARKS
				PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
PA 1	S-BAND POWER AMP RADIATION INC	PASSIVE PASSIVE	16/ 16	YES 248/343 (-13/158)	OFF 233/373 (-40/212)	INT 233/343 (-40/158)	ON 248/343 (-13/158)	ON 248/343 (-13/158)	OFF 233/373 (-40/212)	ON DURING PRELAUNCH FOR CHECKOUT
PA 2	AMPLIFIERS MSC	PASSIVE PASSIVE	10/ 10	YES 253/343 (-4/158)	OFF 233/363 (-40/194)	INT 233/343 (-40/158)	ON 253/343 (-4/158)	ON 253/343 (-4/158)	OFF 233/363 (-40/194)	ON DURING PRELAUNCH FOR CHECKOUT

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM RF MULTIPLEXERS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX						REMARKS
				PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
RFM 1	RF MULTIPLEXER	PASSIVE	0/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	WAVECOM INC.	PASSIVE	0	241/324 (-25/125)	235/396 (-35/254)	235/324 (-35/125)	241/324 (-25/125)	241/324 (-25/125)	235/396 (-35/254)	CHECKOUT
RFM 2	MULTIPLEXER	PASSIVE	0/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	EMERSON ELECTRIC	PASSIVE	0	255/324 (0/125)	235/344 (-35/160)	235/324 (-35/125)	255/324 (0/125)	255/324 (0/125)	235/344 (-35/160)	CHECKOUT

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM DECODER

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
DEC 1	MCR-904 DECODER MOTOROLA INC.	PASSIVE PASSIVE	2/ 2	YES 233/348 (-40/167)	OFF 223/358 (-58/185)	INT 223/348 (-58/167)	ON 233/348 (-40/167)	ON 233/348 (-40/167)	OFF 223/358 (-58/185)	ON DURING PRELAUNCH FOR CHECKOUT

INSTRUMENTATION SUBSYSTEM

EQUIPMENT ITEM PRESSURE TRANSDUCERS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
PRES 1	TRANSDUCER PRES.	PASSIVE	0/	YES	YES	INT	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	GULTON INDUSTRIES	PASSIVE	0	233/344 (-40/160)	233/344 (-40/160)	233/344 (-40/160)	233/344 (-40/160)	233/344 (-40/160)	233/344 (-40/160)	CHECKOUT AND STAB
PRES 2	TRANSDUCER PRES.	PASSIVE	0/	YES	YES	INT	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	BALDWIN-LIMA	PASSIVE	0	235/394 (-35/250)	235/394 (-35/250)	235/394 (-35/250)	235/394 (-35/250)	235/394 (-35/250)	235/394 (-35/250)	CHECKOUT AND STAB
PRES 3	TRANSDUCER PRES.	PASSIVE	0/	YES	YES	INT	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	GENISCO TECH CORP.	PASSIVE	0	144/422 (*00/300)	144/422 (*00/300)	144/422 (*00/300)	144/422 (*00/300)	144/422 (*00/300)	144/422 (*00/300)	CHECKOUT AND STAB
PRES 4	TRANSDUCER PRES.	PASSIVE	0/	YES	YES	INT	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	GULTON INDUS. INC.	PASSIVE	0	269/310 (25/100)	269/310 (25/100)	235/310 (-35/100)	269/310 (25/100)	269/310 (25/100)	269/310 (25/100)	CHECKOUT AND STAB

INSTRUMENTATION SUBSYSTEM

EQUIPMENT ITEM TEMPERATURE TRANSDUCERS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX						REMARKS
				PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
TEMP 1	TRANSDUCER TEMP HY-CAL ENGINEERING	PASSIVE PASSIVE	0/ 0	YES 148/423 (*93/302)	YES 148/423 (*93/302)	INT 155/423 (*80/302)	ON 148/423 (*93/302)	ON 148/423 (*93/302)	YES 148/423 (*93/302)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
TEMP 2	TRANSDUCER TEMP. ROSEMOUNT ENGR. CO	PASSIVE PASSIVE	0/ 0	YES 235/422 (-35/300)	YES 235/422 (-35/300)	INT 235/422 (-35/300)	ON 235/422 (-35/300)	ON 235/422 (-35/300)	YES 235/422 (-35/300)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
TEMP 3	TRANSDUCER TEMP. ROSEMOUNT ENGR. CO	PASSIVE PASSIVE	0/ 0	YES 266/310 (20/100)	YES 266/310 (20/100)	INT 235/310 (-35/100)	ON 266/310 (20/100)	ON 266/310 (20/100)	YES 266/310 (20/100)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB
TEMP 4	TRANSDUCER TEMP. ROSEMOUNT ENGR. CO	PASSIVE PASSIVE	0/ 0	YES 219/355 (-65/180)	YES 219/355 (-65/180)	INT 219/355 (-65/180)	ON 219/355 (-65/180)	ON 219/355 (-65/180)	YES 219/355 (-65/180)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB

INSTRUMENTATION SUBSYSTEM

EQUIPMENT ITEM CURRENT MEASUREMENTS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
CURR 1	SHUNTS-CURRENT	PASSIVE	0/	YES	YES	INT	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	MARTIN MARIETTA	PASSIVE	0	223/378 (-58/221)	223/378 (-58/221)	223/378 (-58/221)	223/378 (-58/221)	223/378 (-58/221)	223/378 (-58/221)	CHECKOUT AND STAB

ELECTRICAL POWER SUBSYSTEM

EQUIPMENT ITEM FUEL CELL POWER SYSTEMS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX PRELAUNCH	SHUTTLE CARRY	MANEUVERS SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	REMARKS
FC 1	TUG FUEL CELLS	ACTIVE	820/	YES	OFF	ON	ON	ON	OFF	ON DURING PRELAUNCH FOR
	PRATT AND WHITNEY	ACTIVE	322	277/355 (40/180)	273/394 (32/250)	277/355 (40/180)	277/355 (40/180)	277/355 (40/180)	273/394 (32/250)	CHECKOUT
FC 2	FUEL CELLS	ACTIVE	30/	YES	OFF	ON	ON	ON	OFF	ON DURING PRELAUNCH FOR
	GENERAL ELECTRIC	ACTIVE	30	273/322 (32/120)	273/366 (32/200)	273/322 (32/120)	273/322 (32/120)	273/322 (32/120)	273/366 (32/200)	CHECKOUT

ELECTRICAL POWER SUBSYSTEM

EQUIPMENT ITEM BATTERIES

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX						REMARKS
				PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
BAT 1	25 AH PRI. BATTERY	PASSIVE	2/	YES	OFF	ON	ON	ON	OFF	ON DURING PRELAUNCH FOR
	ELECTRIC STORAGE	PASSIVE	28	167/299 (*59/ 80)	283/310 (50/100)	167/299 (*59/ 80)	167/299 (*59/ 80)	167/299 (*59/ 80)	283/310 (50/100)	CHECKOUT
BAT 2	165 AH PRI BATTERY	PASSIVE	45/	YES	OFF	ON	ON	ON	OFF	ON DURING PRELAUNCH FOR
	AGLE-PICHER INDUS	PASSIVE	70	283/299 (50/ 80)	249/272 (-10/ 30)	283/299 (50/ 80)	283/299 (50/ 80)	283/299 (50/ 80)	249/272 (-10/ 30)	CHECKOUT
BAT 3	15 AMP-HR BATTERY	PASSIVE	62/	YES	OFF	ON	ON	ON	OFF	ON DURING PRELAUNCH FOR
	EAGLE PICHER	PASSIVE	96	283/366 (50/200)	238/324 (-30/125)	283/366 (50/200)	283/366 (50/200)	283/366 (50/200)	238/324 (-30/125)	CHECKOUT

III.

SPACE TUG THERMAL CONTROL

EQUIPMENT PHYSICAL CHARACTERISTICS AND CONSTRAINTS CATALOGUE

PREPARED FOR

NATIONAL AERONAUTICS AND SPACE ADMINSTRATION

MARSHALL SPACE FLIGHT CENTER

UNDER CONTRACT NAS 8-29670

BY

MARTIN MARIETTA CORPORATION

DENVER DIVISION

PACKAGE SHAPE RECT RECTANGULAR.

PACKAGE SHAPE CYLI CYLINDRICAL.

PACKAGE SHAPE SPHE SPHERE.

ALPHA SOLAR ABSORBTIVITY.

EMISS SURFACE EMISSIVITY.

POWER DENSITY THE TOTAL DISSIPATED POWER PER UNIT SURFACE AREA.

TIME CONSTANT HOURS THE TIME REQUIRED TO ACHIEVE 67 PRECENT OF THE DELTA TEMPERATURE DEFINED BY THE DESIGN OPERATING TEMPERATURE LESS ROOM AMBIENT TEMPERATURE.

ADIABATIC RISE RATE THE TEMPERATURE RISE IN ONE HOUR IF ALL THE HEAT DISSIPATED IS CONTAINED WITHIN THE UNIT.

THERMAL MASS THE AMOUNT OF ENERGY REQUIRED TO RAISE A UNIT ONE DEGREE IN TEMPERATURE.

ALLOWABLE SINK TEMP. THE EQUIVALENT VACUUM CHAMBER WALL TEMPERATURE WHICH WILL RESULT IN SPECEIFIED CASE TEMPERATURE.

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM INERTIAL MEASUREMENT UNITS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG K/(F) DESIGN MIN	DESIGN MAX	SINK QUAL MIN	QUAL MAX	OP MODE
IMU 1	CAROUSEL 5B DELCO ELECTRONICS (80.0)	36.3	RECT	8440. (9.1)	49102. (1.73)	.90/ .90	116/ 189	137/223 (12/ 20)	1.59 1.49	3 6 7 11	30.6 16.2	225 -54	296 73	220 -62	298 77	CONT
	MARRIED WITH MAGIC 352 COMPUTER MOUNT WITH Z-AXIS ALONG LONGITUDNIAL AXIS MAX CABLE LENGTH 1.8 METERS (6.0 FEET) QUALIFIED FOR 9 HOUR MISSION OPERATIONAL IN 8 HOURS															
IMU 2	NIS 200 NORTHOP CORP ELEC (17.0)	7.7	CYLI	2434. (2.6)	8921. (.32)	.90/ .90	70/ 70	287/287 (26/ 26)	.93 .93	11 11 20 20	6.5 3.4	-0 -460	302 85	-0 -460	302 85	CONT
	UNIT IS DESIGN FOR AIRCRAFT USE WITH COOLING ACHIEVED BY AIRCRAFT AIRFLOW AND HEAT EXCHANGER FAST START IN 17 SECONDS, NORMAL START 3 MINUTES,UNIT IS THERMAL STABILIZED IN 15 MINUTES UNIT IS PAINTED GRAY COLOR STD MIL SPEC HEAT EXCHANGER IS 5 IN BY 7 IN BY 0.5 IN THICK. UNIT IS MARRIED TO AIRCRAFT COMPUTER ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 41. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 41. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
IMU 3	VIKING IRU HAMILTON STANDARD (30.5)	13.8	RECT	3542. (3.8)	14011. (.49)	.85/ .85	50/ 95	141/268 (13/ 24)	1.44 1.32	4 8 8 15	11.8 6.2	273 32	307 94	-0 -460	268 22	CONT
	THE UNIT IS MARRIED TO HDC-402 COMPUTER.CABLE LENGTH 5. FT BETWEEN IMU AND COMPUTER.UNIT IS MOUTED WITH ITS X-AXIS ALONG LONGITIDUAL AXIS OF VEHICLE.UNIT IS ENVIRONMENTS TEMPERATURE DEPENDENT AT-30 DEG.C OPERATIONAL IN 121 MINUTES,AT 24 DEG. C OPERATIONAL IN 45 MINUTES. UNIT WAS BUILT FOR VIKING PROGRAM AND IS POWERED UP 3HRS PRIOR TO MARS REENTRY. ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 37. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
IMU 4	MICRON ESG AUTONETICS RI (10.0)	4.5	RECT	1419. (1.5)	3304. (.12)	.90/ .90	50/ 50	352/352 (32/ 32)	.92 .92	13 13 24 24	3.9 2.0	-0 -460	290 63	-0 -460	290 63	CONT
	THE MICRON IS IN THE DEVELOPMENT STAGE AT PRESENT TIME FOR WRIGHT PATTERSON AIR FORCE AVIONICS. THE PROGRAM WILL GO INTO PHASE 2 AT END OF YEAR WITH EXPECTED PRODUCTION IN 1977. UNIT IS DESIGN FOR AIRCRAFT AND STRATEGIC CRUISE MISSILES. UNIT AT PRESENT IS DESIGN WITH AN ACTIVE COOLING SYSTEM USING FORCED COOL AIR AND COLD PLATE. UNIT CAN BE MODIFIED FOR SPACE ENVIRONMENT AND USE OF A PASSIVE THERMAL DESIGN. ALL DATA IS PRELIMINARY INFORMATION ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 33. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 33. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM INERTIAL MEASUREMENT UNITS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
IMU 5	H478 STRAPDOWN IMU HONEYWELL	2.7 (6.0)	RECT	1180. (1.3)	2454. (.09)	.80/ .80	30/ 254/*49 230 (23/181)		.80 .42	13 105 24 189	2.3 1.2	-0 -460	290 63	-0 -460	278 41	CONT
	THE UNIT HAS INTERNAL HEATERS THAT MAINTAIN THE UNIT WITHIN OPERATING TEMPERATURE. THE UNIT THERMAL DESIGN IS PASSIVE WITH CONDUCTION TO THE MOUNTING SURFACE. UNIT REQUIRE 200 WATTS FOR FAST WARM UP. UNIT HAS A BLUE ANODIZED FINISH BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. UNIT WAS QUALIFIED ON THE SHAG PROGRAM.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 213. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 215. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
IMU 6	H-448 AGENA IMU HONEYWELL	17.0 (37.5)	RECT	4901. (5.3)	20612. (.73)	.25/ .85	135/ 275/561 275 (25/ 52)		1.20 1.01	9 20 17 36	14.4 7.6	-0 -460	266 20	-0 -460	266 20	CONT
	THE H-448 AGENA STRAPDOWN IMU HAS AN ACTIVE THERMAL SYSTEM IT USES A COLD PLATE WITH PLATE TEMPERATURE OF 10.6 TO 60 DEG. C(60 TO 140 DEG. F). UNIT IS PAINTED WITH A WHITE POLYURETHANE PAINT,HOWEVER UNIT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS MARRIED TO THE AGENA COMPUTER HDC-501 DIGITAL COMPUTER. THE H-448 IMU HAS BEEN SPACE QUALIFIED ON THE AGENA PROGRAM. THE UNIT HAS AN INTERNAL HEATERS THAT MAINTAIN UNIT WITHIN OPERATING TEMP.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 150. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 150. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
IMU 7	HEXAD IMU HONEYWELL	60.9 (*4.2)	RECT	13577. (14.6)	95238. (3.36)	.25/ .85	198/ 145/225 306 (13/ 20)		1.61 1.53	4 6 7 11	51.5 27.2	218 -66	310 99	115 -252	310 99	CONT
	THE HEXAD IMU IS IN DEVELOPMENT IT HAS INTERNAL HEATERS THAT HAVE VARIABLE POWER AND MAINTAIN THE UNIT WITHIN OPERATING TEMPERATURE. THE UNIT THERMAL DESIGN IS ACTIVE WITH A COLD PLATE UTILIZED TO MAINTAIN THE UNIT TEMPERATURE REQUIREMENTS. THE HEXAD IMU IS PAINTED WITH A WHITE POLYURETHANE PAINT, HOWEVER UNIT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.															
IMU 8	BLOCK 5D STRAPDOWN HONEYWELL	9.9 (21.9)	RECT	3084. (3.3)	11356. (.40)	.25/ .85	36/ 116/141 43 (10/ 13)		1.36 1.33	4 5 8 9	8.4 4.4	274 33	285 53	217 -68	297 75	CONT
	THE BLOCK 5D STRAPDOWN IMU IS IN DEVELOPMENT, AND HAS A PASSIVE COOLING SYSTEM OF RADIATION OUT TO SPACE. THE UNIT IS THERMALLY ISOLATED FROM ITS MOUNTING SURFACE. UNIT REQUIRE 24.2 WATTS OF HEATER POWER AT ASCENT AND 7.7 WATTS FOR IN ORBIT OPERATION. THE UNIT IS PAINTED WITH A WHITE POLYURETHANE PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.															

