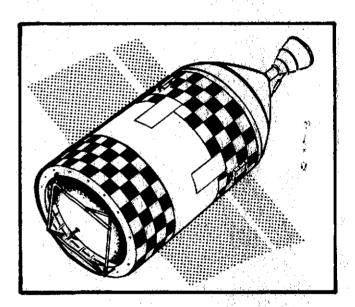
Catalogue

April 1974

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



(NASA-CR-120310) SPACE TUG THERMAL CONTROL EQUIPMENT THERMAL REQUIREMENTS, CHARACTERISTICS AND CONSTRAINTS CATALOGUE (Martin Marietta Corp.) 187 p HC \$12.50

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MARTIN MARRETTA

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

bу

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.

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

AVIONICS SYSTEM

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	POWER	REMARKS	+ 1	, , +
			(POUNDS)	(WATTS)		+4	2+
					(EAR	+ V (HT	, . t
***	***	***	***	***	***	**	**
IMU		2	80.	40.	MOUNTED AT POSITI	ON 1 W	ITH
STAR TRACKER		2	50.	18.	POSITION 1		
ELECTRONICS		S	24.				
HORIZON SCANNE	ER.	S	70.	38.	POSITION 3. POSSI	BLY	
ELECTRONICS		2	10.		DEPLOYED.		
	(A)	2	70.	155.	POSITION 2, W/3 P	OSITIO	N
	(A)	2	20.		MIRROR YAG		
TELEVISION	(A)	2	20.	10.	POSITION 2+ FORWA + ZOOM+ ONE GIMBA		KING
ACS ELECTRONIC	CS .	2	28.	18.5			
SUN SENSOR		2	8.0	0.0	MOUNTED ON EXTERI POSITION 2 AND 4	OR AT	
TOTALS			372.8	279.5	***************************************		
	ENCL		N RENDEZV		B#####################################		****

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.

```
SPACE TUG EQUIPMENT DATA BANK FINAL DATA
                                                         PAGE I-4
  THERMAL REQUIREMENTS. PHYSICAL CHARACTERISTICS. AND CONSTRAINTS
   AVIONICS SYSTEM
   GUIDANCE NAVIGATION AND CONTROL SURSYSTEM
 ***************
IMU I 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
                               WATTS ##
                          95.
                    94.0 AT 211. DEG (WATTS AT DEG. KELVIN)
   21.0 AT 297. DEG.
   21.0 AT 75. DEG,
                    94.0 AT -80. DEG
                                     (WATTS AT DEG. FAHRENHEIT)
  OUTPUT POWER
                             0. WATTS ** MILLI-WATT OUTPUT
  THERMAL DESIGN
                          ACTIVE
                                   챵
                                      PASSIVE
  PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS
    NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF
    MISSION ON-TIMES * SHUT/TUG ON* TUG/OPBIT 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 58 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.

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.

AVIONICS SYSTEM

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM *******************************

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 3541.9 SQ. CENTIMETERS * 549.0 SQ. INCHES

PACKAGE AREA 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.

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

PROGRAM.

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

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

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ************

AUTONETICS RI 4 MICRON ESG 219. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (-65. TO 160. DEG. F) 211. TO 368. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-80. TO 203. DEG. F) 219. TO 344. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-65 TO 160 DEG F)

219. TO 344. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-65, TO 160, DEG, F)

PACKAGE SHAPE RECTANGULAR 9.1 CENTIMETERS PACKAGE SIZE * LENGTH 20.3 * WIDTH 17.8 * HEIGHT 8.0 * WIDTH 3.6 INCHES LENGTH 7.0 # HEIGHT 1419.4 SQ. CENTIMETERS * 220.0 SQ. INCHES PACKAGE AREA

201.6 CU. INCHES

3303.6 CU. CENTIMETERS PACKAGE VOLUME CASE MATERIAL ALUMINUM

CASE WEIGHT 4.0 POUNDS 1.8 KILOGRAMS * 4.5 KILOGRAMS * 10.0 POUNDS TOTAL WEIGHT ALPHA = 0.90* EMISSIVITY = 0.90 SURFACE PROPERTIES

50.0 WATTS ## INPUT STEADY STATE POWER 0.0 WATTS ## OUTPUT POWER

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 PHONE 216-647-5058 EXTENSION MR ROBERT D. FAGALY 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 18 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) 225. TO 366. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-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 10.2 CENTIMETERS PACKAGE SIZE * LENGTH 24.4 * WIDTH 9.9 # HEIGHT 9.6 * WIDTH 3.9 # HEIGHT 4.0 INCHES LENGTH 1179.9 SQ. CENTIMETERS * . 182.9 SQ. INCHES PACKAGE AREA 4 PACKAGE VOLUME 2454.1 CU. CENTIMETERS 149.8 CU. INCHES CASE MATERIAL ALUMINUM CASE WEIGHT .9 KILOGRAMS # 1.9 POUNDS 6.0 POUNDS TOTAL WEIGHT 2.7 KILOGRAMS * SURFACE PROPERTIES ALPHA = 0.80* EMISSIVITY = 0.80 30.0 WATTS ** UNIT REQUIRE HEATER POWER INPUT STEADY STATE POWER OUTPUT POWER 0.0 WATTS ## THERMAL DESTON 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 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.

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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ****************

HONEYWELL IMU 6 H-448 AGENA IMU 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)

1257.8 CU. INCHES

PACKAGE SHAPE RECTANGULAR

16.0 * HEIGHT 41.9 CENTIMETERS PACKAGE SIZE # LENGTH 30.7 * WIDTH

6.3 # HEIGHT LENGTH 12.1 * WIDTH 16.5 INCHES 4901.0 SQ. CENTIMETERS * 759.7 SQ. INCHES

20611.6 CU. CENTIMETERS * PACKAGE VOLUME CASE MATERIAL

ALUMINUM 4.5 KILOGRAMS *

10.0 POUNDS

CASE WEIGHT TOTAL WEIGHT

PACKAGE AREA

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

******************************* PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY OFF MISSION ON-TIMES * SHUT/TUG ON* TUG/OPBIT ON* TUG/PAY 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. H-448 IMU HAS BEEN SPACE QUALIFIED ON THE AGENA PROGRAM. THE UNIT

HAS AN INTERNAL HEATERS THAT MAINTAIN UNIT WITHIN OPERATING TEMP.

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 (GUID-ANCE: 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) 264. TO 344. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE 15. TO 160. DEG. F) 264. TO 333. DEG. K 15. TO 140. DEG. F) 264. TO 333. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

QUALIFICATION TEST TEMPERATURE REQUIREMENTS 15. TO 140. DEG. F)

PACKAGE SHAPE RECTANGULAR

PACKAGE SIZE * LENGTH 68.6 * WIDTH 52.1 * HEIGHT 26.7 CENTIMETERS 27.0 * WIDTH 20.5 * HEIGHT 10.5 INCHES LENGTH

13577.4 SQ. CENTIMETERS # PACKAGE AREA 2104.5 SO. INCHES 95237.5 CU. CENTIMETERS # PACKAGE VOLUME 5811.7 CU. INCHES

CASE MATERIAL ALUMINUM

18.1 KILOGRAMS * CASE WEIGHT 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

0.0 WATTS ** OUTPUT POWER 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 PAINT ED 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 MOUNT ED IN A DODERAHEDRAL OFIENTATION. EACH OF THE SENSOR ASSEMBLIES CONTAIN ONE GYRO. ONE ACCELEROMETER. REBALANCE ELECTRONICS, INTER-FACE 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 ************

DGG8088A1 IMU 8 BLOCK 5D STRAPDOWN HONEYWELL 304. TO 308. DEG. K DESIGN OPERATING CASE TEMPERATURE 88. TO 95. DEG. F) 272. TO 344. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE 30. TO 160. DEG. F) 268. TO 328. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 23. TO 131. DEG. F) 268. TO 318. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS 23. TO 113. DEG. F) PACKAGE SHAPE RECTANGULAR

27.9 * WIDTH 22.9 * HEIGHT 17.8 CENTIMETERS PACKAGE SIZE * LENGTH 9.0 * HEIGHT 7.0 INCHES 11.0 * WIDTH LENGTH

3083.9 SQ. CENTIMETERS * 478.0 SQ. INCHES PACKAGE AREA 693.0 CU. INCHES 11356.2 CU. CENTIMETERS Ħ PACKAGE VOLUME

CASE MATERIAL ALUMINUM

2.0 KILOGRAMS * 4.5 POUNDS CASE WEIGHT 4 21.9 POUNDS TOTAL WEIGHT 9.9 KILOGRAMS

* EMISSIVITY = 0.85 SURFACE PROPERTIES ALPHA = 0.25

36.0 WATTS **HAS VARIABLE HEATER POWER INPUT STEADY STATE POWER 0.0 WATTS ** OUTPUT POWER

PASSIVE * PASSIVE THERMAL DESTON

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 50 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.

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 PHONE 813-531-4611 EXTENSION 3378 MR. HARVEY H. WHELESS 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

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.

QUALIFICATION TEST WERE SCHEDULE TO BEGIN IN JULY 1973.

AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

****************** IMU 9 H-319 CENTAUR IRU HONFYWELL

GIMBALED 278. TO 322. DEG. K DESIGN OPERATING CASE TEMPERATURE

40. TO 120. DEG. F) 239. TO 344. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE

(-30. TO 160. DEG. F) 273. TO 322. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

32. TO 120. DEG. F)

266. TO 322. DEG. K 20. TO 120. DEG. F) QUALIFICATION TEST TEMPERATURE REQUIREMENTS

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 10472.8 SQ. CENTIMETERS * 1623.3 SQ. INCHES

PACKAGE AREA 4403.5 CU. INCHES 72160.8 CU. CENTIMETERS 4 PACKAGE VOLUME

MAGNESIUM CASE MATERIAL .

7.5 KILOGRAMS # 16.6 POUNDS CASE WEIGHT

62.5 POUNDS TOTAL WEIGHT 28.3 KILOGRAMS

SURFACE PROPERTIES ALPHA = 0.25# EMISSIVITY = 0.85

INPUT STEADY STATE POWER 90.0 WATTS ## 0.0 WATTS ## OUTPUT POWER

THERMAL DESTON 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 CEN-TAUR 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 PACKAGE VÜLUME

3719.6 SQ. CENTIMETERS * 576.5 SQ. INCHES 14009.5 CU. CENTIMETERS 4 854.9 CU. INCHES

CASE MATERIAL MAGNESIUM

CASE WEIGHT 4.7 KILOGRAMS . . 10.4 POUNDS

TOTAL WEIGHT 11.3 KILOGRAMS * 25.0 POUNDS

SURFACE PROPERTIES * EMISSIVITY = 0.85 ALPHA = 0.25

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 INER-TIAL 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 REQUIRE MENTS.

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.

CATIONS TO EXTEND ITS MISSION TIME.

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 MODIFI-

AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ******************************* 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 36.1 * HEIGHT PACKAGE SIZE * LENGTH 35.6 * WIDTH 19.8 CENTIMETERS LENGTH 14.0 * WIDTH - 14.2 * HEIGHT 7.8 INCHES 5403.3 SQ. CENTIMETERS * 837.5 SQ. INCHES PACKAGE AREA 25410.4 CU. CENTIMETERS * 1550.6 CU. INCHES PACKAGE VOLUME 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 = 0.9 144.0 WATTS ## INPUT STEADY STATE POWER 0.0 WATTS ## OUTPUT POWER 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 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 PROPER-TIES ARE BASED ON DIGS WHICH HAS ALUMINIZED PAINT BUT UNIT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. *****************************

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 INTER-IM 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.

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SPACE TUG EQUIPMENT DATA BANK
                                    FINAL DATA
  THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS
   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
                                     7.7 * HEIGHT ' 7.3
                        13.5 # WIDTH
                                                         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 MEIGHT
                         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. FAHRENMEIT)
  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
                                                          NO
  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.
  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. MAHONFY
                                 PHONE 214-252-7423 EXTENSION
  THE SKN-2400 INERTIAL NAVIGATION UNIT (INU) CONSISTS OF THE FOLLOW
  ING FUNCTIONAL MODULES A 4 GIMBAL INERTIAL PLATFORM PLATFORM ELE
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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 FOLLOW

ING FUNCTIONAL MODULES A 4 GIMBAL INERTIAL PLATFORM PLATFORM ELE

CTRONICS. DC/DC POWER SUPPLY. I/O, ADAPTER, BATTERY. CPU AND

MEMORY. THE CPU AND MEMORY IS THE SKC-3000 COMPUTER. THE INU CAN

RE 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.

SPACE TUG EQUIPMENT DATA BANK FINAL DATA THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS 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 HTOIW # 0.55 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 * EMISSIVITY = 0.90 ALPHA = 0.90INPUT 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 (WATTS AT DEG. FAHRENHEIT) 75. DEG 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 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. ******************* 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 PHONE 214-252-7423 EXTENSION MR. T. H. MAHONEY AND MR. M. GUBERMAN PHONE 201-256-4000 EXTENSION 5377 THE KT-70 IMU IS AN OFF-THE SHELF AND IN PRODUCTION UNIT. IT HAS

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 *********************************

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

LENGTH 12.0 * WIDTH 8.8 * HEIGHT 5.5 INCHES PACKAGE AREA 2836.7 SQ. CENTIMETERS * 440.0 SQ. INCHES

PACKAGE VOLUME 580.8 CU. INCHES 9517.6 CU. CENTIMETERS

CASE MATERIAL ALUMINUM

2.3 KILOGPAMS CASE WEIGHT # 5.0 POUNDS

TOTAL WEIGHT II.5 POUNDS 5.2 KILOGRAMS *

ALPHA = 0.85 * EMISSIVITY = 0.85SUPFACE PROPERTIES

23.1 WATTS ## INPUT STEADY STATE POWER

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

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 MAIN-TAIN 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 ON-BOARD THE SKYLAB.

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 REQUIR-ED 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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM *** ST 1 CT-401 SENSOR 263. TO 323. DEG. K DESIGN OPERATING CASE TEMPERATURE (14. TO 122. DEG. F) 243. TO 333. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-22. TO 140. DEG. F) 263. TO 323. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (14. TO 122. DEG. F) 253. TO 333. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS -4. TO 140. DEG. F) PACKAGE SHAPE RECTANGULAR 30.5 * WIDTH 13.5 * HEIGHT 15.2 CENTIMETERS PACKAGE SIZE * LENGTH LENGTH 12.0 * WIDTH 5.3 * HEIGHT 6.0 INCHES 2160.0 SQ. CENTIMETERS * 334.8 SQ. INCHES PACKAGE AREA 6253.3 CU. CENTIMETERS * PACKAGE VOLUME 381.6 CU. INCHES CASE MATERIAL ALUMINUM 3.0 POUNDS 1.4 KILOGRAMS # CASE WEIGHT TOTAL WEIGHT 5.0 KILOGRAMS * 11.0 POUNDS SURFACE PROPERTIES ALPHA = 0.85 * EMISSIVITY = 0.9INPUT STEADY STATE POWER 5.0 WATTS ## 0.0 WATTS ## OUTPUT POWER THERMAL DESTON 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 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.

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 PHONE 303-441-4000 EXTENSION4383 MR DON VANLANDINGHAM 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.

AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

ST 2 STAR TRACKER HONEYWELL
DESIGN OPERATING CASE TEMPERATURE

NON-OPERATING AND STORAGE CASE TEMPERATURE

ACGEPTANCE TEST TEMPERATURE REQUIREMENTS

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

OUALIFICATION TEST TEMPERATURE REQUIREMENTS

(14. TO 50. DEG. F)

263. TO 283. DEG. K

(14. TO 50. DEG. F)

PACKAGE SHAPE CYLINDRICAL 12.7 # HEIGHT 0.0 CENTIMETERS PACKAGE SIZE * LENGTH 50.8 * WIDTH 5.0 * HEIGHT 0.0 INCHES LENGTH 20.0 # WIDTH 5067.1 SQ. CENTIMETERS * 785.4 SQ. INCHES PACKAGE AREA 1570.8 CU. INCHES PACKAGE VOLUME 25740.7 CU. CENTIMETERS

CASE MATERIAL ALUMINUM
CASE WEIGHT .5 KILOGR

TOTAL WEIGHT

.5 KILOGRAMS * 1.0 POUNDS
3.2 KILOGRAMS * 7.0 POUNDS
ALPHA = 0.90 * EMISSIVITY = 0.90

SURFACE PROPERTIES ALPHA = 0.90 INPUT STEADY STATE POWER 3.0 WATTS **

OUTPUT POWER O. 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 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.

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) 289. TO 300. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 60. TO 80. DEG. F)

QUALIFICATION TEST TEMPERATURE REQUIREMENTS 293. TO 323. DEG. K 68. TO 122. DEG. F)

PACKAGE SHAPE CYLINDRICAL 7.6 * HEIGHT PACKAGE SIZE * LENGTH 0.0 CENTIMETERS 38.1 * WIDTH 3.0 * HEIGHT 15.0 * WIDTH 0.0 INCHES LENGTH 2189.0 SQ. CENTIMETERS * 339.3 SQ. INCHES PACKAGE AREA 6950.0 CU. CENTIMETERS ŏ 424.1 CU. INCHES PACKAGE VOLUME

CASE MATERIAL ALUMINUM 4 7.0 POUNDS CASE WEIGHT 3.2 KILOGRAMS TOTAL WEIGHT 6.8 KILOGRAMS * 15.0 POUNDS

* EMISSIVITY = 0.90. SURFACE PROPERTIES ALPHA = 0.90

WATTS ## INPUT STEADY STATE POWER 20. 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 PHONE 213-988-2600 EXTENSION 422 MR BERNARD GRABUIS 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.

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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ************************** EMR PHOTOELECTRIC 5 574 STAR CAMERA DESIGN OPERATING CASE TEMPERATURE 263. TO 313. DEG. K 13. TO 104. DEG. F) 218. TO 343. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (~67. TO 158. DEG. F) 263. TO 313. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 13. TO 104. DEG. F) 263. TO 313. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS 13. TO 104. DEG. F) PACKAGE SHAPE RECTANGULAR 15.2 * HEIGHT PACKAGE SIZE * LENGTH 30.5 CENTIMETERS HTGIW # S.OI 6.0 # HEIGHT 12.0 INCHES 4.0 * WIDTH LENGTH 1858.1 SQ. CENTIMETERS * 288.0 SQ. INCHES PACKAGE AREA 288.0 CU. INCHES PACKAGE VOLUME 4719.5 CU. CENTIMETERS CASE MATERIAL MAGNESIUM CASE WEIGHT 1.0 KILOGRAMS 2.1 POUNDS TOTAL WEIGHT 11.7 POUNDS 5.3 KILOGRAMS SURFACE PROPERTIES ALPHA = 0.90* EMISSIVITY = 0.90 INPUT STEADY STATE POWER 4.4 WATTS ** OUTPUT POWER WATTS ## 0. PASSIVE * PASSIVE THERMAL DESIGN ************************* 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 OPERA-

TIONAL. 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. 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

PAGE I-24 THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ***************************** BENDIX CORPORATION P/N 2126798-1 STRAPDOWN 6 OAO STAR TRACKER DESIGN OPERATING CASE TEMPERATURE 244. TO 311. DEG. K (-20. TO 100. DEG. F) 239. TO 328. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-30 TO 130 DEG. F) 244. TO 311. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-20. TO 100. DEG. F) 244. TO 311. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-20° TO 100° DEG. F) PACKAGE SHAPE RECTANGULAR 31.7 * WIDTH 20.3 * HEIGHT 15.2 CENTIMETERS PACKAGE SIZE * LENGTH 8.0 * HEIGHT LENGTH 12.5 # WIDTH 6.0 INCHES 2877.4 SQ. CENTIMETERS * 446.0 SQ. INCHES PACKAGE AREA PACKAGE VOLUME 600.0 CU. INCHES 9832.2 CU. CENTIMETERS CASE MATERIAL ALUMINUM 2.0 POUNDS CASE WEIGHT .9 KILOGRAMS * TOTAL WEIGHT 7.3 KILOGRAMS * 16.0 POUNDS SURFACE PROPERTIES ALPHA = 0.70* EMISSIVITY = 0.85 INPUT STEADY STATE POWER WATTS ## 6. 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 OAD-IV STRAPDOWN STAR TRACKER HAS A PASSIVE THERMAL CONTROL HEAT IS REJECTED BY CONDUCTION TO A RADIATION SHIELD HAVING A PER-MISSIBLE TEMPERATURE EXCURSION OF -29 TO 38 DEG.C(-20 TO 100 DEG NO HEATERS ARE REQUIRED WITHIN THIS RANGE. UNIT IS HARD MOUNTED TO VEHICLE MOUNTING FLANGE. UNIT REQUIRE CLEAR UNOBSTRACT-ED 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 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 DISEC-TOR PHOTOMULTIPLIER TUBE (FW 143) AND ASSOCIATED PROCESSING ELEC-TRONICS. 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.

AVIONICS SYSTEM

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GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM
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P/N-2125000-3 GIMBAL 7 OMA ATM STAR TRKR. BENDIX CORPORATION DESIGN OPERATING CASE TEMPERATURE 247. TO 305. DEG. K (-15° 10 90. DEG. F) 233. TO 328. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-40. TO 130. DEG. F) 255. TO 305. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

0. TO 90. DEG. F)

255. TO 305. DEG. K 0. TO 90. DEG. FI QUALIFICATION TEST TEMPERATURE REQUIREMENTS 90. DEG. F)

PACKAGE SHAPE RECTANGULAR

32.0 * HEIGHT 55.9 CENTIMETERS PACKAGE SIZE * LENGTH 43.4 # #IDTH 17.1 * WIDTH 12.6 * HEIGHT 22.0 INCHES LENGTH

11211.1 SQ. CENTIMETERS * 1737.7 SQ. INCHES PACKAGE AREA 77676.6 CU. CENTIMETERS * 4740.1 CU. INCHES PACKAGE VOLUME

ALUMINUM CASE MATERIAL

2.7 KILOGRAMS * 6.0 POUNDS CASE WEIGHT 18.1 KILOGRAMS * 40.0 POUNDS TOTAL WEIGHT

ALPHA = 0.250 * EMISSIVITY = 0.90. SURFACE PROPERTIES

8.6 WATTS ** THE ARE 3 HEATERS INPUT STEADY STATE POWER 10.0 AT 258. DEG. 20.0 AT 261. DEG (WATTS AT DEG. KELVIN)

10. DEG (WATTS AT DEG. FAHRENHEIT) 20.0 AT 10.0 AT 5. DEG.

0.0 WATTS ** OUTPUT POWER

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 OMA ATM STAR TRACKER IS A GIMBALLED UNIT. THE ABOVE DIMENSIONS ARE EXTERIOR LIMITS SEE REF FOR MORE DETAIL DESCRIPTION. 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 .

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

PHONE 201-288-2000 EXTENSION 6111 MR. JIM TONGE THE APOLLO TELESCOPE MOUNT (ATM) STAR TRACKER SYSTEM CONSISTS OF THE OPTICAL MECHANICAL ASSEMBLY (OMA) AND A STAR TRACKER ELECTRO-NICS (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 COM-BINATION 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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM *** ST 8 KS-199 STAR TRKR KOLLSMAN INSTR. GIMBAL UNIT 261. TO 294. DEG. K DESIGN OPERATING CASE TEMPERATURE 70. DEG. F) 10. TO 272. TO 311. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE 30. TO 100. DEG. F) 261. TO 294. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 10. TO 70. DEG. F) 244. TO 311. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-20 TO 100 DEG F) PACKAGE SHAPE RECTANGULAR 38.1 * WIDTH 24.1 * HEIGHT 24.1 CENTIMETERS PACKAGE SIZE + LENGTH 15.0 ₩ WIDTH 9.5 * HEIGHT 9.5 INCHES LENGTH 4841.9 SQ. CENTIMETERS * 750.5 SQ. INCHES PACKAGE AREA 22184.0 CU. CENTIMETERS * 1353.7 CU. INCHES PACKAGE VOLUME CASE MATERIAL ALUMINUM 4 12.0 POUNDS CASE WEIGHT 5.4 KILOGRAMS 9.1 KILOGRAMS 20.0 POUNDS TOTAL WEIGHT * EMISSIVITY = 0.75 ALPHA = 0.20SURFACE PROPERTIES 8.7 WATTS ## INPUT STEADY STATE POWER 0.0 WATTS ## OUTPUT POWER 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 ENGINE-ERING 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-INSULA TION 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. 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 DEG REES ABOUT EACH AXIS. UNIT ACQUISITION TIME IS LESS THAN 1 SECOND.

REF. TELEPHONE CONVERSATION WITH MR JAMES CARVELLA OF KOLLSMAN, AND DATA SUMMARY OF THE KS-199 STAR TRACKER DATED MAY 15, 1973

GURATION WITH A SAVING IN WEIGHT SIZE AND POWER.

THE KS-199 STAR TRACKER CAN BE IMPROVED FROM ITS PRESENT MOL CONFI

AVIONICS SYSTEM

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ******************************

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

247. 10 329. DEG. K DESIGN OPERATING CASE TEMPERATURE (-15. TO 132. DEG. F)

218, TO 343, DEG, K NON-OPERATING AND STORAGE CASE TEMPERATURE

(-67. TO 158. DEG. F)

255. TO 305. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 0 . TO 90. DEG. F)

247. TO 329. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-15. TO 132. DEG. F)

PACKAGE SHAPE RECTANGULAR

34.3 * HEIGHT 15.7 CENTIMETERS PACKAGE SIZE * LENGTH 47.0 # WIDTH

13.5 * HEIGHT 6.2 18.5 * WIDTH INCHES LENGTH

5782.6 SQ. CENTIMETERS 4 896.3 SQ. INCHES PACKAGE AREA

PACKAGE VOLUME 1548.4 CU. INCHES 25374.5 CU. CENTIMETERS

CASE MATERIAL ALUMINUM

1.8 KILOGRAMS CASE WEIGHT 4.0 POUNDS

TOTAL WEIGHT 14.5 KILOGRAMS * 32.0 POUNDS * EMISSIVITY = 0.85

SURFACE PROPERTIES ALPHA = 0.70

INPUT STEADY STATE POWER 15.1 WATTS ## OUTPUT POWER 8.6 WATTS ##

- PASSIVE * PASSIVE THERMAL DESIGN

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

PHONE 201-288-2000 EXTENSION 6111 MR. JIM TONGE THE ATM STAR TRACKER ELECTRONICS UNIT IS PART OF THE ATM STAR TRACKER SYSTEM THAT WAS BUILT FOR NASA MSFC AND IS ONBOARD THE 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 GIM-BAL SUSPENSION. THE STE UNIT INCLUDES THE 28 VDC POWER SUPPLY. SERVO AMPLIFIERS. DIGITAL LOGIC UNIT, ENCODER PROCESSING ELECTRO-NICS. 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 TEMP-ERATURE RANGE DIRECTLY FROM THE ATM POWER SUPPLY BUS.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ************* ELECTRONIC UNIT STE 2 KS-199 STAR TRKR. KOLLSMAN INSTR. 261. TO 294. DEG. K DESIGN OPERATING CASE TEMPERATURE 10. TO 70. DEG. F) 272. TO 311. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE 30. TO 100. DEG. F) 261. TO 294. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 10. TO 70. DEG. F) 244. TO 311. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-20. TO 100. DEG. F) PACKAGE SHAPE RECTANGULAR 21.8 * WIDTH 17.8 * HEIGHT 20.3 CENTIMETERS PACKAGE SIZE * LENGTH 7.0 * HEIGHT 8.0 INCHES LENGTH 8.6 * WIDTH 2387.1 SQ. CENTIMETERS * 370.0 SQ. INCHES PACKAGE AREA 7892.0 CU. CENTIMETERS 4 481.6 CU. INCHES PACKAGE VOLUME ALUMINUM CASE MATERIAL 5.0 POUNDS # CASE WEIGHT 2.3 KILOGRAMS 4.5 KILOGRAMS # 10.0 POUNDS TOTAL WEIGHT ALPHA = 0.20* EMISSIVITY = 0.75 SURFACE PROPERTIES 14.3 WATTS ## INPUT STEADY STATE POWER 0.0 WATTS ** OUTPUT POWER PASSIVE # PASSIVE THERMAL DESIGN *********************** 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 ENGINE-ERING 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 PHONE 516-921-4300 EXTENSION 2122 MR. JAMES CARVELLA 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

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.

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

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM *********************** 1 HORIZON SENSOR QUANTIC INDUSTRIES MODEL 5079 DESIGN OPERATING CASE TEMPERATURE 255. TO 339. DEG. K 0. TO 150. DEG. F) 233. TO 339. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-40° TO 150° DEG° F) ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 275. TO 339. DEG. K 35. TO 150. DEG. F) 255. TO 339. DEG. K 0. TO 150. DEG. F) QUALIFICATION TEST TEMPERATURE REQUIREMENTS PACKAGE SHAPE CYLINDRICAL 10.2 * HEIGHT 0.0 CENTIMETERS PACKAGE SIZE * LENGTH 20.1 * WIDTH 7.9 # WIDTH 4.0 * HEIGHT 0.0 INCHES LENGTH PACKAGE AREA 1929.5 SQ. CENTIMETERS # 299.1 SQ. INCHES PACKAGE VOLUME 397.1 CU. INCHES 6507.3 CU. CENTIMETERS CASE MATERIAL ALUMINUM 1.4 KILOGRAMS * 3.0 POUNDS CASE WEIGHT TOTAL WEIGHT 3.2 KILOGRAMS * 7.0 POUNDS ALPHA = 0.20 * EMISSIVITY = 0.05 SURFACE PROPERTIES INPUT STEADY STATE POWER 1.6 WATTS ** OUTPUT POWER O. 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 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.

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 OPER-ATES ON THE RADIATION-BALANCE PRINCIPLE. THE UNIT IS DESIGNED FOR EARTH-ORBITING SATELLITES OPERATING AT SYNCHRONOUS AND NEAR SYN-CHRONOUS ALTITUDE. THIS SENSOR HAS BEEN QUALIFIED FOR SPACE EN-VIRONMENT 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.

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

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 4 ONE YEAR ORBITAL MISSION. THE 13-159 SENSOR IS A CONTCAL 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 IPIDITED ALUMINUM BUT CAN BE PAINTED PER CUSTOMFR THERMAL REQUIREMENTS.