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM INERTIAL MEASUREMENT UNITS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
IMU 9	H-319 CENTAUR IRU HONEYWELL	28.3 (62.5)	RECT	10473. (11.3)	72161. (2.55)	.25/ .85	90/ 170	85/162 (7/ 15)	1.13 1.06	3 7 6 12	24.9 13.1	225 -53	307 94	202 -94	307 94	CONT
	THE CENTAUR INERTIAL REFERENCE UNIT (IRU) IS MARRIED TO THE CENTAUR SYSTEM ELECTRONICS UNIT (SEU). THE IRU IS A GIMBALED SYSTEM, IT HAS A PASSIVE THERMAL DESIGN OF RADIATION TO SPACE. THE UNIT IS PAINTED WITH A WHITE POLYURETHANE PAINT. BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT HAS INTERNAL HEATERS WHICH MAINTAIN THE UNIT WITHIN OPERATING TEMPERATURE. THE IRU CASE WEIGHT INCLUDES 4 KG (8.8LB) OF ALUMINUM.															
IMU 9	H-319 CENTAUR SEU HONEYWELL	11.3 (25.0)	RECT	3720. (4.0)	14009. (.49)	.25/ .85	30/ 30	80/ 80 (7/ 7)	1.31 1.31	3 3 5 5	10.2 5.4	255 0	308 96	213 -74	319 116	CONT
	THE CENTAUR SYSTEM ELECTRONICS UNIT (SEU) IS MARRIED TO THE INERTIAL REFERENCE UNIT(IRU). THE SEU UTILIZES RADIATION TO SPACE AS THE UNIT PASSIVE THERMAL CONTROL. THE SEU IS PAINTED WITH A WHITE POLYURETHANE PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.															
IMU 10	DIGS IMU HAMILTON STANDARD	18.1 (40.0)	RECT	4323. (4.7)	18747. (.66)	.90/ .90	100/ 195	231/451 (21/ 41)	1.36 1.20	6 13 12 23	15.4 8.1	-0 -460	297 75	-0 -460	297 75	CONT
	THE DIGS USES A PHASE-CHANGE (WAX) HEAT SINK AND INTERNAL HEATERS FOR A TEMPERATURE CONTROL. UNIT INTERNAL GYROS ARE DESIGN TO OPERATE AT 71.1 + OR- 0.6 DEG.C(160 +OR-1 DEG.F). UNIT REQUIRES 620 WATTS INCLUDING 425 WATTS GROUND POWER FOR FAST WARM UP. UNIT NEED 60 MINUTES OF WARM UP PRIOR TO BEING OPERATIONAL. THE DIGS SURFACES ARE PAINTED WITH ALUMINIZED PAINT. ABOVE DATA INCLUDES THE DIGS AND ITS SUPPORTING CRADLE. UNIT IS THERMALLY ISOLATED. ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 3. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 3. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
IMU 11	RSD IMU HAMILTON STANDARD	29.2 (64.4)	RECT	5403. (5.8)	25410. (.90)	.90/ .90	144/ 144	266/266 (24/ 24)	1.71 1.71	6 6 11 11	24.8 13.1	243 -22	290 63	243 -22	290 63	CONT
	THE REDUNDANT STRAPDOWN IMU IS IN DEVELOPMENT AT PRESENT, IT IS BASED ON 2 DIGS IMU COUPLED TOGETHER. UNIT IS EXPECTED TO BE THERMALLY ISOLATED AND HAVE INTERNAL HEATERS TO MAINTAIN OPERATING TEMPERATURE. ABOVE DATA IS BASED ON DIGS TEMPERATURE RANGE NO FUTHER INFORMATION IS AVAILABLE AT PRESENT TIME. SURFACE PROPERTIES ARE BASED ON DIGS WHICH HAS ALUMINIZED PAINT BUT UNIT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.															

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM INERTIAL MEASUREMENT UNITS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN MAX	QUAL MIN MAX	OP MODE
IMU 12	SKN-2400 INU	10.9	RECT	3338.	12435.	.90/	450/	*48/479	.63	51 18	9.2	-0 -0	-0 -0	CONT
	SINGER COMPANY	(24.0)		(3.6)	(.44)	.90	160	(125/ 44)	.87	92 33	4.8	-460 -460	-460 -460	
	THE INU CONTAINS A FAN AND IS AIR COOLED BY FORCED AIR AND CONDUC TION. UNIT IS DESIGN FOR ARIFRACT USE BUT CAN BE MODEFIED FOR SPACE ENVIRONMENT. UNIT INCLUDES THE SKC-3000 COMPUTER BUT CAN BE FUNCTIONAL WITHOUT COMPUTER. UNIT REQUIRED 2.5 MINUTES TO WARM-UP HOWEVER IT IS A FUNCTION OF AVAILABLE POWER FOR HEATERS AND TEMP- ERATURE THAT SETS THE WARM-UP PERIOD. UNIT IS PAINTED BLACK BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.														
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 121. AND 210. TO MAINTAIN THE MIN AND MAX OPERATING TEMP														
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 121. AND 210. TO MAINTAIN THE MIN AND MAX QUAL TEMP														
IMU 13	KT-70 IMU	26.9	RECT	7381.	39657.	.90/	392/	531/162	.95	18 5	22.8	-0 246	-0 246	CONT
	SINGER COMPANY	(59.4)		(7.9)	(1.40)	.90	120	(49/ 15)	1.16	32 9	12.0	-460 -16	-460 -16	
	THE KT-70 IMU IS A 4 GIMBAL SYSTEM IT HAS AN ACTIVE COOLING SYSTEM OF HEAT TRANSFER THROUGH COLD PLATE. THE BASIC KT-70 IMU WAS BUILT FOR SEVERAL AIRCRAFT PROGRAMS INCLUDING THE A7D/E, F105 AND P3C IN ADDITION UNIT IS USED ON THE SRAM MISSILE AND IS UNDER EVAL UATION FOR THE SPACE SHUTTLE. UNIT HAS INTERNAL HEATERS THAT WARM UP UNIT TO OPERATING TEMPERATURE. UNIT REQUIRE 14 MINUTES FOR WARM UP FOR SHUTTLE CONFIGURATION. UNIT IS PAINTED BLACK.														
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 34. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP														
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 34. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP														

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM RATE GYROS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
RG 1	ATM RATE GYROS	5.2	RECT	2839.	9518.	.85/	33/ 118/158		.75	7 10	4.4	-0	294	-0	294	CONT
	MARTIN MARIETTA CO(11.5)	(3.1)		(.34)	.85	45 (10/ 14)		.72	14 19	2.3	-460	70	-460	70		

THE ATM RATE GYRO HAS AN INTERNAL PROPORTIONAL HEATER THAT MAINTAIN THE UNIT AT 67.8 + OR - 1 DEG.C(154 + OR -1 DEG. F). THE UNIT THERMAL DESIGN IS PASSIVE WITH RADIATION AND CONDUCTION TO THE SURROUNDING ENVIRONMENT AND MOUNTING STRACTURE. THE UNIT HAS A BLACK ANODIZED FINISH BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SPACE QUALIFIED AND PRESENTLY OPERATING ONBOARD THE SKYLAB.

****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 4. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP

****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 4. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM STAR TRACKERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG K/(F) DESIGN MIN	DESIGN MAX	QUAL MIN	QUAL MAX	OP MODE
ST 1	CT-401 SENSOR	5.0	RECT	2160.	6253.	.85/	5/	23/ 23	.93	1 1	4.2	256	319	245	330	INT
	BBRC	(11.0)		(2.3)	(.22)	.90	5 (	2/ 2)	.93	2 2	2.2	2	115	-17	134	
	UNIT HAS NO PREFERRED ORIENTATION BUT REQUIRES ITS BRIGHT OBJECT SENSOR TO BE LOCATED NEAR BY TO PROTECT TRACKER FROM BRIGHT LIGHT. POWER IS UNDER 3 WATTS FOR REGULATED +,-10 VDC AND +5 VDC AND 5 WATTS FOR 28 VOLTS UNREGULATED. UNIT IS OPERATIONAL IN 15 MINUTES.															
ST 2	STAR TRACKER	3.2	CYLI	5067.	25741.	.90/	3/	5/ 5	.33	1 1	2.7	261	281	261	281	INT
	HONEYWELL	(7.0)		(5.5)	(.91)	.90	3 (	0/ 0)	.33	2 2	1.4	11	47	11	47	
	UNIT WILL HAVE A MODULAR COMPONENT DESIGN, AND WILL INCOPORATE A PASSIVE THERMAL DESIGN. SURFACE PROPERTIES WILL DEPEND ON CUSTOMER THERMAL REQUIREMENTS. EXPECTED THERMAL QUALIFICATION TEST IS 1975. ALL DATA INDICATED ABOVE IS PRELIMINARY ENGINEERING DATA.															
ST 3	MMOS	6.8	CYLI	2189.	6950.	.90/	20/	91/ 91	1.18	3 3	5.8	273	309	273	309	INT
	ITT GILFILLAN	(15.0)		(2.4)	(.25)	.90	20 (	8/ 8)	1.18	6 6	3.1	32	96	32	96	
	UNIT IS COLD PLATED WITH APPROX. 75 PERCENT OF COOLING ACHIEVED THRU MOUNTING FLANGE. UNIT SHOULD BE MOUNTED LOOKING OUT TO SPACE. IT HAS SEVERAL MODES OF OPERATION WITH 20 WATTS STEADY STATE POWER MAX POWER FOR ALL MODES AND 13 WATTS MIN POWER FOR ONE MODE. UNIT SHOULD BE COUPLED TO A COMPUTER.UNIT IS IN PROTOTYPE STAGE. UNIT HAS NOT BEEN QUAL TESTED. EXPECTED COLD PLATE IS 15.6 TO 37.8 DEG C (60 TO 100 DEG F) WITH QUAL TEST EXCEEDING VALUES.															
ST 4	5698 STAR TRACKER	1.8	RECT	857.	1646.	.90/	3/	35/ 35	.86	2 2	1.5	230	312	230	312	INT
	EMR PHOTOELECTRIC	(4.0)		(.9)	(.06)	.90	3 (	3/ 3)	.86	3 3	.8	-45	103	-45	103	
	THE 569B STAR TRACKER DIMENSIONS DO NOT INCLUDE THE OPTICS. THE UNIT IS BLACK ANODIZED. REQUIRES APPROX 30 MINUTES TO BE OPERATIONAL. UNIT HAS NO LIMITATIONS ON MOUNTING LOCATIONS. THE 569B USES THE ASCOP 571E-01-14 QUADRANT MULTIPLIER PHOTOTUBE WHICH IS 180 GRAMS,(.12 LBS) 3.5 CM O.D X 10.8 CM LENGTH (1.37 IN O.D.X 4.25 LENGTH) AND HAS A STAINLESS STEEL HOUSING. UNIT IS SPACE QUALIFIED. COOLING BY CONDUCTION AND RADIATION.															
ST 5	574 STAR CAMERA	5.3	RECT	1858.	4719.	.90/	4/	23/ 23	1.25	1 1	4.6	255	309	255	309	INT
	EMR PHOTOELECTRIC	(11.7)		(2.0)	(.17)	.90	4 (	2/ 2)	1.25	1 1	2.4	1	97	1	97	
	THE 574 STAR CAMERA DIMENSIONS DO NOT INCLUDE THE OPTICS. THE UNIT SURFACE IS IRIDITE 15. UNIT REQUIRE APPROX 30 MINUTES TO BE OPERATIONAL. UNIT HAS NO LIMITATIONS ON MOUNTING ORIENTATION IN VEHICLE UNIT IS DESIGN FOR SPACE ENVIRONMENT AND IS THERMALLY CONTROLED BY RADIATION AND CONDUCTION OF THE HEAT TO THE ENVIRONMENT AND THE MOUNTING LOCATIONS. UNIT FINISH IS CUSTOMER DEPENDENT.															

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM STAR TRACKERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG K/(F) DESIGN MIN MAX	SINK QUAL MIN MAX	OP MODE
ST 6	OAO STAR TRACKER BENDIX CORPORATION	7.3 (16.0)	RECT	2877. (3.1)	9832. (.35)	.70/ .85	6/ 6	20/ 20 (1/ 1)	1.15 1.15	1 1 1 1	6.1 3.2	236 307 -33 93	236 307 -33 93	INT
	THE OAO-IV STRAPDOWN STAR TRACKER HAS A PASSIVE THERMAL CONTROL HEAT IS REJECTED BY CONDUCTION TO A RADIATION SHIELD HAVING A PERMISSIBLE TEMPERATURE EXCURSION OF -29 TO 38 DEG.C(-20 TO 100 DEG F). NO HEATERS ARE REQUIRED WITHIN THIS RANGE. UNIT IS HARD MOUNTED TO VEHICLE MOUNTING FLANGE. UNIT REQUIRE CLEAR UNOBSTRACTED VIEW TO OPERATE PROPERLY													
ST 7	OMA ATM STAR TRKR. BENDIX CORPORATION	18.1 (40.0)	RECT	11211. (12.1)	77677. (2.74)	.25/ .90	18/ 28	16/ 25 (1/ 2)	.73 .72	1 1 2 3	15.3 8.0	238 302 -30 84	247 302 -14 84	INT
	THE OMA ATM STAR TRACKER IS A GIMBALLED UNIT. THE ABOVE DIMENSIONS ARE EXTERIOR LIMITS SEE REF FOR MORE DETAIL DESCRIPTION. UNIT IS MARRIED TO ATM STAR TRACKER ELECTRONICS UNIT. UNIT HAS 3 INTERNAL HEATERS OF 10 WATTS EACH TWO OF THE HEATERS HAVE SET POINTS OF -23 .3 TO -15.0 (-9.9 TO 5.0 DEG.F) AND THE THIRD HEATER HAS SET POIN OF -15.3 TO -6.7 DEG C (5.5 TO 22.5 DEG.F). UNIT IS THERMALLY ISOLATED, PAINTED WHITE, AND HAS A SUPERINSULATION BLANKET COVERING .													
ST 8	KS-199 STAR TRKR KOLLSMAN INSTR.	9.1 (20.0)	RECT	4842. (5.2)	22184. (.78)	.20/ .75	8/ 18	17/ 38 (1/ 3)	1.11 1.07	1 2 2 4	7.8 4.1	247 290 -14 62	226 307 -51 93	INT
	THE KS-199 STAR TRACKER WAS BUILT FOR THE MOL PROGRAM. ONE ENGINEERING MODEL WAS BUILT AND FUNCTIONAL TESTED. THE GIMBAL SENSOR IS COUPLED TO AN ELECTRONIC UNIT. THE TRACKER HAS INTERNAL HEATERS TOTALING 10 WATTS AND ARE USED FOR FAST WARM UP WHEN UNIT IS BELOW -11.8 DEG C(10 DEG. F). THE UNIT THERMAL DESIGN IS PASSIVE WITH UNIT THERMALLY ISOLATED FROM MOUNTING, AND COVERED BY SUPER-INSULATION BLANKET TO MAINTAIN PROPER OPERATING TEMPERATURE.													

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM STAR TRACKER ELECTRONICS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
STE 1	ATM STE	14.5	RECT	5783.	25375.	.70/	6/	11/ 11	1.03	0 0	12.2	243	327	243	327	INT
	BENDIX CORPORATION	(32.0)		(6.2)	(.90)	.85	6	(1/ 1)	1.03	1 1	6.4	-22	129	-22	129	
	THE ATM STAR TRACKER ELECTRONICS (STE) UNIT IS MARRIED TO THE ATM OMA GIMBAL STAR TRACKER THE STE IS PAINTED BLACK AND IS DESIGN FOR RADIATION AND CONDUCTION COOLING. THE STE UNIT SUPPLIES THE STEADY STATE POWER TO THE OMA THE OMA HEATER POWER IS SUPPLIED DIRECTLY OF THE ATM 28 VDC BUS. UNIT IS MOUNTED ON THE ATM RACK THERE ARE NO MOUNTING LIMITATIONS OF CABLE LENGTH REQUIREMENTS.															
STE 2	KS-199 STAR TRKR	4.5	RECT	2387.	7892.	.20/	14/	59/ 59	1.05	3 3	3.9	238	279	215	298	INT
	OLLSMAN INSTR.	(10.0)		(2.6)	(.28)	.75	14	(5/ 5)	1.05	7 7	2.0	-30	43	-71	77	
	THE KS-199 STAR TRACKER WAS BUILT FOR THE MOL PROGRAM. ONE ENGINEERING MODEL WAS BUILT AND FUNCTIONALY TESTED. THE ELECTRONIC UNIT IS COUPLED TO THE STAR TRACKER OPTICS. THE UNIT IS DESIGNED FOR SPACE ENVIRONMENT BUT THE ABOVE TEMPERATURE IS BASED ON THE OPTICS UNIT. THE ELECTRONIC UNIT WAS PLACED INSIDE THE MOL. THE UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION TO THE VEHICLE ENVIRONMENT.															

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM HORIZON SCANNERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
HS 1	HORIZON SENSOR QUANTIC INDUSTRIES	3.2 (7.0)	CYLI	1930. (2.1)	6507. (.23)	.20/ .05	1/ 8/ 8 1 (0/ 0)		9.87 9.87	0 0 1 1	2.7 1.4	191 -115	318 112	191 -115	318 112	INT
	THE 5079 MODEL IS THERMALLY ISOLATED FROM CONDUCTION AND RADIATION I" HAS AN NCR-2 MULTILAYERS SUPER INSULATION ALUMINIZED MYLAR BLANKET WHICH COVERS THE TOTAL UNIT WITH THE EXCEPTION OF THE OPTICS.UNIT HAS NO CABLE LIMITATION,UNIT SHOULD BE MOUNTED IN THE VEHICLE WHERE THERE ARE NO STRUCTURAL INTERFERENCE WITH THE OPTICS VIEW.THIS UNIT IS SPACE QUALIFIED AND HAS FLOWN ON SEVERAL SPACE VEHICLES. CONTRACT AGENCY IS SAMSO.															
HS 2	HORIZON SENSOR BARNES ENGR. CO.	3.4 (7.5)	CYLI	1386. (1.5)	3936. (.14)	.35/ .50	6/ 43/ 43 6 (4/ 4)		1.59 1.59	2 2 3 3	2.9 1.5	228 -48	322 120	228 -48	322 120	INT
	FOR TUG TWO HORIZON SENSORS ARE REQUIRED TO ENABLE PITCH AND ROLL SENSING THE 2 SENSORS ARE IDENTICAL AND ARE COUPLED TO A COMMON POWER SUPPLY UNIT.CONDUCTION IS THRU BOTTOM FLANGE. THE TWO SENSORS ARE REQUIRED TO BE POSITIONED SUCH THAT THEIR SCAN CONES INTERSECT AT THE EARTH DISC CENTER WITH A HALF CONES ANGLE OF 55 DEGREES. UNIT IS OPERATIONAL IN 2 MINUTES FROM POWER ON.															
HS 3	LAHS LASC	1.5 (3.3)	RECT	1084. (1.2)	2360. (.08)	.90/ .90	3/ 28/ 28 3 (2/ 2)		.51 .51	2 2 4 4	1.3 .7	234 -38	332 138	234 -38	332 138	INT
	UNIT IS CONTAINED IN A SINGLE PACKAGE PER AXIS. FOR TWO AXIS SENSING TWO HEADS ARE REQUIRED. THE UNIT IS PAINTED BLACK ANODIZED ALUMINUM.BUT CAN BE PAINTED PER CUSTOMER THERMAL REQUIREMENTS. NO LIMITATIONS ON UNIT MOUNTING LOCATION OR CABLE LENGTH.															
HS 4	NOHS LMSC	1.8 (4.0)	RECT	1239. (1.3)	2622. (.09)	.90/ .90	3/ 28/ 28 3 (2/ 2)		.54 .54	2 2 4 4	1.5 .8	234 -38	332 138	234 -38	332 138	INT
	UNIT IS BLACK ANODIZED BUT CAN BE PAINTED PER CUSTOMER THERMAL REQUIREMENTS. MAJORITY OF COOLING IS BY RADIATOON WITH VERY LITTLE THRU CONDUCTION. NO LIMITATIONS ON MOUNTING LOCATION OR CABLE LENGTH.															
HS 5	DSHS LMSC	4.1 (9.0)	RECT	1989. (2.1)	5067. (.18)	.90/ .90	14/ 70/ 70 14 (6/ 6)		.73 .73	4 4 7 7	3.4 1.8	216 -70	326 127	216 -70	326 127	INT
	UNIT IS BLACK ANODIZED BUT CAN BE PAINTED PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS DESIGNED FOR COOLING BY RADIATION AND CONDUCTION. NO LIMITATIONS ON MOUNTING LOCATIONS OR CABLE LENGTH.															

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM HORIZON SCANNERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
HS 6	MOD.IV HORIZON SYS	3.4	RECT	2176.	6897.	.90/	10/	45/ 45	.56	3 3	2.9	240	332	240	321	INT
	QUANTIC INDUSTRIES	(7.5)		(2.3)	(.24)	.90	10	(4/ 4)	.56	6 6	1.5	-26	139	-26	118	

THE MOD IV SENSOR IS COMPOSED OF 4 TRACKERS AND 1 ELECTRONIC UNIT EACH OF THE TRACKERS IS FINISHED WITH BLACK ANODIZE ALUMINUM. EACH TRACKER APPROX POWER STEADY STATE IS 2.5 WATTS. TOTAL AVERAGE POWER CONSUMPTION IS 25 WATTS. ALLOWABLE CABLE LENGTH IS AT LEAST 6.25 METERS (20 FT). THE ABOVE UNIT IS A REDESIGNED AND REPACKAGED MOD IV HORIZON SENSOR THAT WAS SPACE FLOWN ON A SAMSO VEHICLE IN 1970. THE NEW MODIFIED MOD IV IS BUILT FOR SAMSO.

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM HORIZON SCANNER ELECTRONICS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
HSE 1	POWER SUPPLY H.S.	1.3	REC	697.	1180.	.35/	3/	43/ 43	1.18	2 2	1.1	228	322	228	322	INT
	BARNES ENGR. CO.	(2.8)		(.8)	(.04)	.50	3	(4/ 4)	1.18	5 5	.6	-47	120	-47	120	
	UNIT IS MARRIED TO THE HORIZON SENSOR MODEL 13-159.															
	POWER SUPPLY UNIT WILL REQUIRE MODIFICATION TO BE COUPLED TO															
	TWO SENSORS. UNIT INPUT POWER LEVEL IS BASED ON DOUBLING THE															
	POWER SUPPLY UNIT ASSOCIATED WITH ONE HORIZON SENSOR POWER SUPPLY															
	THE SINGLE SENSOR POWER SUPPLY HAS A 7.5 WATTS INPUT STEADY STATE															
	POWER.															
	CONDUCTION IS THRU BOTTOM MOUNTING PLATE.															
HSE 2	MOD IV HORIZON CEU	15.9	RECT	4539.	18804.	.20/	5/	11/ 11	20.08	0 0	13.3	139	310	139	295	INT
	QUANTIC INDUSTRIES	(35.0)		(4.9)	(.66)	.05	5	(1/ 1)	20.08	0 0	7.0	-208	99	-208	72	
	THE CEU HAS A PASSIVE THERMAL CONTROL DESIGN IT USES A MULTI-LAYER															
	ALUMINIZED MYLAR INSULATION BLANKET. THE CEU IS COUPLED TO THE 4															
	TRACKERS OF THE MOD IV HORIZON SENSOR. UNIT TOTAL AVERAGE POWER															
	CONSUMPTION IS 25 WATTS OF WHICH 10 WATTS IS DISSIPATED IN THE															
	TRACKERS. CABLE LENGTH IS AT LEAST 6.25 METERS (20 FT).															

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM SUN SENSOR

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN MAX	QUAL MIN MAX	OP MODE
SS 1	REFRACTDSYN SUN	.0	RECT	8.	2.	.90/	0/	0/ 0	1.78	0 0	.0	253 358	253 358	INT
	H H CONTROLS CO.	(.1)		(.0)	(.00)	.90	0 (	0/ 0)	1.78	0 0	.0	-3 185	-3 185	
	UNIT IS APPROXIMATELY 1 GRAM IN WEIGHT HAS NO POWER INPUT AND NO MOUTING LIMITATIONS. UNIT HAS FLOWN ON AGENA B. UNIT IS COVERED BY A BLACK EPOSY HYSO TYPE 111C. NO LIMITATION ON CONNECTING CABLE LENGTH.													
SS 2	FINE SUN SENSOR AS	.2	RECT	172.	148.	.90/	0/	0/ 0	.35	0 0	.2	253 358	243 368	INT
	BBRS	(.4)		(.2)	(.01)	.90	0 (	0/ 0)	.35	0 0	.1	-3 185	-22 202	
	HE UNIT WEIGHT IS APPROX 170 GRAMS. O LIMITATION ON MOUTING LOCATION. NDIVIDUAL SENSORS ARE CHROMICOATED ALUMINUM.SENSOR BLOCK IS ALUM- NUM WITH ANODIZED MOUNTING PADS.RETAINERS ARE ALUMINUM BLACK ANO- IZED.													
SS 3	DIGITAL SUN SENSOR	.1	RECT	129.	94.	.86/	0/	0/ 0	.47	0 0	.1	253 318	253 318	INT
	ADCOLE CORPORATION(	.3)		(.1)	(.00)	.86	0 (	0/ 0)	.47	0 0	.1	-3 113	-3 113	
	THE 15564 SUN SENSOR IS A DIGITAL SUN SENSOR WITH SENSOR AND ELECT RONICS IN 1 UNIT. THE UNIT DISSIPATE HEAT BY CONDUCTION TO THE MOUNTINGS FLANGE. THE UNIT IS PAINTED WITH BLACK EPOXY PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT HAS A 0.048 WATTS DISSIPATED POWER. THE 15564 SUN SENSOR HAS BEEN SPACE QUALI FIED AND FLOWN ON THE ESRO IV EUROPEAN SATELLITE.													
SS 4	DIGITAL SUNSENSOR	.4	RECT	367.	470.	.34/	0/	0/ 0	3.85	0 0	.3	253 333	243 343	INT
	ADCOLE CORPORATION(	.9)		(.4)	(.02)	.10	0 (	0/ 0)	3.85	0 0	.2	-3 140	-22 157	
	THE 16765 SUN SENSOR IS A DIGITAL SUN SENSOR WITH THE SENSOR AND ELECTRONICS IN 1 UNIT. THE UNIT DISSIPATE HEAT BY CONDUCTION TO THE MOUNTINGS. THE UNIT SURFACE IS IRIDITE ALUMINUM, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT HAS A 0.028 WATTS DISSIPATED POWER. THE 16765 SUN SENSOR HAS BEEN SPACE FLOWN ON ONE OF THE NAVY RESEARCH LABORATORY SATELLITES.													