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

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ******

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)

244. TO 336. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-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 CENTIMETERS 15_e2 * WIDTH 15.2 * HEIGHT

6.0 # WIDTH 6.0 * HEIGHT 4.0 LENGTH INCHES

PACKAGE AREA 1083.9 SQ. CENTIMETERS # 168.0 SQ. INCHES

PACKAGE VÜLUME 2359.7 CU. CENTIMETERS * 144.0 CU. INCHES

CASE MATERIAL ALUMINUM

CASE WEIGHT .5 POUNDS .2 KILOGRAMS *

TOTAL WEIGHT 1.5 KILOGRAMS # 3.3 POUNDS

SURFACE PROPERTIES * EMISSIVITY = 0.90 ALPHA = 0.90

3.1 WATTS ##PER HEAD INPUT STEADY STATE POWER

OUTPUT POWER O. WATTS ##

THERMAL DESTON 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 ALTIT-UDE OF 835 KILOMETER PER OPTICAL SYSTEM SET UP. EACH UNIT IS CON-TAINED 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 THIS UNIT IS SPACE QUALIFIED. IT IS A 3-AXIS STRAPDOWN REQUIRED. OFF-THE-SHELF HORIZON SENSOR.

SPACE TUG EQUIPMENT DATA BANK FINAL DATA PAGE I-32 THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM
GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

************ 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) 244. TO 336. DEG. K (-20. TO 145. DEG. F) QUALIFICATION TEST TEMPERATURE REQUIREMENTS 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 .5 POUNDS CASE WEIGHT .2 KILOGRAMS * 4.0 POUNDS TOTAL WEIGHT 1.8 KILOGRAMS * ALPHA = 0.90 * EMISSIVITY = 0.90 SURFACE PROPERTIES INPUT STEADY STATE POWER 3.5 WATTS ## OUTPUT POWER O. 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 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.

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 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

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) 244. TO 336. DEG. K

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

(-20. TO 145. DEG. F)

PACKAGE SHAPE RECTANGULAR

PACKAGE SIZE * LENGTH 24.1 * WIDTH 23.6 * HEIGHT 8.9 CENTIMETERS

9.5 * WIDTH LENGTH 9.3 * HEIGHT 3.5 INCHES

PACKAGE AREA PACKAGE VOLUME 1989.0 SQ. CENTIMETERS * 308.3 SQ. INCHES 5067.3 CU. CENTIMETERS ₩` 309.2 CU. INCHES

CASE MATERIAL ALUMINUM

CASE WEIGHT

1.0 POUNDS .5 KILOGRAMS ₩.

TOTAL WEIGHT 4.1 KILOGRAMS * 9.0 POUNDS

SURFACE PROPERTIES ALPHA = 0.90 * EMISSIVITY = 0.90

INPUT STEADY STATE POWER OUTPUT POWER

14. WATTS ## 0. WATTS ##

THERMAL DESIGN

PASSIVE # PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

QUALIFIED AND IS IN FLIGHT UNIT PRODUCTION.

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.

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. POWER IS FROM A 28 VOLTS UNREGULATED SOURCE. THE DSAS IS FULLY

THERMAL REQUIREMENTS. PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM *************** HS 6 MOD. IV HORIZON SYS QUANTIC INDUSTRIES 255. TO 339. DEG. K DESIGN OPERATING CASE TEMPERATURE 0. TO 150. DEG. F) 236. TO 339. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-35° TO 150° DEG° F) 255. TO 328. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 0. TO 130. DEG. F) 255. TO 328. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS 0. TO 130. DEG. F) PACKAGE SHAPE RECTANGULAR 19.8 * HEIGHT 18.0 CENTIMETERS PACKAGE SIZE * LENGTH 19.3 * WIDTH 7.8 * HEIGHT 7.1 INCHES 7.6 * WIDTH LENGTH 337.2 SQ. INCHES 2175.7 SQ. CENTIMETERS * PACKAGE AREA . 6897.1 CU. CENTIMETERS 420.9 CU. INCHES PACKAGE VOLUME CASE MATERIAL ALUMINUM 3.5 POUNDS 상 CASE WEIGHT 1.6 KILOGRAMS 3.4 KILOGRAMS * 7.5 POUNDS TOTAL WEIGHT SURFACE PROPERTIES * EMISSIVITY = 0.90ALPHA = 0.9010.0 WATTS ##4TRKS 2.5 INPUT STEADY STATE POWER 0.0 WATTS ## OUTPUT POWER 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 SENSOR IS COMPOSED OF 4 TRACKERS AND 1 ELECTRONIC UNIT THE MOD IV 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. ************************ 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 PHONE 415-591-9411 EXTENSION MR SHELDON KNIGHT THE MOD IV HORIZON SENSOR IS A STATIC, HIGH-ACCURACY, HIGH RELI-ABILITY 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 CUNTROL 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.

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

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ******************************** 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) 255. TO 328. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS 0. TO 130. DEG. F) PACKAGE SHAPE RECTANGULAR PACKAGE SIZE * LENGTH 19.0 CENTIMETERS 45.7 # WIDTH 21.6 * HEIGHT 18.0 # WIDTH 8.5 * HEIGHT LENGTH 7.5 INCHES PACKAGE AREA 4538.7 SO. CENTIMETERS * 703.5 SQ. INCHES PACKAGE VOLUME 18804.2 CU. CENTIMETERS 1147.5 CU. INCHES CASE MATERIAL ALUMINUM CASE WEIGHT 5.0 POUNDS 2.3 KILOGRAMS Ų. 4 TOTAL WEIGHT 35.0 POUNDS 15.9 KILOGRAMS SURFACE PROPERTIES ALPHA = 0.20 # EMISSIVITY = 0.05 15.0 WATTS **DEPEND ON NUMBER OF SENSOR INPUT STEADY STATE POWER 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 PRO-GRAM 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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS . AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ********************************** MODEL, 5-4 SS 1 REFRACTOSYN SUN H H CONTROLS CO. 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) 253. TO 358. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS -4. TO 185. DEG. F) 253. TO 358. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS -4. TO 185. DEG. F) PACKAGE SHAPE RECTANGULAR 1.5 * WIDTH 1.0 * HEIGHT 1.0 CENTIMETERS PACKAGE SIZE * LENGTH .4 INCHES .6 * WIDTH .4 * HEIGHT LENGTH 1.3 SQ. INCHES PACKAGE AREA 8.3 SQ. CENTIMETERS * 1.6 CU. CENTIMETERS 4 .1 CU. INCHES PACKAGE VOLUME CASE MATERIAL EPOXY BLACK HYSOL 111C 0.0 KILOGRAMS # 0.0 POUNDS CASE WEIGHT 4 TOTAL WEIGHT .0 KILOGRAMS .1 POUNDS ALPHA = 0.90 * EMISSIVITY = 0.90 SURFACE PROPERTIES 0.0 WATTS ** INPUT STEADY STATE POWER 0.0 WATTS ## OUTPUT POWER THERMAL DESTON PASSIVE * PASSIVE PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF MISSION UN-TIMES * SHUT/TUG OFF* TUG/ORBIT ON* TUG/PAY ON UNIT IS APPROXIMATELY I 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 Hahacontrols coa Inca 16 FROST STREET ARLINGTON MASSACHUSETTS 02174 THE DATA CONTAINED HEREIN WAS OBTAINED FROM PHONE 617-646-2626 EXTENSION MR. HAROLD H. SEWARD 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.

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THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS
 AVIONICS SYSTEM
 GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM
*************
                                           SS-100 SERIES
 2 FINE SUN SENSOR AS
                       BBRS
                                             253. TO 358. DEG. K
DESIGN OPERATING CASE TEMPERATURE
                                             -4. TO 185. DEG. F)
                                             233. TO 373. DEG. K
NON-OPERATING AND STORAGE CASE TEMPERATURE
                                           ( -40. TO 212. DEG. F)
                                             253. TO 358. DEG. K
ACCEPTANCE TEST TEMPERATURE REQUIREMENTS
                                              -4 o TO 185. DEG. F)
                                             243. TO 368. DEG. K
QUALIFICATION TEST TEMPERATURE REQUIREMENTS
                                           ( -22. TO 203. DEG. F)
                   RECTANGULAR
PACKAGE SHAPE
                                                    4.3 CENTIMETERS
                                     4.8 * HEIGHT
                       7.1 * WIDTH
PACKAGE SIZE * LENGTH
                                     1.9 * HEIGHT
                                                    1.7
                                                         INCHES
                        2.8 * WIDIH
               LENGTH
                                                26.6 SQ. INCHES
                     171.7 SQ. CENTIMETERS
PACKAGE AREA
                                                 9.0 CU. INCHES
                     148.2 CU. CENTIMETERS
PACKAGE VOLUME
                   ALUMINUM
CASE MATERIAL
                                            .3 POUNDS
                         .1 KILOGRAMS
CASE WEIGHT
                                     4
                                            .4 POUNDS
                         .2 KILOGRAMS
TOTAL WEIGHT
                         ALPHA = 0.90
                                      * EMISSIVITY = 0.90
SURFACE PROPERTIES
                            O. WATTS ##
 INPUT STEADY STATE POWER
                                WATTS **
OUTPUT POWER
                         PASSIVE
                                  * PASSIVE
 THERMAL DESIGN
 *************************************
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 ALUM-
INUM WITH ANODIZED MOUNTING PADS. RETAINERS ARE ALUMINUM BLACK ANO-
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THE FINE SUN SENSOR ASSEMBLIES SS-100 SERIES IS DESIGNED AND BALL BROTHERS RESEARCH CORPORATION BUILT BY P.O. BOX 1062 BOULDER COLORADO 80302

DIZED.

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 APPLICAT-IONS. AND VARIATIONS HAVE BEEN FLOWN ON AEROBEE ROCKETS AND ON ORBITING SOLAR OBSERVATORIES AS WELL AS OTHER SATELLITES.

THERMAL REQUIREMENTS. PHYSICAL CHARACTERISTICS. AND CONSTRAINTS AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ********** 3 DIGITAL SUN SENSOR ADCOLE CORPORATION MODEL 15564 253. TO 318. DEG. K DESIGN OPERATING CASE TEMPERATURE -4. TO 113. DEG. F) 208. TO 358. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-85. TO 185. DEG. F) 253. TO 318. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS -4. TO 113. DEG. F) 253. TO 318. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS -4. TO 113. DEG. F) RECTANGULAR PACKAGE SHAPE 3.3 CENTIMETERS PACKAGE SIZE * LENGTH 4.3 * HEIGHT 6.6 * WIDTH 2.6 & WIDTH 1.7 * HEIGHT 1.3 INCHES LENGTH 4 20.0 SQ. INCHES 129.2 SO. CENTIMETERS PACKAGE AREA ä 5.7 CU. INCHES PACKAGE VOLUME 94.2 CU. CENTIMETERS ALUMINUM CASE MATERIAL .1 POUNDS .O KILOGRAMS 4 CASE WEIGHT .1 KILOGRAMS 4 .3 POUNDS TOTAL WEIGHT ALPHA = 0.86* EMISSIVITY = 0.86 SURFACE PROPERTIES 0.05WATTS ** INPUT STEADY STATE POWER 0.0 WATTS ** OUTPUT POWER PASSIVE * PASSIVE THERMAL DESIGN 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 PHONE 617-890-3400 EXTENSION 56 MR. H. N. LOWELL

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 & 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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS - AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM **** MODEL 16765 ADCOLE CORPORATION SS 4 DIGITAL SUNSENSOR 253. TO 333. DEG. K DESIGN OPERATING CASE TEMPERATURE -4. TO 140. DEG. F) 208. TO 358. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-85. TO 185. DEG. F) 253. TO 333. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS -4. TO 140. DEG. F) 243. TO 343. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-22. TO 158. DEG. F). PACKAGE SHAPE RECTANGULAR 6.6 * HEIGHT PACKAGE SIZE * LENGTH 9.7 CENTIMETERS 7.4 * WIDTH 3.8 INCHES 2.9 * WIDTH 2.6 # HEIGHT LENGTH 367.0 SQ. CENTIMETERS * 56.9 SQ. INCHES PACKAGE AREA PACKAGE VOLUME 469.5 CU. CENTIMETERS # 28.7 CU. INCHES CASE MATERIAL ALUMINUM .3 POUNDS CASE WEIGHT .1 KILOGRAMS 44 44 .9 POUNDS TOTAL WEIGHT .4 KILOGRAMS SURFACE PROPERTIES ALPHA = 0.34 * EMISSIVITY = 0.1 INPUT STEADY STATE POWER 0.0 WATTS ** OUTPUT POWER 0.0 WATTS ## PASSIVE * PASSIVE THERMAL DESIGN ****************************** 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. 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 PHONE 617-890-3400 EXTENSION 56

MR. H. N. LOWELL 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.

PAGE I-41 THERMAL REQUIREMENTS. PHYSICAL CHARACTERISTICS. AND CONSTRAINTS AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ********************* ITT GILFILLAN LR | SCAN LASAR HADAR 293. TO 323. DEG. K DESIGN OPERATING CASE TEMPERATURE 68. TO 122. DEG. F) 289. TO 323. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE 60. TO 122. DEG. F) ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 289. TO 300. DEG. K (60. TO 80. DEG. F) 293. TO 323. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS: (68. TO 122. DEG. F) PACKAGE SHAPE RECTANGULAR 30.5 * WIDTH 22.9 * HEIGHT 61.0 CENTIMETERS PACKAGE SIZE * LENGTH 9.0 * HEIGHT 24.0 INCHES LENGTH 12.0 * WIDTH 7896.8 SQ. CENTIMETERS * 1224.0 SQ. INCHES PACKAGE AREA 42475.3 CU. CENTIMETERS * 2592.0 CU. INCHES PACKAGE VOLUME ALUMINUM CASE MATERIAL 4.5 KILOGRAMS 4 10.0 POUNDS CASE WEIGHT 60.0 POUNDS 27.2 KILOGRAMS * TOTAL WEIGHT ALPHA = 0.90 * EMISSIVITY = 0.90 SURFACE PROPERTIES INPUT STEADY STATE POWER WATTS ** 30. WATTS ** 0. OUTPUT POWER * ACTIVE ACTIVE THERMAL DESIGN ****************************** 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.

AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM **** LR 2 SCAN LASAR RADAR ITT GILFILLAN 293. TO 323. DEG. K DESIGN OPERATING CASE TEMPERATURE (68. TO 122. DEG. F) 289. TO 323. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (60° TO 122° DEG° E) 289. TO 300. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (60. TO 80. DEG. F) 293. TO 323. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (68. TO 122. DEG. F) PACKAGE SHAPE RECTANGUI AR PACKAGE SIZE * LENGTH 61.0 CENTIMETERS 30.5 * WIDTH 25.4 * HEIGHT 12.0 * WIDTH 10.0 * HEIGHT 24.0 INCHES LENGTH 1296.0 SQ. INCHES 8361.3 SQ. CENTIMETERS * PACKAGE AREA 47194.7 CU. CENTIMETERS * PACKAGE VOLUME 2880.0 CU. INCHES CASE MATERIAL ALUMINUM 7.0 POUNDS 4 CASE WEIGHT 3.2 KILOGRAMS 31.8 KILOGRAMS * TOTAL WEIGHT 70.0 POUNDS ALPHA = 0.90SURFACE PROPERTIES * EMISSIVITY = 0.90 INPUT STEADY STATE POWER 70. WATTS ## OUTPUT POWER WATTS ** 0. ACTIVE THERMAL DESIGN 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 PRELIM-

INARY INFORMATION. UNIT IS COUPLED TO AN ELECTRONICS UNIT WHICH IS ALSO IN DESIGN STAGE. THIS UNIT IS EXPECTED TO BE THERMOELECT-

THE DIODE PUMPED YAG LASER RADAR IS BEING DESIGNED BY ITT GILFILLAN

RICLY COOLED.

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 COOPERA-TIVE TARGET AND 1.5 MILES FOR A PASSIVE NON-COOPERATIVE TARGET. THE ABOVE DATA IS PRELIMINARY INFORMATION ON THIS UNIT.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

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AVIONICS SYSTEM
  GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM
************************
LR 3 SCAN LASER RADAR
                        ITT GILFILLAN
                                             293. TO 323. DEG. K
 DESIGN OPERATING CASE TEMPERATURE
                                             68. TO 122. DEG. F)
                                             289. TO 323. DEG. K
 NON-OPERATING AND STORAGE CASE TEMPERATURE
                                              60. TO 122. DEG. F)
                                             289. TO 300. DEG. K
 ACCEPTANCE TEST TEMPERATURE REQUIREMENTS
                                            ( 60. TO 80. DEG. F)
                                             293. TO 323. DEG. K
 QUALIFICATION TEST TEMPERATURE REQUIREMENTS
                                             68. TO 122. DEG. F)
                    RECTANGULAR
 PACKAGE SHAPE
                                                  76.2 CENTIMETERS
 PACKAGE SIZE * LENGTH 30.5 * WIDTH 30.5 * HEIGHT
                LENGTH 12.0 * WIDTH 12.0 * HEIGHT 30.0 INCHES
                    11148.4 SQ. CENTIMETERS * 1728.0 SQ. INCHES
 PACKAGE AREA
                    70792.1 CU. CENTIMETERS *
                                              4320.0 CU. INCHES
 PACKAGE VOLUME
 CASE MATERIAL
                    ALUMINUM
                        9.1 KILOGRAMS *
                                         20.0 POUNDS
 CASE WEIGHT
  TOTAL WEIGHT
                       45.4 KILOGRAMS * 100.0 POUNDS
                         ALPHA = 0.90 \times EMISSIVITY = 0.90
  SURFACE PROPERTIES
  INPUT STEADY STATE POWER 600. WATTS **
                               WATTS ##
  OUTPUT POWER
                            0。
                         ACTIVE
  THERMAL DESIGN
                                 * 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 PRF-DESIGN STAGE AND ALL ABOVE DATA IS PRELIMINARY INFO.
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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 THE UNIT POWER CAN BE INCREASED TO APPROXIMATELY 10K WATTS UNIT 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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ************* LRE 1 ELEC.LASER RADAR ITT GILFILLAN 293. TO 323. DEG. K DESIGN OPERATING CASE TEMPERATURE (68. TO 122. DEG. F) 289. TO 323. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE 60. TO 122. DEG. F) 289. TO 300. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (60% TO 80% DEG. F) 293. TO 323. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS 68. TO 122. DEG. F) RECTANGULAR PACKAGE SHAPE PACKAGE SIZE * LENGTH 30.5 * WIDTH 30.5 * HEIGHT 22.9 CENTIMETERS LENGTH 12.0 * WIDTH 12.0 * HEIGHT 9.0 INCHES 4645.2 SQ. CENTIMETERS * 720.0 SQ. INCHES PACKAGE AREA 21237.6 CU. CENTIMETERS * 1296.0 CU. INCHES PACKAGE VOLUME CASE MATERIAL ALUMINUM 3.0 POUNDS 1.4 KILOGRAMS * CASE WEIGHT 15.0 POUNDS 6.8 KILOGRAMS # TOTAL WEIGHT * EMISSIVITY = 0.90 ALPHA = 0.90SURFACE PROPERTIES ** STTAW 0.05 INPUT STEADY STATE POWER OUTPUT POWER 0 。 WATTS. ** PASSIVE * PASSIVE THERMAL DESIGN *********************** 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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ************************************ LRE 2 ELEC LASER RADAR ITT GILFILLAN . 293. TO 323. DEG. K DESIGN OPERATING CASE TEMPERATURE (68. TO 122. DEG. F) NON-OPERATING AND STORAGE CASE TEMPERATURE 289. TO 323. DEG. K 60. TO 122. DEG. F) 289. TO 300. DEG. K 60. TO 80. DEG. F) ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 293. TO 323. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS 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 5574.2 SQ. CENTIMETERS * PACKAGE AREA 864.0 SQ. INCHES. -PACKAGE VOLUME 28316.8 CU. CENTIMETERS * 1728.0 CU. INCHES CASE MATERIAL ALUMINUM 5.0 POUNDS CASE WEIGHT 2.3 KILOGRAMS * TOTAL WEIGHT 9.1 KILOGRAMS * 20.0 POUNDS SURFACE PROPERTIES ALPHA = 0.90 * EMISSIVITY = 0.90 INPUT STEADY STATE POWER 30.0 WATTS ** O. WATTS ## OUTPUT POWER 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 INFOR-MATION. 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.

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) 293. TO 323. DEG. K

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

68. TO 122. DEG. F)

PACKAGE SHAPE RECTANGULAR

PACKAGE SIZE * LENGTH 30.5 * HEIGHT 61.0 CENTIMETERS 30.5 * WIDTH

LENGTH 12.0 * WIDTH 12.0 * HEIGHT 24.0 INCHES

PACKAGE AREA PACKAGE VOLUME

9290.3 SQ. CENTIMETERS * 1440.0 SQ. INCHES 56633.7 CU. CENTIMETERS # 3456.0 CU. INCHES

CASE MATERIAL ALUMINUM

CASE WEIGHT

0.0 KILOGRAMS * 0.0 POUNDS

TOTAL WEIGHT 31.8 KILOGRAMS * SURFACE PROPERTIES

70.0 POUNDS ALPHA = 0.90 * EMISSIVITY = 0.90

INPUT STEADY STATE POWER 150. WATTS **

OUTPUT POWER WATTS ## 0.

ACTIVE THERMAL DESIGN * 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 ELEC-TRONICS 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.

AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM ******************************** P/N 2RD2800 1 COLOR TELEVISION WESTINGHOUSE 253. TO 338. DEG. K DESIGN OPERATING CASE TEMPERATURE -4. TO' 149. DEG. F) NON-OPERATING AND STORAGE CASE TEMPERATURE 219. TO 373. DEG. K (-65. TO 212. DEG. F) 219. TO 338. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-65. TO 149. DEG. F) 219. TO 338. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-65. TO 149. DEG. F) PACKAGE SHAPE RECTANGULAR 16.5 CENTIMETERS PACKAGE SIZE * LENGTH 28.7 * WIDTH 11.4 # HEIGHT LENGTH 11.3 * WIDTH 4.5 # HEIGHT 6.5 INCHES 1981.3 SQ. CENTIMETERS * PACKAGE AREA 307.1 SQ. INCHES # 330.5 CU. INCHES PACKAGE VOLUME 5416.3 CU. CENTIMETERS ALUMINUM CASE MATERIAL 2.5 POUNDS 1.1 KILOGRAMS # CASE WEIGHT 5.7 KILOGRAMS * 12.5 POUNDS TOTAL WEIGHT SURFACE PROPERTIES ALPHA = 0.20* EMISSIVITY = 0.86 INPUT STEADY STATE POWER 28.0 WATTS **AT 28 VDC OUTPUT POWER 0.0 WATTS ** THERMAL DESTON 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 SKYLAR 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 PHONE 303-794-5211 EXTENSION 4119 MR. HERB HAWLK 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 SKYLAR IT WAS DESIGN TO BE ATTACHED TO A BOOM AND PLACED

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

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.

RCA GOVERNMENT AND COMMERCIAL SYSTEMS ASTRO-ELECTRONICS DIVISION P.O. BOX 800 PRINCETON. NEW JERSEY 08540
THE DATA CONTAINED HEREIN WAS OBTAINED FROM 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 OPERATE 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 COMPOSITE 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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM *******************************

P/N 837G5000000 ACSE -1 VALVE DRIVE AMP. MARTIN MARIETTA CO DESIGN OPERATING CASE TEMPERATURE

. 236. TO 366. DEG. K (-35. TO 200. DEG. F)

236. TO 398. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-35. TO 257. DEG. F)

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 236. TO 366. DEG. K

(-35. TO 200. DEG. F)

236. TO 366. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-35. TO 200. DEG. F)

PACKAGE SHAPE RECTANGULAR

17.8 # HEIGHT 19.8 CENTIMETERS PACKAGE SIZE * LENGTH 26.7 * WIDTH

LENGTH 10.5 # WIDTH 7.0 * HEIGHT 7.8 INCHES

2709.7 SQ. CENTIMETERS * 420.0 SQ. INCHES PACKAGE AREA 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 ## PASSIVE

THERMAL DESIGN * 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 ENVIRON-MENT AND THE MARTIAN ATMOSPHERE. UNIT HAS A PASSIVE THERMAL DE-SIGN 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.

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM		UANTITY	WEIGHT (POUNDS)		POWER (WATTS)	VOLUME (CU FT.)
			UNIT	TOTAL	· · -	
********	**	***	****	***	****	****
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 CONTRULLER	#	5	6.	12.	15.	.20
u				*****		**********
TOTALS				116.	136.	1.50
***	* # #	***	***	***	***	****

CONTINUOUS OPERATION OF SUBSYSTEM FROM PRELAUNCH TO LANDING.

TIMELINES

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM

DELCO ELECTRONICS

305. TO 328. DEG. K DESIGN OPERATING CASE TEMPERATURE 90. TO 130. DEG. F)

NON-OPERATING AND STORAGE CASE TEMPERATURE

236. TO 344. DEG. K (-35. TO 160. DEG. F)

P/N 7888760-031

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

20.0 * WIDTH 16.0 * HEIGHT 9.0 INCHES LENGTH

PACKAGE AREA PACKAGE. VOLUME 47194.7 CU. CENTIMETERS

8309.7 SQ. CENTIMETERS * 1288.0 SQ. INCHES 2880.0 CU. INCHES

CASE MATERIAL ALUMINIUM

CASE WEIGHT TOTAL WEIGHT 9.1 KILOGRAMS 삼 20.0 POUNDS

36.1 KILOGRAMS * 79.5 POUNDS

SURFACE PROPERTIES

* EMISSIVITY = 0.90 ALPHA = 0.90

INPUT STEADY STATE POWER 208. WATTS ** 215MAX

OUTPUT POWER

WATTS ** 0.

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

MARRIED TO CAROUSEL 5B IMU

QUALIFIED FOR A 9 HOUR MISSION

FUNCTION IN LESS THAN ONE MINUTE AFTER POWER-ON

THE DATA CONTAINED HEREIN WAS OBTAINED FROM

THE MAGIC 352 COMPUTER IS DESIGNED AND BUILT BY DELCO ELECTRONICS DIVISION OF GENERAL MOTOR CORPORATION 6767 HOLISTER AVE. GOLTA: CALIFORNIA 93017

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 58 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 PSTA) 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.

COMP 2 MAGIC 352 DIGS DELCO ELECTRONICS P/N 7554180+011
DESIGN OPERATING CASE TEMPERATURE 253. TO 343. DEG. K

NON-OPERATING AND STORAGE CASE TEMPERATURE 208. TO 423. DEG. K

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 263. TO 333. DEG. K

QUALIFICATION TEST TEMPERATURE REQUIREMENTS 253. TO 343. DEG. K

(-4. TO 158. DEG. F)

PACKAGE SHAPE RECTANGULAR 19.8 CENTIMETERS 48.3 * WIDTH 27.9 * HEIGHT PACKAGE SIZE # LENGTH 11.0 * HEIGHT 7.8 INCHES 19.0 * WIDTH LENGTH 5716.1 SO. CENTIMETERS * 886.0 SQ. INCHES PACKAGE AREA 1630.2 CU. INCHES 26714.2 CU. CENTIMETERS PACKAGE VOLUME CASE MATERIAL ALUMINIUM

12.5 POUNDS 5.7 KILOGRAMS * CASE WEIGHT 50.0 POUNDS TOTAL WEIGHT 22.7 KILOGRAMS * SURFACE PROPERTIES ALPHA = 0.900 * EMISSIVITY = 0.900INPUT STEADY STATE POWER 175. WATTS ** 21 WATTS DISCRETE POWER OUTPUT POWER WATTS ## 0. THERMAL DESIGN ACTIVE **A** PASSIVE

NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY YES MISSION ON-TIMES * SHUTZTUG ON* TUGZORBIT ON* TUGZPAY 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) RELIFF 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.

THERMAL REQUIPEMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM . ********************************** COMP 3 469 COMPUTER CONTROL DATA CORP. 253. TO 338. DEG. K DESIGN OPERATING CASE TEMPERATURE -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) 253. TO 338. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS -4. TO 149. DEG. F) PACKAGE SHAPE RECTANGULAR PACKAGE SIZE * LENGTH 10.7 * WIDTH 10.7 * HEIGHT 21.3 CENTIMETERS 4.2 # WIDTH 4.2 * HEIGHT LENGTH 8.4 INCHES PACKAGE AREA 1138.1 SQ. CENTIMETERS * 176.4 SQ. INCHES PACKAGE VULUME 2428.2 CU. CENTIMETERS 148.2 CU. INCHES CASE MATERIAL ALUMINUM .5 KILOGRAMS * 1.0 POUNDS CASE WEIGHT TOTAL WEIGHT 4.5 KILOGRAMS * 10.0 POUNDS ALPHA = 0.90 * EMISSIVITY = 0.90SURFACE PROPERTIES INPUT STEADY STATE POWER 20.0 WATTS ## OUTPUT POWER O. 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 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.

THE 469 CLASS-A PLATED WIRE COMPUTER IS DESIGNED AND BUILT BY CONTROL DATA CORPORATION. MINNEAPOLIS MILITARY PRODUCTS DIVISION 3101 EAST BOTH 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 AK TO 32K. THIS UNIT WOULD CONSIST OF FOUR 8K MEMOR-IES 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 SPACE-CRAFT SYSTEM. THE UNIT CURRENTLY USED ON THE ITT TALOS AND MMC. PERSHING MISSILE SYSTEMS. THE 469 WAS CONSIDERED FOR USE ON HEAD 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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM ****

COMP . 4 469 DOUBLE DENSITY CONTROL DATA CORP. DESIGN OPERATING CASE TEMPERATURE

NON-OPERATING AND STORAGE CASE TEMPERATURE

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

PACKAGE SHAPE RECTANGULAR

PACKAGE SIZE * LENGTH 10.7 * WIDTH 10.7 # HEIGHT 12.2 CENTIMETERS 4.2 * WIDTH 4.2 * HEIGHT LENGTH 4.8 INCHES

PACKAGE AREA PACKAGE VOLUME

747.9 SQ. CENTIMETERS + 115.9 SQ. INCHES 1387.5 CU. CENTIMETERS . 84.7 CU. INCHES

253. TO 338. DEG. K (-4. TO 149. DEG. F)

218. TO 368. DEG. K (-67. TO 203. DEG. F) 253. TO 338. DEG. K

(-4. TO 149. DEG. F)

253. TO 338. DEG. K -4. TO 149. DEG. F)

CASE MATERIAL ALUMINUM

CASE WEIGHT TOTAL WEIGHT

0.0 POUNDS 0.0 KILOGRAMS 6.0 POUNDS 2.7 KILOGRAMS * ALPHA = 0.90* EMISSIVITY = 0.90

SURFACE PROPERTIES INPUT STEADY STATE POWER 16.0 WATTS ##

OUTPUT POWER O. 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 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.