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM LASER RADARS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
LR 1	SCAN LASAR RADAR	27.2	RECT	7897.	42475.	.90/	30/	37/ 37	1.36	1 1	22.9	285	317	285	317	INT
	ITT GILFILLAN	(60.0)		(8.5)	(1.50)	.90	30 (	3/ 3)	1.36	2 2	12.1	54	111	54	111	
	UNIT IS IN ENGINEERING STAGE AND IS NOT COMPLETED. UNIT IS MARRIED TO AN ELECTRONICS PACKAGE WHICH IS 9 BY 12 BY 12 INCHS WEIGHT 15 LBS AND POWER LEVEL OF 20 WATTS. DATA ABOVE IS PRELIMINARY INFORMATION. NO COOLING REQUIRED UNIT IS COLD PLATED. SYSTEM TOTAL POWER IS 50 WATTS. SURFACE PROPERTIES WILL DEPEND ON CUSTOMER THERMAL REQUIREMENTS.															
LR 2	SCAN LASAR RADAR	31.8	RECT	8361.	47195.	.90/	70/	83/ 83	1.43	2 2	26.7	275	310	275	310	INT
	ITT GILFILLAN	(70.0)		(9.0)	(1.67)	.90	70 (	7/ 7)	1.43	4 4	14.1	35	98	35	98	
	UNIT IS IN CONCEPTUAL DESIGN STAGE AND ABOVE DATA ARE PRELIMINARY INFORMATION. UNIT IS COUPLED TO AN ELECTRONICS UNIT WHICH IS ALSO IN DESIGN STAGE. THIS UNIT IS EXPECTED TO BE THERMOELECTRICLY COOLED.															
LR 3	SCAN LASER RADAR	45.4	RECT	11148.	70792.	.90/	600/	538/538	1.14	16 16	38.2	-0	140	-0	140	INT
	ITT GILFILLAN	(*0.0)		(12.0)	(2.50)	.90	600 (	50/ 50)	1.14	29 29	20.2	-460	-206	-460	-206	
	UNIT IS A PRE-DESIGN STAGE AND ALL ABOVE DATA IS PRELIMINARY INFO. THIS UNIT IS DESIGNED TO HAVE AN ACTIVE COOLING SYSTEM. UNIT IS COUPLED TO AN ELECTRONICS UNIT WHICH IS ALSO IN DESIGN STAGE. ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 178. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 178. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM LASER RADAR ELECTRONICS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE K/HR F/HR DEG MIN DEG MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN	DESIGN MAX	QUAL MIN	QUAL MAX	OP MODE
LRE 1	ELEC.LASER RADAR	6.8	RECT	4645.	21238.	.90/	20/	43/ 43	.57	3 3	5.7	284	316	284	316	INT
	ITT GILFILLAN	(15.0)		(5.0)	(.75)	.90	20	(4/ 4)	.57	6 6	3.0	52	110	52	110	
	UNIT MARRIED TO THE SCANNING LASER RADAR TRANSMITTER-RECEIVER. UNIT IS IN DEVELOPMENT AND ABOVE DATA IS PRELIMINARY INFORMATION UNIT IS EXPECTED TO BE PASSIVE THERMAL CONTROL WITH NO ACTIVE COOL ING REQUIRED.															
LRE 2	ELEC LASER RADAR	9.1	RECT	5574.	28317.	.90/	30/	53/ 53	.63	4 4	7.7	282	315	282	315	INT
	ITT GILFILLAN	(20.0)		(6.0)	(1.00)	.90	30	(5/ 5)	.63	7 7	4.0	48	107	48	107	
	UNIT IS IN DESIGN STAGE AND ALL ABOVE DATA IS PRELIMINARY INFOR- MATION. UNIT IS COUPLED TO A TRANSMITTER/RECEIVER UNIT OF THE SCANNING LASER RADAR. UNIT IS DESIGNED TO HAVE A THERMOELECTRIC COOLING SYSTEM.															
LRE 3	ELEC LASER RADAR	31.8	RECT	9290.	56634.	.90/	150/	161/161	1.21	5 5	26.5	255	296	255	296	INT
	ITT GILFILLAN	(70.0)		(10.0)	(2.00)	.90	150	(15/ 15)	1.21	10 10	14.0	-0	74	-0	74	
	THIS UNIT IS MARRIED TO THE TRANSMITTER/RECEIVER OF THE HIGH POWER SCANNING LASER RADAR. THIS UNIT IS IN DESIGN STAGE, AND ALL ABOVE DATA IS PRELIMINARY INFORMATION. UNIT IS DESIGNED WITH AN ACTIVE COOLING SYSTEM.															

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM TELEVISION

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE K/HR F/HR DEG MIN DEG MIN	ADIABATIC RISE RATE K/HR F/HR DEG MAX DEG MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG K/(F) DESIGN MIN	ALLOWABLE TEMP. DEG K/(F) DESIGN MAX	SINK QUAL MIN	SINK QUAL MAX	OP MODE
TV 1	COLOR TELEVISION	5.7	RECT	1981.	5416.	.20/	28/	141/141	.99	6	6	4.8	186	317	-0	317	INT
	WESTINGHOUSE	(12.5)		(2.1)	(.19)	.86	28	(13/ 13)	.99	11	11	2.5	-123	112	-460	112	
	THE SKYLAR COLOR T.V. CAMERA WAS DESIGN WITH A PASSIVE THERMAL CONTROL OF RADIATION FROM THE SURFACES. THE UNIT IS PAINTED WITH A WHITE CAT-A-LAC PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. CAMERA IS DESIGN FOR SPACE ENVIRONMENT AND WAS TO BE USED AS THE T.V.CAMERA FOR THE T-027 EXPIREMENT ONBOARD SKYLAB. DIMENSIONS OF CAMERA DOES NOT INCLUDE LENS WHICH IS 16.5 CM (6.5 IN) LONG NOR THE HANDLE WHICH IS 14 CM (5.5 IN) LONG.																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 6. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP																
TV 2	LUNAR T.V. SYSTEM	5.8	RECT	2774.	7669.	.25/	14/	53/ 53	8.78	3	3	4.9	-0	-0	-0	-0	INT
	RCA	(12.8)		(3.0)	(.27)	.05	14	(4/ 4)	8.78	5	5	2.6	-460	-460	-460	-460	
	THERMAL CONTROL OF THE CTV IS ACHIEVED BY THE INTERACTION OF A SECOND-SURFACE MIRROR ON THE TOP OF THE CAMERA WITH THE LUNAR SURFACE AND WITH DEEP SPACE. THE CTV REJECTS HEAT THROUGH RADIATION AND RECEIVES HEAT BY INTERNAL HEAT DISSIPATION, SOLAR RADIATION INCIDENT TO THE MIRROR RADIATOR, AND LUNAR SURFACE RADIATION WHEN THE RADIATOR IS TILTED TOWARD THE LUNAR SURFACE. A THERMAL INSULATION BLANKET COVERS THE REMAINING SURFACES OF THE CAMERA.																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 11. AND 6. TO MAINTAIN THE MIN AND MAX OPERATING TEMP																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 12. AND 6. TO MAINTAIN THE MIN AND MAX QUAL TEMP																

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM ACS ELECTRONICS

REF. NO.		DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
ACSE	1	VALVE DRIVE AMP.	5.4	RECT	2710.	9395.	.90/	38/	140/140	.59	8 8	4.7	137	351	137	351	CONT
		MARTIN MARIETTA CO(12.0)			(2.9)	(.33)	.90	38	(13/ 13)	.59	15 15	2.5	-211	173	-211	173	

THE VALVE DRIVE AMPLIFIER ELECTRONIC COMPONENT IS DESIGN FOR THE VIKING LANDER CAPSULE. UNIT IS DESIGN TO WITHSTAND SPACE ENVIRONMENT AND THE MARTIAN ATMOSPHERE. UNIT HAS A PASSIVE THERMAL DESIGN OF RADIATION TO SPACE AND CONDUCTION TO MOUNTINGS. UNIT IS FINISH PER CUSTOMER REQUIREMENTS. UNIT IS DESIGN TO BE ABLE TO BE EXPOSED TO 125 DEG.C.(257 DEG.F) STERILIZATION TEMPERATURE.

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM COMPUTERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE DEG DEG MIN	ADIABATIC RATE K/HR F/HR MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
COMP 1	MAGIC 352	36.1	RECT	8310.	47195.	.90/	208/ 250/250		1.42	7	7	30.5	248	285	234	306	CONT
	DELCO ELECTRONICS (79.5)			(8.9)	(1.67)	.90	208 (23/ 23)		1.42	12	12	16.1	-12	53	-38	91	
	MARRIED TO CAROUSEL 58 IMU																
	QUALIFIED FOR A 9 HOUR MISSION																
	FUNCTION IN LESS THAN ONE MINUTE AFTER POWER-ON																
COMP 2	MAGIC 352 DIGS	22.7	RECT	5716.	26714.	.90/	175/ 306/342		1.17	9	10	19.2	-0	297	-0	297	CONT
	DELCO ELECTRONICS (50.0)			(6.2)	(.94)	.90	196 (28/ 31)		1.14	17	19	10.1	-460	76	-460	76	
	BOX DESIGN INCLUDES EXTERNAL CASE AIR HEAT EXCHANGER																
	THERMAL MASS AND RADIATION IN FLIGHT																
	90 MINUTE MISSION LIFETIME																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 76. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 76. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP																
COMP 3	469 COMPUTER	4.5	RECT	1138.	2428.	.90/	20/ 175/175		1.29	5	5	3.8	161	313	161	313	CONT
	CONTROL DATA CORP.(10.0)			(1.2)	(.09)	.90	20 (16/ 16)		1.29	9	9	2.0	-169	104	-169	104	
	THE 469 COMPUTER IS DESIGNED WITH A COLD PLATE. THE PLATE IS 12.7																
	X 11.9 X 2.1 CENTIMETERS (5. X 4.7 X .82 IN) AND COUPLES AS A																
	MOUNTING PLATE AND FLANGE. SURFACE FINISH PER CUSTOMER REQUIRE-																
	MENTS. CABLE LENGTH IS LIMITED TO 1.8 METERS (6 FT).																
	MICRO-SECOND TIME DELAY FROM POWER ON.																
	UNIT IS SPACE QUALIFIED.																
	BASEPLATE MUST CONDUCT 12 TO 15 WATTS TO MOUNTING FRAMEWORK.																
COMP 4	469 DOUBLE DENSITY	2.7	RECT	.748.	1388.	.90/	16/ 213/213		1.15	7	7	2.3	-0	307	-0	307	CONT
	CONTROL DATA CORP.(6.0)			(.8)	(.05)	.90	16 (19/ 19)		1.15	13	13	1.2	-460	93	-460	93	
	THE 469 COMPUTER IS DESIGNED WITH A COLDPLATE AND MUST CONDUCT 12																
	TO 15 WATTS TO MOUNTING FRAMEWORK. THE PLATE IS 12.7 X 11.9 X 2.1																
	CENTIMETERS (5. X 4.7 X .82 IN). SURFACE FINISH PER CUSTOMER																
	REQUIREMENTS. CABLE LENGTH IS LIMITED TO 1.8 METERS (6 FT).																
	MICRO-SECOND TIME DELAY FROM POWER ON. THE UNIT IS SPACE QUALIF-																
	IED.																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED * AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED * AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP																
COMP 5	LS-52 COMPUTER	15.0	RECT	3959.	16440.	.90/	205/ 517/517		1.00	17	17	12.7	-0	250	-0	250	CONT
	LEAR SIEGLER INC (33.0)			(4.3)	(.58)	.90	205 (48/ 48)		1.00	30	30	6.7	-460	-9	-460	-9	
	PRESENTLY DESIGNED FOR FORCED AIR COOLING AND CAN BE MODIFIED FOR																
	COLD PLATE. SURFACE PROPERTIES PER CUSTOMER REQUIREMENT. CABLE																
	LENGTHS UP TO 15 METERS (50 FT) DEPENDING ON COMPONENTS.																
	OPERATION WITHIN A FEW SECONDS OF POWER ON.																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 158. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 158. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP																