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.

AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM ***************** COMP 5 LS-52 COMPUTER LEAR SIEGLER INC 219. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (-65. TO 160. DEG. F) 211. TO 368. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (~80. TO 203. DEG. F). 219. TO 344. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-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 7.6 * WIDTH 11.0 * HEIGHT 12.0 INCHES LENGTH 3958.7 SQ. CENTIMETERS # PACKAGE AREA 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** ĕ. 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 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.

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.

THERMAL REQUIREMENTS: PHYSICAL CHARACTERISTICS: AND CONSTRAINTS AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM ******************************** COMP 6 BR-1018M COMPUTER BUNKER RAMO 218. TO 358. DEG. K DESIGN OPERATING CASE TEMPERATURE (-67. TO 185. DEG. F) NON-OPERATING AND STORAGE CASE TEMPERATURE 218. TO 398. DEG. K (-67. TO 257. DEG. F) 218. TO 358. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-67. TO 185. DEG. F) 218. TO 358. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-67. TO 185. DEG. F) PACKAGE SHAPE RECTANGULAR PACKAGE SIZE * LENGTH 30.5 * WIDTH 10.2 * HEIGHT 15.2 CENTIMETERS HIGIW * 0.SI 4.0 * HEIGHT 6.0 INCHES LENGTH PACKAGE AREA 1858.1 SQ. CENTIMETERS # 288.0 SQ. INCHES 4719.5 CU. CENTIMETERS * PACKAGE VOLUME 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 ## * PASSIVE THERMAL DESIGN 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 UNIT COMPONENTS ARE HEAT SUNK TO BASE PLATE. COOLING IS BY CON-DUCTION. 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.

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 COMPU-TER 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).

AVIONICS SYSTEM

DATA MANAGEMENT SUBSYSTEM

7 CP-16A COMPUTER GENERAL ELECTRIC

DESIGN OPERATING CASE TEMPERATURE . 219. TO 344. DEG. K (-65. TO 160. DEG. F)

211. TO 368. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

(-80. TO 203. DEG. F) 219. TO 344. DEG. K (-65. TO 160. DEG. F) 219. TO 344. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS

(-65. TO 160. DEG. F)

PACKAGE SHAPE RECTANGULAR

PACKAGE SIZE * LENGTH 32.0 * WIDTH 20.3 * HEIGHT 19.3 CENTIMETERS

12.6 # WIDTH 8.0 * HEIGHT 7.6 INCHES LENGTH

514.7 SQ. INCHES 3320.8 SQ. CENTIMETERS * PACKAGE AREA # 766.1 CU. INCHES PACKAGE VOLUME 12553.8 CU. CENTIMETERS

CASE MATERIAL ALUMINUM

6.8 POUNDS CASE WEIGHT ö 3.1 KILOGRAMS

TOTAL WEIGHT 11.3 KILOGRAMS 4 24.9 POUNDS

* EMISSIVITY = 0.90 SURFACE PROPERTIES ALPHA = 0.90

INPUT STEADY STATE POWER 242.0 WATTS **

0.0 WATTS ** OUTPUT POWER

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 CON-DUCTION AND RADIATION.SURFACE PROPERTIES ARE PER CUSTOMER THERMAL REQUIREMENTS, UNIT 45 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-164 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

PHONE 315-797-1000 EXTENSION 7736 MR HOWARD ESTEY 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 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 CONSUMP-TION. UNIT MEMORY CAN BE CONVERTED TO PLATE WIRE MEMORY WITH REDUC TION IN SIZE WEIGHT AND POWER CONSUMTPION. THE CP-16A IS QUALIFIED TO MIL-E-5400 CLASS 2X, AND MIL-E-16400 (EMI).

THERMAL REQUIREMENTS. PHYSICAL CHARACTERISTICS. AND CONSTRAINTS

AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM ****** COMP 8 CP-24A COMPUTER GENERAL ELECTRIC 233. TO 348. DEG. K DESIGN OPERATING CASE TEMPERATURE (-40 . TO 167 . DEG . F) 208. TO 388. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-85° TO 239° DEG° F) 233. TO 348. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-40. TO 167. DEG. F) 219. TO 358. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-65. TO 185. DEG. F) PACKAGE SHAPE RECTANGULAR 31.2 CENTIMETERS 24.1 # WIDTH 26.7 # HEIGHT PACKAGE SIZE * LENGTH 9.5 * WINTH 10.5 * HEIGHT 12.3 INCHES -LENGTH 4461.3 SQ. CENTIMETERS 691.5 SQ. INCHES PACKAGE AREA 1226.9 CU. INCHES 45-20105.7 CU. CENTIMETERS PACKAGE VOLUME CASE MATERIAL ALUMINUM 3.9 KILOGRAMS 8.5 POUNDS CASE WEIGHT 38.0 POUNDS 17.2 KILOGRAMS # TOTAL WEIGHT ALPHA = 0.90 * EMISSIVITY = 0.90 SURFACE PROPERTIES 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 RE-QUIREMENTS. IN STAND BY MODE UNIT DISSIPATE 75 WATTS. MAXIMUM CARLE 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 PHONE 315-797-1000 EXTENSION 7736 MR HOWARD ESTEY

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.

AVIONICS SYSTEM

DATA MANAGEMENT SUBSYSTEM

COMP. 9 CP-32A COMPUTER GENERAL ELECTRIC

219. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (-65. TO 160. DEG. F)

NON-OPFRATING AND STORAGE CASE TEMPERATURE

211. TO 368. DEG. K

(-80. TO 203. DEG. F) 219. TO 344. DEG. K

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

(-65. TO 160. DEG. F) 219. TO 344. DEG. K

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

(-65. TO 160. DEG. F)

RECTANGULAR PACKAGE SHAPE

PACKAGE SIZE * LENGTH 45.7 # WINTH 25.7 * HEIGHT 19.3 CENTIMETERS

LENGTH 18.0 * WIDTH 10.1 * HEIGHT 7.6 INCHES

PACKAGE AREA PACKAGE VOLUME

5101.4 SQ. CENTIMETERS * 790.7 SG. INCHES 22641.7 CU. CENTIMETERS * 1381.7 CU. INCHES

CASE MATERIAL ALUMINUM

CASE WEIGHT

4.0 KILOGRAMS **⇔** 8.9 POUNDS

TOTAL WEIGHT SURFACE PROPERTIES 18.9 KILOGRAMS # 41.7 POUNDS * EMISSIVITY = 0.90

ALPHA = 0.90WATTS ## IMPUT STEADY STATE POWER 365.

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 ATRCRAFT USE IT CAN BE MODIFIED FOR SPACECRAFT USF. IT HAS A FORCED AIR COOLING SYSTEM AND CAN BE CON VERTED 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 MOUNT ED 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 DE-SIGN 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 JUNIT 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).

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM COMP 10 SCP-234 COMPUTER. 263. TO 333. DEG. K DESIGN OPERATING CASE TEMPERATURE (14. TO 140. DEG. F) 253. TO 358. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE -4. TO 185. DEG. F) 263. TO 333. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 14. TO 140. DEG. F) 263. TO 333. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (14° TO 140° DEG° F) PACKAGE SHAPE RECTANGULAR PACKAGE SIZE # LENGTH 23.6 * WIDTH 22.6 * HEIGHT 14.5 CENTIMETERS 9.3 * WIDTH 8.9 * HEIGHT 5.7 INCHES LENGTH 373.0 SQ. INCHES 2406.6 SQ. CENTIMETERS * PACKAGE AREA 7731.2 CU. CENTIMETERS 4 471.8 CU. INCHES PACKAGE VOLUME MAGNESIUM CASE MATERIAL .5 POUNDS * CASE WEIGHT .2 KILOGRAMS TOTAL WEIGHT 5.3 KILOGRAMS * 11.7 POUNDS * EMISSIVITY = 0.90 SURFACE PROPERTIES ALPHA = 0.903.5 WATTS ## INPUT STEADY STATE POWER OUTPUT POWER 0.0 WATTS ## * PASSIVE THERMAL DESIGN 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 DE-PEND 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 CON-VERTER. 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.

THERMAL REQUIREMENTS. PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM

DATA MANAGEMENT SUBSYSTEM

COMP 11 RAC-261 COMPUTER RAYTHEON COMPANY.

DESIGN OPERATING CASE TEMPERATURE

219. TO 344. DEG. K (-65. TÓ 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)

RECTANGULAR PACKAGE SHAPE

PACKAGE SIZE * LENGTH 49.8 * WIDTH 12.2 * HEIGHT 15.2 CENTIMETERS

LENGTH 19.6 * WINTH 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 SURFACE PROPERTIES

13.6 KILOGRAMS 30.0 POUNDS

ALPHA = 0.90 # EMISSIVITY = 0.90.

INPUT STEADY STATE POWER 200. WATTS ##

OUTPUT POWER

0.0 WATTS ##

THERMAL DESIGN

1920 S. C. S. S.

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 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 REQUIR-EMENTS. UNIT CAN BE MODIFIED FOR SPACE USE WITHOUT CHANGING ITS BASIC MODE.

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 PHONE 617-443-9521 EXTENSION 2881 MR K.A. JENSEN

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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM DATA MANAGEMENT

PACKAGE AREA

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

71.1 * WIDTH 25.7 * HEIGHT 28.0 * WIDTH 10.1 * HEIGHT PACKAGE SIZE * LENGTH 19.3 CENTIMETERS

LENGTH 7.6 INCHES 7385.3 SQ. CENTIMETERS * 1144.7 SQ. INCHES

PACKAGE VOLUME 35220.4 CU. CENTIMETERS *

MAGNESIUM

2149.3 CU. INCHES

CASE MATERIAL CASE WEIGHT

4.5 KILOGRAMS ø 10.0 POUNDS

TOTAL WEIGHT SURFACE PROPERTIES

26.1 KILOGRAMS 57.5 POUNDS 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) 211. TO 368. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-80. TO 203. DEG. F) 219. TO 344. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-65. TO 160. DEG. F) 219. TO 344. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-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 41 323.4 SQ. INCHES PACKAGE VOLUME 6037.8 CU. CENTIMETERS 368.4 CU. INCHES CASE MATERIAL MAGNESIUM CASE WEIGHT 1.8 KILOGRAMS 4.0 POUNDS ₽ 20.0 POUNDS TOTAL WEIGHT 9.1 KILOGRAMS SURFACE PROPERTIES INPUT STEADY STATE POWER AO.O 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 CHOS 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 ASSUMP-TION 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.

THERMAL REQUIREMENTS. PHYSICAL CHARACTERISTICS. AND CONSTRAINTS AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM ************ COMP 14 MILLICOMPUTLER WESTINGHOUSE 218. TO 398. DEG. K DESIGN OPERATING CASE TEMPERATURE (-67. TO 257. DEG. F) 211. TO 423. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-80. TO 302. DEG. F) 218. TO 398. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-67° TO 257° DEG° F) 218. TO 398. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-67. TO 257. DEG. F) RECTANGULAR PACKAGE SHAPE 15.2 CENTIMETERS 24.1 * WIDTH 14.0 * HEIGHT PACKAGE SIZE * LENGTH 5.5 * HEIGHT 6.0 INCHES 9.5 * WIDTH LENGTH 284.5 SQ. INCHES 1835.5 SQ. CENTIMETERS * PACKAGE AREA 5137.3 CU. CENTIMETERS 45 313.5 CU. INCHES PACKAGE VOLUME ALUMINUM CASE MATERIAL .5 KILOGRAMS 甘 1.0 POUNDS CASE WEIGHT 10.0 POUNDS 4.5 KILOGRAMS ᄷ TOTAL WEIGHT * EMISSIVITY = 0.85 ALPHA = 0.85SURFACE PROPERTIES B.O WATTS ## INPUT STEADY STATE POWER 0.0 WATTS ** OUTPUT POWER PASSIVE * PASSIVE THERMAL DESIGN 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 THE MILLICOMPUTER IS DESIGN FOR BOTH AIRCHAFT AND SPACE ENVIRON-MENT. IT IS COOLED BY CONDUCTION AND ITS SURFACES ARE BLACK IRIDITE BUT CAN BE FINISHED PER CUSTOMER THERMAL PEQUIREMENTS. ABOVE DATA IS RASED ON A MILLICOMPUTER WITH CPU ROM 32K WORD SEMICONDUCTOR MEMORY AND A GENERAL PURPOSE I/O IT DOES NOT IN-CLUDE 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 PHONE 301-765-3660 EXTENSION JIM H. BROWN THE MILLICOMPUTER IS PART OF A FAMILY OF FAST, LIGHTWEIGHT.MILIT-ARY 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 NAVIG ATION. AT PRESENT THE COMPUTER IS USED IN AN AIRCRAFT AS PRIME FIRE CONTROL SYSTEM AND OTHER MEMBERS OF FAMILY ARE USED IN THE B-576. 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.

THERMAL REQUIREMENTS. PHYSICAL CHARACTERISTICS. AND CONSTRAINTS AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM *********************** COMP 15 MAGIC IV COMPUTER - DELCO ELECTRONICS 219. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (~65. TO 160. DEG. F) 211. TO 368. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-80. TO 203. DEG. F) 219. TO 344. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (~65. TO 160. DEG. F) QUALIFICATION TEST TEMPERATURE REQUIREMENTS 219. TO 344. DEG. K (-65. TO 160. DEG. F) PACKAGE SHAPE RECTANGULAR -16.5 * HEIGHT 13.0 CENTIMETERS PACKAGE SIZE * LENGTH 19.0 # WIDTH 7.5 * WIDTH 6.5 * HEIGHT 5.l LENGTH 1550.3 SQ. CENTIMETERS # 240.3 SQ. INCHES PACKAGE AREA 248.6 CU. INCHES 삼 4074.2 CU. CENTIMETERS PACKAGE VULUME ALUMINUM CASE MATERIAL 4.1 POUNDS 1.9 KILOGRAMS ti-CASE WEIGHT 4.9 KILOGRAMS * 10.8 POUNDS TOTAL WEIGHT SURFACE PROPERTIES * EMISSIVITY = 0.90 ALPHA = 0.90INPUT STEADY STATE POWER 39.0 WATTS ## 0.0 WATTS ## OUTPUT POWER PASSIVE * PASSIVE THERMAL DESIGN ******************************* 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 RE QUITREMENTS. UNIT IS BEING DESIGN FOR SPACE ENVIRONMENT ***************************** 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

PHONE 805-968-1011 EXTENSION 301 MR. JACK TONEY 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 CORF 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.

AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM ************************

COMP 16 MAGIC 362 COMPUTER DELCO ELECTRONICS 218. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (-67. TO 160. DEG. F)

218. TO 398. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-67. TO 257. DEG. F)

218. TO 344. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

(-67. TO 160. DEG. F) 218. TO 344. DEG. K

QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-67. TO 160. DEG. F)

PACKAGE SHAPE RECTANGULAR 13.0 CENTIMETERS PACKAGE SIZE * LENGTH 8.8 * WIDTH 17.8 * HEIGHT 7.4 * WIDTH 7.0 * HEIGHT 17.8 * HEIGHT 18.8 * WIDTH LENGTH 5.1 INCHES

250.5 SQ. INCHES 1616.0 SQ. CENTIMETERS * PACKAGE AREA 4 264.2 CU. INCHES PACKAGE VOLUME 4329.1 CU. CENTIMETERS

CASE MATERIAL ALUMINUM

CASE WEIGHT 2.0 KILOGRAMS * 4.5 POUNDS 5.2 KILOGRAMS * TOTAL WEIGHT 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

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. 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.

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 PHONE 805-968-1011 EXTENSION 301 MR. JACK TONEY 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. 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. 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 OUTAIFIED COMPUTER DELCO ELECTRONICS P73-02A APRIL 1973. AND MAGIC 362 SERIES AEROSPACE DIGITAL COMPUTERS TECHNICAL DESCRIPTION, DELCO ELECTRONICS 573-49 JULY 1973.

AVIONICS SYSTEM

DATA MANAGEMENT SUBSYSTEM

COMP 17 MICRO-0 1808 ARMA DIV. OF AMBAC

219. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (-65. TO 160. DEG. F).

NON-OPERATING AND STORAGE CASE TEMPERATURE

211. TO 398. DEG. K (-80° to 257° DEG° E)

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

7.3 * HEIGHT LENGTH 23.5 * WIDTH 5.3 INCHES

PACKAGE AREA 4319.9 SQ. CENTIMETERS * 669.6 SQ. INCHES PACKAGE VOLUME 14899.4 CU. CENTIMETERS 참 909.2 CU. INCHES

CASE MATERIAL **ALUMINUM**

CASE WEIGHT 1.8 KILOGRAMS TOTAL WEIGHT

45 4.0 POUNDS 16.3 KILOGRAMS * 36.0 POUNDS

SURFACE PROPERTIES

ALPHA = 0.90* EMISSIVITY = 0.90

WATTS ## INPUT STEADY STATE POWER 106.

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 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.

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 ECZ 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

AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM ********** COMP 18 AOP COMPUTER WESTINGHOUSE 253. TO 353. DEG. K DESIGN OPERATING CASE TEMPERATURE

(-4. TO 176. DEG. F) 218. TO 398. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-67. TO 257. DEG. F)

253. TO 353. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (, -4. TO 176. DEG. F)

253. TO 353. DEG. K -4. TO 176. DEG. F) QUALIFICATION TEST TEMPERATURE REQUIREMENTS

PACKAGE SHAPE RECTAGULAR

17.8 * HEIGHT 55.9 CENTIMETERS PACKAGE SIZE * LENGTH 22.9 # WIDTH 22.0

9.0 * WIDTH 7.0 * HEIGHT LENGTH 5354.8 SQ. CENTIMETERS # 830.0 SQ. INCHES

1386.0 CU. INCHES

22712.5 CU. CENTIMETERS PACKAGE VOLUME **ALUMINUM** CASE MATERIAL

PACKAGE AREA

415 3.0 POUNDS 1.4 KILOGRAMS CASE WEIGHT

* 31.0 POUNDS TOTAL WEIGHT 14.1 KILOGRAMS

SURFACE PROPERTIES * EMISSIVITY = 0.85 ALPHA = 0.85

13.6 WATTS ## INPUT STEADY STATE POWER 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 COOL-ING ACHIEVED BY RADIATION AND CONDUCTION. UNIT SURFACE IS BLACK IRIDITE. THE AOP DESCRIBED ABOVE INCLUDES A CPU, A 32K PLATED WIRE MEMORY A COMPLETE T/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

PHONE 301-765-3660 EXTENSION MR. JIM H. BROWN 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.

AVIONICS SYSTEM

DATA MANAGEMENT SUBSYSTEM

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. TU 368. DEG. K

(-79a TO 203a DEG. F) 219. TO 344. DEG. K

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

(-65 TO 160 DEG. F) 219. TO 344. DEG. K

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

(-65. TO 160. DEG. F)

PACKAGE SHAPE RECTANGULAR

PACKAGE SIZE * LENGTH 3.8 CENTIMETERS 16.3 * WIDTH 16.0 * HEIGHT

6.4 * WIDTH 6.3 * HEIGHT 1.5 INCHES LENGTH

PACKAGE AREA PACKAGE VOLUME 766.1 SQ. CENTIMETERS * 118.7 SQ. INCHES 60.5 CU. INCHES 991.1 CU. CENTIMETERS *

CASE MATERIAL ALUMINUM

CASE WEIGHT TOTAL WEIGHT

.3 POUNDS -1 KILOGRAMS *

.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

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 CONDUCT ED 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.

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 SPECIFIC ATION 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 CIRC-UIT 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

241. TO 325. DEG. K DESIGN OPERATING CASE TEMPERATURE (-25. TO 125. DEG. F)

241. TO 325. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-25° TO 125° DEG° F)

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 255. TO 311. DEG. K 0. TO 100. DEG. F)

241. TO 333. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-25, TO 140, DEG, F)

PACKAGE SHAPE RECTANGULAR

PACKAGE SIZE * LENGTH 27.4 CENTIMETERS 40.6 # WIDTH 26.7 * HEIGHT

16.0 * WIDTH 10.5 * HEIGHT 10.8 INCHES LENGTH

5860.6 SQ. CENTIMETERS * 908.4 SQ. INCHES PACKAGE AREA PACKAGE VOLUME 29732.7 CU. CENTIMETERS # 1814.4 CU. INCHES

CASE MATERIAL ALUMINUM

10.0 POUNDS ₩ CASE WEIGHT 4.5 KILOGRAMS

TOTAL WEIGHT 21.3 KILOGRAMS 47.0 POUNDS

* EMISSIVITY = 0.90 SURFACE PROPERTIES ALPHA = 0.90

INPUT STEADY STATE POWER 25.0 WATTS ## 0.0 WATTS ## OUTPUT POWER

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. PETERSRURG, 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 VIK-ING 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

218. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (-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

49.8 * WIDTH 21.1 * HEIGHT 19.3 CENTIMETERS PACKAGE SIZE * LENGTH

LENGTH 19.6 → WIDTH 8.3 * HEIGHT 7.6 INCHES

PACKAGE AREA PACKAGE VOLUME 4835.1 SQ. CENTIMETERS * 749.4 SQ. INCHES

20260.4 CU. CENTIMETERS * 1236.4 CU. INCHES

CASE MATERIAL ALUMINUM

7.0 KILOGRAMS * 15.4 POUNDS

CASE WEIGHT 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 BK 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 FINTSH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS EX-PANDABLE 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 AROVE 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 CIR-CUIT HOARD 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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM ******** COMP 22 HDC-601P COMPUTER HONEYWELL 218. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (-67. TO 160. DEG. F) 218. TO 398. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-67. TO 257. DEG. F) 244. TO 322. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (~20. TO 120. DEG. F) 218. TO 344. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-67. TO 160. DEG. F) PACKAGE SHAPE RECTANGULAR 19.3 CENTIMETERS PACKAGE SIZE * LENGTH 49.8 * WIDTH 21.1 * HEIGHT .7.6 INCHES 19.6 * WIDTH 8.3 * HEIGHT LENGTH 749.4 SQ. INCHES 4835.1 SQ. CENTIMETERS * PACKAGE AREA 20260.4 CU. CENTIMETERS 1236.4 CH. INCHES * PACKAGE VULUME ALUMINUM CASE MATERIAL 15.4 POUNDS 7.0 KILOGRAMS * CASE WEIGHT 37.0 POUNDS 16.8 KILOGRAMS 禁 TOTAL WEIGHT * EMISSIVITY = 0.90 ALPHA = 0.90SURFACE PROPERTIES INPUT STEADY STATE POWER 120.0 WATTS ** 28 VDC 0.0 WATTS ## OUTPUT POWER ACTIVE **ACTIVE** THERMAL DESIGN 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'S 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 MEMO-RY 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

PHONE 813-531-4611 EXTENSION 3378 MR. HARVFY H. WHELESS THE HOC-601P COMPUTER IS AN OFF THE SHELF IN PRODUCTION UNIT. THE DATA ABOVE DESCRIBE A HOG-60-1P 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.

219. TO 366. DEG. K

(-65. TO 199. DEG. F) 219. TO 347. DEG. K

(-65. TO 165. DEG. F) 219. TO 361. DEG. K (-65. TO 190. DEG. F)

219. TO 361. DEG. K

27.9 CENTIMETERS

(-65. TO 190. DEG. F)

1361.0 SQ. INCHES

3141.6 CU. INCHES

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM

DATA MANAGEMENT SUBSYSTEM

COMP 23 HDC-602 COMPUTER HONEYWELL

DESIGN OPERATING CASE TEMPERATURE

NON-OPERATING AND STORAGE CASE TEMPERATURE

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

PACKAGE SHAPE RECTANGULAR

24.0 * WIDTH 11.9 * HEIGHT 11.0 INCHES LENGTH

PACKAGE AREA PACKAGE VOLUME

CASE MATERIAL ALUMINUM

CASE WEIGHT .

TOTAL WEIGHT SURFACE PROPERTIES

OUTPUT POWER

THERMAL DESIGN

PACKAGE SIZE * LENGTH 61.0 * WIDTH 30.2 * HEIGHT

8780.6 SQ. CENTIMETERS

51481.6 CU. CENTIMETERS

4.1 KILOGRAMS * 20.4 KILOGRAMS * 45.0 POUNDS

* EMISSIVITY = 0.85. ALPHA = 0.25INPUT STEADY STATE POWER 170.0 WATTS ** +28VDC

4

9.0 POUNDS

0.0 WATTS ** PASSIVE PASSIVE

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. ****************

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

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.

REF. BROCHURE. AUTONETICS ADVANCED D200 FAMILY OF MOS/LSI GENERAL-PURPOSE COMPUTERS PUB. NO P71-828/401

IS THE FORERUNNER OF THE DIZ16 DIGITAL COMPUTER. THE D200 FAMILY COMPUTER HAVE BEEN USED ON SEVERAL PROGRAMS INCLUDING THE F-1110

NAVIGATION SYSTEM.

AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM ************************************* COMP 25 DIZIG COMPUTER AUTONETICS R.I. 219. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (-65. TO 160. DEG. F) 211. TO 368. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-80. TO 203. DEG. F) 219. TO 344. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-65. TO 160. DEG. F) 219. TO 344. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-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 禁 3.0 POUNDS TOTAL WEIGHT 16.0 POUNDS 7.3 KILOGRAMS * SURFACE PROPERTIES ALPHA = 0.90 * EMISSIVITY = 0.90 INPUT STEADY STATE POWER 75.0 WATTS **28 VOC 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 ANTI-CIPATED 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 4 MODULAR UNIT WITH 32K WORDS MEMORY.

THE DIZIA 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 DIZ16 IS MUCH LIKE ITS FORERUN NER THE D216 COMPUTER BUT WITH A FASTER PROCESSOR. THE D1216 IS IN THE FINAL STAGE OF DEVELOPMENT. IT IS EXPECTED TO BE QUAL TESTED DURING 1974 FOR SPACE ENVIRONMENT. THE DIZIG COMPUTER DES-CRIBED ABOVE IS BUILT IN MODULAR FORM IT INCLUDES THE FOLLOWING A PMOS LSI PROCESSOR, A 32K X 16 BIT WORDS PLATED WIRE, RANDOM AC CESS. 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 DIPLE MEMORY IS EXPANDABLE TO 65K X 16 BIT WORDS MEMORY. THE DIZIG 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.

*************** COMP 26 D232 COMPUTER AUTONETICS R.I 219. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (-65. TO 160. DEG. F) 211. TO 368. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-80° TO 203° DEG° F) 219. TO 344. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS -(-65. TO 160. DEG. F) 219. TO 344. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-65. TO 160. DEG. F)

PACKAGE SHAPE RECTANGULAR 30.5 CENTIMETERS PACKAGE SIZE * LENGTH 27.9 * WIDTH 17.8 * HEIGHT 7.0 * HEIGHT 12.0 INCHES 11.0 * WIDTH LENGTH 3780.6 SQ. CENTIMETERS * 586.0 SQ. INCHES PACKAGE AREA 15141.6 CU. CENTIMETERS * 924.0 CU. INCHES PACKAGE VOLUME ALUMINUM CASE MATERIAL 2.7 KILOGRAMS 4 6.0 POUNDS CASE WEIGHT 30.0 POUNDS 13.6 KILOGRAMS * TOTAL WEIGHT ALPHA = 0.90 * EMISSIVITY = 0.90

SURFACE PROPERTIES 140.0 WATTS ** 28 VDC POWER SUPPLY INPUT STEADY STATE POWER OUTPUT POWER 0.0 WATTS ##

4 PASSIVE PASSIVE THERMAL DESIGN

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 THE D232 COMPUTER IS IN FINAL STAGE OF DEVELOPMENT AND IS SCHEDULE TO BE OPERATIONAL NEAR THE END OF 1973. THE D232 COMPUTER IS DE-SIGN WITH A PASSIVE THERMAL CONTROL OF CONDUCTION TO A COLDPLATE. THE UNIT SURFACE IS IRIDITE ALUMINUM BUT FINISH IS APPLICATION DE-PENDENT. THE 0232 COMPUTER IS SIMILAR TO THE DIZIG 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 MIRALUMA AVENUE ANAHEIM, CALIFORNIA 92803 THE DATA CONTAINED HEREIN WAS OBTAINED FROM PHONE 714-632-3374 EXTENSION MR. VINCE MAREK THE D232 COMPUTER IS A MEMBER OF THE D200 FAMILY OF MOS/LSI COM-PUTERS. 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 FOLLOW-ING A PMOS LST PROCESSOR. A 65K X 32 BIT WORDS PLATED WIRE, RAN-DOM 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. 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.

AVIONICS SYSTEM

THERMAL DESIGN

DURING FLIGHT.

DATA MANAGEMENT SUBSYSTEM

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P/N 1882218~1
COMP 27 TDY-300 COMPUTER TELEDYNE
   DESIGN OPERATING CASE TEMPERATURE
                                                  253. TO 344. DEG. K
                                                  -4. TO 160. DEG. F)
                                                  219. TO 344. DEG. K
    NON-OPERATING AND STORAGE CASE TEMPERATURE
                                                ( -65. TO 160. DEG. F)
                                                  243. TO 344. DEG. K
    ACCEPTANCE TEST TEMPERATURE REQUIREMENTS
                                                ( -22. TO 160. DEG. F)
                                                  243. TO 344. DEG. K
    QUALIFICATION TEST TEMPERATURE REQUIREMENTS
                                                ( -22. TO 160. DEG. F)
                      RECTANGULAR
    PACKAGE SHAPE
                                                        30.5 CENTIMETERS
    PACKAGE SIZE * LENGTH
                          41.9 * WIDTH
                                         33.8 # HEIGHT
                          16.5 * WIDTH 13.3 * HEIGHT 12.0 INCHES
                  LENGTH
                       7445.8 SQ. CENTIMETERS * 1154.1 SQ. INCHES
    PACKAGE AREA
   PACKAGE VOLUME
                      43153.7 CU. CENTIMETERS
                                                   2633.4 CU. INCHES
    CASE MATERIAL
                      ALUMINUM
                                              14.0 POUNDS
                           6.4 KILOGRAMS *
    CASE WEIGHT
                           21.5 KILOGRAMS *
                                              47.5 POUNDS
    TOTAL WEIGHT
    SURFACE PROPERTIES
                            ALPHA = 0.26 * EMISSIVITY = 0.26
    INPUT STEADY STATE POWER 143.0 WATTS **
    OUTPUT POWER
                                0.0 WATTS ##
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PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS

ACTIVE

THE TDY-300 DIGITAL COMPUTER IS DESIGN AND BUILT BY

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 PADIATION 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/HP-FT SQ-DEG F. UNIT IS PAINTED WITH ALUMINIZED PAINT.

* PASSIVE

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

REF. MDAC SPECIFICATION DOCUMENT 1882218 GUIDANCE COMPUTER, DIGS AND LETTER OF SEPTEMBER 20 1973, FROM MR. JAMES E. FITHIAN.

PAGE I-78 SPACE TUG EQUIPMENT DATA BANK FINAL DATA THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM DATA MANAGEMENT SUBSYSTEM **************** P/N 7516288 COMP 28 TDY-310 CENTAUR TELEDYNE 253. TO 333. DEG. K DESIGN OPERATING CASE TEMPERATURE -4. TO 140. DEG. F) 219. TO 344. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-65. TO 160. DEG. F) 243. TO 343. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-22. TO 158. DEG. F) 243. TO 343. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-22° TO 158° DEG° F) PACKAGE SHAPE RECTANGULAR 24.9 CENTIMETERS 35.3 * HEIGHT PACKAGE SIZE * LENGTH 38.9 * WIDTH 15.3 * WIDTH 13.9 * HEIGHT 9.8 INCHES LENGTH 6436.5 SQ. CENTIMETERS * 997.7 SQ. INCHES PACKAGE AREA 34153.4 CU. CENTIMETERS * 2084.2 CH. INCHES PACKAGE VULUME ALUMINUM CASE MATERIAL CASE WEIGHT 8.1 KILOGRAMS # 17.8 POUNDS 28.1 KILOGRAMS * 62.0 POUNDS TOTAL WEIGHT ALPHA = 0.25SURFACE PROPERTIES * 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 PHONE 213-886-2211 EXTENSION 2544 MR JAMES E. FITHIAN 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

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 OFFTHE-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 218. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (-67. TO 160. DEG. F) 211. TO 373. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-80 . TO 212 . DEG. F) 218. TO 344. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-67. TO 160. DEG. F) 218. TO 344. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-67. TO 160. DEG. F) RECTANGULAR PACKAGE SHAPE 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 43-100.0 POUNDS TOTAL WEIGHT 45.4 KILOGRAMS * EMISSIVITY = 0.90 SURFACE PROPERTIES ALPHA = 0.90INPUT STEADY STATE POWER 800.0 WATTS ** 28 VDC AND 115 VAC 400 HZ 10.0 WATTS ## OUTPUT POWER THERMAL DESIGN ACTIVE 43 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 MODIFI ED 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 MEM ORY COMPUTER. UNIT SURFACES ARE ANODIZED ALUMINUM THAT ARE PAINT-ED 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 PHONE 214-252-7423 EXTENSION MR. T. R. MAHONEY AND MP. M. GUBERMAN

PHONE 201 256-4000 EXTENSION 5377 THE SKC-2000 COMPUTER IS A GENERAL PURPOSE AIRBORNE DIGITAL COMPUT ER. 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 H7 AND 28 VDC POWER SUPPLY AND SPECIAL BI 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

TR I EREP TAPE RECORDER MARTIN MARIETTA DESIGN OPERATING CASE TEMPERATURE

289. TO 314. DEG. K 60. TO 105. DEG. F)

P/N PD8300140-010

NON-OPERATING AND STORAGE CASE TEMPERATURE

278. TO 314. DEG. K

(40° TO 105° DEG° F) 278. TO 305. DEG. K

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

(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 PACKAGE VOLUME

8767.7 SQ. CENTIMETERS * 1359.0 SQ. INCHES 54568.9 CU. CENTIMETERS * 3330.0 CU. INCHES

CASE MATERIAL ALUMINUM

CASE WEIGHT TOTAL WEIGHT

22.5 POUNDS 10.2 KILOGRAMS *

90.0 POUNDS 40.8 KILOGRAMS ALPHA = 0.85 * EMISSIVITY = 0.50

SURFACE PROPERTIES INPUT STEADY STATE POWER 187.0 WATTS ** 28 VDC POWER SOURCE

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 EREP TAPF RECORDER WAS BUILT FOR THE SKYLAB PROGRAM. 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 DISSIPA TION OF 35 WATTS IN STANDBY MODE.173 WATTS IN SLOW SPEED RECORD. AND 187 WATTS FOR HIGH SPEED RECORD.

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 ELECTRO-NICS 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)。

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EQUIPMENT ITEM		UANITY	WEIG			VOLUME	
				(POUNDS)		(CU FI.)	
***	**	***	UNIT	JATOT *****		*****	
TRANSPONDER, PM	*	2	16.	32.	36.	.70	
TRANSMITTER + FM	4	2	23.	46.	60.	.70	
POWER AMPLIFIER	#	S	12.	24.	127.	.50	
HYBRID JUNCTION		1	4.	4 0	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	ann aige stir d	10° 40° 40° 40° 40° 40° 40°		155.	239,	2.78	
NOTES * REDUNDA	NT						

CONTINUOUS OPERATION OF SUBSYSTEM FROM 3.91 HOURS TO 98.60 HOURS.

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THERMAL REQUIREMENTS. PHYSICAL CHARACTERISTICS. AND CONSTRAINTS
   AVIONICS SYSTEM
   COMMUNICATION SUBSYSTEM
  ******************************
                                            P/N PD6400439-040
TPM 1 S-BAND TRANSPONDER PHILCO FORD COPP
                                              241. TO 325. DEG. K
  DESIGN OPERATING CASE TEMPERATURE
                                             ( -25. TO 125. DEG. F)
                                              236. TO 396. DEG. K
   NON-OPERATING AND STORAGE CASE TEMPERATURE
                                             ( -35. TO 254. DEG. F)
                                               255. TO 311. DEG. K
   ACCEPTANCE TEST TEMPERATURE REQUIREMENTS
                                                0. TO 100. DEG. F)
                                               241. TO 325. DEG. K
  QUALIFICATION TEST TEMPERATURE REQUIREMENTS
                                             ( -25. TO 125. DEG. F)
  PACKAGE SHAPE
                     RECTANGULAR
                                       6.3 # HEIGHT
                                                    12.7 CENTIMETERS
  PACKAGE SIZE * LENGTH 27.4 * WIDTH
                                                    5.0 INCHES
                        10.8 * WINTH
                 LENGTH
                                       2.5 * HEIGHT
                      1206.4 SQ. CENTIMETERS
                                            *
                                                 187.0 SQ. INCHES
   PACKAGE AREA
                                                 135.0 CU. INCHES
                      2212.3 CU. CENTIMETERS
   PACKAGE VOLUME
                     ALUMINUM
   CASE MATERIAL
                                             1.9 POUNDS
   CASE WEIGHT
                          .9 KILOGRAMS
                                        4
                                             3.8 POUNDS
                         1.7 KILOGRAMS
                                       45
   TOTAL WEIGHT
                                        * EMISSIVITY = 0.85
                          ALPHA = 0.85
   SURFACE PROPERTIES
                             6.4 WATTS ##
   INPUT STEADY STATE POWER
   OUTPUT POWER
                             0.2 WATTS ##
                          PASSIVE
                                   * PASSIVE
   THERMAL DESIGN
   **************************************
   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-RAND TPANSPONDER 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.
   THE STON 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
                                  PHONE 303-794-5211 EXTENSION 4841
   MR. T.E. WATSON AND
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THE STON 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.

PHONE 303-794 5211 EXTENSION 2103

MR. B. HARNEL

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM

TRM 2 S-BAND SGLS TRANSP MOTOROLA INC. DESIGN OPERATING CASE TEMPERATURE

243. TO 353. DEG. K (-22. TO 176. DEG. F)

MSR-101/MST-201

233. TO 363. DEG. K

NON-OPERATING AND STORAGE CASE TEMPERATURE

(-40. TO 194. DEG. F)

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

243. TO 353. DEG. K 1 -22. TO 176. DEG. F)

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

243. TO 353. DEG. K (-22. TO 176. DEG. F)

PACKAGE SHAPE RECTANGULAR

7.9 CENTIMETERS 7.4 * HEIGHT PACKAGE SIZE * LENGTH 10.9 * WIDTH

LENGTH 4.3 * WIDTH 2.9 * HEIGHT 3.1 INCHES

PACKAGE AREA PACKAGE VOLUME 448.9 SQ. CENTIMETERS * 69.6 SQ. INCHES 38.7 CU. INCHES 633.5 CU. CENTIMETERS

ALUMINUM CASE MATERIAL

CASE WEIGHT

.8 POUNDS .4 KILOGRAMS

TOTAL WEIGHT SURFACE PROPERTIES 1.4 KILOGRAMS # 3.0 POUNDS ALPHA = 0.90 . * EMISSIVITY = 0.90

INPUT STEADY STATE POWER

2.8 WATTS ## 0.0 WATTS **

OUTPUT POWER 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/ORHIT ON* TUG/PAY ON THE MSR-101 S-BAND RECEIVER IS PART OF S-BAND SGLS TRANSPONDER. UNIT IS DESTRON 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

THE MSR-101/MST-201 SIMPLIFIED S-BAND SGLS TRANSPONDER IS DESIGN AND BUTLE 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 RECEIV ER 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 PECEIVER 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 TRANS-PONDER BY MOTOROLA GOVERNMENT ELEVTRONICS DIVISION.

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM ************

MSR-101/MST-201 3 S-BAND SGLS TRANSP MOTOROLA INC. 243. TO 353. DEG. K DESIGN OPERATING CASE TEMPERATURE (-22. TO 176. DEG. F) 233. TO 363. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-40. TO 194. DEG. F) 243. TO 353. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-22. TO 176. DEG. F) 243. TO 353. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-22. TO 176. DEG. F) PACKAGE SHAPE RECTANGULAR

8.4 CENTIMETERS 8.4 # HEIGHT PACKAGE SIZE * LENGTH 11.4 # WIOTH 3.3 INCHES LENGTH 4.5 ♥ WIDTH 3.3 * HEIGHT 81.2 SQ. INCHES 523.7 SQ. CENTIMETERS PACKAGE AREA 4 49.0 CU. INCHES PACKAGE VOLUME 803.0 CU. CENTIMETERS

CASE MATERIAL ALUMINUM CASE WEIGHT

.4 KILOGRAMS 45 -8 POUNDS 1.4 KILOGRAMS * 3.1 POUNDS

TOTAL WEIGHT ALPHA = 0.90* EMISSIVITY = 0.90 SURFACE PROPERTIES 33.6 WATTS **AT 28 VDC AND 1.2 AMP MAX INPUT STEADY STATE POWER

2.0 WATTS ** OUTPUT POWER PASSIVE THERMAL DESIGN PASSIVE 45

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 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.

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 PHONE 602-949-2471 EXTENSION MP. C. L. MAVITY 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 MOTOPOLA GOVERNMENT ELECTRONICS DIVISION.

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM *******************

TPM 4 S-BAND SGLS TRANSP MOTOROLA INC. MSR-101/MST-501 243. TO 353. DEG. K DESIGN OPERATING CASE TEMPERATURE (-22. TO 176. DEG. F) 233. TO 363. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-40. TO 194. DEG. F) 243. TO 353. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-22. TO 176. DEG. F) 243. TO 353. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS

(-22. TO 176. DEG. F)

PACKAGE SHAPE RECTANGULAR 8.4 CENTIMETERS A.4 * HEIGHT PACKAGE SIZE * LENGTH 11.4 * WIDTH 3.3 INCHES LENGTH 4.5 # WIDTH 3.3 * HEIGHT 81.2 SQ. INCHES

PACKAGE AREA 523.7 SQ. CENTIMETERS * PACKAGE VOLUME 803.0 CU. CENTIMETERS # 49.0 CU. INCHES

CASE MATERIAL ALUMINUM

.8 POUNDS .4 KILOGRAMS * CASE WEIGHT . 1.4 KILOGRAMS 3.1 POUNDS TOTAL WEIGHT

ALPHA = 0.90 * EMISSIVITY = 0.90. SURFACE PROPERTIES

56. WATTS **AT 28 VDC AND 2.0 AMP*MAX INPUT STEADY STATE POWER

5.0 WATTS ## DUTPUT POWER 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 MST-501 S-RAND TRANSMITTEP 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.

THE MSR-101/MST-501 SIMPLIFIED S-BAND SGLS TRANSPONDER IS DE-SIGN AND BUILT BY MOTOROLA INC. GOVERNMENT ELECTRONICS DIVISION 8201 E. MCDOWELL ROAD, SCOTTSDALE, ARTZONA 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 RE POWER OUTPUT AND THE MST-201 HAS A 2 WATTS RF POWER OUTPUT, FOR MORE DETAILED DISCUSSION REFER TO MST-201 TRANSMITTER.

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM

TPM 5 MSX-201S S-BAND MOTOROLA INC. DESIGN OPERATING CASE TEMPERATURE

NON-OPERATING AND STORAGE CASE TEMPERATURE

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

PACKAGE SHAPE RECTANGULAR

PACKAGE SIZE * LENGTH 10.9 * WIDTH 14.7 * HEIGHT 5.8 * HEIGHT 3.3 L.ENGTH 4.3 * WIDTH

PACKAGE AREA PACKAGE VOLUME

ALUMINUM CASE MATERIAL

CASE WEIGHT TOTAL WEIGHT

SURFACE PROPERTIES

INPUT STEADY STATE POWER OUTPUT POWER

THERMAL DESIGN

SGLS TRANSPONDER 243. TO 353. DEG. K

(-22. TO 176. DEG. F)

233. TO 363. DEG. K (-40. TO 194. DEG. F)

243. TO 353. DEG. K

(~22. TO 176. DEG. F)

243. TO 353. DEG. K (~22. TO 176. DEG. F)

8.4 CENTIMETERS INCHES

116.5 SQ. INCHES 751.9 SQ. CENTIMETERS * 82.3 CU. INCHES 1348.7 CU. CENTIMETERS

> 1.2 POUNDS .5 KILOGRAMS *

4.9 POUNDS 43-2.2 KILOGRAMS # EMISSIVITY = 0.90 ALPHA = 0.90

36.4 WATTS **AT 28 VDC

2.0 WATTS ## PASSIVE PASSIVE 4

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 MOUNITNES, 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 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. ****************************

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 PHONE 602-949-2471 EXTENSION MR. C.L. MAVITY THE MSX-2015 TRANSPONDER IS BASICLLY THE MSR-101/MST-201 TRANS-PONDER 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 IDEN-TICAL 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 TPANSPONDER HAS TWO PACKAGES SEPERATING THE RECEIVER AND TRANS-MITTER.

AVIONICS SYSTEM

COMMUNICATION SUBSYSTEM

TPM 6 MSX-501s S-BAND MOTOROLA INC. DESIGN OPERATING CASE TEMPERATURE

243. TO 353. DEG. K (-22. TO 176. DEG. F)

SGLS TRANPSONDER

NON-OPERATING AND STORAGE CASE TEMPERATURE

233. TO 363. DEG. K

(-40. TO 194. DEG. F) 243. TO 353. DEG. K

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

(-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 3.3 INCHES

LENGTH 4.3 # WIDTH 5.8 * HEIGHT PACKAGE AREA 751.9 SQ. CENTIMETERS #

116.5 SQ. INCHES

PACKAGE VULUME

1348.7 CU. CENTIMETERS

82.3 CU. INCHES

CASE MATERIAL CASE WEIGHT

ALUMINUM

.5 KILOGRAMS # 1.2 POUNDS

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

TOTAL WEIGHT

5.0 WATTS ## * PASSIVE

THERMAL DESTON 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-2015 TRANSPONDER THE ONLY EXCEPTION IS THE MSX-501S HAS A 5 WATTS RE POWER OUTPUT WHERE AS THE MSX-2015 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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM COMMUNICATION SUBSYSTEM ************************* RECEIVER. TR-36 TRANSPONDER CUBIC CORPORATION 239. TO 344. DEG. K DESIGN OPERATING CASE TEMPERATURE (-30° TO 160° DEG° F) 233. TO 344. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-40. TO 160. DEG. F) 250. TO 333. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-10. TO 140. DEG. F) 239. TO 344. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-30 TO 160 DEG F) PACKAGE SHAPE RECTANGULAR 5.6 CENTIMETERS PACKAGE SIZE * LENGTH 16.0 * WIDTH 26.4 * HEIGHT 6.3 * WIDTH 10.4 * HEIGHT 2.2 INCHES LENGTH 204.5 SU. INCHES 1319.5 SQ. CENTIMETERS * PACKAGE AREA 11 144.1 CU. INCHES 2362.1 CU. CENTIMETERS PACKAGE VOLUME CASE MATERIAL ALUMINUM 1.0 POUNDS .5 KILOGRAMS * CASE WEIGHT 2.3 KILOGRAMS * 5.1 POUNDS TOTAL WEIGHT ALPHA = 0.900 * EMISSIVITY = 0.90 SURFACE PROPERTIES 6.5 WATTS ## 28 VDC AND 225 MA INPUT STEADY STATE POWER 0.0 WATTS ## OUTPUT POWER * PASSIVE PASSIVE THERMAL DESIGN PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS NON MISSION ON-TIMES *PRE! AUNCH 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. RECEIVER HAS PASSIVE COOLING BY CONDUCTION THRU MOUNTING SUR-FACE, 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. ************************* 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 PHONE 714-277-6780 EXTENSION MR. R. M. TEMPELTON 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, BASE-BAND 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 -12408M. 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 SYM-BOLS. THESE ARE PRESENT IN THE RECIEVED SIGNAL AS FSK-MODULATED 65 76,95, KHZ SUBCARRIERS. THE SUBCARRIERS ARE AM MODULATED BY THE CLOCK FREG. AND RECOVERED IN THE OUTPUT AS READ PULSES. CROSS STRAPPED PRN OUTPUTS ARE PROVIDED WHICH ACCOMODATE A 500 KHZ RANG-ING 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
                                                TRANSMITTER
                           CUBIC CORPORATION
  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
                         PTGIW # 8.15
                                       13.0 # HEIGHT
                                                        5.1 CENTIMETERS
                  LENGTH
                           8.6 # WIDTH
                                         5.1 # HEIGHT
                                                        2.0
                                                             INCHES
  PACKAGE AREA
                        919.5 SO. CENTIMETERS
                                                   142.5 SQ. INCHES
  PACKAGE VOLUME
                                               *
                                                    87.7 CU. INCHES
                       1437.5 CU. CENTIMETERS
                      ALUMINUM
  CASE MATERIAL
                                                .5 POUNDS
   CASE WEIGHT
                            .2 KILOGRAMS
                                         *
                           1.8 KILOGRAMS *
   TOTAL WFIGHT
                                               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 RE-QUIREMENTS. UNIT IS SPACE QUALIFIED AND IS USED ON A USAF PROGRAM

THE TR-36 SGLS TRANSPONDER (TRANSMITTER) IS DESIGN AND BUILT BY CURIC 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 INTER-CONNECTED 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 DAM-AGE 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

7 TR-36 TRANSPONDER CUBIC CORPORATION DESIGN OPERATING CASE TEMPERATURE

~239. TO 344. DEG. K (-30° TO 160° DEG• F)

BASEBAND ASSEMBLY

NON-OPERATING AND STORAGE CASE TEMPERATURE

233. TO 344. DEG. K

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

(-40° TO 160° DEG° F) 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

6.3 CENTIMETERS 23.1 * WIDTH 10.2 * HEIGHT PACKAGE SIZE * LENGTH

4.0 * HEIGHT 2.5 9.1 # WIDTH INCHES LENGTH

PACKAGE AREA PACKAGE VOLUME

892.3 SQ. CENTIMETERS * 138.3 SQ. INCHES 91.0 CU. INCHES 1491.2 CU. CENTIMETERS

CASE MATERIAL ALUMINUM

.5 POUNDS .2 KILOGRAMS 4

CASE WEIGHT 1.3 KILOGRAMS * 2.8 POUNDS TOTAL WEIGHT

ALPHA = 0.900 * EMISSIVITY = 0.900 SURFACE PROPERTIES

4.5 WATTS ##150 MA AT 28 VDC INPUT STEADY STATE POWER

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 BASEBAND 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.

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

PHONE 714-277-6780 EXTENSION MR R. M. TEMPELTON 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-RAN-DOM NOISE (PRN) CODE SEQUENCE. ITS OUTPUT SIGNAL IS A COMPOSITE RANGING WITH TWO PCM SURCARRIER CHANNELS OF 1.024 AND 1.700 MHZ. THE BAEBAND INPUT POWER IS A 22 TO 33 VDC AND 150 MA NOMINAL THE BASEBAND RECIEVES PCM DATA TRAINS AND BI-PHASE MOD-CURRENT. ULATES 1.024 AND 1.700 MHZ INTERNALLY GENERATED SUBCARRIER FREQUE-NCIES. 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 RETWEEN TRANSPONDER SETS.

REF. TECHNICAL DATA SHEETS ON MODEL TR-36 SGLS TRANSPONDER BY CURIC 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 VULUME 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 SURFACE AND HADIATION 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 DISSIPPATION.

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 CONSIST 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 INFORMATION SEE REFERENCE DOCUMENT.

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM

TEM 1 TWTA S-BAND WATKINS- JOHNSON DESIGN OPERATING CASE TEMPERATURE

241. TO 325. DEG. K (-25. TO 125. DEG. F)

P/N PD6400439-070

NON-OPERATING AND STORAGE CASE TEMPERATURE

236. TO 396. DEG. K

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

(-35° TO 254° DEG° F) 255. TO 311. DEG. K

0. TO 100. DEG. F) 241. TO 328. DEG. K

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

(-25° TO 130° DEG° F)

PACKAGE SHAPE RECTANGULAR

PACKAGE SIZE * LENGTH 30.5 * WIDTH 11.2 * HEIGHT 15.5 CENTIMETERS

4.4 * HEIGHT 6.1 INCHES LENGTH 12.0 * WIDTH

PACKAGE AREA PACKAGE VOLUME

CASE WEIGHT

TOTAL WEIGHT

1972.1 SQ. CENTIMETERS *

305.7 SQ. INCHES 322.1 CU. INCHES

5277.9 CU. CENTIMETERS CASE MATERIAL

ALUMINUM

1.8 KILOGRAMS 4.0 POUNDS 4

* 9.6 POUNDS 4.4 KILOGRAMS

SURFACE PROPERTIES

ALPHA = 0.90 * EMISSIVITY = 0.85

INPUT STEADY STATE POWER 82.5 WATTS ## OUTPUT POWER

22.0 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 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.

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 PHONE 303 794 5211 EXTNESION 2103

MR.B. HARMEL 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.

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM ****************************** TFM 2 MTT-201 S-BAND FM MOTOROLA INC. DESIGN OPERATING CASE TEMPERATURE 243. TO 353. DEG. K (-22. TO 176. DEG. F) 233. TO 363. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-40. TO 194. DEG. F) 243. TO 353. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-22. TO 176. DEG. F) 243. TU 353. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-22. TO 176. DEG. F) PACKAGE SHAPE RECTANGULAR 7.4 # HEIGHT 6.6 CENTIMETERS PACKAGE SIZE * LENGTH 10.9 * ₩IDTH 2.9 * HEIGHT LENGTH 4.3 # WINTH 2.6 INCHES 402.5 SQ. CENTIMETERS * 62.4 SQ. INCHES PACKAGE AREA 32.4 CU. INCHES PACKAGE VOLUME 531.3 CU. CENTIMETERS CASE MATERIAL ALUMINUM CASE WEIGHT . .5 KILUGRAMS -31 1.0 POUNDS TOTAL WEIGHT 1.0 KILOGRAMS * 2.3 POUNDS * EMISSIVITY = 0.90 SURFACE PROPERTIES ALPHA = 0.90INPUT STEADY STATE POWER 28.0 WATTS **28 +OR- 4 VDC POWER SUPPLY 2.8 WATTS ## OUTPUT POWER 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-201 S-RAND 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 FLACK PAINT. BUT CAN BE FINISH PER CUSTOMER THERMAL REQUIREMENTS. UNIT IS PACKAGED IN A MERMETICLY SEALED CASE.

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 502-949-2471 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 ISOLA TOR TO PREVENT DAMAGE BY HIGH VSWR LOADS, A DC ISOLATION OF ALL INPUTS FROM EACH OTHER AND THE CASE-AND A REVERSE POLARITY PROTECT ION BY A SERIES OF DIODES TO PROTECT AGAINST REVERSAL OF INPUT VOLTAGE PULARITY. UNIT MEETS ELECTROMAGNETIC COMPATIBILITY MIL-STD-461.

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM

TEM -3 MTT-501 S-RAND FM MOTOROLA INC.

DESIGN OPERATING CASE TEMPERATURE

243. TO 353. DEG. K (-22. TO 176. DEG. F)

NON-OPERATING AND STORAGE CASE TEMPERATURE

233. TU 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. TU 353. DEG. K

(-22. TO 176. DEG. F)

PACKAGE SHAPE RECTANGULAR

6.6 CENTIMETERS PACKAGE SIZE * LENGTH 12.4 * WIDTH 7.4 * HEIGHT

4.9 * WIDTH 2.9 * HEIGHT 2.6 INCHES LENGTH 69.0 SQ. INCHES

PACKAGE AREA PACKAGE VULUME 445.0 SQ. CENTIMETERS 36.9 CU. INCHES 605.4 CU. CENTIMETERS

CASE MATERIAL ALUMINUM

CASE WEIGHT

1.0 POUNDS .5 KILOGRAMS 4

TOTAL WEIGHT

2.3 POUNDS 1.0 KILOGRAMS *

SURFACE PROPERTIES

ALPHA = 0.90 * EMISSIVITY = 0.90

67.0 WATTS **28 +OR- 4 VDC POWER SUPPLY INPUT STEADY STATE POWER 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 * SHUTZTUG INT* TUGZORBIT ON* TUGZPAY ON THE MTT-501 S-RAND 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.

THE MTT-501 S-BAND FM TELEMETRY TRANSMITTER IS DESIGN AND BUILT BY MOTOROLA INC. GOVERMENT FLECTRONICS DIVISION 8201 E. MCDOWELL ROAD, SCOTTSDALE, ARIZONA 85252 THE DATA CONTAINED HEREIN WAS OBTAINED FROM

PHONE 602-949-2471 EXTENSION MR. C.L. MAVITY 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 ISOLAT ION OF ALL INPUTS FROM EACH OTHER AND THE CASE, AND A REVERSE POLARITY PROTECTION BY MEAN OF A SERIES OF DIDDES TO PROTECT AGAINST REVERSAL OF INPUT VOLTAGE POLARITY. UNIT MEETS ELECTRO-MAGNETIC COMPATIBILITY MIL-STD-461.

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM

TEM 4 S-BAND TRANSMITTER EMR

P/N P06400418-079 269. TO 368. DEG. K

DESIGN OPERATING CASE TEMPERATURE

25. TO 202. DEG. F)

NON-OPERATING AND STORAGE CASE TEMPERATURE

236. TO 344. DEG. K (~35. TO 160. NEG. F)

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

269. TO 311. DEG. K

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

(25° TO 100° DEG° F) 265. TO 383. DEG. K

18. TO 229. DEG. F)

PACKAGE SHAPE RECTANGULAR

12.7 CENTIMETERS PACKAGE SIZE * LENGTH 30.5 * WIDTH 19.0 * HEIGHT

LENGTH 12.0 * WIDTH 7.5 * HEIGHT 5.0 INCHES

PACKAGE AREA

2419.3 SQ. CENTIMETERS * 7374.2 CU. CENTIMETERS

375.0 SW. INCHES 450.0 CU. INCHES

PACKAGE VOLUME CASE MATERIAL

ALUMINUM

2.5 POUNDS 1.1 KILOGRAMS 4

CASE WEIGHT 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, FLURIDA 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.

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AVIONICS SYSTEM
 COMMUNICATION SUBSYSTEM
**********
                       RADIATION INC
 I S-BAND POWER AMP
                                           248. TO 343. DEG. K
 DESIGN OPERATING CASE TEMPERATURE
                                          ( -13. TO 158. DEG. F)
                                           233. TO 373. DEG. K
 NON-OPERATING AND STORAGE CASE TEMPÉRATURE
                                          ( -40. TO 212. DEG. F)
                                            248. TO 343. DEG. K
 ACCEPTANCE TEST TEMPERATURE REQUIREMENTS
                                          ( -13. TO 158. DEG. F)
                                            233. TO 363. DEG. K
 QUALIFICATION TEST TEMPERATURE REQUIREMENTS
                                          ( -40. TO 194. DEG. F)
                  TANGULAR
 PACKAGE SHAPE
                                                  2.5 CENTIMETERS
                       9.7 # WIDTH
                                    5.3 * HEIGHT
 PACKAGE SIZE * LENGTH
                                                  1.0 INCHES
                                    2.1 * HEIGHT
                       3.8 * WIDTH
               LENGTH
                                              27.8 SQ. INCHES
                    179.1 SQ. CENTIMETERS
                                          #
 PACKAGE AREA
                                               B.O CU. INCHES
                    130.8 CU. CENTIMETERS
 PACKAGE VOLUME
                  ALUMINUM
 CASE MATERIAL
                                           .2 POUNDS
                        .1 KILOGRAMS
                                    *
 CASE WEIGHT
                                    *
                                           .3 POUNDS
                        .1 KILOGRAMS
 TOTAL WEIGHT
                                     * EMISSIVITY = 0.90
                        ALPHA = 0.90
 SURFACE PROPERTIES
                          23.2 WATTS ##28 VUC POWER SOURCE.
 INPUT STEADY STATE POWER
                           7.0 WATTS ##
 OUTPUT POWER
                                 * PASSIVE
                        PASSIVE
 THERMAL DESIGN
 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 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).