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM COMPUTERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
COMP 6	8R-1018M COMPUTER	5.9	RECT	1858.	4719.	.90/	27/ 145/239		.94	5 9	5.0	-0	341	-0	341	CONT
	BUNKER RAMO	(13.0)		(2.0)	(.17)	.90	44 (13/ 22)		.90	10 17	2.6	-460	155	-460	155	
	UNIT COMPONENTS ARE HEAT SUNK TO BASE PLATE. COOLING IS BY CONDUCTION. CABLE MAX LENGTH 1.52 METER (5 FT). UNIT IS DESIGN FOR AIRCRAFT, BUT CAN BE MODIFIED FOR SPACE APPLICATIONS. ABOVE UNIT IS SIZED FOR 16K WORD MEMORY AND POWER SUPPLY. A 32K WORD MEMORY UNIT WILL HAVE A SEPERATE MEMORY PACKAGE OF 15.3 X15.3 X10.2 CM (6.0X6.0X4.0 IN). UNIT SURFACES ARE BLACK ANODIZED, CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 23. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 23. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
COMP 7	CP-16A COMPUTER	11.3	RECT	3321.	12554.	.90/	242/ 728/728		.82	26 26	9.5	-0	-0	-0	-0	CONT
	GENERAL ELECTRIC	(24.9)		(3.6)	(.44)	.90	242 (67/ 67)		.82	48 48	5.0	-460	-460	-460	-460	
	THE CP-16 IS AN AIRCRAFT COMPUTER IT CAN BE MODIFIED FOR SPACE VEHICLE USE. IT IS FORCED AIR COOLED AND CAN BE CONVERTED TO CONDUCTION AND RADIATION. SURFACE PROPERTIES ARE PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS PAINTED WITH GRAY EPOXY PAINT AT PRESENT USE UNIT AT STAND BY MODE WILL USE APPROX. 200 WATTS. MAXIMUM CABLE LENGTH IS 15 METERS (50 FEET). UNIT DOES NOT REQUIRE ANY SPECIAL ORIENTATION IN VEHICLE.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 203. AND 3. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 203. AND 3. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
COMP 8	CP-24A COMPUTER	17.2	RECT	4461.	20106.	.90/	94/ 211/211		1.17	6 6	14.5	-0	320	-0	333	CONT
	GENERAL ELECTRIC	(38.0)		(4.8)	(.71)	.90	94 (19/ 19)		1.17	12 12	7.7	-460	117	-460	139	
	THE CP-24A IS DESIGN TO MEET THE REQUIREMENTS OF SPACE MISSIONS. THE UNIT THERMAL CONTROL IS BY CONDUCTION TO COLD PLATE MOUNTING. UNIT IS PAINTED BLACK BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. IN STAND BY MODE UNIT DISSIPATE 75 WATTS. MAXIMUM CABLE LENGTH IS 15 METERS (50 FEET). UNIT HAS NO SPECIAL MOUNTING REQUIREMENTS TO THE VEHICLE. OPERATIONAL WITHIN 300 NANOSECONDS.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 27. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 42. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
COMP 9	CP-32A COMPUTER	18.9	RECT	5101.	22642.	.90/	365/ 715/715		.89	24 24	15.9	-0	90	-0	90	CONT
	GENERAL ELECTRIC	(41.7)		(5.5)	(.80)	.90	365 (66/ 66)		.89	43 43	8.4	-460	-297	-460	-297	
	THE CP-32 IS DESIGNED FOR AIRCRAFT USE IT CAN BE MODIFIED FOR SPACECRAFT USE. IT HAS A FORCED AIR COOLING SYSTEM AND CAN BE CONVERTED-TO CONDUCTION COOLING. UNIT IS PAINTED WITH A GRAY EPOXY PAINT AT PRESENT USAGE BUT IS APPLICATION DEPENDENT. IN STAND BY MODE UNIT DISSIPATE 293 WATTS. MAXIMUM CABLE LENGTH IS 15 METERS (50 FEET). NO SPECIAL ORIETATION IS REQUIRED FOR UNIT TO BE MOUNTED IN VEHICLE.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 305. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 305. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM COMPUTERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN MAX	ALLOWABLE SINK TEMP. DEG K/(F) QUAL MIN MAX	OP MODE
COMP 10	SCP-234 COMPUTER.	5.3	RECT	2407.	7731.	.90/	3/ 14/ 14		.83	0 0	4.5	259 331	259 331	CONT
	RCA	(11.7)		(2.6)	(.27)	.90	3 (1/ 1).		.83	1 1	2.4	6 136	6 136	
	THE STANDARD CONTROL PROCESSOR IS A COMPUTER DESIGN FOR SPASE USAGE, IT IS DEVELOPED FOR A DOD PROGRAM THAT IS CLASSIFIED. UNIT WILL BE LAUNCH IN THE FUTURE. IT IS DESIGN FOR A PASSIVE COOLING BY RADIATION. UNIT IS PAINTED WITH BLACK PAINT. CABLE LENGTH DEPEND ON UNIT SPEED AND CABLE CAPACITANCE. UNIT STEADY STATE POWER IS INDEPENDENT OF MEMORY SIZE. UNIT POWER DOES NOT INCLUDE POWER CONVERTER FROM 28 VDC TO +10 VDC, -10 VDC.													
COMP 11	RAC-261 COMPUTER	13.6	RECT	3103.	9250.	.90/	200/ 644/644		1.08	18 18	11.4	-0 195	-0 195	CONT
	RAYTHEON COMPANY.	(30.0)		(3.3)	(.33)	.90	200 (59/ 59)		1.08	33 33	6.0	-460 -108	-460 -108	
	THE RAC-261 IECM CMPUTER IS DESIGN FOR AN AIRCRAFT USE IT HAS A PASSIVE THERMAL CONTROL OF CONDUCTION THRU SIDE WALLS OF UNIT. SURFACE IS IRIDITED BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT CAN BE MODIFIED FOR SPACE USE WITHOUT CHANGING ITS BASIC MODE.													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 163. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 163. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP													
COMP 12	AP-101 COMPUTER	26.1	RECT	7385.	35220.	.90/	340/ 460/460		.98	15 15	22.5	-0 266	-0 266	CONT
	IBM	(57.5)		(7.9)	(1.24)	.90	340 (42/ 42)		.98	28 28	11.9	-460 20	-460 20	
	THE AP-101 COMPUTER IS DESIGN FOR ACTIVE COOLING BY MEANS OF FORCE AIR CIRCULATION. UNIT CAN BE MODIFIED TO PASSIVE THERMAL CONTROL. UNIT POWER CAN BE REDUCED TO 280 WATTS STEADY STATE BY REDUCING DUTY CYCLE TO 200 KOP/S FROM 500 KOP/S. UNIT CABLE LENGTH IS DEPENDENT ON DESIGN CONSIDERATIONS. SURFACE PROPERTIES ARE GOLD MYLAR BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS.													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 253. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 253. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP													
COMP 13	ADVANCE TECH COMP	9.1	RECT	2087.	6038.	.90/	80/ 383/383		1.25	10 10	7.9	-0 284	-0 284	CONT
	IBM	(20.0)		(2.2)	(.21)	.90	80 (35/ 35)		1.25	19 19	4.2	-460 52	-460 52	
	THE ABOVE DATA IS FOR A PROJECTED ADVANCED TECHNOLOGY COMPUTER IN THE 1977 TIME PERIOD. THE COMPUTER IS ASSUMED TO BE A 64K WORDS MEMORY, AND USING A CMOS LSI / MONOLITHIC NONVOLATILITY MEMORY. PHYSICAL PARAMETERS ARE BASED ON EXPECTED TECHNOLOGY OF 1977. DIMENSION IS BASED ON UNIT VOLUME OF 5950 CC, (363 CUBIC INCHES) UNIT IS ASSUMED TO BE DESIGN TO MEET MIL-E-5400 CLASS 2, AND HAVE A PASSIVE THERMAL CONTROL IN THE FORM OF RADIATION AND CONDUCTION													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 55. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 55. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP													

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM COMPUTERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN	DESIGN MAX	QUAL MIN	QUAL MAX	OP MODE
COMP 14	MILLICOMPUTLER	4.5	RECT	1835.	5137.	.85/	8/	43/ 43	.65	2	3.8	192	394	192	394	CONT
	WESTINGHOUSE	(10.0)		(2.0)	(.18)	.85	8	(4/ 4)	.65	3	2.0	-113	250	-113	250	
	THE MILLICOMPUTER IS DESIGN FOR BOTH AIRCRAFT AND SPACE ENVIRONMENT. IT IS COOLED BY CONDUCTION AND ITS SURFACES ARE BLACK IRIDITE BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. ABOVE DATA IS BASED ON A MILLICOMPUTER WITH CPU ROM 32K WORD SEMICONDUCTOR MEMORY AND A GENERAL PURPOSE I/O IT DOES NOT INCLUDE THE 28 VDC POWER SUPPLY. THE ADDITION OF THE POWER SUPPLY WILL INCREASE THE UNIT HEIGHT BY APPROX. 5.1 CM (2 IN).															
COMP 15	MAGIC IV COMPUTER	4.9	RECT	1550.	4074.	.90/	39/	251/251	.96	9	4.2	-0	309	-0	309	CONT
	DELCO ELECTRONICS (10.8)			(1.7)	(.14)	.90	39	(23/ 23)	.96	17	2.2	-460	96	-460	96	
	THE UNIT IS COOLED BY HEAT CONDUCTION TO AN EXTERNAL HEAT SINK (COLD PLATE). COLD PLATE MAXIMUM TEMPERATURE IS 71 DEGREES C (160 DEGREES F). THE MAGIC IV IS IN DEVELOPMENT AT PRESENT WITH PROTOTYPE COMPUTER SCHEDULED TO BE AVAILABLE IN MID- 1974 AND PRODUCTION PLANNED FOR LATE 1974. THE UNIT SURFACE PROPERTIES AT PRESENT IS BLACK PAINT BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS BEING DESIGN FOR SPACE ENVIRONMENT															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 21. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 21. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
COMP 16	MAGIC 362 COMPUTER	5.2	RECT	1616.	4329.	.90/	58/	358/358	.92	13	4.4	-0	289	-0	289	CONT
	DELCO ELECTRONICS (11.5)			(1.7)	(.15)	.90	58	(33/ 33)	.92	24	2.3	-460	61	-460	61	
	UNIT IS COOLED BY HEAT CONDUCTION TO A COLD PLATE. THE MAGIC 362 IS DESIGN TO QUALIFY FOR SPACE ENVIRONMENT. THE UNIT IS PAINTED BLACK BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. THE MAGIC 362 IS AN OFF-THE-SHELF COMPUTER THAT IS IN PRODUCTION. UNIT HAS NO MOUNTING LIMITATION ON VEHICLE AND HAS NO SPECIFIED CABLE LENGTH REQUIREMENTS. CABLE LENGTH WILL DEPEND ON COMPONENTS.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 39. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 39. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
COMP 17	MICRO-D 1808	16.3	RECT	4320.	14899.	.90/	106/	245/245	1.14	8	13.7	-0	310	-0	310	CONT
	ARMA DIV. OF AMBAC(36.0)			(4.6)	(.53)	.90	106	(22/ 22)	1.14	14	7.2	-460	98	-460	98	
	THE MICRO D COMPUTER IS AN AIRCRAFT DESIGN COMPUTER THAT USES THE AIRCRAFT FORCED AIR AS THE UNIT COOLING SYSTEM. CABLE LENGTH IS LIMITED TO APPROX. 2.5 METERS (8 FT). THERE IS NO INDICATION WHETHER UNIT CAN BE MODIFIED FOR A SPACE ENVIRONMENT. SURFACES ARE PAINTED BLACK BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIRE MENTS. THE ABOVE DATA IS FOR A 32K x 18 BIT WORD CORE MEMORY IT DOES NOT INCLUDE A POWER SUPPLY.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 55. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 55. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM COMPUTERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
COMP 18	AOP COMPUTER	14.1	RECT	5355.	22712.	.85/	13/	25/ 25	.91	1 1	11.8	244	350	244	350	CONT
	WESTINGHOUSE	(31.0)		(5.8)	(.80)	.85	13 (	2/ 2)	.91	2 2	6.2	-19	170	-19	170	
	THE ADVANCE ONBOARD PROCESSOR IS A PROTOTYPE UNIT THAT IS BEING DEVELOPED FOR NASA GODDARD SPACE FLIGHT CENTER FOR USE ON SPACE SATELLITES. UNIT HAS A COMPLETE PASSIVE THERMAL DESIGN WITH COOLING ACHIEVED BY RADIATION AND CONDUCTION. UNIT SURFACE IS BLACK IRIDITE. THE AOP DESCRIBED ABOVE INCLUDES A CPU, A 32K PLATED WIRE MEMORY A COMPLETE I/O AND A 28 VDC POWER SUPPLY. UNIT IS DESIGN FOR SPACE ENVIRONMENT AND IS BEING QUAL TESTED AT PRESENT.															
COMP 19	HDC-301 COMPUTER	.7	RECT	766.	991.	.90/	16/	208/208	.27	29 29	.6	-0	315	-0	315	CONT
	HONEYWELL	(1.5)		(.8)	(.03)	.90	16 (	19/ 19)	.27	52 52	.3	-460	109	-460	109	
	THE HDC-301 COMPUTER HAS A PASSIVE THERMAL CONTROL HEAT IS CONDUCTED TO THE MOUNTING EDGES. THE ABOVE UNIT SIZE IS BASED ON A 4K WORD MEMORY. UNIT IS EXPANDABLE TO 32K WORD MEMORY. UNIT HAS CONFORMAL COATING.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 7. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 7. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
COMP 20	HDC-402 COMPUTER	21.3	RECT	5861.	29733.	.90/	25/	42/ 42	1.41	1 1	18.0	225	318	225	327	CONT
	HONEYWELL	(47.0)		(6.3)	(1.05)	.90	25 (	3/ 3)	1.41	2 2	9.5	-54	113	-54	129	
	THE HDC-402 COMPUTER IS DESIGN FOR THE VIKING PROGRAM. IT HAS A PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION. THE UNIT IS PAINTED WITH BLACK PAINT. THE UNIT IS QUAL. TESTED TO 60 DEG.C (140 DEG F) FOR SHORT TIME DURING ENTRY, AND TO 40.6 DEG.C(115 DEG F) FOR MARS OPERATION. UNIT AT ENTRY DISSIPATE 40 WATTS OF POWER WHILE CONTROLLING VEHICLE MARS ENTRY. THE ABOVE DATA IS FOR THE DUAL REDUNDANT SYSTEM WITH 18K X 25 BIT PLATED WIRE MEMORY.															
COMP 21	HDC-601C COMPUTER	15.9	RECT	4835.	20260.	.90/	160/	330/330	.95	12 12	13.5	-0	295	-0	295	CONT
	HONEYWELL	(35.0)		(5.2)	(.72)	.90	160 (	30/ 30)	.95	22 22	7.1	-460	71	-460	71	
	THE HDC-601C IS AN 8K X 16 BIT CORE MEMORY COMPUTER. IT IS DESIGN WITH AN ACTIVE COLD PLATE COOLING SYSTEM UTILIZING FORCED AIR. UNIT CAN BE MODIFIED TO USE A PASSIVE THERMAL CONTROL FOR SPACE APPLICATIONS. THE HDC-601C IS PAINTED WITH A GRAY ENAMEL PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS EXPANDABLE TO 32K WORD MEMORY WITH THE ADDITIONAL MEMORY HOUSED WITHIN THE COMPUTER MAINFRAME.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 104. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 104. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM COMPUTERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN	ADIABATIC RISE RATE DEG K/HR DEG F/HR MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MAX	ALLOWABLE SINK TEMP. DEG K/(F) QUAL MIN	ALLOWABLE SINK TEMP. DEG K/(F) QUAL MAX	OP MODE
COMP 22	HDC-601P COMPUTER HONEYWELL	16.8 (37.0)	RECT	4835. (5.2)	20260. (.72)	.90/ .90	120/ 120	248/248 (23/ 23)	1.06 1.06	8 15	8 15	14.3 7.5	-0 -460	309 97	-0 -460	309 97	CONT
	THE HDC-601P IS AN 8K X 16 BIT PLATED WIRE MEMORY COMPUTER. IT IS DESIGN WITH AN ACTIVE COLD PLATE COOLING SYSTEM UTILIZING FORCED AIR. UNIT CAN BE MODIFIED TO USE A PASSIVE THERMAL CONTROL FOR SPACE APPLICATIONS. THE HDC-601P IS PAINTED WITH A GRAY ENAMEL PAINT. BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS EXPANDABLE TO 32K WORDS MEMORY WITH UP TO 16K PLATED WIRE MEMORY HOUSED IN THE COMPUTER MAINFRAME.AND REST IN AUXILARY MEMORY. ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 64. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 64. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP																
COMP 23	HDC-602 COMPUTER HONEYWELL	20.4 (45.0)	RECT	8781. (9.5)	51482. (1.82)	.25/ .85	170/ 170	193/193 (17/ 17)	.68 .68	10 18	10 18	17.2 9.1	-0 -460	343 158	-0 -460	337 147	CONT
	THE HDC-602 DIGITAL COMPUTER IS DESIGN WITH A PASSIVE RADIANT COOLED THERMAL SYSTEM. THE UNIT IS PRESENTLY IN DEVELOPMENT STAGE AND WILL BE USED IN THE SPACE SHUTTLE MAIN ENGINE CONTROLLER. THE HDC-602 IS AN HERMETICAL SEALED UNIT AND IS PAINTED WITH A WHITE POLY URETHANE PAINT. BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENT THE HDC-602 DESCRIBED ABOVE HAS A 16K X 17 BIT WORDS PLATED WIRE MEMORY. UNIT IS EXPANDABLE TO 32K WORDS MEMORY. ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 72. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 72. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP																
COMP 24	D216 COMPUTER AUTONETICS R.I.	7.3 (16.0)	RECT	2387. (2.6)	7571. (.27)	.90/ .90	65/ 65	272/272 (25/ 25)	.90 .90	11 20	11 20	6.1 3.2	-0 -460	305 90	-0 -460	305 90	CONT
	THE D216 DIGITAL COMPUTER IS DESIGN FOR USE FOR BOTH AIRCRAFT AND MISSILES. THE UNIT THERMAL CONTROL IS BY MEANS OF CONDUCTIVE COOLING TO A COLDPLATE. UNIT HAS A IRIDITE ALUMINUM FINISH BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. THE ABOVE D216 DIGITAL COMPUTER IS A 7 MODULE UNIT INCLUDING THE 28 VDC POWER SUPPLY ALL PACKAGED IN ONE BOX. THE D216 HAS A 32K X 16 BIT WORDS PLATED WIRE MEMORY AND MEMORY SIZE CAN VARY FROM 8K TO 65K WORDS. ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 37. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 37. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP																
COMP 25	DI216 COMPUTER AUTONETICS R.I.	7.3 (16.0)	RECT	2387. (2.6)	7571. (.27)	.90/ .90	75/ 75	314/314 (29/ 29)	.88 .88	12 23	12 23	6.1 3.2	-0 -460	298 77	-0 -460	298 77	CONT
	THE DI216 COMPUTER IS IN THE FINAL STAGE OF DEVELOPMENT WITH ANTICIPATED QUALIFICATIONS TESTS COMPLITION DURING 1974. THE UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF HEAT CONDUCTION TO A COLD PLATE. UNIT SURFACE IS IRIDITED ALUMINUM BUT COULD BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. THE DI216 IS A MODULAR UNIT WITH 32K WORDS MEMORY. ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 47. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP ****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 47. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP																