 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
                                PHONE 305-727-5003 EXTENSION
 MR. J.PAUL REYNOLDS
 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.
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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.

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM

****************************** MSC

91000 SERTES 2 AMPLIFIERS 253. TO 343. DEG. K DESIGN OPERATING CASE TEMPERATURE

-4. TO 158. DEG. F) 233. TO 363. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE

(-40, TO 194, DEG, F) ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 253. TO 343. DEG. K

~4. TO 158. DEG. F)

253. TO 343. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS ~4. TO 158. DEG. F)

PACKAGE SHAPE RECTANGULAR

1.3 CENTIMETERS 6.3 * HEIGHT PACKAGE SIZE * LENGTH 10.2 * WIDTH

2.5 * HEIGHT LENGTH 4.0 4 WIDTH .5 INCHES

PACKAGE AREA 171.0 SQ. CENTIMETERS 4 26.5 SQ. INCHES PACKAGE VOLUME 81.9 CU. CENTIMETERS ** 5.0 CU. INCHES

CASE MATERIAL ALUMINUM

.3 POUNDS CASE WEIGHT .1 KILOGRAMS ₩.

.3 KILOGRAMS # .6 POUNDS TOTAL WEIGHT

ALPHA = 0.90 * EMISSIVITY = 0.90 SURFACE PROPERTIES

40.0 WATTS ## INPUT STEADY STATE POWER

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 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.

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

PHONE 201-469-3311 EXTENSION MR. CARL J. LUMP 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-F-5400 FOR HIGH RELIABILITY AND SPACE APPLICATIONS.

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM -P/N PD6400439-060 WAVECOM INC. REM 1 RE MULTIPLEXER 241. TO 325. DEG. K DESIGN OPERATING CASE TEMPERATURE (-25. TO 125. DEG. F) 236. TO 396. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-35° TO 254° DEG. F) 255. TO 311. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 0. TO 100. DEG. F) 241. TO 325. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-25. TO 125. DEG. F) PACKAGE SHAPE RECTANGULAR 6.3 * HEIGHT 12.7 CENTIMETERS 30.5 * WIDTH PACKAGE SIZE * LENGTH 2.5 * HEIGHT 5.0 INCHES 12.0 * WIDTH LENGTH 205.0 SQ. INCHES 1322.6 SQ. CENTIMETERS * PACKAGE AREA 2458.1 CU. CENTIMETERS 150.0 CU. INCHES PACKAGE VOLUME ALUMINUM CASE MATERIAL .8 POUNDS .4 KILOGRAMS CASE WEIGHT 3.5 POUNUS 1.6 KILOGRAMS 4 TOTAL WEIGHT * FMISSIVITY = 0.85 ALPHA = 0.90SURFACE PROPERTIES 0.0 WATTS ** INPUT STEADY STATE POWER 0.0 WATTS ## OUTPUT POWER * PASSIVE PASSIVE THERMAL DESIGN ************************* 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 RE 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

THE VIKING MULTIPLEXER IS DESIGN AND BUILT BY

FINISH PER CUSTOMER THERMAL REQUIREMENTS.

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 FQUIPMENT THAT IS PACKAGED IN THE VIKING MCA.

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM!

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. TU 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

.5 POUNDS CASE WEIGHT .S KILOGRAMS * TOTAL WEIGHT

SUPFACE PROPERTIES

INPUT STEADY STATE POWER 0.0 WATTS ** OUTPUT POWER 0.0 WATTS ## THERMAL DESTON 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 MULTIPLEXER IS A PASSIVE ELECTRONIC UNIT WITH NO POWER DISSIPA TION. THE UNIT IS DESIGN WITH A PASSIVE THERMAL CONTROL OF RADIA-TION 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.

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. ROATWRIGHT PHONE 303-794-5211 EXTENSION 3156 THE TELEMETRY S-BAND MULTIPLEXER IS AN OFF-THE-SHELF AND IN PRODUC TION 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 CHAN-NELS ARE OPERATING INDIVIDUALLY OR SIMULTANEOUSLY. UNIT IS AVAILABLE WITH A THREE CHANNEL SYSTEM BUT IT HAS A LARGER CASE AND HIGHER WEIGHT.

AVIONICS SYSTEM COMMUNICATION SUBSYSTEM

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)

55.4 CU. INCHES

PACKAGE SHAPE RECTANGULAR

8.4 CENTIMETERS 15.2 * HEIGHT PACKAGE SIZE * LENGTH - 7.1 * WIDTH

6.0 * HEIGHT 3.3 INCHES LENGTH 2.8 # WIDTH 91.7 SQ. INCHES 591.5 SQ. CENTIMETERS *

#

908.5 CU. CENTIMETERS PACKAGE VOLUME CASE MATERIAL ALUMINUM

PACKAGE AREA

1.0 POUNDS 45 CASE WEIGHT .5 KILOGRAMS 1.4 KILOGRAMS * 3.0 POUNDS TOTAL WEIGHT

ALPHA = 0.90 \Rightarrow EMISSIVITY = 0.90 SURFACE PROPERTIES

2.8 WATTS **AT 28 VOC POWER SUPPLY INPUT STEADY STATE POWER

0.0 WATTS ## OUTPUT POWER

PASSIVE * PASSIVE THERMAL DESIGN

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 THER MAL DESIGN OF CONDUCTION TO THE BOTTOM MOUNTING SURFACE AND RADIA-TION 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.

THE MCH-904 COMMAND RECEIVER/DECODER IS DESIGN AND BUILT BY MOTOROLA INC. GOVERNMENT ELECTRONICS DIVISION 8201 E. MCDOWELL ROAD, SCOTTSDALE, ARTZONA 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 EM 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.

SUBSYSTEM	PRESS	TEMP	POSITION	VOLTAGE	CURRENT	FLOW	FIGUI					
*****	· ቊ ጜ ቊ ጜ ጭ ጳ	****	***	****	***	***	***	****				
ELECTRICAL POWER		1	-	3	3	~	•	100				
PROPELLANT FEED. FILL AND DRAIN	. ~	441	~	, con-	-	•	•••	10				
PROPELLANT MANAGEMENT	-	-	æ	⊶	-	₩.	18	-				
PRESSURIZATION	17	21	4	-	-	-	4	37				
REACTION CONTROL	. 32	6	-		-		4	38				
THRUST VECTOR CONTROL	5	. 2	3	-	-	40	w	-				
FUEL CELL	5	10	- 	ea		1	-					
	************		#7 ₁₅₀		************			~_~ ~~~~~				
TOTALS	53	40	7	3	3	1	52	185				
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CONTINUOUS OPERATION OF SUBSYSTEM FROM PRELAUNCH TO LANDING.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM INSTRUMENTATION SURSYSTEM PRES I TRANSDUCER PRES. GULTON INDUSTRIES P/N PD7400081-010 DESIGN OPERATING CASE TEMPERATURE 233. TO 344. DEG. K (-40. TO 160. DEG. F) 233. TO 344. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-40. TO 160. DEG. F) 233. TO 344. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-40. TO 160. DEG. F) 233. TO 344. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-40 TO 160 DEG F) PACKAGE SHAPE NORICAL PACKAGE SIZE * LENGTH HTGIW * E.E 1.3 * HEIGHT 0.0 CENTIMETERS 1.3 * WIDTH .5 * HEIGHT 0.0 INCHES LENGTH 8.4 SQ. CENTIMETERS # PACKAGE AREA 1.3 SO. INCHES PACKAGE VOLUME ₩ 0.0 CU. CENTIMETERS 0.0 CU. INCHES CASE MATERIAL STAINLESS STEEL 0.0 POUNDS CASE WEIGHT 0.0 KILOGRAMS -25 TOTAL WEIGHT .1 KILOGRAMS th. .3 POUNDS SURFACE PROPERTIES ALPHA = 0.35 # EMISSIVITY = 0.200.0 WATTS ** INPUT STEADY STATE POWER . 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 * SHUTZTUG INT* TUGZORBIT ON* TUGZPAY 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.

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 PHONE 303-794-5211 EXTENSION 4618 MR. C. W. MCANALLY THE PRESSURE TRANSDUCER IS AN OFF-THE-SHELF AND IN PRODUCTION ITEM UNIT IS DESIGN TO OPERATE OVER THE RANGE OF U TO 4.14 N/CM SQ (0 TO 6 PSIA). UNIT IS DESIGN TO WITHSTAND PRESURE UP TO 16.56 N/CM SQ (24 PSI4) 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 PRE-SENT USED UNROARD SKYLAB AS THE PRESSURE MEASUREMENT OF THE MULTI-PUL DOCKING ADAPTOR (MDA).

REF. PD7400081 TRANSDUCER PRESSURE. ABSOLUTE MARTIN MARIETTA CORP-ORATION DENVER DIVISION.

AVIONICS SYSTEM

PACKAGE AREA

INSTRUMENTATION SUBSYSTEM

PRES 2 TRANSDUCER PRES. P/N PD74S0041-011 BALDWIN-LIMA 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) 236. TO 394. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-35° TO 250° DEG° F) 236. TO 394. DEG. K

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

(-35° TO 250° DEG° F) CYLINDRICAL

12.6 SQ. INCHES

2.7 CU. INCHES

PACKAGE SHAPE PACKAGE SIZE * LENGTH 8.9 # WIDTH

0.0 CENTIMETERS 1.3 * HEIGHT LENGTH 3.5 # WIDTH .5 * HEIGHT 0.0 INCHES 81.1 SQ. CENTIMETERS *

PACKAGE VOLUME 45.0 CU. CENTIMETERS CASE MATERIAL STAINLESS STEEL

45 0.0 POUNDS CASE WEIGHT 0.0 KILOGRAMS * 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 PRESSURE TRANSDUCER IS A PASSIVE UNIT WITH NO POWER DISSIPA-TION. UNIT IS MAINTAINED WITHIN THE ABOVE TEMPERATURE RANGE BY RADIATION TO ENVIRONMENT AND CONDUCTION TO MOUNTING. UNIT HAS A STAINLESS STEFL 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.

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 PRODUC TION UNIT. UNIT IS DESIGN TO OPERATE OVER VARIOUS PRESSURE RANGES WITH THE MAXIMUM BEING 0 TO 345 N/CM SQ (0 TO 500 PSIA). TRANSDU-CER 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.

AVIONICS SYSTEM INSTRUMENTATION SUBSYSTEM *** GENISCO TECH CORP. P/N PD74S0048-003 PRES 3 TRANSDUCER PRES. 144. TO 422. DEG. K DESIGN OPERATING CASE TEMPERATURE (-200. TO 300. DEG. F) 144. TO 422. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-200 TO 300 DEG. F) ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

144. TO 422. DEG. K (-200. TO 300. DEG. F) 144. TO 422. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-200. TO 300. DEG. F)

PACKAGE SHAPE CYLINDRICAL

1.5 * HEIGHT 0.0 CENTIMETERS PACKAGE SIZE * LENGTH 6.6 * WIDTH INCHES 6 # HEIGHT 0.0 2.6 A MIDTH LENGTH

12.1 SQ. INCHES 77.8 SQ. CENTIMETERS * PACKAGE AREA 4 2.9 CU. INCHES PACKAGE VOLUME 48.2 CU. CENTIMETERS

CASE MATERIAL STAINLESS STEEL

0.0 POUNDS 4 CASE WEIGHT 0.0 KILOGRAMS .2 KILOGRAMS * .5 POUNDS TOTAL WEIGHT

* EMISSIVITY = 0.20 SURFACE PROPERTIES ALPHA = 0.35

0.0 WATTS ## INPUT STEADY STATE POWER OUTPUT POWER 0.0 WATTS ##

PASSIVE * PASSIVE THERMAL DESIGN

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 THER-MAL RADIATION AND CONDUCTION TO ITS ENVIRONMENT. THE UNIT STAIN-LESS STEEL CASE IS NOT PAINTED OR FINISH IN ANY SPECIAL WAY OTHER THAN STANDARD STAINLESS STEFL FINISH.

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 (n TO 300 PSIA). UNIT IS DESIGN TO WITHSTAND A PRE-SSURE OF 150 PRECENT OF ITS RATED FULL SCALE PRESSURE FOR 10 SEC-ONDS 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.

AVIONICS SYSTEM

INSTRUMENTATION SUBSYSTEM

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P/N PD7400085-010 PRES 4 TRANSDUCER PRES. GULTON INDUS. INC. 269. TO 311. DEG. K DESIGN OPERATING CASE TEMPERATURE

25. TO 100. DEG. F)

236. TO 344. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE

(-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

0.0 CENTIMETERS 1.5 * HEIGHT PACKAGE SIZE * LENGTH 8.6 * WIDTH 0.0 INCHES

.6 * HEIGHT . LENGTH 3.4 * WIDTH 97.3 SQ. CENTIMETERS # 15.1 SQ. INCHES

PACKAGE AREA 63.0 CU. CENTIMETERS 3.8 CU. INCHES PACKAGE VOLUME

CASE MATERIAL STAINLESS STEEL

0.0 POUNDS CASE WEIGHT 0.0 KILOGRAMS * .6 POUNDS TOTAL WEIGHT

.3 KILOGRAMS * ALPHA = 0.350 * EMISSIVITY = 0.200 SURFACE PROPERTIES

0.0 WATTS ## INPUT STEADY STATE 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 YES MISSION ON-TIMES * SHUT/TUG INT* TUG/OPBIT ON* TUG/PAY THE DIFFERENTIAL PRESSURE TRANSDUCER IS A PASSIVE UNIT. IT IS DE-SIGN TO INDICATE A PRESSURE DIFFERENCE OF + TO - 3.45 N/CM SQ (+ TO -5.0 PSID). UNIT HAS NO REAL POWER DISSIPATION AND ITS TEMPERA TURE 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 PRESSURF TRANSDUCER IS DESIGN AND BUILT BY GULTON INDUSTRIES INC. SERVONIC/INSTRUMENTATION DIVISION 1644 WHITTIFR AVENUE COSTA MESA, CALIFORNIA 92627

THE DATA CONTAINED HEREIN WAS OBTAINED FROM

PHONE 303-794-5211 EXTENSION 3156 MR. J. F. BOATWRIGHT 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 TITE WHICH IS EXPECTED TO BE FLOWN SOMETIME DURING THE FIRST PART OF 1974.

THERMAL REQUIREMENTS: PHYSICAL CHARACTERISTICS: AND CONSTRAINTS

AVIONICS SYSTEM INSTRUMENTATION SUBSYSTEM

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TEMP 1 TRANSDUCER TEMP HY-CAL ENGINEERING DESIGN OPERATING CASE TEMPERATURE

P/N PD7400082-009 148. TO 423. DEG. K (-193. TO 302. DEG. F)

NON-OPERATING AND STORAGE CASE TEMPERATURE

155. TO 409. DEG. K

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

(-180. TO 277. DEG. F) 148. TO 423. DEG. K

QUALIFICATION TEST TEMPERATURE REQUIREMENTS

(-193. TO 302. DEG. F) 148. TO 423. DEG. K

(-193, TO 302, DEG, F)

PACKAGE SHAPE RECTANGULAR

.3 CENTIMETERS PACKAGE SIZE * LENGTH 2.0 * WIDTH 2.0 # HEIGHT .A * HEIGHT • l INCHES

LENGTH HTGIW # 8.

1.6 SQ. INCHES

PACKAGE AREA PACKAGE VOLUME 10.3 SQ. CENTIMETERS ₩ . .1 CU. INCHES 1.0 CU. CENTIMETERS

STAINLESS STEEL

CASE MATERIAL CASE WEIGHT

0.0 POUNDS 0.0 KILOGRAMS 45 .O KILOGRAMS .1 POUNDS

TOTAL WEIGHT SURFACE PROPERTIES

ALPHA = 0.35 * EMISSIVITY = 0.20

INPUT STEADY STATE POWER

0.0 WATTS ## 0.0 WATTS ##

OUTPUT POWER THERMAL DESTON

PASSIVE 4 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 PADIATION AND CONDUCTION. UNIT CASE IS STAIN-LESS 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

PHONE 303-794-5211 EXTENSION 4618 MR. C. W. MCANALLY 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.

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. 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.

AVIONICS SYSTEM INSTRUMENTATION SURSYSTEM *********************** ROSEMOUNT ENGR. CU P/N PD7450030-503 3 TRANSDUCER TEMP. 266. TO 311. DEG. K DESIGN OPERATING CASE TEMPERATURE 20. TO 100. DEG. F) 236. TO 344. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-35. TO 160. DEG. F) 266. TO 311. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (20. TO 100. DEG. F) 266. TO 311. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (20. TO 100. DEG. F) PACKAGE SHAPE CYLINDRICAL .8 * HEIGHT 0.0 CENTIMETERS PACKAGE SIZE * LENGTH 5.8 * WIDTH .3 # HEIGHT 0.0 INCHES 2.3 * WIDTH LENGTH 31.6 SQ. CENTIMETERS * 4.9 SQ. INCHES PACKAGE AREA .7 CU. INCHES PACKAGE VOLUME 10.7 CU. CENTIMETERS STATNLESS STEFL CASE MATERIAL 0.0 KILOGRAMS # 0.0 POUNDS CASE WEIGHT .3 KILOGRAMS * .6 POUNDS TOTAL WEIGHT ALPHA = 0.35 * EMISSIVITY = 0.20 SURFACE PROPERTIES 0.0 WATTS ** INPUT STEADY STATE POWER 0.0 WATTS ## OUTPUT POWER PASSIVE # PASSIVE THERMAL DESIGN 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 SENSI-TIVE ELEMENT IS THERMALY ISOLATED FROM THE UNIT BODY. THE UNIT THERMAL DESIGN IS TO RADIATE AND CONDUCT TO THE SURROUNDING. TRANS DUCER 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 RY 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 OFSIGN 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.

THERMAL REQUIREMENTS, EPHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM INSTRUMENTATION SUBSYSTEM ************************ P/N PD74S0025-502 TEMP 4 TRANSDUCER TEMP. ROSEMOUNT ENGR. CO DESIGN OPERATING CASE TEMPERATURE 219. TO 355. DEG. K (-65. TO 180. DEG. F) 219. TO 355. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE (-65. TO 180. DEG. F) 219. TO 355. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (-65. TO 180. DEG. F) 219. TO 355. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS (-65. TO 180. DEG. F) PACKAGE SHAPE CYLINDRICAL 1.0 * HEIGHT 0.0 CENTIMETERS PACKAGE SIZE * LENGTH 5.8 # WIDTH 0.0 INCHES .4 # HEIGHT LENGTH 2.3 * WIDTH 6.8 SQ. INCHES 43.8 SQ. CENTIMETERS 45 PACKAGE AREA 1.2 CU. INCHES PACKAGE VOLUME 18.9 CU. CENTIMETERS STAINLESS STEEL CASE MATERIAL 0.0 POUNDS CASE WEIGHT 0.0 KILOGRAMS * .3 KILOGRAMS * TOTAL WEIGHT .6 POUNDS SURFACE PROPERTIES ALPHA = 0.35 * EMISSIVITY = 0.200.0 WATTS ** INPUT STEADY STATE POWER 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 PASSIVE UNIT WITH NO REAL POWER DISSIPATION. UNIT HAS A PRORE 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 RADI-ATE TO THE SURROUNDINGS. UNIT IS MADE FROM STAINLESS STEEL AND IS NOT PAINTED. TRANSDUCER IS SPACE QUALIFIED AND FLOWN ON SEVERAL TITAN VEHICLES

************************* 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 PROPEL-LANT TEMPERATURE. TRANSDUCER IS SPACE QUALIFIED AND IS SPACE FLOWN ONBUARD 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 HYDPAZINE AND UDMH.

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

THERMAL REQUIREMENTS. PHYSICAL CHARACTERISTICS. AND CONSTRAINTS

AVIONICS SYSTEM INSTRUMENTATION SUBSYSTEM **********

CURR 1 SHUNTS-CURRENT MARTIN MARIETTA DESIGN OPERATING CASE TEMPERATURE

MMC STD. 92018 223. TO 378. DEG. K

NON-OPERATING AND STORAGE CASE TEMPERATURE

(-58. TO 221. DEG. F) 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)

RECTANGULAR PACKAGE SHAPE

3.3 * HEIGHT 4.3 CENTIMETERS PACKAGE SIZE * LENGTH 5.1 * WIDTH 1.3 * HEIGHT 1.7 HTGIW # 0.S INCHES LENGTH

PACKAGE AREA

105.9 SQ. CENTIMETERS 72.4 CU. CENTIMETERS

16.4 SQ. INCHES 4.4 CU. INCHES

PACKAGE VOLUME CASE MATERIAL .

FIBERGLASS

0.0 POUNDS 0.0 KILOGRAMS

.3 POUNDS

CASE WEIGHT TOTAL WEIGHT

.1 KILOGRAMS

 \Rightarrow EMISSIVITY = 0.9

SURFACE PROPERTIES INPUT STEADY STATE POWER

ALPHA = 0.90.0 WATTS ##

OUTPUT POWER

0.0 WATTS **

THERMAL DESIGN

PASSIVE * PASSIVE

PHYSICAL CHARACTERISTICS AND CONSTRAINTS REMARKS NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT YES* REENTRY 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. **************************

THE INSTRUMENT SHUNIS 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.

***	***	***	***	***	***	##
EQUIPMENT ITEM		QUANITY	WEIGHT (POUNDS)	POWER (WATTS)	VOLUME (CU FT.)	##.
FUEL CELL POWER PLANT	#	1	36.	1500.	1.13	
BATTERY SILVER ZINC	4.4	1	10 .	560.	.12	
POWER DISTRIBUT	LION	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.

THERMAL REQUIREMENTS. PHYSICAL CHAPACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM ELECTRICAL POWER SUBSYSTEM *************** PRATT AND WHITNEY FC 1 TUG FUEL CELLS DESIGN OPERATING CASE TEMPERATURE 278. TO 355. DEG. K 40. TO 180. DEG. F) 273. TO 394. DEG. K NON-OPERATING AND STORAGE CASE TEMPERATURE 32. TO 250. DEG. F) 278. TO 355. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS 40. TO 180. DEG. F) 278. TO 355. DEG. K (40. TO 180. DEG. F) QUALIFICATION TEST TEMPERATURE REQUIREMENTS RECTANGULAR PACKAGE SHAPE 36.8 * WIDTH 16.0 * HEIGHT 30.7 CENTIMETERS PACKAGE SIZE * LENGTH 6.3 * HEIGHT 12.1 INCHES 14.5 * WIDTH LENGTH 4426.2 SQ. CENTIMETERS * 686.1 SQ. INCHES PACKAGE AREA 4 1105.3 CU. INCHES 18113.2 CU. CENTIMETERS PACKAGE VOLUME CASE MATERIAL ALUMINUM 3.3 POUNDS 1.5 KILOGRAMS # 1 CASE WEIGHT 15.0 KILOGRAMS * 33.0 POUNDS TOTAL WEIGHT ALPHA = 0.20 * EMISSIVITY = 0.05 SURFACE PROPERTIES 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 0.0 WATTS ** OUTPUT POWER THERMAL DESIGN ACTIVE * ACTIVE PHYSICAL CHAPACTERISTICS AND CONSTRAINTS REMARKS NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF.

MISSION ON-TIMES * SHUT/TUG ON* TUG/ORBIT ON* TUG/PAY 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 ACT-IVF 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 OPERAT-ING TEMPERATURE. THE LIMITING FACTOR ON THE LOW END OF THE TEMP-RATURE RANGE IS THE FREEZING POINT OF WATER.

****************** 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 PHONE 203-565-2764 EXTENSION MR. L. M. HANDLEY 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 AD-VANCE 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 OPERAT-ING 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 KFFP 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.

THERMAL REQUIREMENTS, PHYSICAL CHARACTERISTICS, AND CONSTRAINTS AVIONICS SYSTEM ELECTRICAL POWER SUBSYSTEM ******************************* 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) 273. TO 366. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS 32. TO 200. DEG. F) PACKAGE SHAPE RECTANGULAR PACKAGE SIZE * LENGTH 36.8 * WIDTH 50.8 * HEIGHT 33.0 CENTIMETERS 14.5 * WIDTH 20.0 * HEIGHT 13.0 LENGTH 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 O. 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 ELECTRO-LYTE 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 OPERA-TION. 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.

BAT 1 25 AH PRI. BATTERY ELECTRIC STORAGE 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

22.4 * HEIGHT 18.3 CENTIMETERS 34.3 * WIDTH PACKAGE SIZE * LENGTH 7.2 INCHES 8.8 * HEIGHT

13.5 # WIDTH LENGTH 3604.6 SQ. CENTIMETERS * 558.7 SQ. INCHES PACKAGE AREA ₩ 855.4 CU. INCHES 14016.8 CU. CENTIMETERS

PACKAGE VOLUME MUINATIT CASE MATERIAL

CASE WEIGHT

3.6 POUNDS 1.6 KILOGRAMS * 36.0 POUNDS

16.3 KILOGRAMS * TOTAL WEIGHT ALPHA = 0.448 * EMISSIVITY = 0.129SURFACE PROPERTIES

INPUT STEADY STATE POWER . . 0.0 WATTS **AT 28 VDC

10. AMP (WATTS AT AMPS-LOAD TA 8.S 1. AMP, 28. ΔT

0.0 WATTS ** OUTPUT POWER

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 RADIA-TION 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 VOLT-AGE 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 TRAN-SIENT 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.

THERMAL REQUIREMENTS. PHYSICAL CHARACTERISTICS. AND CONSTRAINTS

AVIONICS SYSTEM ELECTRICAL POWER SUBSYSTEM ******************************* 2 165 AH PRI BATTERY EAGLE-PICHER INDUS P/N PD9400033-001 DESIGN OPERATING CASE TEMPERATURE 253. 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) 283. TO 300. DEG. K ACCEPTANCE TEST TEMPERATURE REQUIREMENTS (50. TO 80. DEG. F) 257. TO 320. DEG. K QUALIFICATION TEST TEMPERATURE REQUIREMENTS 3. TO 117. DEG. F) PACKAGE SHAPE RECTANGULAR 21.3 CENTIMETERS PACKAGE SIZE * LENGTH 41.7 * WIDTH 22.1 * HEIGHT 8.7 * HEIGHT 16.4 * WIDTH 8.4 INCHES LENGTH 4561.5 SQ. CENTIMETERS * PACKAGE AREA 707.0 SQ. INCHES PACKAGE VOLUME 19640.1 CU. CENTIMETERS 1198.5 CU. INCHES

CASE MATERIAL MAGNESIUM 3.6 KILOGRAMS * 7.9 POUNDS CASE WEIGHT

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 DESTON PASSIVE PASSIVE

************************* PHYSICAL CHAPACTERISTICS 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 PADIATION FROM THE OTHER SURFACES. UNIT IS PAINTED WITH A BLACK PAINT BUT CAN BE FINISH PER CUSTOMER THER-MAL 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

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-HP 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.

THERMAL REQUIREMENTS, PHYSICAL CHAPACTERISTICS, AND CONSTRAINTS

AVIONICS SYSTEM
ELECTRICAL POWER SUBSYSTEM

BAT 3 15 AMP-HR BATTERY LEAGLE PICHER DESIGN OPERATING CASE TEMPERATURE

283. TO 366. DEG. K

P/N PD9450028

NON-OPERATING AND STORAGE CASE TEMPERATURE

50. TO 200. DEG. F) 239. TO 325. DEG. K

(-30. TO 125. DEG. F) 283. TO 366. DEG. K

ACCEPTANCE TEST TEMPERATURE REQUIREMENTS

(, 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 1303.4 SQ. CENTIMETERS * 202.0 SQ. INCHES

PACKAGE AREA
PACKAGE VOLUME

CASE WEIGHT

DRY STORAGE.

3078.6 CU. CENTIMETERS * 18

187.9 CU. INCHES

CASE MATERIAL STATNLESS STEEL

2.7 KILOGRAMS # 6.0 POUNDS 8.6 KILOGRAMS # 19.0 POUNDS

TOTAL WEIGHT 8.6 KILOGRAMS * 19.0 SURFACE PROPERTIES ALPHA = 0.900 * EMISS

SURFACE PROPERTIES ALPHA = 0.900 * EMISSIVITY = 0.900 INPUT STEADY STATE POWER 0.0 WATTS ** 25 TO 32 VOC

62.5 AT 625, LOAD 96.0 AT 960. LOAD(WATTS AT WATTS LOAD OUTPUT POWER 0.0 WATTS **

OUTPUT POWER 0.0 WATTS **
THERMAL DESIGN PASSIVE * PASSIVE

PHYSICAL CHAPACTERISTICS AND CONSTRAINTS REMARKS
NON MISSION ON-TIMES *PRELAUNCH YES* ASCENT OFF* REENTRY OFF
MISSION ON-TIMES * SHUTZTUG ON* TUGZORBIT ON* TUGZPAY ON

THE ABOVE 15 AMP-HR BATTERY IS ONLY CAPABILITY DATA BASED ON AN FXISTING 4 AMP-HR BATTERY. THE UNIT WILL HAVE PASSIVE THERMAL CONTPOL 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

FRY DISCHARGE POWER GENERATED AS INTERNAL HEAT. BATTERY TEMPERA-TURE RANGE IS BASED ON UNIT BEING USED ONCE.

本价格的 TANGE 13 DASED ON ONE DELING OSED ONCE #

THE 15 AMP-HR WET 2RV 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 DEVELOPMENT 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 OPERATING 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
TUPE OF 93.3 DEG. C (200 DEG. F). FOR LONG BATTERY LIFF UNIT
SHOULD BE MAINTAINED BELOW 52 DEG. C(125 DEG F) FOR OPERATING

REF. EAGLE PITCHER TECHNICAL DATA SHEETS OF 26 APRIL 1973 EPP-0473 175/GMC AND PD9450028 4 AMP-HR 28 V PRIMARY BATTERY MMC.

TEMPERATURE AND BETWEEN 1 AND 10 DEG. C (30 AND 50 DEG. F) DURING

II.

SPACE TUG THERMAL CONTROL
EQUIPMENT THERMAL REQUIREMENTS CATALOGUE

NATIONAL AERONAUTICS AND SPACE ADMINSTRATION

MARSHALL SPACE FLIGHT CENTER

PREPARED FOR

UNDER CONTRACT NAS 8-29670

ВY

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.

EQUIPMENT THERMAL REQUIREMENTS CATALOGUE GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM EQUIPMENT ITEM INERTIAL MEASUREMENT UNITS

	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN	POWER WATTS	MISSION PH	ASE THERMAL	REQUIREM	ENTS AND TI	EMPERATURE			REMARKS	
	-	GROUND/	MIN/	PRELAUNCH	SHUTTLE	ı	MANEUVERS		REENTRY			
		ORBITAL	ХДМ			SHUTTLE TUG	TUG ORBITAL	PAYLOAD Tug	AND LANDING		. `	

IMU 1	CAROUSEL 58	ACTIVE	116/	YES	YES	ON	ON	ON	OFF		TO LAUNCH	FOR
	DELCO ELECTRONICS	PASSIVE	189	288/319	288/319	288/319	288/319	288/319		CHECKOUT	AND STAB	
				(60/115)	(60/115)	(60/115)	(60/115)	(60/115)	(-35/160)		•	
JMU 2	NIS 200 .	ACTIVE	. 7:0/	YES	YES	ON	ON	ON	OFF	ON PRIOR	TO LAUNCH	FOR
	NORTHOP CORP ELEC	PASSIVE	70	219/344	219/344	219/344	219/344	219/344	219/347	CHECKOUT	AND STAB	
				(-65/160)	(-65/160)	(-65/160)	(-65/160)	(-65/160)	(-65/165)			
IMU 3	VIKING IRU	ACTIVE	50/	YES	YES	0N	ON	ON	OFF	ON PRIOR	TO LAUNCH	FOR
	HAMILTON STANDARD	PASSIVE	95	324/330	324/330	324/330	324/330	324/330	235/324	CHECKOUT	AND STAB	
				(125/135)	(125/135)	(125/135)	(125/135)	(125/135)	(-35/125)			
IMU 4	MICHON ESG	ACTIVE	50/	YES	YES	ON	ON	ON	OFF	ON PRIOR	TO LAUNCH	FOR
	AUTONETICS RI	ACTIVE	50	219/344	219/344	219/344	219/344	219/344	210/368	CHECKOUT	AND STAB	
				(-65/160)	(-65/160)	(-65/160)	(-65/160)	(-65/160)	(-80/203)			
TMU 5	H478 STRAPDOWN IMU	PASSIVE	30/	YE5	YES	ON	ON	ON	OFF	ON PRIOR	TO LAUNCH	FOR
4 .70	HONEYWELL	PASSIVE	230	236/335	236/335	236/335	236/335	236/335	224/366	CHECKOUT	AND STAB	
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	, - 40		(-34/145)	(-34/145)	(-34/145)	(-34/145)	(-34/145)	(-55/200)			
TMU 6	H-448 AGENA IMU	ACTIVE	135/	YES	YES	ON	ON	ON	OFF	ON PRIOR	TO LAUNCH	FOR
	HONEYWELL	ACTIVE	275	269/322	269/322	269/322	269/322	269/322	255/344	CHECKOUT	AND STAB	
				(25/120)	(25/120)	(25/120)	(25/120)	(25/120)	(0/160)			
IMU 7	HEXAD IMU	ACTIVE	198/	YES	YES	ON	ON	ON	OFF	ON PRIOR	TO LAUNCH	FOR
	HONEYWELL	ACTIVE	305	288/333	288/333	288/333	288/333	288/333	263/344	CHECKOUT	AND STAB	
		,		(60/140)	(60/140)	(60/140)	(60/140)	(60/140)	(15/160)			
IMU 8	BLOCK 5D STRAPDOWN	PASSIVE	36/		YES	ON	ON	ON	OFF	ON PRIOR	TO LAUNCH	FOR
-	HONEYWELL	PASSIVE	43	304/308	304/308	304/308	304/308	304/308	272/344	CHECKOUT	AND STAB	
				(88/ 95)	(88/95)	(88/ 95)	(88/ 95)	(88/ 95)	(30/160)			
IMU 9	H-319 CENTAUR IRU	PASSIVE	90/	YES	, YES	ON	ON	ON	OFF		TO LAUNCH	FOR
	HONEYWELL	PASSIVE	170	277/322	277/322	277/322	277/322	277/322	238/344	CHECKOUT	AND STAB	
					(40/120)		(40/120)	(40/120)	(-30/160)		·	
IMU 9	H-319 CENTAUR SEU	PASSIVE	30/	YES	YES	ON	ON	ON	OFF		TO LAUNCH	FOR
	HONEYWELL	PASSIVE	30	277/322	277/322	277/322	277/322	. 277/322	238/344	CHECKOUT	AND STAB	
	·			(40/120)	(40/120)							
IMUlo	DIGS IMU	ACTIV	100/	YES	YES	ON	ON	ON	OFF		TO LAUNCH	FOR
	HAMILTON STANDARD	PASSIVE	195	305/333	305/333	305/333	305/333	305/333	266/344	CHECKOUT	AND STAB	
			_	(90/140)	(90/140)	(90/140)	(90/140)					
IMU11	RSD JMU	PASSIVE	144/	YES	YES	ON	ON	ON	OFF		TO LAUNCH	FOR
	HAMILTON STANDARD	PASSIVE	144	305/333	305/333	305/333	305/333	305/333	219/344	CHECKOUT	AND STAB	
				(90/140)	(90/140)	(90/140)	(90/140)	(90/140)	(~65/160)			
IMU12	SKN-2400 INU	ACTIVE	#50 /	YES	YES	ON	ON	ON	OFF	ON PRIOR	TO LAUNCH	FOR
	SINGER COMPANY	ACTIVE	160	218/344	218/344	218/344	218/344	218/344	210/368		AND STAB	
		·	=	(-67/160)	(-67/160)	(-67/160)	(-67/160)	(-67/160)	(~80/203)			
IMU13	KT-70 IMU	ACTIVE	392/	YES	YES	ON	ON	ON	OFF	ON PRIOR	TO LAUNCH	FOR
	SINGER COMPANY	ACTIVE	120	218/344	218/344	218/344	218/344	218/344	218/344	CHECKOUT	AND STAB	
				(-67/160)	(-67/160)	(-67/160)	(-67/160)	(-67/160)	(-67/160)			

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EQUIPMENT THERMAL REQUIREMENTS CATALOGUE

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM RATE GYROS

							**					
REF.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/	POWER WATTS MIN/			LVIN / (FA	ENTS AND TO HRENHEIT) - MANEUVERS			RI	EMARKS	_ _ _ _ _ _ _ _ _
		ORBITAL	MAX	PRELAUNCH	CARRY	SHUTTLE TUG	TUG ORBITAL	PAYLOAD TUG	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)	0N 233/315 (-40/109)	OFF 233/347 (-40/165)	ON DURING CHECKOUT	PHELAUNCH	FOR

EQUIPMENT THERMAL REQUIREMENTS CATALOGUE GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM STAR TRACKERS

REF.	DESCRIPTION AND MANUFACTURE	THERMAL	POWER WATTS	MISSION PH	ASE THERMA	L REQUIREM	ENTS AND T	EMPERATURE	LIMITS	REMARKS
	THIS POLICE	GROUND/	MINZ	PRELAUNCH	SHUTTIE		MANEUVERS	- MIN / MA		
		ORBITAL	MAX	THELFAUTON	CARRY	SHUTTLE	TUG	PAYLOAD	REENTRY	
:.	·	~~~~~~		*****	*****	TUG	OKBIIAL	TUG	LANDING	**==***
ST 1	CT-401 SENSOR	PASSIVE	5/	YES	OFF	OFF	TAIT	INT	٥٠٠	AN BUDING BUT Allines PA
	BARC	PASSIVE	5	263/323	243/333	243/333	243/122	243/323	243/333	ON DURING PRELAUNCH FO
		, 43311	,	(14/122)				(-22/122)		CHECKOUT
ST 2	STAR TRACKER	PASSIVE	3/	YES	0FF	0FF	INT	INT	(-22/140) OFF	ALL BURTHS BBC Alman Ca
	HONEYWELL	PASSIVE	3	263/283	255/302	255/302	255/ 50	255/283	255/302	ON DURING PRELAUNCH FO
			3	(14/ 50)				(0/50)		CHECKOUT
ST 3	MMOS	PASSIVE	20/	YES	OFF	OFF.	INT	INT	OFF	ON DURING PRELAUNCH FO
	ITT GILFILLAN	PASSIVE	20	293/323	288/323	288/323	288/122	288/323	288/323	
		. 203116	2.0	(68/122)		(69/122)		(60/122)		CHECKOUT
ST 4	569B STAR TRACKER	PASSIVE	3/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FO
	EMR PHOTOELECTRIC	PASSIVE	3	243/318	218/348	218/348	218/113	218/318	218/348	CHECKOUT
			5	(~22/113)				(-67/113)		CHECKOOT
ST 5	574 STAR CAMERA	PASSIVE	4/	YES	OFF	OFF	INT	INT	0FF	ON DURING PRELAUNCH FO
	EMP PHOTUELECTRIC		4	262/313	218/343	214/343	218/104	218/313	218/343	CHECKOUT
			•	(13/104)				(-67/104)		CHECKOOT
ST 6	OAO STAR TRACKER	PASSIVE	6/	YE5	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FO
	BENDIX CORPORATION		6	244/310	238/327	238/327	238/100		238/327	CHECKOUT
			J	(-20/100)				(-30/100)		CHECKOOT
ST 7	OMA ATM STAR TRKR.	PASSIVE	18/	YES	OFF	0FF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	BENDIX CORPORATION		28	247/305	233/327	233/327	233/ 90	233/305	233/327	CHECKOUT
				(-15/ 90)				(-40/ 90)		CHECKOOT
ST A	KS-199 STAR TRKR	PASSIVE	87	YES	OFF	UFF	INT	INT	OFF	ON DURING PRELAUNCH FO
	KOLLSMAN INSTR.	PASSIVE	18	260/294	272/310	272/310	272/ 70	272/294	272/310	CHECKOUT
	• • • • • • • • • • • • • • • • • • • •							(30/ 70)		CHECKOOL

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EQUIPMENT THERMAL REQUIREMENTS CATALOGUE GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM EQUIPMENT ITEM STAR TRACKER ELECTRONICS

REF. NO.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHI PRELAUNCH	DEGREES KE	LVIN / (FA	_	EMPERATURE - MIN / MA. PAYLOAD TUG		REMARKS
STE 1	ATM STE	PASSIVE	6/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	BENDIX CORPORATION	PASSIVE	6	247/328	218/343	218/343	218/132	218/328	218/343	CHECKOUT
•				(+15/132)	(-67/158)	(-67/158)	(-40/132)	(-67/132)	(-67/158)	
STF 2	KS-199 STAR TRKR	PASSIVE	14/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH FOR
	OLLSMAN INSTR.	PASSIVE	14	260/294	272/310	272/310	272/ 70	272/294	272/310	CHECKOUT
				(-10/70)	(30/100)	(30/100)	(-40/ 70)	(30/ 70)	(30/100)	

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM HORIZON SCANNERS

REF		DESCRIPTION AND MANUFACTURE	THERMAL DESIGN	POWER WATTS MIN/	MISSION PHO PRELAUNCH	DEGREES KE	LVIN / (FA	HKENHEIT)	EMPERATURE - MIN / MA	X	REMARKS	
	·	·	GROUND/ ORBITAL	MAX	PRELAUNCH	CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING		
НS	1	HORIZON SENSOR	PASSIVE	1/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH	FOR
		QUANTIC INDUSTRIES	PASSIVE	1	255/338	233/338	233/338	233/150	233/338	233/338	CHECKOUT	
					(0/150)	(-40/150)	(-40/150)	(-40/150)	(~40/150)	(-40/150)		
H5		HORIZON SENSOR	PASSIVE	.6/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH	FOR
		BARNES ENGR. CO.	PASSIVE	6	255/333	238/347	238/347	238/140	238/333	238/347	CHECKOUT	
		•			(0/140)	(-30/165)	(-30/165)	(-40/140)	(-30/140)	(-30/165)		
нS	3	L AHS	PASSIVE	3/	YES	OFF	0FF	INT	INT	OFF	ON DURING PRELAUNCH	FOR
		LASC	PASSIVE	3	244/335	227/338	227/338	227/145	227/335	227/338	CHECKOUT	
					(-20/145)	(-50/150)	(-50/150)	(-40/145)	(-50/145)	(-50/150)		
HS	4	NOHS	PASSIVE	3/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH	FOR
		ĹMSC	PASSIVE	3	244/335	227/338	227/338	227/145	227/335	227/338	CHECKOUT	
					(-20/145)	(-50/150)	(-50/150)	(-40/145)	(-50/145)	(-50/150)		
HS	5	DSHS	PASSIVE	14/	YES	0FF	UFF	INT	INT	OFF	ON DURING PRELAUNCH	FOR
		LMSC	PASSIVE	14	244/335	227/338	227/338	227/145	227/335	227/338	CHECKOUT	
		•	_		(-20/145)	(-50/150)	(-50/150)	(-40/145)	(-50/145)			
H5	6	MOD. IV HURIZON SYS	PASSIVE	10/	YES	OFF	OFF	INT	INT	OFF	ON DURING PRELAUNCH	FOR
		QUANTIC INDUSTRIES	PASSIVE	10	255/338 (0/150)	235/338	235/338 (-35/150)	235/150 (-40/150)	235/336	235/338	CHECKOUT	

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM HORIZON SCANNER ELECTRONICS

REF.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN	POWER WATTS	MISSION PHA			ENTS AND THE			REMARKS
		GROUND/ ORBITAL	MIN/ MAX	PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
	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
	MOD IV HORIZON ÇEU QUANTIC INDUSTRIES		5/ 5	YES 255/338 (0/150)	0FF 235/338 (-35/150)	0FF 235/338 (-35/150)	INT 235/150 (-40/150)	INT 235/338 (-35/150)	0FF 235/338 (-35/150)	ON DURING PRELAUNCH FOR CHECKOUT

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EQUIPMENT THERMAL REQUIREMENTS CATALOGUE GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM SUN SENSOR

REF.		THERMAL DESIGN	POWER WATTS	MISSION PH				EMPERATURE - MIN / MA		REMARKS
		GROUND/ ORBITAL	MIN/ MAX	PRELAUNCH	SHUTTLE CARRY		MANEUVERS	PAYLOAD TUG	REENTRY AND LANDING	
***		~~~~~				~	*****			
SS I	REFRACTOSYN SUN	PASSIVE	0/	YES	OFF	OFF	ON	ON	OFF ·	ON DURING PRELAUNCH FOR
	H H CONTROLS CO.	PASSIVE	0	253/358	253/358	253/358	253/358	253/358	253/358	CHECKOUT
				(-4/185)	(-4/185)	(-4/185)	(-4/185)	(-4/185)	(-4/185)	
SS 2	FINE SUN SENSOR AS	PASSIVE	0/	YES	OFF	OFF	ON	ON	OFF	ON DURING PRELAUNCH FOR
	RBRS	PASSIVE	. 0	253/358 -	233/373	233/373	253/358	253/358	233/373	CHECKOUT
•				(-4/185)	(-40/212)	(-40/212)	(-4/185)	(-4/185)	(-40/212)	
SS 3	DIGITAL SUN SENSOR	PASSIVE	0/	YES	OFF	OFF	ON	ON	0FF	ON DURING PRELAUNCH FOR
	ADCOLE CORPORATION	PASSIVE	0	253/318	208/358	208/358	253/318	253/318	208/358	CHECKOUT
				(-4/113)	(-85/185)	(-85/185)	(-4/113)	(-4/113)	(~85/185)	
SS 4	DIGITAL SUNSENSOR	PASSIVE	0/	YES	OFF	OFF	ON	ON	OFF	ON DURING PRELAUNCH FOR
	ADCOLE CORPORATION		o .	253/333	208/358	208/358	253/333	253/333	208/358	CHECKOUT
			•	(-4/140)	(-85/185)	(-85/185)	(-4/140)	(-4/140)	(-85/185)	

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM LASER RADARS

REF.	DESCRIPTION AND	THERMAL DESIGN	POWER WATTS	MISSION PH	ASE THERMAL					REMARKS
		GROUND/ ORBITAL	MIN/ MAX	PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	•
~ ~ ~ ~ ~ ~ ~					45-	255	-==	7.1.7	A#1:	OU SUPERIOR OFFER ALMON FOR
LR 1	SCAN LASAR RADAR	ACTIVE	30/	YES	OFF	OFF	OFF	INT	OFF	ON DURING PRELAUNCH FOR
	ITT GILFILLAN	ACTIVE	30	293/323	288/323	288/323	288/323	288/323	288/323	CHECKOUT
•				(68/122)	(60/122)	(60/122)	(60/122)	(60/122)	(60/122)	v.
LR 2	SCAN LASAR RADAR	ACTIVE	70/	YES	OFF	OFF	OFF	INT	OFF	ON DURING PRELAUNCH FOR
	ITT GILFILLAN	ACTIVE	70	293/323	288/323	288/323	288/323	288/323	288/323	CHECKOUT
				(68/122)	(60/122)	(60/122)	(60/122)	(60/122)	(60/122)	
103	SCAN LASER RADAR	ACTIVE	600/	Y£5	OFF	OFF	OFF	INT	OFF	ON DURING PRELAUNCH FOR
EK 3	ITT GILFILLAN	ACTIVE	600	293/323	288/323	288/323	288/323	288/323	288/323	CHECKOUT
•	III OIL ILLAN	MUITTE	000	(551/86)						-

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM LASER RADAR ELECTRONICS

REF.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN	POWER WATTS	MISSION PH	ASE THERMAI					REMARKS
****		GROUND/ ORBITAL	MIN/ MAX	PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
LRE 1	ELEC.LASER RADAR	PASSIVE	20/	YES	OFF	OFF	OFF	INT	OFF	ON DURING PRELAUNCH FOR
	ITT GILFILLAN	PASSIVE	20	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
	ELEC LASER RADAR ITT GILFILLAN	ACTIVE ACTIVE	30/ 30	YES 293/323	0FF 288/323	0FF 288/323	0FF 288/323	INT 288/323	OFF 288/323	ON DURING PRELAUNCH FOR CHECKOUT
-	ELEC LASER RADAR ITT GILFILLAN	ACTIVE ACTIVE	150/ 150	(68/122) YES 293/323 (68/122)	OFF 288/323	(60/122) OFF 288/323 (60/122)	0FF 288/323	TNT ESE/88S	0FF 288/323	ON DURING PRELAUNCH FOR CHECKOUT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM TELEVISION

REF.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN	POWER WATTS		EGREES KE	_VIN / (FAI	HRENHEIT) ·		X	REMARKS	
		GROUND/ ORBITAL	MIN/ MAX	PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY . AND LANDING		
TV 1	COLOR TELEVISION	PASSIVE	28/	YES	OFF .	OFF	OFF	INT	OFF	ON DURING PRELAUNC	H FOR
_	WESTINGHOUSE	PASSIVE	28	253/338 (- 4/149)	219/373 (-65/212)	219/373 (-65/212)	219/373 (-65/212)	219/338 (-65/149)	219/373 (~65/212)	CHECKOUT	
	LUNAR T.V. SYSTEM RCA	PASSIVE PASSIVE	14/	YES 263/323 (.14/122)	0FF 263/323 (14/122)	OFF 263/323 (14/122)	0FF 263/323 (14/122)	INT 263/323 (14/122)	0FF 263/323 (14/122)	ON DURING PRELAUNC CHECKOUT	H FOR

EQUIPMENT THERMAL REQUIREMENTS CATALOGUE GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM EQUIPMENT ITEM ACS ELECTRONICS

REF.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/	POWER WATTS	MISSION PHA	EGREES KE	LVIN / (FA		EMPERATURE - MIN / MA		Ri	EMARKS	
		ORBITAL	MAX		CARRY	SHUTTLE TUG	TUG ORBITAL	PAYLOAD Tug	AND LANDING			
	VALVE DRIVE AMP. MARTIN MARIETTA CO	PASSIVE PASSIVE	38/ 38	YES 235/366 (-35/200)	0FF 235/396 (-35/257)	ON 235/366 (-35/200)	ON 235/366 (+35/200)	0N 235/366 (-35/200)	0FF 235/398 (~35/257)	ON DURING	PRELAUNCH	FOR

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM COMPUTERS

	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/	POWER WATTS		ASE THERMAI DEGREES KEI	LVIN / (FA			•		REMARKS
		OPBITAL		PRELAUNCH	CARRY		TUG	PAYLOAD TUG		~~~	
COMP 1	MAGIC 352	ACT1VE	7802	YES	YES		ON	٥N	YES		TO LAUNCH FOR
	DELCO ELECTRONICS	PASSIVE	208	305/327	305/327		305/327	305/327	305/327	CHECKOUT	AND STAB
•					(90/130)						
COMP 2	MAGIC 352 DIGS		1757	YES.	YES	ON	ON	ON ·	YES		TO LAUNCH FOR
	DELCO ELECTRONICS	PASSIVE	196	253/343	253/343	253/343	253/343		253/343	CHECKOUT	AND STAB
					(-4/158)						
COMP 3	469 COMPUTER	PASSIVE	20/	YES	YES	ÖN	ON	ON	YES		TO LAUNCH FOR
	CONTROL DATA CORP.	PASSIVE	20	253/338		253/338	253/338	253/338		CHECKOUT	AND STAB
					(-4/149)						
COMP 4	469 DOUBLE DENSITY		16/	YES	YES	ON	ON	ON	YES		TO LAUNCH FOR
	CONTROL DATA CORP.	PASSIVE	16	253/338	253/338	253/338	253/J38	253/338	253/338	CHECKOUT	AND STAB
			_		(-4/149)						
COMP 5	LS-52 COMPUTER	ACTIVE	205/	YES	YES	0N	ON	ON	YES		TO LAUNCH FOR
	LEAR SIEGLER INC	ACTIVE	205	219/344	219/344	219/344	219/344	219/344	219/344	CHECKOUT	AND STAB
					(-65/160)						
COMP 6	RP-1018M COMPUTER		27/	YES	YES	ON	ON	ON	YES		TO LAUNCH FOR
	BUNKER RAMO .	PASSIVE	44	218/358	218/358	218/358	218/358	218/358	218/358	CHECKOUT	AND STAB
				(-67/185)							
COMP 7	CP-164 COMPUTER	ACTIVE	242/	YES	YES	ON	ON	ON	YES		TO LAUNCH FOR
	GENERAL ELECTRIC	ACTIVE	242	219/344		219/344	219/344		219/344		AND STAB
					(-65/160)	· -		· · · · · · · · · · · · · · · · · · ·			
COMP 8	CP-24A COMPUTER	ACTIVE	94/	YES	YES		•	0N	YES		TO LAUNCH FOR
	GENERAL ELECTRIC	ACTIVE	94	233/348	233/348	233/348	233/348	233/348			AND STAB
			2454		(-40/167)						-6
COWb à	CP-32A COMPUTER	ACTIVE	365/	YES	YES		ON		YES		TO LAUNCH FOR
	GENERAL ELECTRIC	ACTIVE	365	219/344	219/344	219/344	219/344	219/344	219/344	CHECKOOL	AND STAB
	555 554 STUDUTES	0.007./-	- 4		(-65/160)					A. 0-100	*** * * * * * * * * * * * * * * * * *
COMPIG	SCP-234 COMPUTER.		3/	YES	YES	ON	0N	ON	YES		TO LAUNCH FOR
	RCA	PASSIVE	3	263/333	263/333	263/333	263/333	263/333		CHECKOOL	AND STAB
					(14/140)						
COMP11	PAC-261 COMPUTER	PASSIVE	7002	YES	YES	ON	ON	ON	YES		TO LAUNCH FOR
	RAYTHEON COMPANY.	PASSIVE	200	219/344	219/344	219/344	219/344	219/344		CHECKOOL	AND STAB
					(-65/160)						
COMBIS	AP-101 COMPUTER	ACTIVE	340/	YES	YES	0N	NO	ON	YES		TO LAUNCH FOR
-	TBM	ACTIVE	340	219/344	219/344	219/344	219/344	219/344			AND STAB
		0.007.45	001		(-65/160)						TO 1 41/11/2015 TO 2
COW513	ADVANCE TECH COMP		80/	YES	YES	0N	ON 219/344	0N	YES		TO LAUNCH FOR
	IBM	PASSIVE	80	219/344	219/344	219/344		219/344	219/344		AND STAB
	MATEL TOOMS OF ST	0466195			(-65/160)	0N (-02\100)	. ON (-02\100)		YES		TO LAIDING TOO
COMP 14	MILLICOMPUTLER	PASSIVE	8/	YES	YES			0N 2194308			TO LAUNCH FOR
	WESTINGHOUSE	PASSIVE	8	218/398	218/398	218/398	218/398		218/398		AND STAB
				(-0//25/)	(-67/257)	1-01/2011	1-01/5311	(-01/231)	(-01/62()		

DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM COMPUTERS

	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN	POWER WATTS	MISSION PHASE THERMAL REQUIREMENTS AND TEMPERATURE LIMITS DEGREES KELVIN / (FAHRENHEIT) - MIN / MAX							REMARKS		
		GROUND/	MINZ	PRELAUNCH			MANEUVERS		REENTRY				
		ORBITAL		\$ 11.4 E/1 = 11.5	CARRY	SHUTTLE TUG		PAYLOAD TUG	AND LANDING				
				***					~~_~~~				
COMPIS	MAGIC IV COMPUTER	DACCTUE	39/	YES	YES	ON	oN	ON	YES	ON PRIOR	TO LAUNCH	FOR	
00/11/12	DELCO ELECTRONICS		39	219/344	219/344	219/344	219/344	219/344		CHECKOUT			
	DEECO RECEIRMICS	- HOOTY	39				(-65/160)			•			
COMPLA	MAGIC 362 COMPUTER	PASSIVE	58/	YES	YES.	ON	ON	ON	YES	ON PRIOR	TO LAUNCH	FOR	
CONTIO	DELCO ELECTRONICS		58	218/344	218/344		218/344	218/344	218/344	CHECKOUT			
	WELCO CERCIAMATOS	LH2214E	36	(=67/160)			(-67/160)			G., 2 -, ,			
COMPIT	MICRO-D 1808	ACTIVE	106/	YES	YES	ON	ON	ON	YES	ON PRIOR	TO LAUNCH	FOR	
COMPLI	ARMA DIV. OF AMBAC		106	219/344	219/344	219/344	219/344	219/344	219/344	CHECKOUT			
	ACHA DIVE OF ANDAC	KC114E	100	(-65/160)			(-65/160)						
COMOTR	AOP COMPUTER	PASSIVE	13/	YES	YES	00	ON	ON	YES	ON PRIOR	TO LAUNCH	FOR	
COMETO	WESTINGHOUSE	PASSIVE	13/	253/353	253/353	253/353	253/353	253/353	253/353	CHECKOUT			
•	MC 31 INGHOUSE	7716647	13				(-4/176)			011251100			
C04010	HOC. 301 COMBUTED	O. C. Tur	164	YES	YES	000	ON	ON	YES	ON POTOR	TO LAUNCH	FOR	