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM COMPUTERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN MAX	QUAL MIN MAX	OP MODE
COMP 26	D232 COMPUTER	13.6	RECT	3781.	15142.	.90/	140/ 370/370	1.01	12	12	11.5	-0	287	-0	287	CONT
	AUTONETICS R.I	(30.0)		(4.1)	(.53)	.90	140 (34/ 34)	1.01	23	23	6.0	-460	57	-460	57	
	THE D232 COMPUTER IS IN FINAL STAGE OF DEVELOPMENT AND IS SCHEDULE TO BE OPERATIONAL NEAR THE END OF 1973. THE D232 COMPUTER IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION TO A COLDPLATE. THE UNIT SURFACE IS IRIDITE ALUMINUM BUT FINISH IS APPLICATION DEPENDENT. THE D232 COMPUTER IS SIMILAR TO THE D1216 COMPUTER BUT HAS A 65K X 16 BIT WORDS PLATED WIRE MEMORY AND REQUIRES HIGHER POWER.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 95. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 95. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
COMP 27	TDY-300 COMPUTER	21.5	RECT	7446.	43154.	.26/	143/ 192/192	2.47	8	8	18.2	-0	180	-0	180	CONT
	TELEDYNE	(47.5)		(8.0)	(1.52)	.26	143 (17/ 17)	2.47	14	14	9.6	-460	-135	-460	-135	
	THE TDY-300 IS DESIGN FOR SPACE ENVIRONMENT IT IS THE COMPUTER FOR THE DELTA LAUNCH VEHICLE. UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL IN SPACE BY MEANS OF RADIATION AND CONDUCTION. UNIT REQUIRES AIR CONDITION AIR FOR PRELAUNCH OPERATION WITH THE COMPARTMENT AIR TEMPERATURE BETWEEN 22.2 AND 29.9 DEG C (72 TO 85 DEG.F) AND WITH AN AVERAGE CONVECTIVE HEAT TRANSFER COEFFICIENT BETWEEN 0.5 AND 2.0 BTU/HR-FT SQ-DEG F. UNIT IS PAINTED WITH ALUMINIZED PAINT.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 98. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 104. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
COMP 28	TDY-310 CENTAUR	28.1	RECT	6437.	34153.	.25/	235/ 365/365	1.28	10	10	23.8	-0	270	-0	288	CONT
	TELEDYNE	(62.0)		(5.9)	(1.21)	.92	235 (33/ 33)	1.28	18	18	12.5	-460	26	-460	58	
	THE TDY-310 IS THE GUIDANCE COMPUTER ONBOARD THE CENTAUR LAUNCH VEHICLE. UNIT IS DESIGN FOR A PASSIVE THERMAL CONTROL IN SPACE BY DISSIPATING HEAT BY RADIATION AND CONDUCTION AND AN ACTIVE CONTROL ON THE GROUND BY REQUIRING AIR CONDITION AIR FOR CONVECTIVE COOLING. UNIT IS PAINTED WITH A WHITE PAINT S-13G, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS COUPLED TO THE CENTAUR IMU. ABOVE UNIT IS A 16K X 24 BITS CORE MEMORY COMPUTER.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 97. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 117. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
COMP 29	SKC2000 COMPUTER	45.4	RECT	5729.	25236.	.90/	790/ *78/*78	1.52	21	21	38.1	-0	-0	-0	-0	CONT
	SINGER COMPANY	(*0.0)		(6.2)	(.89)	.90	790 (128/128)	1.52	39	39	20.1	-460	-460	-460	-460	
	THE SKC-2000 IS DESIGN FOR AIRCRAFT USE IT HAS AN ACTIVE THERMAL CONTROL OF CONDUCTION AND FORCED AIR COOLING, UNIT COULD BE MODIFIED FOR A PASSIVE COOLING SYSTEM. ABOVE POWER IS BASED ON THE B1 COMPUTER APPLICATIONS AND IT INCLUDES SPECIAL B1 TYPE I/O WHICH IS APPROX. 100 WATTS OF DISSIPATED POWER. UNIT IS A 32K WORD CORE MEMORY COMPUTER. UNIT SURFACES ARE ANODIZED ALUMINUM THAT ARE PAINTED BLACK, OR PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS IN 2 BOXES															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 724. AND 378. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 724. AND 378. TO MAINTAIN THE MIN AND MAX QUAL TEMP															

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM TAPE RECORDERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE DEG DEG MIN	ADIABATIC RATE K/HR F/HR MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
TR 1	EREP TAPE RECORDER MARTIN MARIETTA	40.8 (90.0)	RECT	8768. (9.4)	54569. (1.93)	.85/ .50	187/ 187	213/213 (19/ 19)	2.67 2.67	5 10	5 10	34.5 18.2	-0 -460	216 -70	-0 -460	185 -124	CONT

THE EREP TAPE RECORDER WAS BUILT FOR THE SKYLAB PROGRAM. THE UNIT IS ONBOARD THE SKYLAB AND UTILIZES THE EREP COOLANT LOOP FOR ITS THERMAL CONTROL. THE UNIT IS PAINTED WITH A GRAY PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT HAS A POWER DISSIPATION OF 35 WATTS IN STANDBY MODE,173 WATTS IN SLOW SPEED RECORD, AND 187 WATTS FOR HIGH SPEED RECORD.

****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 14. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP

****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 39. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM TRANSPONDERS, PM

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN MAX	QUAL MIN MAX	OP MODE
TPM 1	S-BAND TRANSPONDER PHILCO FORD CORP	1.7 (3.8)	RECT	1206. (1.3)	2212. (.08)	.85/ .85	6/ 6	51/ 51 (4/ 4)	.59 .59	4 4 7 7	1.5 .8	219 316 -63 110	219 316 -63 110	INT
	THE S-BAND TRANSPONDER IS DESIGN FOR THE VIKING PROGRAM. IT HAS A PASSIVE THERMAL DESIGN OF CONDUCTION TO MOUNTING SURFACES AND RADIATION TO THE ENVIRONMENT. UNIT IS ASSUMED TO BE PAINTED BLACK FOR SPACE TUG ALTHOUGH FOR VIKING IT IS VACUUM GOLD PLATED. THERE ARE NO CABLE LIMITATIONS ON THIS UNIT. AND UNIT HAS NO WARM UP REQ IREMENTS.													
TPM 2	S-BAND SGLS TRANSP MOTOROLA INC.	1.4 (3.0)	RECT	449. (.5)	633. (.02)	.90/ .90	2/ 2	62/ 62 (5/ 5)	.98 .98	2 2 4 4	1.1 .6	218 346 -66 163	218 346 -66 163	INT
	THE MSR-101 S-BAND RECEIVER IS PART OF S-BAND SGLS TRANSPONDER. UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION TO MO- UNTING POINTS AND RADIATION FROM CASE SURFACES. UNIT IS PAINTED WITH BLACK PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIRE- MENTS. UNIT HAS A STANDBY INPUT POWER MODE OF 0.9 WATT. THE MSR- 101 IS THE RECEIVER/DEMODULATOR UNIT OF THE TRANSPONDER AND THE MST-201 OR MST-501 ARE THE TRANSMITTER/BASEBAND UNIT OF THE TRANSP													
TPM 3	S-BAND SGLS TRANSP MOTOROLA INC.	1.4 (3.1)	RECT	524. (.6)	803. (.03)	.90/ .90	31/ 31	603/603 (56/ 56)	.66 .66	28 28 50 50	1.2 .6	-0 247 -460 -13	-0 247 -460 -13	INT
	THE MST-201 S-BAND TRANSMITTER IS PART OF THE S-BAND SGLS TRANSPON DER. UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION THE MOUNTING POINTS AND RADIATION FROM CASE SURFACES. UNIT IS PAIN ED WITH BLACK PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIR EMENTS. UNIT IS DESIGN FOR SPACE ENVIRONMENT. ITS INPUT POWER REQUIREMENTS IS 22 TO 32 VDC AND 1.2 AMP.,MAXIMUM INPUT CURRENT. UNIT IS COUPLED TO THE MSR-101 RECEIVER.													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 22. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 22. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP													
TPM 4	S-BAND SGLS TRANSP MOTOROLA INC.	1.4 (3.1)	RECT	524. (.6)	803. (.03)	.90/ .90	51/ 51	973/973 (90/ 90)	.57 .57	45 45 81 81	1.2 .6	-0 -0 -460 -460	-0 -0 -460 -460	INT
	THE MST-501 S-BAND TRANSMITTER IS PART OF THE S-BAND SGLS TRANSPON DER. UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION TO MOUNTING POINTS AND RADIATION FROM CASE SURFACES. UNIT IS PAINT ED WITH BLACK PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIR EMENTS. UNIT IS DESIGN FOR SPACE ENVIRONMENT. ITS INPUT POWER REQUIREMENTS IS 22 TO 32 VDC AND 2.0 AMP., MAXIMUM INPUT CURRENT. UNIT IS COUPLED TO THE MSR-101 RECEIVER.													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 42. AND 9. TO MAINTAIN THE MIN AND MAX OPERATING TEMP													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 42. AND 9. TO MAINTAIN THE MIN AND MAX QUAL TEMP													

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM TRANSPONDERS, PM

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN MAX	QUAL MIN MAX	OP MODE
TPM 5	MSX-201S S-BAND MOTOROLA INC.	2.2 (4.9)	RECT	752. (.8)	1349. (.05)	.90/ .90	34/ 457/457 34 (42/ 42)	.77 .77	19 34	19 34	1.9 1.0	-0 -460	285 53	-0 -460	285 53	INT
	THE MSX-201S TRANSPONDER IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION TO THE BOTTOM SURFACE AND MOUNTINGS, AND RADIATION FROM THE OTHER SURFACES. UNIT IS PAINTED WITH A BLACK PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS IN ENGINEERING STAGE AND WILL REQUIRE SOME FURTHER WORK BEFORE IT IS READY FOR PRODUCTION. UNIT IS A SINGLE PACKAGE OF THE MSR-101/MST-201 TRANSPONDER. THE MSX-201S IS PACKAGED IN A SEALED CASE.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 21. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 21. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
TPM 6	MSX-501S S-BAND MOTOROLA INC.	2.2 (4.9)	RECT	752. (.8)	1349. (.05)	.90/ .90	53/ 715/715 53 (66/ 66)	.69 .69	30 54	30 54	1.9 1.0	-0 -460	199 -101	-0 -460	199 -101	INT
	THE MSX-501S TRANSPONDER IS DESIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION TO THE BOTTOM SURFACE AND MOUNTINGS, AND RADIATION FROM THE OTHER SURFACES. UNIT IS PAINTED WITH A BLACK PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS IN ENGIN EERING STAGE AND WILL REQUIRE SOME FURTHER WORK BEFORE UNIT IS READY FOR PRODUCTION. THE MSX-501S IS PACKAGED IN A SEALED UNIT.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 40. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 40. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
TPM 7	TR-36 TRANSPONDER CUBIC CORPORATION	2.3 (5.1)	RECT	1319. (1.4)	2362. (.08)	.90/ .90	6/ 49/ 49 6 (4/ 4)	.60 .60	3 6	3 6	1.9 1.0	218 -66	338 149	218 -66	338 149	INT
	THE TR-36 S-BAND SGLS TRANPSONDER IS BUILT FROM 4 SEPARATE UNITS RECEIVER, TRANSMITTER, MULTICOUPLER AND BASEBAND ASSEMBLY. THE RECEIVER HAS PASSIVE COOLING BY CONDUCTION THRU MOUNTING SURFACE, AND RADIATION FROM REST OF SURFACES. UNIT IS BUILT IN A SEALED CASE AND IS PAINTED BLACK BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SPACE QUALIFIED AND IS USED ON USAF PROGRAM.															
TPM 7	TR-36 TRANSPONDER CUBIC CORPORATION	1.8 (4.0)	RECT	919. (1.0)	1437. (.05)	.90/ .90	25/ 271/271 25 (25/ 25)	.59 .59	17 31	17 31	1.5 .8	-0 -460	305 90	-0 -460	305 90	INT
	THE TRANSMITTER OF THE TR-36 TRANSPONDER IS DESIGN WITH A PASSIVE THERMAL CONTROL. COOLING IS BY CONDUCTION THROUGH BASE PLATE AND RADIATION FROM OTHER SURFACES. UNIT IS BUILT IN A SEALED CASE AND IS PAINTED BLACK, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SPACE QUALIFIED AND IS USED ON A USAF PROGRAM															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 10. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 10. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM -TRANSPONDERS, PM

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN MAX	QUAL MIN MAX	OP MODE
TPM 7	TR-36 TRANSPONDER	1.3	RECT	892.	1491.	.90/	4/	50/ 50	.49	4 4	1.1	218 338	218 338	INT
	CUBIC CORPORATION	(2.8)		(1.0)	(.05)	.90	4	(4/ 4)	.49	7 7	.6	-67 148	-67 148	
	THE RASEBAND ASSEBLY OF THE TR-36 TRANSPONDER IS DESIGN WITH A PAS SIVE THERMAL CONTROL. UNIT IS COOLED BY CONDUCTION THROUGH MOUNT- ING SURFACE AND RADIATION FROM REMAINING SURFACES. UNIT IS BUILT WITH A SEALED PACKAGE AND IS PAINTED BLACK BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SAPCE QUALIFIED AND IS USED ON A USAF PROGRAM.													
TPM 7	TR-36 TRANSPONDER	.4	RECT	447.	523.	.90/	0/	0/ 0	.29	0 0	.3	238 344	238 344	INT
	CUBIC CORPORATION	(.8)		(.5)	(.02)	.90	0	(0/ 0)	.29	0 0	.2	-29 160	-29 160	
	THE MULTICOUPLER OF THE TR-36 TRANSPONDER IS DESIGN WITH A PASSIVE THERMAL CONTROL. UNIT IS COOLED BY CONDUCTION THROUGH MOUNTING SUR FACE AND RADIATION FROM REMAINING SURFACES. UNIT IS BUILT WITH A SEALED CASE AND IS PAINTED BLACK BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SPACE QUALIFIED AND IS USED ON A USAF PROGRAM. UNIT IS BASICALLY A PASSIVE UNIT WITH NO HEAT DISSI- PATION.													

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM TRANSMITTERS, FM

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN MAX	QUAL MIN MAX	OP MODE
TFM 1	TWTA S-BAND	4.4	RECT	1972.	5278.	.90/	60/ 306/306		.74	17 17	3.7	-0 262	-0 268	INT
	WATKINS- JOHNSON	(9.6)		(2.1)	(.19)	.85	60 (28/ 28)		.74	30 30	2.0	-460 13	-460 22	
	THE TRAVELING WAVE TUBE AMPLIFIER IS AN S-BAND AMPLIFIER USED ON THE VIKING PROGRAM. IT HAS A PASSIVE THERMAL DESIGN OF CONDUCTION TO THE BOTTOM SURFACE AND MOUNTING POINTS AND SOME RADIATION TO SURROUNDING SURFACES AND ENVIRONMENT. UNIT IS PAINTED WITH A BLACK ENAMEL PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIRE MENTS. UNIT REQUIRE A MAXIMUM OF 2 MINUTES FOR WARM UP PRIOR TO BEING OPERATIONAL.													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 28. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 28. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP													
TFM 2	MTT-201 S-BAND FM	1.0	RECT	402.	531.	.90/	25/ 626/626		.63	29 29	.9	-0 239	-0 239	INT
	MOTOROLA INC.	(2.3)		(.4)	(.02)	.90	25 (58/ 58)		.63	53 53	.5	-460 -27	-460 -27	
	THE MTT-201 S-BAND TRANSMITTER IS DESIGN WITH A PASSIVE THERMAL DESIGN OF CONDUCTION TO THE BOTTOM SURFACE AND MOUNTINGS, AND RADIATION FROM OTHER SURFACES. THE UNIT IS PAINTED WITH A BLACK PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS PACKAGED IN A HERMETICLY SEALED CASE.													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 18. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 18. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP													
TFM 3	MTT-501 S-BAND FM	1.0	RECT	445.	605.	.90/	60/ *48/*48		.45	71 71	.9	-0 -0	-0 -0	INT
	MOTOROLA INC.	(2.3)		(.5)	(.02)	.90	60 (125/125)		.45	128 128	.5	-460 -460	-460 -460	
	THE MTT-501 S-BAND TRANSMITTER IS DESIGN WITH A PASSIVE THERMAL DESIGN OF CONDUCTION TO THE BOTTOM SURFACE AND MOUNTINGS, AND RAD- IATION FROM THE REMAINING SURFACES. UNIT IS PAINTED WITH A BLACK PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS PACKAGED IN A HERMETICLY SEALED CASE.													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 52. AND 25. TO MAINTAIN THE MIN AND MAX OPERATING TEMP													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 52. AND 25. TO MAINTAIN THE MIN AND MAX QUAL TEMP													
TFM 4	S-BAND TRANSMITTER	6.5	RECT	2419.	7374.	.90/	205/ 847/847		.57	39 39	5.5	-0 203	-0 264	INT
	EMR	(14.4)		(2.6)	(.26)	.90	205 (78/ 78)		.57	70 70	2.9	-460 -94	-460 15	
	THE S-BAND TRANSMITTER IS DESIGN WITH A PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION. UNIT IS PAINTED BLACK BUT CAN BE FIN ISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS SPACE QUALIFIED AND HAS BEEN SPACE FLOWN ONBOARD THE TITAN III ON SEVERAL FLIGHTS. UNIT CASE IS HERMETICLY SEALED AND MAINTAINS ATMOSPHERIC PRESSURE FOR EXTENDED PERIODS. UNIT OPERATE ON AN INPUT VOLTAGE RANGE OF 25 TO 32 VDC.													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 140. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 144. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP													

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM POWER AMPLIFIERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN MAX	QUAL MIN MAX	OP MODE
PA 1	S-BAND POWER AMP	.1	TANG	179.	131.	.90/	16/ 904/904	.17	146 146	.1	-0 -0	-0 -0	-0 -0	INT
	RADIATION INC	(.3)		(.2)	(.00)	.90	16 (84/ 84)	.17	262 262	.1	-460 -460	-460 -460		
	THE UNIT IS DESIGN WITH A HEAT SINK BASE PLATE FOR CONDUCTION COOL ING. UNIT IS MOUNTED TO COLD PLATE FOR COOLING. THE UNIT SEMICON- DUCTOR COMPONENTS ARE SOFT-SOLDERED TO THE HEAT SINK PLATE. UNIT HAS AN ALUMINUM ANODIZED FINISH BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENT. UNIT WAS TESTED TO PRESSURE ALTITUDE OF 1 X 10-7 TORR. AMPLIFIER WEIGHT IS LESS THAN 150 GRAMS (0.33 LBS).													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 13. AND 3. TO MAINTAIN THE MIN AND MAX OPERATING TEMP													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 13. AND * TO MAINTAIN THE MIN AND MAX QUAL TEMP													
PA 2	AMPLIFIERS	.3	RECT	171.	82.	.90/	10/ 584/584	.41	45 45	.2	-0 222	-0 222		INT
	MSC	(.6)		(.2)	(.00)	.90	10 (54/ 54)	.41	81 81	.1	-460 -59	-460 -59		
	THE 91000 SERIES S-BAND TELEMETRY AMPLIFIER IS A NON TUNABLE MICRO WAVE INTEGRATED CIRCUIT POWER AMPLIFIER SPECIFICALLY DESIGNED FOR USE IN S-BAND TELEMETRY SYSTEMS. THE UNIT IS DESIGN TO BE INCOPORA TED INTO A TOTAL SYSTEM PACKAGE. UNIT IS DESIGN WITH PASSIVE THER- MAL CONTROL OF RADIATION AND CONDUCTION TO SURFACES. UNIT HAS AN ANODIZED ALUMINUM FINISH BUT CAN BE FINISHED PER CUSTOMER THERMAL REQUIREMENTS. UNIT DESIGN FOR SPACE APPLICATION.													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 6. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP													
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 6. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP													

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM RF MULTIPLEXERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN MAX	QUAL MIN MAX	OP MODE
RFM 1	RF MULTIPLEXER	1.6	RECT	1323.	2458.	.90/	0/	0/ 0	.51	0 0	1.3	241 324	241 324	INT
	WAVECOM INC.	(3.5)		(1.4)	(.09)	.85	0	(0/ 0)	.51	0 0	.7	-25 125	-25 125	
	THE VIKING RF MULTIPLEXER IS DESIGN A BUILT FOR THE VIKING MARS LANDER. THE UNIT IS A PASSIVE DEVICE AND DOES NOT DISSIPATE ANY POWER. IT HAS A PASSIVE THERMAL CONTROL OF CONDUCTION TO THE BOTTOM SURFACES AND MOUNTINGS AND RADIATION FROM THE REMAINING SURFACES. UNIT IS PAINTED WITH A BLACK ENAMEL PAINT, BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS.													
RFM 2	MULTIPLEXER	.9	RECT	658.	1032.	.90/	0/	0/ 0	.56	0 0	.8	255 324	255 324	INT
	EMERSON ELECTRIC	(2.0)		(.7)	(.04)	.90	0	(0/ 0)	.56	0 0	.4	0 125	0 125	
	THE MULTIPLEXER IS A PASSIVE ELECTRONIC UNIT WITH NO POWER DISSIPATION. THE UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION FROM THE UNIT SURFACES. THE UNIT IS PAINTED BLACK BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT HAS A SEALED CASE AND HAS BEEN SPACE QUALIFIED ONBOARD THE TITAN III LAUNCH VEHICLE.													

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM DECODER

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG K/(F) DESIGN MIN MAX	SINK QUAL MIN MAX	OP MODE
DEC 1	MCR-904 DECODER	1.4	RECT	591.	908.	.90/	2/	47/ 47	.78	2 2	1.2	212 342	212 342	INT
	MOTOROLA INC.	(3.0)		(.6)	(.03)	.90	2	(4/ 4)	.78	4 4	.6	-77 156	-77 156	

THE MCR-904 COMMAND RECEIVER/DECODER IS DESIGN WITH A PASSIVE THERMAL DESIGN OF CONDUCTION TO THE BOTTOM MOUNTING SURFACE AND RADIATION FROM THE OTHER SURFACES. THE UNIT HAS AN IRIDITE ALUMINUM FINISH BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS PACKAGED IN AN HERMETICLY SEALED CASE. UNIT RESPOND TIME FOR COMMAND IS 15 MILLISECONDS MAXIMUM.