COMPIA	HOC+301 COMPUTER	PASSIVE	16/	219/344	219/344	219/344	219/344	219/344	219/344				
	HONEYWELL	PASSIVE	16		(-65/160)		(-65/160)			CHECKOOL	AND		
	HOS ASSESSMENTED	D. CCTUE	25.4	YES	YES	00	ON (#62)160)	ON (~63/160/	YES	ON POTOR	TO LAUNCH	END	
COMPZO	HOC-402 COMPUTER	PASSIVE	25/	_	241/324	241/324	241/324	241/324	241/324		AND STAB	1 011	
	HONEYWELL	PASSIVE	25	241/324			(-25/125)			CHECKOOL	HILD DING		
****	USA COLO TOURITER	407745			YES		ON	ON	YES	AN POTOD	TO LAUNCH	EOS	
COMPSI	HDC-601C COMPUTER	ACTIVE	160/	YES	218/344	0N 218/344	218/344	218/344	218/344		AND STAB	, 0,,	
	HONEYWELL	ACTIVE	160	218/344			(-67/160)			CHECKOOI	MAD STAD		
	1100 (A10 -A101750	407745					ON	ON (-01)1001	YES	ON PRIOR	TO LAUNCH	EDR	
COMP22	HDC-601P COMPUTER	ACTIVE	120/	YES	YES	0N			218/344		AND STAB	1 011	
	HONEAMEFF	ACTIVE	120	218/344	218/344	218/344	218/344	218/344		CHECKOOI	AND SIND		
							(-67/160)	ON (~61) 160)	YES	ON PRITOR	TO LAUNCH	500	
COMP23	HDC-602 COMPUTER	PASSIVE	170/	YES	YES	0N	ON 219/365	219/365	219/365		AND STAB	FUR	
	HONEYWELL	PASSIVE	170	219/365	219/365	219/365	513/202				AND SING		
							(-65/199)		YES	AN BOTOR	TO LAUNCH	500	
COMP24	D216 COMPUTER	PASSIVE	65/	YES	YES	ON	ON	ON 2107377	219/344		AND STAB	FUR	
	AUTONETICS R.I.	PASSIVE	65	219/344	219/344	219/344	219/344	219/344		CHECKOOT	ANU STAB		
							(-65/160)			AN COLOR	TO I ANDROLL	-0 43	
C0MP25	DIZI6 COMPUTER	PASSIVE	75/	YES	YES	ON	ON	ON	YES		TO LAUNCH	FUR	
	AUTONETICS P.I.	PASSIVE	75	219/344	219/344	219/344	219/344	219/344	219/344	CHECKOU	AND STAB		
							(-65/160)						
COMP26	0232 COMPUTER	PASSIVE	140/	YES	YES	ON	ON	ON	YES	*	TO LAUNCH	FUR	
	AUTONETICS R.I	PASSIVE	140	219/344	219/344	219/344	219/344	219/344	219/344		AND STAB		
				(-65/160)		(-65/160)	(-65/160)						
COMP27	TDY-300 COMPUTER	ACTIVE	143/	YES	YES	ON	ON	ON .	YES		TO LAUNCH	FOR	
	LEDYNE	PASSIVE	143	253/344	253/344	253/344	253/344	253/344	253/344		AND STAB		
	.			(-4/160)	(-4/160)	(-4/160)	(-4/160)	(~4/160)					
859MO	TDY-310 CENTAUR	ACTIVE '	235/	YES	YES	٥N	ON	ON	YES	ON PRIOR	TO LAUNCH	FOR	
	TELEDYNE	PASSIVE		253/333	253/333	253/333	253/333	253/333	253/333		AND STAB		
	•			(-4/140)	(-4/140)	(-4/140)	(-4/140)	(-4/140)	(-4/140)				

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EQUIPMENT THERMAL REQUIREMENTS CATALOGUE

EQUIPMENT ITEM COMPUTERS

REF.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/ ORBITAL	POWER WATTS MIN/ MAX	MISSION PHA E PRELAUNCH		.VIN / (FA	ENTS AND TE HRENHEIT) - MANEUVERS TUG ORBITAL			REMARKS
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)	0N 218/344 (-67/160)	YES 218/344 (-67/160)	

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DATA MANAGEMENT SUBSYSTEM

EQUIPMENT ITEM TAPE RECORDERS

REF.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/	POWER WATTS MIN/			L REQUIREMENTS AND T LVIN / (FAHRENHEIT) MANEUVERS		- MIN / MAX		REMARKS	
		ORBITAL	MAX		CARRY	SHUTTLE TUG	TUG ORBITAL	PAYLOAD TUG	AND LANDING		
	EREP TAPE RECORDER MARTIN MARTETTA	ACTIVE ACTIVE	187/ 187	YES 288/313	YES 288/313	ON 288/313	ON 288/313	ON 288/313	YES 288/313	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB	

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM TRANSPONDERS. PM

REF.			POWER	MISSION PH						REMARKS
NO.	MANUFACTURE.	DESIGN	WATTS					- MIN / MA		
		GROUND/	MIN/	PRELAUNCH			MANEUVERS		REENTRY	
		ORBITAL	MAX	•	CARRY	SHUTTLE	TUG	PAYLOAD	AND	•
	****			***********		TU6	ORBITAL	TUG	LANDING	
: Tom 1	S-BAND TRANSPONDER	DACCIVE	6/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FO
1111 4	PHILCO FORD CORP	PASSIVE	6	241/324	235/396	235/324	241/324	241/324	235/396	CHECKOUT
1	FHILLD FORD COMP	LM2211E	0	(-25/125)		(-35/125)	(-25/125)			CHECKOOT
TDM 2	S-BAND SGLS TRANSP	DACCIVE	2/	YES	0FF	INT	ON	. ON	0FF	ON DURING PRELAUNCH FO
IFM E	MOTOROLA INC.	PASSIVE	2	243/353	233/363	233/353	243/353	243/353	233/363	CHECKOUT
	MOTOROCE 1NC.	LM3314E	ε		(-40/194)			(-22/176)		CHECKOOI
TOM 3	S-BAND SGLS TRANSP	TVE .	31/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FO
irn J	MOTOROLA INC.	PASSIVE	31	243/353	233/363	233/353	243/353	243/353	233/363	CHECKOUT
	MOTOROLE INC.	M MOOTAE	21					(-22/176)		CHECKOOT
TDM 4	S-BAND SGLS TRANSP	PACSIVE	51/	YES	0FF	INT	ON		0FF	ON DURING PRELAUNCH FO
7571 7	MOTOROLA INC.	PASSIVE	51	243/353	233/363	233/353	243/353	243/353	233/363	CHECKOUT
	MOTOROLA INC.	1 433116	31					(-22/176)		CITEOROGI
TPM 5	MSX-201S S-BAND	PASSIVE	34/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FO
	MOTOROLA INC.	PASSIVE	34	243/353	233/363	233/353	243/353	243/353	233/363	CHECKOUT
	MOTOROEM INC.	1 455111	٥.					(-22/176)		OFFE OR OUT
TPM 6	MSX-5015 S-BAND	PASSIVE	53/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FO
	MOTOROLA INC.	PASSIVE	53	243/353	233/363	233/353	243/353	243/353	233/363	CHECKOUT
				(-22/176)						
TPM 7	TR-36 TRANSPONDER	PASSIVE	6/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FO
	CUBIC CURPORATION		6	238/344	233/344	233/344	238/344	238/344	233/344	CHECKOUT
				(-30/160)	(-40/160)	(-40/160)	(-30/160)	(-30/160)	(-40/160)	
TPM 7	TR-36 TRANSPONDER	PASSIVE	25/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FO
	CUBIC CORPORATION	PASSIVE	25	238/344	233/344	233/344	238/344	238/344	233/344	CHECKOUT
				(-30/160)	(-40/160)	(-40/160)	(-30/160)	(-30/160)	(-40/160)	•
TPM 7	TR-36 TRANSPONDER	PASSIVE	4/	YES	OFF.	INT	ON	ON	OFF	ON DURING PRELAUNCH FO
	CUBIC CORPORATION	PASSIVE	4	238/344	233/344	233/344	238/344		233/344	CHECKOUT
				(-30/160)	(-40/160)	(-40/160)	(-30/160)	(-30/160)	(-40/160)	
TPM 7	TR-36 TRANSPONDER	PASSIVE	0/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FO
	CUBIC CORPORATION	PASSIVE	0	238/344	233/344	233/344	238/344	238/344	233/344	CHECKOUT
				(-30/160)	(-40/160)	(-40/160)	(-30/160)	(-30/160)	(-40/160)	•

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM TRANSMITTERS. FM

REF.	DESCRIPTION AND	THERMAL DESIGN	POWER WATTS	MISSION PH	ASE THERMAI	LIMITS X	REMARKS			
	-	GROUND/	MIN/	PRELAUNCH	SHUTTLE	Į	MANEUVERS		REENTRY	
	<u>-</u> _	ORBITAL	MAX		CARRY	SHUTTLE TUG	TUG ORBITAL	PAYLOAD TUG	AND LANDING	·
TFM 1	THTA S-BAND	PASSIVE	60/	YES	OFF	INT	ON	ON	0FF	ON DURING PRELAUNCH FOR
•	WATKINS- JOHNSON	PASSIVE	60	241/324	235/396	235/324	241/324	241/324	235/396	CHECKOUT
				(-25/125)	(-35/254)	(-35/125)	(-25/125)	(-25/125)	(-35/254)	
TFM 2	MTT-201 S-BAND FM	PASSIVE	25/	YES	QFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	MOTOROLA INC.	PASSIVE	25	243/353	233/363	233/353	243/353	243/353	233/363	CHECKOUT
				(-22/176)	(-40/194)	(-40/176)	(-22/176)	(-22/176)	(-40/194)	
TFM 3	MTT-501 S-RAND FM	PASSIVE	60/	YES	OFF	INT	ON	ON		ON DURING PRELAUNCH FOR
	MOTOROLA THE.	PASSIVE	60	243/353	233/363	233/353	243/353	243/353	233/363	CHECKOUT
		1 433211.		(-22/176)	(-40/194)	(-40/176)	(-22/176)	$\{-22/176\}$		
TFM 4	S-BAND TRANSMITTER	PASSIVE	205/	YES	OFF	INT	ON	ON	OFF	ON DURING PRELAUNCH FOR
	EMR	PASSIVE	205	269/367	235/344	235/367	269/367	269/367	235/344	CHECKOUT
	Emb	LASSIAE	200		= : :					: :
				(25/202)	(-35/160)	(-35/202)	(25/202)	(25/202)	(-35/160)	•

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EQUIPMENT THERMAL REQUIREMENTS CATALOGUE

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM POWER AMPLIFIERS

REF.	DESCRIPTION AND	THERMAL DESIGN	POWER WATTS	MISSION PHA	· · · · · · · · · · · · · · · · · · ·		ENTS AND T			REMARKS	
		GROUND/ ORBITAL	MIN/ MAX	PRELAUNCH	SHUTTLE	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	·	
PA 1	S-BAND POWER AMP	PASSIVE	16/	YES	0FF	INT	ON	ON '	OFF	ON DURING PRELAUNCH FOR	R
•	RADIATION INC	PASSIVE	16	248/343 (-13/158)	233/373	233/343	248/343 (-13/158)	248/343 (-13/158)	233/373 (-40/212)	CHECKOUT	
_	AMPLIFIERS MSC	PASSIVE PASSIVE	10/	YES 253/343 (-4/158)	0FF 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	Ŕ

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM RF MULTIPLEXERS

REF.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN GROUND/	POWER WATTS		EGREES KE	X	REMARKS			
		ORBITAL	MIN/ MAX	PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
RFM 1	RF MULTIPLEXER	PASSIVE	0/	YES	OFF	INT	0N	ON	0FF	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	235/396 (=35/254)	CHECKOUT
	MULTIPLEXER EMERSON ELECTRIC	PASSIVE PASSIVE	0/	YES 255/324 (0/125)	OFF 235/344 (-35/160)	INT 235/324 (-35/125)	ON 255/324 (0/125)	ON 255/324 (0/125)	0FF 235/344 (-35/160)	ON DURING PRELAUNCH FOR CHECKOUT

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM DECODER

REF.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN	POWER WATTS	MISSION PHA				TEMPERATURE - MIN / MA		REMARKS
		GROUND/ ORBITAL	MIN/ Max	PRELAUNCH	SHUTTLE	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
	MCR-904 DECODER	PASSIVE PASSIVE	2/	YES 233/348 (-40/167)	0FF 223/358 (-58/185)	INT 223/348 (•58/167)	ON 233/348 (-40/167)	0N 233/348 (-40/167)	0FF 223/35a (~58/185)	ON DURING PRELAUNCH FOR CHECKOUT

INSTRUMENTATION SUBSYSTEM

EQUIPMENT ITEM PRESSURE TRANSDUCERS

REF.	DESCRIPTION AND MANUFACTURE	THERMAL DESIGN	POWER WATTS	MISSION PH		L REQUIREM		EMPERATURE - MIN / MA.			REMARKS
·		GROUND/ ORBITAL	MIN/ MAX	PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING		
PRES 1	TRANSDUCER PRES.	PASSIVE	0/	YES	YES	INT	ON	ON	YES	ON PRIOR	TO LAUNCH FOR
	GULTON INDUSTRIES	PASSIVE	0	233/344	233/344	233/344	233/344	233/344	233/344	CHECKOUT	AND STAB
				(~40/160)	(-40/160)	(-40/160)	(-40/160)	(-40/160)	(-40/160)		
PRES 2	TRANSDUCER PRES.	PASSIVE	0/	YES	YES	INT	ON	. 0N	YES	ON PRIOR	TO LAUNCH FOR
	BALDWIN-LIMA	PASSIVE	0	235/394	235/394	235/394	235/394	235/394	235/394	CHECKOUT	AND STAB
				(-35/250)	(-35/250)	(-35/250)	(-35/250)	(+35/250)	(-35/250)		
PRES 3	TRANSDUCER PRES.	PASSIVE	0/	YES .	YES	INT	ON	ON	YES	ON PRIOR	TO LAUNCH FOR
	GENISCO TECH CORP.	PASSIVE	0	144/422	144/422	144/422	144/422	144/422	144/422	CHECKOUT	AND STAB
	•			(*00/300)	(*00/300)	(*00/300)	(*00/300)	(400/300)	(*00/300)		
PRES 4	TRANSDUCER PRES.	PASSIVE	0/	YES	YES	INT	ON	ON	YES	ON PRIOR	TO LAUNCH FOR
	GULTON INDUS. INC.	PASSIVE	0	269/310	269/310	235/310	269/310	269/310	269/310	CHECKOUT	AND STAB
		-		(25/100)	(25/100)	(-35/100)	(25/100)	(25/100)	(25/100)		

INSTRUMENTATION SUBSYSTEM

EQUIPMENT ITEM TEMPERATURE TRANSDUCERS

REF.		THERMAL DESIGN	POWER WATTS	MISSION PH	ASE THERMAN			EMPERATURE - MIN / MA		REMARKS
,,,,,	MANUFACTURE	GROUND/ ORBITAL	MIN/ MAX	PRELAUNCH		_	MANEUVERS TUG ORBITAL	PAYLOAD TUG	REENTRY AND LANDING	
									-	
TEMP 1	TRANSDUCER TEMP	PASSIVE	0/	YES	YE5	INT	ON	ON -	YES	ON PRIOR TO LAUNCH FOR
	HY-CAL ENGINEERING	PASSIVE	0	148/423	148/423	155/423	148/423	148/423	148/423	CHECKOUT AND STAB
-				(*93/302)	(*93/302)	(480/302)	(*93/302)	(*93/302)	(*93/302)	
TEMP 2	TRANSDUCER TEMP.	PASSIVE	0/	YES	YES	INT	ON	ON	YES	ON PRIOR TO LAUNCH FOR
	ROSEMOUNT FNGR. CO	PASSIVE	0	235/422	235/422	235/422	235/422	235/422	235/422	CHECKOUT AND STAB
			_	(-35/300)	(-35/300)	(-35/300)	(~35/300)	(-35/300)	(-35/300)	
TEMP 3	TRANSDUCER TEMP.	PASSIVE	0/	YES	YES	INT	ON	0N	YES	ON PRIOR TO LAUNCH FOR
-	ROSEMOUNT ENGR. CO	PASSIVE	O .	266/310	266/310	235/310	266/310	266/310	266/310	CHECKOUT AND STAB
			•	(20/100)	(20/100)	(-35/100)	(20/100)	(20/100)	(20/100)	•
TEMP 4	TRANSDUCER TEMP.	PASSIVE	07	YES	YES	INT	ON	0.0	YES	ON PRIOR TO LAUNCH FOR
	ROSEMOUNT ENGR. CO		0	219/355	219/355	219/355	219/355	219/355	219/355	CHECKOUT AND STAB
	•			(-65/180)	(-65/180)	(-65/180)	(~65/180)	(-65/180)	(-65/180)	

EQUIPMENT THERMAL REQUIREMENTS CATALOGUE INSTRUMENTATION SUBSYSTEM

EQUIPMENT ITEM CURRENT MEASUREMENTS

REF. DESCRIPTION NO. MANUFACTURE	AMD THERMAL DESIGN GROUND/	POWER WATTS MIN/	MISSION PHA		_VIN / (FA		EMPERATURE - MIN / MA		REMARKS
	ORBITAL	MAX	****	CARRY	SHUTTLE TUG	TUG ORBITAL	PAYLOAD TUG	AND LANDING	
CURR 1 SHUNTS-CURREN MARTIN MARIET		0/	YES 223/378 (-58/221)	YES 223/378 (-58/221)	INT 223/378 (-58/221)	ON 223/378 (-58/221)	ON 223/378 (-58/221)	YES 223/378 (-58/221)	ON PRIOR TO LAUNCH FOR CHECKOUT AND STAB

ELECTRICAL POWER SUBSYSTEM

EQUIPMENT ITEM FUEL CELL POWER SYSTEMS

REF.	DESCRIPTION AND MANUFACTURE	THERMAL	POWER WATTS		EGREES KEL	VIN / (FA	HRENHEIT) .			REMARKS
		GROUND/ ORBITAL	MIN/ MAX	PRELAUNCH	SHUTTLE CARRY	SHUTTLE TUG	MANEUVERS TUG ORBITAL	PAYLOAD TUG	AND LANDING	
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
	FUEL CELLS GENERAL ELECTRIC	ACTIVE ACTIVE	30/ 30	YES 273/322 (32/120)	0FF 273/366 (32/200)	ON 273/322 (32/120)	ON 273/322 (32/120)	ON 273/322 (32/120)	0FF 273/366 (32/200)	ON DURING PRELAUNCH FOR CHECKOUT

ELECTRICAL POWER SUBSYSTEM

EQUIPMENT ITEM BATTERIES

REF.		THERMAL DESIGN	POWER WATTS	MISSION PH			ENTS AND THRENHEIT)			REMARKS
		GROUND/ ORBITAL	MIN/ MAX	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 STOPAGE	PASSIVE	28	167/299 (#59/-80)	283/310 (50/100)	167/299	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	283/299 (50/80)	283/299 (50/80)	249/272 (-10/ 30)	CHECKOUT
BAT 3	15 AMP+HR BATTERY EAGLE PICHER	PASSIVE PASSIVE	62/ 96	YES 283/366 (50/200)	0FF 238/324 (+30/125)	ON 283/366 (50/200)	ON 283/366 (50/200)	ON 283/366 (50/200)	0FF 238/324 (-30/125)	ON DURING PRELAUNCH FOR 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.

EQUIPMENT TIEM INERTIAL MEASUREMENT UNITS

		dM31						MIATUIA MIATWIA	0° IO W Re Ol ND IS	ESENT : A RIA AND US BUDTAMS	1 PI 66 23° 2000 33° 33°	EXCEED EFIWINVI CE ENAII NG LOBCI E2° NNI.	E MISSIL STEM USI TA IS PR TA IS PR	IC CRUIS OLING SY ACL DA ACL DS HEAT LOS	STRATEG STIVE CO CAN BE: DESIGN	TEND OF YERR WI TOR AIRCRAFT AND SOSIGN WITH AN AC SOLD PLATE, UNIT PASSIVE THERMAL ****** NOTE COND	* / /	
C0MT	69 062	095 0-	- 4,	0 -	XAM (INA 8.5 . 0.5	13 13 78	13 13	NIATNIA Se. Se.	358\358 35\ 35) 1H9I4 2	FOR WI FOR WI FOR WI FOR WI	.90\ .90 WI TIME GO INTO	3304°	1419. (1.5) STAGE A AROGRA	RECT RECT NICS, TH	4.5 (10.0) THE DEV THE DEV	THE MICRON IS IN. PATTERSON AIR FOR	[M 4 JA [n₩I
C0/41	22	09+- 0-	- 7 6	35	2 ° 9 11 ° 8	ST 8	8	7*35	1-30 1-30 3HRS 1DUAL) 26 14 . 100611 1007 A 100 A 100 GER	.85 ENGTH S PERENIO PERATIO ENGTIO	CABLE LI X-AXIS PERATURI PERATURI PERATURI	.3.8) 4.11 115 6.415 1EM 4.415 1EM 6.415 1EM 7.41 115 7.41 115 7.	EOW AIKI WINNLER WONLED DC-#0S C	(30.5) (30.5) (3017 IS JAIT IS JAIT IS JAIRY	VIKING 19U THE UNIT IS MARRI THE UNIT IS MARRI MILIO DE COMPUTER, AXIS OF VEHICLE,U AXIS OF VEHICLE,U MINUTES, UNIT WAS PRIOR TO MARS REF	H H J J L L	≅ ∩wI
1003		•	TEMP	JAUG	XAM QNA	NIW	3HT	NIATNIA NIATNIA	D348 7	IIM GT2 GNA GNA	*1* *1* ** COTOB	EXCEED EXCEED	IS PAINT BY 0.5 MPUTER SES MUST SES MUST	DS+ NORM BY 7 IN CREFT CO CREFT CO	LT SECON TE S IN TO AIR TO AIR TOTIVE	FAST START IN I STABLLIZED IN I HEAT EXCHANGER UNIT IS MARRIED WARRY NOTE COND	•	,,,,,
CONT	30 <i>E</i> 28		505 - 28		* **E 5*9	50 11			2877287 26/ 26) 3688FT) OT	06°		(5*2)	BAFT USE	7.7 (0.71) 581A 803	DPERATIONAL IN 8 DATHOP CORP ELEC DRIHOP CORP ELEC DPERATOR AND HEA	N S	UMI
C0#1	895 71	29 ~ 297		- -24 552	2°91 . 3°02	11	Ę		£55\7£1 (05 \51		06° /06°	(EL*T).	(1.6) (1.8)	EBZ (6"0 OWBUTER OWBUTER	1°0 WIS 1°0 WEL 1°0 WEL 100°0)	AROUSEL SR MOUNT WITH MAGI MOUNT WITH Z-AXIS MAX CABLE LENGTH SUBLETEROTH) 	IMN
WODE Ob	7	Diy AUA	.¢N • 0E¢	DE2I		RATE SVHR SVHR	SEC K	HONBS C	POWER (W/FT2)	STTAW NIM XAM		CUBIC .	204984 4384 84002 40 40 (13)	ZHVbE		ESCRIPTION ANUFACTURER AND PEMARKS		NO°

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM INERTIAL MEASUREMENT UNITS

	DESCRIPTION MANUFACTURER AND REMARKS	KG (LBS)	SHAPE	AREA SQUARE CM	CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FI2)	TIME CONST. HOURS MIN MAX	ADIABATI RISE RAT DEG K/HR DEG F/HR MIN MAX	C THERMA E MASS W-HR/K OTU/F	L ALLU TEMI DES: MIN	OWABLE P. DEG IGN	SINA K/(A QUA	(F) NL	OP MODE
[MU · 5	5 H478 STRAPDOWN IN HONEYWELL THE UNIT HAS INT OPERATING TEMPER CONDUCTION TO TH FAST WARM UP. U PER CUSTOMER THE PROGRAM.	NU 2.7 (6.0) FERNAL HE RATURE. T ME MOUNTI UNIT HAS	RECT FATERS THE UNIT	1180. { 1.3} HAT MAIN' THERMAL ACE. UNI' ANODIZED	2454. (.09) TAIN THI DESIGN T REQUIN	.80/ .80 E UNIT IS PAS RE 200 BUT CA	30/ 230 WITHIN SIVE W WATTS N RE F	254/*49 (23/181 ITH FOR INISHED	.80	13 105	2.3	-0	290 63 -			CONT
	***** NOTE CON									N THE MIN N THE MIN				TEMP		
¥MU €	HONEYWELL THE H-449 AGENA A COLD PLATE WIT DEG. F). UNIT I UNIT CAN RE FINI MARRIED TO THE A H-449 IMU HAS RE HAS AN INTERNAL ****** NOTE CON	TH PLATE IS PAINTE ISH PER CA IGENA COM IEN SPACE HEATERS IDUCTIVE	IN IMU H. TEMPERA ID WITH CUSTOMER PUTER HE IN QUALIF THAT MA HEAT LO	(5.3) AS AN AC TURE OF A WHITE THERMAL DC-501 D IED ON TI INTAIN UI SSES MUS	(.73) TIVE THE LO.6 TO POLYURE REQUIRE HE AGENE NIT WITH T EXCEN	.85 ERMAL S 60 DEG THANE P EMENTS. COMPUTE A PROGR HIN OPE D 150.	275 YSTEM . C(60 AINT.H UNIT R. TH AM. T RATING	TO 140 OWEVER IS HE UNIT TEMP. 0. TO	, 1.01	9 20 17 36 N THE MIN N THE MIN	7.6	-460 OPER	20 -			CONT
IMU :		60.9 (*4.2) 5 IN DEVE NO MAINT DESIGN IT TEMPER POLYURET	RECT FLOPMENT FAIN THE IS ACTI RATURE RE	13577. (14.6) IT HAS UNIT WI VE WITH EQUIREME	95238. (3.36) INTERNAL THIN OPLA COLD INTS. TH	+25/ +85 L HEATE ERATING PLATE U E HEXAD	198/ 306 RS THA TEMPE TILIZE IMU I	145/225 (13/ 20 T HAVE RATURE. O TO S PAINT	1.61	4 6 7 1)	51.5	218	310	115 -252	310	CONT
IMU (BLOCK 5D STRAPOOW HONEYWELL THE BLOCK 5D STR COOLING SYSTEM IT ISOLATED FROM IT HEATER POWER AT UNIT IS PAINTED PER CUSTOMER THE	(21.9) RAPDOWN I PE RADIAT S MOUNTE ASCENT A WITH A	IMU IS I FION OUT ING SURF AND 7.7 HHITE PO	TO SPAC ACE. UN WATTS FO LYURETHA	(.40) PMENT: E: THE IT REQU R IN OR	.85 AND HAS UNIT I IRE 24. BIT OPE	43 A PAS S THER 2 WATT	RMALLY 'S OF I. THE	1, 1,33	8	5 8.4 9 4.4	274 33	285 53	217 -68		CONT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM INERTIAL MEASUREMENT UNITS

	DESCRIPTION MANUFACTURER AND REMARKS		PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	CUBIC	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	DENSITY	TIME CONST. HOURS MIN	ADIAS RISE	ATIC RATE VHR VHR	THERMAL MASS W-HR/K	ALLO TEMP DES:	WABLE DEG IGN	SINK (K/(F QUA) L	OP MODE
IMU 9	H-319 CENTAUR IRU HONFYWELL THE CENTAUR INER TAUR SYSTEM ELEC IT HAS A PASSIVE IS PAINTED WITH CUSTOMER THERMAL MAINTAIN THE UNI WEIGHT INCLUDES	(62.5) TIAL REF TRONICS THERMAL WHITE REQUIRE T WITHIN	ERENCE UNIT (SE DESIGN POLYURE MENTS.	10473. (11.3) UNIT (IRI EU). THE OF RADIA THANE PA. UNIT HAS ING TEMPI	72161. (2.55) J) IS MA IRU IS ATION TO INT. BUT INTERNA	.25/ .85 ARRIFD A GIMB SPACE CAN B	90/ 170 TO THE ALED S' • THE U E FINI: ERS WHI	YSTEM; UNIT SH PER ICH		3 6	7 12	24.9 13.1			202 -94		CONT.