INSTRUMENTATION SUBSYSTEM

EQUIPMENT ITEM PRESSURE TRANSDUCERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE DEG MIN	ADIABATIC RATE K/HR F/HR MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
PRES 1	TRANSDUCER PRES.	.1	NDRI	8.	0.	.35/	0/	0/	0 25.77	0	0	.1	233	344	233	344	INT
	GULTON INDUSTRIES	(.3)		(.0)	(0.00)	.20	0	(0/	0)25.77	0	0	.1	-40	160	-40	160	
	THE PRESSURE TRANSDUCER IS A PASSIVE UNIT THAT MEASURED ABSOLUTE PRESSURE UNIT HAS A PASSIVE THERMAL DESIGN OF CONDUCTION TO THE MOUNTING STRUCTURE, AND RADIATION TO ENVIRONMENT. UNIT IS MADE FROM STAINLESS STEEL AND HAS NO PAINT OR FINISH ON IT. UNIT IS SPACE QUALIFIED AND IS ONBOARD THE SKYLAB.																
PRES 2	TRANSDUCER PRES.	.3	CYLI	81.	45.	.35/	0/	0/	0 3.93	0	0	.2	235	394	235	394	INT
	BALDWIN-LIMA	(.6)		(.1)	(.00)	.20	0	(0/	0) 3.93	0	0	.1	-34	250	-34	250	
	THE PRESSURE TRANSDUCER IS A PASSIVE UNIT WITH NO POWER DISSIPATION. UNIT IS MAINTAINED WITHIN THE ABOVE TEMPERATURE RANGE BY RADIATION TO ENVIRONMENT AND CONDUCTION TO MOUNTING. UNIT HAS A STAINLESS STEEL CASE . TRANSDUCER IS SPACE QUALIFIED AND IS USED ON TITAN III LAUNCH VEHICLES PROGRAM. TRANSDUCER HAS VARIOUS TEMPERATURE LIMITS DEPENDING ON MEDIUM SUCH AS, AIR, UDMH, N2H4, AND N204.																
PRES 3	TRANSDUCER PRES.	.2	CYLI	78.	48.	.35/	0/	0/	0 2.91	0	0	.2	144	422	144	422	INT
	GENISCO TECH CORP.	(.5)		(.1)	(.00)	.20	0	(0/	0) 2.91	0	0	.1	-199	300	-199	300	
	THE PRESSURE TRANSDUCER IS A PASSIVE COMPONENT WITH NO REAL POWER DISSIPATION. UNIT IS MAINTAINED IN ITS TEMPERATURE RANGE BY THERMAL RADIATION AND CONDUCTION TO ITS ENVIRONMENT. THE UNIT STAINLESS STEEL CASE IS NOT PAINTED OR FINISH IN ANY SPECIAL WAY OTHER THAN STANDARD STAINLESS STEEL FINISH.																
PRES 4	TRANSDUCER PRES.	.3	CYLI	97.	63.	.35/	0/	0/	0 5.54	0	0	.2	269	310	269	310	INT
	GULTON INDUS. INC.	(.6)		(.1)	(.00)	.20	0	(0/	0) 5.54	0	0	.1	24	100	24	100	
	THE DIFFERENTIAL PRESSURE TRANSDUCER IS A PASSIVE UNIT. IT IS DESIGN TO INDICATE A PRESSURE DIFFERENCE OF + TO - 3.45 N/CM SQ (+ TO -5.0 PSID). UNIT HAS NO REAL POWER DISSIPATION AND ITS TEMPERATURE IS MAINTAINED BY CONDUCTION AND RADIATION TO THE SURROUNDING. UNIT IS MADE FROM STAINLESS STEEL AND IS HERMETICLY SEALED. UNIT HAS NO FINISH. TRANSDUCER IS SPACE QUALIFIED AND IS USED ONBOARD TITAN IIIE LAUNCH VEHICLE.																

INSTRUMENTATION SUBSYSTEM

EQUIPMENT ITEM TEMPERATURE TRANSDUCERS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG K/(F) DESIGN MIN	DESIGN MAX	QUAL MIN	QUAL MAX	OP MODE
TEMP 1	TRANSDUCER TEMP	.0	RECT	10.	1.	.35/	0/	0/	0 4.37	0 0	.0	148	423	148	423	INT
	HY-CAL ENGINEERING	(.1)		(.0)	(.00)	.20	0	(0/	0) 4.37	0 0	.0	-193	302	-193	302	
	THE TEMPERATURE TRANSDUCER IS A PLATINUM UNIT. IT IS A PASSIVE UNIT THAT HAS A MAXIMUM WEIGHT OF 6 GRAMS. TRANDUCER THERMAL CONTROL IS SIMPLY RADIATION AND CONDUCTION. UNIT CASE IS STAINLESS STEEL AND DOES NOT HAVE ANY PAINT OR FINISH ON IT. UNIT IS SPACE QUALIFIED AND SEVERAL DOZEN OF THIS UNIT ARE ONBOARD SKYLAB SUPPLING TEMPERATURE READINGS.															
TEMP 2	TRANSDUCER TEMP.	.2	CYLI	8.	2.	.35/	0/	0/	0 22.38	0 0	.2	235	422	144	310	INT
	ROSEMOUNT ENGR. CO	(.4)		(.0)	(.00)	.20	0	(0/	0) 22.38	0 0	.1	-34	300	-199	100	
	THE SURFACE TEMPERATURE TRANSDUCER IS DESIGN TO MEASURE THE SURFACE TEMPERATURE OF THE PROPELLANT LINES WHICH FEED THE ATTITUDE CONTROL SYSTEM. UNIT IS A SEMI-CYLINORICAL WITH A THICKNESS OF 0.254 CM (0.10 IN) AND AN INSIDE DIAMETER OF 0.32 CM (0.125 IN). TRANSDUCER IS A PASSIVE UNIT THAT CONDUCTS AND RADIATE TO THE SURROUNDING. UNIT HAS NO PAINT OR OTHER THAN STANDARD STAINLESS STEEL FINISH. UNIT IS SPACE QUALIFIED AND IS USED ON TITAN III.															
TEMP 3	TRANSDUCER TEMP.	.3	CYLI	32.	11.	.35/	0/	0/	0 17.05	0 0	.2	266	310	266	310	INT
	ROSEMOUNT ENGR. CO	(.6)		(.0)	(.00)	.20	0	(0/	0) 17.05	0 0	.1	19	100	19	100	
	THE BULK PROPELLANT TEMPERATURE TRANSDUCER HAS A PROBE THAT IS 12.7 CM(5.0 IN) LONG AND IS .64 CM (0.25 IN) IN DIAMETER. THE PROBE IS EXTENDED ALL THE WAY INTO THE PROPELLANT TANK. THE SENSITIVE ELEMENT IS THERMALY ISOLATED FROM THE UNIT BODY. THE UNIT THERMAL DESIGN IS TO RADIATE AND CONDUCT TO THE SURROUNDING. TRANSDUCER IS BASICALLY A PASSIVE DEVICE WITH NO POWER DISSIPATION. UNIT IS SPACE QUALIFIED ON TITAN III PROGRAM.															
TEMP 4	TRANSDUCER TEMP.	.3	CYLI	44.	19.	.35/	0/	0/	0 9.20	0 0	.2	219	355	219	355	INT
	ROSEMOUNT ENGR. CO	(.6)		(.0)	(.00)	.20	0	(0/	0) 9.20	0 0	.1	-65	179	-65	179	
	THE TEMPERATURE TRANSDUCER IS A PASSIVE UNIT WITH NO REAL POWER DISSIPATION. UNIT HAS A PROBE THAT IS 4.6 CM(1.8 IN) LONG THAT IS PLACED INSIDE THE PROPELLANT TANK AND MEASURES THE PROPELLANT TEMPERATURE. THE TRANSDUCER THERMAL DESIGN IS TO CONDUCT AND RADIATE TO THE SURROUNDINGS. UNIT IS MADE FROM STAINLESS STEEL AND IS NOT PAINTED. TRANSDUCER IS SPACE QUALIFIED AND FLOWN ON SEVERAL TITAN VEHICLES															

INSTRUMENTATION SUBSYSTEM

EQUIPMENT ITEM CURRENT MEASUREMENTS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE TEMP. DEG DESIGN MIN	DESIGN MAX	SINK K/(F) QUAL MIN	QUAL MAX	OP MODE
CURR 1	SHUNTS-CURRENT	.1	RECT	106.	72.	.90/	0/	0/ 0	.37	0 0	.1	223	378	223	378	INT
	MARTIN MARIETTA	(.3)		(.1)	(.00)	.90	0 (	0/ 0)	.37	0 0	.1	-58	220	-58	220	

THE CURRENT SHUNT IS A PASSIVE DEVICE USED TO MEASURE CURRENT FLOW. THE SHUNT BASE IS MADE FROM A FIBERGLASS WITH THE ELEMENT ASSEMBLY MADE OUT OF NICKEL CHROME ALLOY. UNIT HAS NO REAL POWER DISSIPATION. AND CONTACT STUDS ARE ISOLATED FROM REST OF SHUNT BASE. UNIT IS NOT PAINTED AND IS SPACE QUALIFIED FOR TITAN.

ELECTRICAL POWER SUBSYSTEM

EQUIPMENT ITEM FUEL CELL POWER SYSTEMS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN	DESIGN MAX	QUAL MIN	QUAL MAX	OP MODE
FC 1	TUG FUEL CELLS	15.0	RECT	4426.	18113.	.20/	820/	*53/728	1.97	68 27	12.6	-0	-0	-0	-0	CONT
	PRATT AND WHITNEY	(33.0)		(4.8)	(.64)	.05	322	(172/ 67)	3.57	123 48	6.6	-460	-460	-460	-460	
	THE FUEL CELLS FOR SPACE TUG ARE AT PRESENT IN DEVELOPMENT FOR NASA-LERC AND THE USAF. UNIT IS DESIGN TO USE A RADIATOR FOR ACTIVE COOLING SYSTEM. IN ADDITION UNIT HAS A MULTI-LAYER INSULATION BLANKET AROUND IT. ABOVE TEMPERATURES ARE THE FUEL CELL INTERNAL TEMPERATURES, WITH 82.2 DEG C(180 DEG.F) BEING THE NORMAL OPERATING TEMPERATURE. THE LIMITING FACTOR ON THE LOW END OF THE TEMPRATURE RANGE IS THE FREEZING POINT OF WATER.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 315. AND 800. TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 315. AND 800. TO MAINTAIN THE MIN AND MAX QUAL TEMP															
FC 2	FUEL CELLS	26.3	RECT	9529.	61779.	.20/	30/	31/ 31	12.72	1 1	20.4	-0	-0	-0	288	CONT
	GENERAL ELECTRIC	(57.9)		(10.3)	(2.18)	.05	30	(2/ 2)	12.72	2 2	10.8	-460	-460	-460	60	
	THE FUEL CELLS FOR SPACE TUG ARE AT PRESENT IN THE DEVELOPMENT STAGE. THE DATA IS BASED ON A NASA TECHNOLOGY STUDY OF FUEL CELLS FOR SPACE SHUTTLE. THE UNIT HAS AN ACTIVE THERMAL CONTROL OF CIRCULATING COOLANT TO MAINTAIN THE FUEL CELL INTERNAL OPERATING TEMPERATURE AT 65 TO 82 DEG C (150 TO 180 DEG. F). IN ADDITION TO COOLANT SYSTEM THE UNIT IS COVERED WITH A MULTI-LAYER INSULATION BLANKET. FREEZING POINT OF WATER IS THE TEMPERATURE LIMIT ON UNIT.															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 15. AND * TO MAINTAIN THE MIN AND MAX OPERATING TEMP															
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 15. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP															

ELECTRICAL POWER SUBSYSTEM

EQUIPMENT ITEM BATTERIES

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	TIME CONST. HOURS MIN MAX	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	THERMAL MASS W-HR/K BTU/F	ALLOWABLE SINK TEMP. DEG K/(F) DESIGN MIN	DESIGN MAX	QUAL MIN	QUAL MAX	OP MODE
BAT 1	25 AH PRI. BATTERY ELECTRIC STORAGE	16.3 (36.0)	RECT	3605. (3.9)	14017. (.49)	.45/ .13	2/ 28	7/ 77 (0/ 7)	13.44 9.09	0 0	2 4	13.0 6.9	-0 -460	289 61	-0 -460	289 61	CONT
	THE 25 AH BATTERY IS DESIGN FOR PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION TO THE SURROUNDING ENVIRONMENT. UNIT HAS A POLISHED TITANIUM FINISH. THE BATTERY IS SPACE QUALIFIED AND HAS BEEN USED ONBOARD THE TITAN III FOR SEVERAL YEARS. THE BATTERY HAS AN APPROXIMATE 90 PRECENT EFFICIENCY, AND UNIT POWER DISSIPATION IS A FUNCTION OF THE UNIT LOADS. UNIT OPERATING VOLTAGE RANGE IS 25 TO 31 VDC.																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 26. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 26. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP																
BAT 2	165 AH PRI BATTERY AGLE-PICHER INDUS	36.7 (81.0)	RECT	4562. (4.9)	19640. (.69)	.90/ .90	45/ 70	98/153 (9/ 14)	3.48 3.30	1 2	2 4	31.3 16.5	241 -24	280 44	192 -113	304 88	CONT
	THE 165 AM-HR BATTERY HAS A PASSIVE THERMAL CONTROL OF CONDUCTION TO MOUNTING SURFACE AND RADIATION FROM THE OTHER SURFACES. UNIT IS PAINTED WITH A BLACK PAINT BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENT. THE BATTERY DISSIPATED POWER IS A FUNCTION OF THE BATTERY LOADS WITH THE UNIT BEING APPROXIMATELY 90 PERCENT EFFICIENT. UNIT IS SPACE QUALIFIED AND WILL BE USE ONBOARD THE TRANSTAGE IN UP-COMING LAUNCHES																
BAT 3	15 AMP-HR BATTERY EAGLE PICHER	8.6 (19.0)	RECT	1303. (1.4)	3079. (.11)	.90/ .90	62/ 96	479/736 (44/ 68)	1.37 1.24	10 19	16 29	6.2 3.3	-0 -460	305 89	-0 -460	305 89	CONT
	THE ABOVE 15 AMP-HR BATTERY IS ONLY CAPABILITY DATA BASED ON AN EXISTING 4 AMP-HR BATTERY. THE UNIT WILL HAVE PASSIVE THERMAL CONTROL OF RADIATION AND CONDUCTION. IN ADDITION UNIT WILL BE SEALED AND PAINTED BLACK OR PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS ASSUMED TO BE 90 PRECENT EFFICIENT WITH 10 PRECENT OF BATT ERY DISCHARGE POWER GENERATED AS INTERNAL HEAT. BATTERY TEMPERATURE RANGE IS BASED ON UNIT BEING USED ONCE.																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 53. AND 0. TO MAINTAIN THE MIN AND MAX OPERATING TEMP																
	****** NOTE CONDUCTIVE HEAT LOSSES MUST EXCEED 53. AND 0. TO MAINTAIN THE MIN AND MAX QUAL TEMP																