IMU 9	H-319 CENTAUR SEU HONEYWELL THE CENTAUR SYSTI TIAL REFERENCE U THE UNIT PASSIVE POLYURETHANE PAI MENTS.	(25.0) EM ELECT NIT(IRU) THERMAL	TRONICS THE ST	(4.0) UNIT (SE EU UTILI: L. THE SI	U) IS M/ ZES RADI EU IS P/	.85 ARRIED [ATION AINTED	30 TO THE TO SPAC WITH A	CE AS WHITE		3 5	3 5	10.2 5.4	255 0		213 -74		CONT
IMU 10	DIGS IMU HAMILTON STANDARD THE DIGS USES A FOR A TEMPERATURI ATE AT 71.1 + OR 620 WATTS INCLUD NEED 60 MINUTES SURFACES ARE PAI THE DIGS AND ITS ###### NOTE CON	PHASE-CHE CONTRO	HANGE (W DL. UNIT EG.C(160 WATTS G UP PRIO TH ALUMI TING CRA	(4.7) AX) HEAT INTERNAL +OR-1 DI ROUND PO R TO BEI NIZED PA DLE. UNI	(.66) SINK AND	.90 ND INTE ARE DE JNIT RE FAST W ATIONAL OVE DAT ERMALLY	195 RNAL HI SIGN TI GUIRES ARM UP THE A INCL ISOLA	O OPER UNIT DIGS UDES TED. O. TO) 1.20	N THE	ES NIM	8.1	-460 OPER		-460	297 75	CONT
IMU 11	***** NOTE CON RSD IMU HAMILTON STANDARD THE REDUNDANT ST BASED ON 2 DIGS THERMALLY ISOLATI TEMPERATURE. ABO FUTHER INFORMATI TIES ARE BASED OF	29.2 (64.4) RAPDOWN IMU COUF ED AND F VE DATA ON IS AN	HEAT LO RECT IMU IS PLED TOG AVE INT IS BASE /AILABLE WHICH HA	5403. 5403. IN DEVEL ETHER. HE ERNAL HE D ON DIG AT PRES S ALUMIN	T EXCEENT 25410. (.90) OPMENT IS NOTED TO THE STATE TO T	.90/ .90 AT PRES EXPECTE D MAINT RATURE E. SURF	ANO 144/ 144 ENT, I D TO B AIN OP RANGE ACE PR	266/266 (24/ 24 T IS E ERATING NO OPER-	1.71	6	6	24.8 13.1	243			290 63	CONT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM INERTIAL MEASUREMENT UNITS

REF.	DESCRIPTION MANUFACTURER AND REMARKS		PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	WATIS	DENSITY Q/A	HOURS MIN		RATE ZHR ZHR	THERMA MASS W-HR/K BTU/F	TEM DES	OWABL P. DE IGN MAX	G K/(I	F) Al	OP MODE
IMU 12	SKN-2400 TNU SINGER COMPANY THE INU CONTAINS TION. UNIT IS DE: SPACE ENVIRONMEN FUNCTIONAL WITHO HOWEVER IT IS A	(24.0) A FAN A SIGN FOR T. UNIT UT COMPL FUNCTION	ND IS A PARIFRA INCLUDE ITER. UN POF AVA	CT USE B S THE SK IT REQUI ILABLE P	(.44) D BY FO UT CAN C-3000 RED 2.5 OWER FO	.90 RCED AI BE MODE COMPUTE MINUTE R HEATE	160 R AND FIED F R BUT S TO W RS AND	OR CAN BE ARM-UP TEMP-		51 92	18 33	9.2 4.8	-0 -460	-0 -460	-0 -460	-0 -460	CONT
· .	ERATURE THAT SET CAN BE FINISH PE ***** NOTE CON ***** NOTE CON	R CUSTON	ER THER	MAL REGU	IREMENT T FXCEE	S. D. 121.	AND	210. TO	MAINTAI Maintai	N THE	MIN MIN	AND MAX	OPER QUAL	RATING TEMP	TEMP		
ΊМЏ 13	KT-70 IMU SINGER COMPANY THE KT-70 IMU IS OF HEAT TRANSFER BUILT FOR SEVERA P3C IN ADDITION UATION FOR THE S UP UNIT TO OPERA	(59.4) A 4 GIM THROUGH L AIRCRI UNIT IS PACE SHO TING TE	4BAL SYS 4 COLD P AFT PROG USED ON JTTLE: U	(7.9) ITEM IT H PLATE. T IRAMS INC I THE SRA INIT HAS RE. UNIT	AS AN A HE BASI LUDING M MISSI INTERNA REQUIRE	.90 CTIVE C C KT-70 THE A70 LE AND LE HEATE 14 MIN	120 COOLING IMU W VE, F1 IS UNC CRS THA	IAS LOS AND DER EVAL LT WARM			5 9		-0 -460	246 -16	-0 -460	246 -16	CONT
٠.	WARM UP FOR SHUT	TEE CONT DUCTIVE	FIGURATI HEAT LO	ON. UNIT	' IS PAI ST EXCEE	NTED BL	ACK.	0. TO	MAINTAI MAINTAI	N THE	MIN MIN	AND MA	K OPEI	RATING L TEMP	5 TEMF		

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM RATE GYROS

PEF. NO.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS		DENSITY	 ADIABAT RISE RA DEG K/H DEG F/H MIN MA	TE MASS R W-HR/ R BTU/F	K DE	LOWABL MP. DE SIGN MAX	Q U 6 K √(F) AL	OP MODE
RG 1	MARTIN MARIETTA O THE ATM RATE GYR TAIN THE UNIT AT UNIT THERMAL DES THE SURROUNDING A BLACK ANODIZED REQUIREMENTS. U	RO HAS AN 67.8 + SIGN IS NEW YORK TO NEW Y	N INTERN OR: - 1 PASSIVE MENT AND BUT CAN	(3.1) AL PROPO DEG.C(15 WITH RAD MOUNTIN BE FINI	RTIONAL 4 + OR IATION G STRAC SH PER	+85 HEATER -1 DEG. AND CON TURE. T CUSTOME	45 THAT F) TOUCTION HE UNI	HE IN TO IT HAS	7 1 14 1		-0 1 -460		-0 -460	294 70	CONT
	BOARD THE SKYLAS ##### NOTE CON ##### NOTE CON	NDUCTIVE					AND		N THE MI						

EQUIPMENT ITEM STAR TRACKERS

	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	ALPHA/	WATTS	POWER DENSITY Q/A W/ M2 (W/FT2)	CONST. HOURS MIN	RISE DEG	RATE K/HR F/HR	THERMAI MASS W-HR/K BTU/F	TEM DES	P. DE	G K/(QU	F) ÁL	OP MODE
ST 1	CT-401 SENSOR BBRC UNIT HAS NO PREF SENSOR TO BE LOC POWER IS UNDER 3 WATTS FOR 28 VOL UNIT IS OPERATION	ATED NEA WATTS F TS UNREC	RIENTATION TO THE RESULT OF TH	PROTECT LATED ++	(.22) EGUIRES TRACKE	ITS BR R FROM	5 IGHT 06 BRIGHT	LIGHT.		1 2	1 2			319 115			INT
ST 2	STAR TRACKER HONEYWELL UNIT WILL HAVE A PASSIVE THERMAL THERMAL REQUIREM EXPECTED THERMAL ALL DATA INDICATE	DESIGN. ENTS. QUALIFI	COMPONISURFACE	(5.5) ENT DESI PROPERT	GN, AND IES WIL 1975.	•90 WILL I L DEPEN	3 NCOPORI D ON CL			_	1 2			281 47		281 47	INT
ST 3	MMOS ITT GILFILLAN UNIT IS COLD PLA THRU MOUNTING FL IT HAS SEVERAL M MAX POWER FOR ALI UNIT SHOULD BE COUNIT HAS NOT BEEL 37.8 DEG C (60 T	(15.0) TED WITH ANGE. UN DDES OF _ MODES DUPLED 1 N QUAL 1	H APPROX. IT SHOULD OPERATION AND 13 TO A COMMITESTED.	(2.4) 75 PER D BE MO ON WITH NATTS MI PUTER.UN EXPECTE	CENT OF UNTED LO 20 WATT N POWER IT IS IN D COLD	.90 COOLIN COKING S STEAD FOR ON PROTO PLATE I	20 G ACHIE OUT TO Y STATE E MODE TYPE ST S 15.6	SPACE. E POWER TAGE. TO	1.18	3 6		5.8 3.1	273 32	309 96	273 32	309 96	INT
ST 4	5698 STAR TRACKER EMR PHOTOFLECTRIC THE 5698 STAR TR UNIT IS BLACK AN TIONAL. UNIT HAS THE 5698 USES THE WHICH IS 180 GRAE O.D.X 4.25 LENGTE UNIT IS SPACE QUE	(4.0) ACKER DI DDIZED. NO LIMI E ASCOP MS.(.12 H) AND H	MENSIONS REQUIR (TATIONS 571E-01- LBS) 3-5 IAS A ST	(.9) S DO NOT RES APPRI ON MOUN -14 QUAD 5 CM O.D AINLESS	INCLUDE OX 30 M TING LOG RANT MUE X 10.8 STEEL HE	.90 E THE O INUTES CATIONS LTIPLIE CM LEN DUSING.	3 PTICS. TO BE (R PHOTO GTH (1	OPERA- OTUBE .37 IN			2	1.5 .8		_		_	INT
ST 5	574 STAR CAMERA EMR PHUTOELECTRIC THE 574 STAR CAME SURFACE IS IRIDI' TIONAL. UNIT HAS UNIT IS DESIGN FOR RADIATION AND COME MOUNTING LOCATION	ERA DIME TE 15. t NO LIMI DR SPACE NDUCTION	INSIONS (INIT REQUIRATIONS FENVIROR FOR THE	JIRE APPI ON MOUN MENT AN HEAT TO	(.17) NCLUDE ROX 30 I TING OR D IS THE	THE OPT MINUTES IENTATI ERMALLY VIRONME	A ICS. TH TO BE ON IN N CONTRO NT AND	OPERA- VEHICLE DLED BY		1 1	1	4.6 2.4		309 97	255 1	309 97	INT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM STAR TRACKERS

		DESCRIPTION MANUFACTURER AND REMARKS		PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	CUBIC	RAD. ALPHA/ EMISS	WATTS		CONST.	ADIAB RISE DEG K DEG F MIN	RATE /HR /HR	₩-HR/K	TEM DES	P. DE	QU QU	f) Al	OP MODE
ST	6	OAO STAR TRACKER BENDIX CORPORATIO THE OAO-IV STRAP HEAT IS REJECTED MISSIBLE TEMPERA F). NO HEATERS MOUNTED TO VEHIC ED VIEW TO OPERA	N(16.0) DOWN ST BY CON TURE EX ARE REO LE MOUN	AR TRACK DUCTION CURSION UIRED WI TING FLA	(3.1) ER HAS A TO A RAD OF +29 THIN THI	PASSIVI IATION : 0 38 DEG S RANGE	.85 E THERM SHIELD G.C(-20 . UNIT	6 AL CON' HAVING TO 100 IS HAN	A PER- 0 DEG RO		1	1	6.1		307 93	236 +33	307 93	INT
ST	7	OMA ATM STAR TRKR BENDIX CORPORATIO THE OMA ATM STAR ARE EXTERIOR LIM MARRIED TO ATM S HEATERS OF 10 WA .3 TO -15.0 (-9. OF -15.3 TO -6.7 LATED+ PAINTED W	N(40.0) TRACKE HITS SEE TAR TRA TTS EAC 9 TO 5.	R IS A G REF FOR CKER ELE 4 TWO OF 0 DEG.F) (5.5 TO	(12.1) IMBALLED MORE DE CTRONICS THE HEA AND THE	(2.74) UNIT. TAIL DE UNIT. TERS HA THIRD .F). UN	.90 THE ABO SCRIPTI UNIT HA VE SET HEATER IT IS T	28 VE DIM ON. UI S 3 IN POINTS HAS SI HERMALI	(1/ 2) ENSIONS NIT IS TERNAL OF -23 ET POIN LY ISO	.73 .72	2		15.3		302 84	247 -14	302	INT
sī	8	KS-199 STAR TRKR KOLLSMAN INSTR. THE KS-199 STAR ERING MODEL WAS COUPLED TO AN EL TOTALING 10 WATT -11.8 DEG C(10 D UNIT THERMALLY I TION BLANKET TO	(20.0) TRACKER BUILT A ECTRONI S AND A DEG. F).	WAS BUI ND FUNCT C UNIT. RE USED THE UNI FROM MO	(5.2) LT FOR T IONAL TE THE TRAC FOR FAST T THERMA UNTING+	(.78) HE MOL STED. T KER HAS WARM U L DESIG AND COV	.75 PROGRAM HE GIMB INTERN P WHEN N IS PA ERED BY	18 ONE AL SEN AL HEA UNIT I SSIVE SUPER	SOR IS TERS S BELOW WITH	1.07	1 2	2 4			290 62		307 93	. INT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM STAR TRACKER ELECTRONICS

REF. NO.	DESCRIPTION MANUFACTURER AND REMARKS		SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)		WATTS MIN/		CONST. HOURS MIN	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	MASS	TEM DES	OWABL IP. DE IGN MAX	G K/(QU	F)	OP MODE
STE 1	ATM STE BENDIX CORPORATION THE ATM STAR TRA OMA GIMBAL STAR FOR RADIATION AN STEADY STATE POWN DIRECTLY OF THE THERE ARE NO MOU	N(32.0) CKER ELECTRACKER TO CONDUCTOR TO THE	CTRONICS THE STE TION COOL TOMA THE DC BUS.	(6.2) (STE) IS PAIN LING. THE OMA HE	(.90) UNIT IS YED BLAM HE STE ME EATER PO MOUNTE	CK AND UNIT SUI DWER IS D ON THI	6 D TO TH IS DES PPLIES SUPPL E ATM H	IGN THE IED Rack		0 0 1 1	12.2 6.4		327 129	243 -22		INT
STE Z	KS-199 STAR TRKR OLLSMAN INSTR. THE KS-199 STAR ERING MODEL WAS IS COUPLED TO THE SPACE ENVIRONMEN UNIT. THE ELECTE DESIGN WITH A PA	(10.0) TRACKER V BUILT AND HE STAR THE HT BUT THE RONIC UNIT	WAS BUIL FUNCTI PACKER O E ABOVE F WAS PL ERMAL CO	(2.6) T FOR T ONALY T PTICS. TEMPERA ACED IN	(.28) HE MOL : ESTED. THE UN TURE IS SIDE:TH	PROGRAM THE ELU IT IS DE BASED (E MOL.	14 ONE ECTRON ESIGNED ON THE THE UN	IC UNIT D FOR OPTICS IT IS		3 3 7	3.9 2.0	238 -30		215 -71	298 77	INT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM HORIZON SCANNERS

	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT PA KG S (LBS)	SHAPE	SURFACE AREA SQUARE CM (FT)				DENSITY	CONST. HOURS MIN	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	MASS W-HR/K	TEM DES	P. DE IGN	G K/(QU	F) Al	OP HODE
HS :	HORIZON SENSOR QUANTIC INDUSTRIE THE 5079 MODEL I IT MAS AN NCR-2 BLANKET WHICH CO OPTICS.UNIT HAS VEHICLE WHERE TH VIEW.THIS UNIT I VEHICLES. CONTRA	S(7.0) S THERMALL MULTILAYER VERS THE 1 NO CABLE L ERE ARE NO S SPACE QU	LY ISOL RS SUPE TOTAL U LIMITAT D STRUC VALIFIE	R INSULA INIT WITA TION, UNI TURAL IN	(.23) DM CONDI ATION AI H THE EX I SHOULD NTERFERE	ENCE MI CEPTION CEPTION CEPTION	AND RAC ED MYLA N OF TH UNTED I TH THE	0/ 0; IATION R E N THE OPTICS	9.87 9.87	0 0 1	-			191 -115		INT
н 5 2	P HORIZON SENSOR BARNES ENGR. CO. FOR TUG TWO HORI SENSING THE 2 SE POWER SUPPLY UNI THE TWO SENSORS CONES INTERSECT OF 55 DEGREES. UNIT IS OPERATIO	ZON SENSOF NSORS ARE T.CONDUCT! ARE REQUIF AT THE FAF	RS ARE IDENTI ION IS RED TO RTH DIS	CAL AND THRU BO BE POSI C CENTER	(.14)) TO EG ARE COUNTOM FLA TIONED S R WITH	NABLE P UPLED T ANGE. SUCH TH A HALF	6 (ITCH AN O A COH AT THEI	R SCAN						228 -48		INT
нѕ	LAHS LASC UNIT IS CONTAINE SENSING TWO HEAD THE UNIT IS PAIN CUSTOMER THERMAL NO LIMITATIONS O	(3.3) D IN A SIN S ARE REQU TED BLACK REQUIREME	NGLE PA JIRED. ANODIZ ENTS.	ED ALUM	(.08) ER AXIS. [NUM+BU	FOR	3 (Two AXI E Paini			2 2 4 4				234 -38		INT
HS 4	NOHS LMSC UNIT IS BLACK AN REQUIREMENTS. MA THRU CONDUCTION. LENGTH.	(4.0) ODIZED BUT JORITY OF	COOLIN	G IS BY	(.09) D PER (RADIATO	CUSTOME	3 (R THERN H VERY	LITTLE	•54	2 2				234 -38		INT
н s (DSHS LMSC UNIT IS BLACK AN REQUIREMENTS. U CONDUCTION. NO LIMITATIONS O	(9.0) ODIZED AUT NIT IS DES	T CAN E SIGNED	FOR COOL	(.18) ED PER (ING BY	CUSTOME RADIAT	14 (R THERM	70/ 70 6/ 6: IAL						216 -70		INT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM HORIZON SCANNERS

REF.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE - CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS		DENSITY Q/A	CONST. HOURS MIN	RISE DEG	RATE K/HR F/HR	_	TEM DES	P. DE	E SIN G K/(QU MIN,	F) Aļ	OP MODE
HS 4	5 MOD.IV HORIZON SY QUANTIC INDUSTRIE THE MOD IV SENS EACH OF THE TRAC TRACKER APPROX F POWER CONSUMPTIO 6.25 METERS (20 MOD IV HORIZON S 1970. THE NEW MO	S(7.5) SOR IS C CKERS IS POWER ST NO IS 25 FT). TH SENSOR T	OMPOSED FINISHE EADY STA WATTS. F ABOVE HAT WAS	(2.3) OF 4 TRA D WITH B TE IS 2. ALLOWABL UNIT IS SPACE FL	('.24) CKERS AT LACK AND 5 WATTS E CABLE A REDES	.90 ND 1 ELI DDIZE AI FOTAL LENGTH IGNED AI A SAMSO	10 ECTRON LUMINU AVERA IS AT ND REP.	M.EACH GE LEAST ACKAGED		3 6		2.9 1.5	-	332 139	240 -26		INT

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM HORIZON SCANNER ELECTRUNICS

REF.	DESCRIPTION MANUFACTURER AND REMARKS		PACKAGE SHAPE	SURFACE AREA SOUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	DENSITY	CONST. HOURS MIN	RISE DEG DEG		THERMA MASS W-HR/K BTU/F	TEM DES		EG KZA QU		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
nac j	BARNES ENGR. CO.			(.a)				(4/ 4		5	5		-47				,
•	UNIT IS MAPRIED						OLED T	^									
	POWER SUPPLY UN TWO SENSORS. UN	II WILL TT TNIDHT	BUMES I	MUDIFICA FUEL IS	IIUN LU Based o	ME COO	PLEU II Ing Th	U F									
	POWER SUPPLY UN	IT ASSOC	TATED WI	TH ONE H	ORIZON	SENSOR	POWER	SUPPLY									
	THE SINGLE SENS																
	POWER. CONDUCTION IS T	HRU BOTT	OM MOUNT	ING PLAT	E.							•				•	
HSF 2	MOD TV HORTZON C	FU 15.9	RECT	4539.	18804.	.20/	5/	11/ 11	80.05	0	0	13.3	139	310	139	295	INT
1150	QUANTIC INDUSTRI			{ 4.9}				(1/ 1		0	0		-208		-208	72	
	THE CEU HAS A P ALUMINIZED MYLA TRACKERS OF THE CONSUMPTION IS	R INSULA MOD IV	TION BLA HORIZON	NKET. TH SENSOR.	E CEU I	S COUPL Tal ave	ED TO RAGE P	THE 4 OWER			÷		-				
	TRACKERS, CARLE							· -	•								

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM SUN SENSOR

		DESCRIPTION MANUFACTURER A REMARKS		WEIGHT	PACKAGE SHAPE	SURFACE	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	POW DENS Q/A W/ (W/F	ER ITY M2 T2)	TIME CONST. MOURS MIN MAX	ADIA RISE DEG DEG MIN	BATIC RATE K/HR F/HR	THERMAI	. ALL TE₩ DES	OWARL P. DE	E SIN G K/(QU	F) AL	OP MODE
5\$	1	REFRACTOSYN SU H H CONTROLS C UNIT IS APPRO MOUTING LIMIT UNIT IS COVER NO LIMITATION	O. XIMA ATIO	(.1) ATFLY 1 ONS. U BY A BL	GRAM IN NIT HAS I ACK EPOS	FLOWN ON Y HYSO T	(.00) HAS NO AGENA YPE 111	.90 POWER I B.	\0 0 A TUGN	(0/	Ô	1.78	-				358 185		358 185	INT
58		FINE SUN SENSO. BBRS HE UNIT WFIGH O LIMITATION NDIVIDUAL SEN NUM WITH ANOD IZED.	T I: ON I	(.4) S APPRO MOUTING S ARE G	X 170 GR. LOCATION	AMS. N. TED ALUM	(.01) INUM _e SE	.90 NSOR BL	OCK IS	ALUM	0 s -			0 Q	_		358 185			INT
55	3	DIGITAL SUN SE ADCOLE CORPORA THE 15564 SUN RONICS IN 1 U MOUNTINGS FLA CAN BE FINISH WATTS DISSIPA FIED AND FLOW	TIO SEI NIT NGE PEI TED	N(.3) NSOR IS . THE U . THE U R CUSTO POWER.	A DIGIT UNIT DIS NIT IS P MER THER THE 155	SIPATE H AINTED W MAL REQU 64 SUN S	(.00) ENSOR W EAT BY ITH BLA IREMENT ENSOR H	ITH SEN CONDUCT CK EPOX S. UNI AS BEEN	O SOR AN ION TO Y PAIN T HAS	(0/ ID ELE) THE IT, BU A 0.0	0) CT T 48		0				318 113		318 113	INT
\$\$	4	DIGITAL SUNSEN ADCOLE CORPORA THE 16765 SUN ELECTRONICS I THE MOUNTINGS FINISH PER CU DISSIPATED PO ONE OF THE NA	TION SEN N 1 N 1 ISTON	N(.9) NSOR IS UNIT. HE UNIT MER THE THE 1	A DIGIT THE UNIT SURFACE RMAL REU 6765 SUN	DISSIPA IS IRID UIREMENT SENSOR	(.02) ENSOR W TE HEAT ITE ALU S. UNI MAS BEE	ITH THE BY CON MINUM, T HAS A N SPACE	0 SENSO DUTTOU BUT CA 8SO.0	(0/ PR AND IN TO AN BE B WATT	0)	3.85 3.85	0	0	•3		333 140	243 -22	343 157	INT

EQUIPMENT ITEM LASER RADARS

	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)		AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD.	WATTS MIN/	POWER	CONST. HOURS HIN	ADIABATIC RISE RATE DEG K/HR DEG F/HR MIN MAX	MASS W-HR/K	TEMP.	DEG K/(F)	OP MODE
LR ;	I SCAN LASAR RADAR ITT GILFILLAN UNIT IS IN ENGIN UNIT IS MARRIED INCHS WEIGHT 15 DATA ABOVE IS PR NO COULING REQUI SYSTEM TOTAL POW	(60.0) EERING TO AN E LBS AND ELIMINA RED UNI ER IS 5	STAGE AND LECTRONION POWER LI RY INFORI T IS COLO U WATTS.	7897. (8.5) D IS NOT CS PACKAL EVEL OF S MATION. D PLATED	(1.50) COMPLE SE WHICH 20 WATT	.90 TED. + 15 9	30 (BY 12 E				22.9 12.1	285 3 54 1		317 111	INT
LR a	P SCAN LASAR RADAR ITT GILFILLAN UNIT IS IN CONCE INARY INFORMATIO IS ALSO IN DESIG	(70.0) PTUAL D N. UNI	ESIGN ST. T IS COU	PLED TO .	(1.67) ABOVE DA AN ELEC	.90 ATA ARE TRONICS	70 PRELIM UNIT V	MHICH		2 2 4 4	26.7 14:1		310 275 98 35	310 98	INT
ĹR :	S SCAN LASER RADAR ITT GTLFILLAN UNIT IS A PRE-DE THIS UNIT IS DES COUPLED TO AN EL ****** NOTE CON	(#0.0) SIGN ST IGNED T ECTRONI DUCTIVE	AGE AND A O HAVE AND CS UNIT N HEAT LOS	(12,0) ALL AHOVI N ACTIVE WHICH IS SSES MUS	(2.50) E DATA COOLING ALSO II T EXCEE	•90 IS PREL 3 SYSTEN DESIGN D 178.	600 / IMINAR) M. UN] N STAGE AND	(50/ 50 / INFO. IT IS E. O. TO () 1.14 Maintai	N THE MIN	20.2 And Max	-460 -2	206 -460 FING TEMP		INT

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EQUIPMENT ITEM LASER RADAR ELECTRONICS

REF,	-	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS		POWER DENSITY Q/A W/ M2 (W/FT2)	CONST. HOURS MIN		RATE HR HR	THERMAI MASS W-HR/K BTU/F	TEM DES	IP. DE IGN	G K/(F)	OP MODE
LRE	1	ELEC.LASER RADAR ITT GILFILLAN UNIT MARRIFD TO UNIT IS IN DEVEL UNIT IS EXPECTED ING REQUIRED.	OPFMENT	NING LA	VE DATA	(.75) R TRANS: IS PHEL	•90 MITTER- INIMARY	20 RECEIVE INFORE	MOITAR	.57 .57	3 6	3	5.7 3.0	284 52	316 110		316 110	INT
LRE	?	ELEC LASER RADAR ITT GILFILLAN UNIT IS IN DESIG MATION. UNIT IS SCANNING LASER R UNIT IS DESIGNED	N STAGE COUPLET ADAR.	AND ALL	(6.0) ABOVE D RANSMITT	(1.00) ATA IS ! EH/RECE	•90 PRELIMI IVER UN	30 NARY II IT-OF		.63 .63	7	4 7	7.7 4.0	282 48	315 107	282 48	315 107	INT .
LPE	3	ELEC LASER RADAR ITT GILFILLAN THIS UNIT IS MAR SCANNING LASER R DATA IS PRELIMIN UNIT IS DESIGNED	(70.0) RIFD TO ADAR. 1 ARY INFO	THE TRAINING THIS UNITED TO THE CONTROL OF THE CONT	T IS IN ! •	(2.00) PRECEIVE DESIGN :	.90 FR OF TI STAGE .	150 HE HIGH			5 10	5 10	26.5 14.0	255 +0	296 74	255 -0	296 74	INT

EQUIPMENT ITEM TELEVISION

	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)		RAD. ALPHA/ EMISS		POWER DENSITY Q/A W/ M2 (W/FT2)	CONST. HOURS MIN	RISE	RATE K/HR F/HR	THERMA MASS W-HR/K BTU/F	TEM! DES	P. DE: IGN	G K/(QU	F) Al	OP MODE
TV 1	COLOR TELEVISION WESTINGHOUSE THE SKYLAR COLOR CONTROL OF RADIA A WHITE CAT-A-LA REGUIREMENTS. CA BE USED AS THE T DIMENSIONS OF CA IN) LONG NOR THE	T.V. CATION FROM PAINT OF THE P	MERA WAS OM THE SI OBJUT CAN DESIGN I FA FOR THE S NOT IN WHICH IS	URFACES. N BE FIN FOR SPACE HE T+027 NCLUDE LE S 14 CM	(.19) WITH A THE UN ISH PER E ENVIRE EXPIRE ENS WHI (5.5 IN	+86 PASSIV IT IS P. CUSTOM ONMENT MENT ON CH IS 1:) LONG.	28 E THER AINTED ER THE AND WA BOARD:	WITH RMAL 5 TO SKYLAB. (6.5	.99		11	2.5	186 -123	112	-460	317	· INT
TV 2	LUNAR T.V. SYSTEM RCA THERMAL CONTROL OND-SURFACE MIRRI AND WITH DEEP SP. RECEIVES HEAT BY DENT TO THE MIRRI RADIATOR IS TILTE BLANKET COVERS TO ************************************	(12.8) DE THE (DR ON TH ACE. TH INTERNA DR RADIA ED TOWAF HE REMAI DUCTIVE	TV IS AGE TOP OF SECTION OF THE LINE SECTION OF THE LINE SECTION OF SECTION OF THE SECTION OF TH	(3.0) CHIEVED F THE CAL EUECTS HI DISSIPAT D LUNAR SURI RFACES OF	(.27) BY THE MERA WI EAT THRO ION. SOURFACE FACE. I F THE CO T. EXCEE	.05 INTERAC TH THE ! OUGH PAI LAR RAD RADIAT A THERM AMERA. D 11.	14 TION OF LUNAR DIATION IATION HE AL INST	SURFACE N AND INCI- EN THE ULATION 6. TO				AND MAX		ATING	TEMP		TNI

GUIDANCE NAVIGATION AND CONTROL SUBSYSTEM

EQUIPMENT ITEM ACS ELECTRONICS

SIGN 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.

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REF NO	· · · · · · · · · · · · · · · · · · ·	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	DENSITY	CONST. HOURS MIN	ADIABATIC RISE RATE DEG K/HR DEG F/HR HIN MAX	MASS W-HR/K	TEM DES		G K/(QU	F) AL	OP MODE
ACSE	1 VALVE DRIVE AMP. MARTIN MARIETTA C THE VALVE DRIVE VIKING LANDER CA MENT AND THE MAR	O(12.0) AMPLIFIE PSULE.	UNIT IS	DESIGN	(33) MPONENT TO WITH	IS DES STAND S	38 IGN FO PACE E	NVIRON-		8 8 15 15	-	137 -211	351 173	137 -211	351 173	CONT

	DESCRIPTION MANUFACTURER AND REMARKS		SHAPE	SURFACE AREA SQUARE CM (FT)	CUBIC CM (FT)	ALPHA/ EMISS	WATTS MIN/ MAX	POWER DENSITY Q/A W/ M2 (W/FT2)	CONST. HOURS MIN	ADIABATI RISE RAT DEG K/HR DEG F/HR MIN MAX	E MASS W-HR/K	TEMP DESI	DEG K.	/(F) Qual	OP MODE
COMP	1 MAGIC 352 DELCO ELECTRONICS MARRIED TO CAROU QUALIFIED FOR A FUNCTION IN LESS	(79.5) ISEL 58) 9 HOUR N	MU 4ISSION	(8.9)	(1.67)	•90				7 7 12 12			285 23 53 -3		CONT
СОМР	2 MAGIC 352 DIGS DELCO ELECTRONICS BOX DESIGN INCLU THERMAL MASS AND 90 MINUTE MISSIC ****** NOTE CON	DES EXTE PADIATI N LIFET! DUCTIVE	ERNAL CA ION IN F IME HEAT LO	LIGHT SSES MUS	("94) EAT EXC	•90 HANGEP D 76•	196 AND	0. TO) 1.14	9 10 17 19 N THE MIN N THE MIN	10.1	-460 OPER	ATING TE	0 76	CONT
COMP	3 469 COMPUTER CONTROL DATA CORF THE 469 COMPUTER X 11.9 X 2.1 CEN MOUNTING PLATE A MENTS: CARLE LEN MICRO-SECOND TIN UNIT IS SPACE QU BASEPLATE MUST C	R IS DES: NTIMETERS ND FLANG NGTH IS U ME DELAY JALIFIED:	IGNED WI S (5. K 3E. SUR IMITED FROM PO	TH A COL 4.7 X .8 RFACE FIN TO 1.8 M OWER ON.	(.09) D PLATE 2 IN) ISH PER ETERS (• THE P AND COU CUSTOM 6 FT).	ZO LATE I PLES A ER REQ	S 12.7 S A UIRE~					313 16 104 -16		CONT
COMP	4 469 DOUBLE DENSIT CONTROL DATA CORE THE 469 COMPUTER TO 15 WATERS TO A CENTIMETERS (5. REQUIREMENTS. CA MICRO-SECOND TIM IED.	P.(6.0) R IS DES HOUNTING X 4.7 X ABLE LEN	IGNED WI FRAMEWO .82 IN) 3TH IS L	(.8) TH A COL PRK. THE SURFAC IMITED T	(.05) DPLATE PLATE I E FINIS O 1.8 M	.90 AND MUS S 12.7 H PER C ETERS (16 T COND X 11.9 USTOME 6 FT)	(19/ 19 UCT 12 X 2.1 8		.7 7 13 13			307 - 93 -46		CONT
	##### NOTE CON						AND AND			N THE MIN N THE MIN				MP	
COMP	5 LS-52 COMPUTER LEAR SIEGLER INC PRESENTLY DESIGN COLD PLATE. SURF LENGTHS UP TO 15 OPERATION WITHIN ****** NOTE CON	(33.0) IED FOR F TACE PROF METERS I A FEW S	FORCED APERTIES (50 FT) SECONDS	(4.3) IR COOLI PER CUST DEPENDI OF POWER	NG AND OMER RE NG ON C ON.	.90 CAN BE QUIREME OMPONEN	205 Modifi Nt. C Ts.	(48/ 48 ED FOR ABLE	1.00	17 17 30 30	6.7	-460	-9 -46		CONT

	DESCRIPTION MANUFACTURER AND REMARKS		PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)			WATTS	POWER DENSITY Q/A W/ M2 (W/FT2)	CONST. HOURS MIN	RISE 6	RATE /HR /HR	THERMA MASS W-HR/K BTU/F	TEM DES	P. DEÓ IGN	3 KZ(1	F) AL	OP MODE
COMP	5 BR-1018M COMPUTED BUNKER RAMO UNIT COMPONENTS DUCTION. CABLE (AIRCRAFT, BUT C, IS SIZED FOR 16+ UNIT WILL HAVE ((6-0X6-0X4-0 IN FINISHED PER CU	(13.0) ARE HEAT MAX LENGT AN RE MOT K WORD ME A SEPERAT UNIT	TH 1.52 DIFIED F EMORY AN TE MEMOR SURFACE	METER (5 OR SPACE O POWER Y PACKAGI S ARE BL	(.17) LATE. (FT). UH APPLICA SUPPLY. E OF 15: ACK ANON	COOLING NIT IS ATIONS. A 32k .3 X15.	44 IS 8Y DESIGN ABOVE WORD 8	FOR UNIT MEMORY 2 CM		5 10	9 17	5.0 2.6	-0 -460	341 155		341 155	CONT
-	***** NOTE CO						AND Gna		MAINTAII Maintaii					_	TEMP		
COMP	7 CP-16A COMPUTER GENERAL FLECTRIC THE CP-16 IS AN VEHICLE USE. IT DUCTION AND RAD REDUTREMENTS. U UNIT AT STAND 8 LENGTH IS 15 ME	AIRCRAFT IS FORCE IATION.SL NIT IS PA Y MODE WITHERS (50	ED AIR C URFACE P AINTED W TLL USE	(3.6) ER IT CA OOLED AN ROPERTIE ITH GRAY APPROX.	N BE MOI D CAN BI S ARE PI EPOXY I 200 WA	.90 DIFIED E CONVE ER CUST PAINT A TTS. MA	242 FOR SP RTED T OMER T T PRES XIMUM	O CON÷ HERMAL ENT USE CABLE		26 48	26 48	9.5 5.0	-0 -460	-0 -460	-0 -460	-0 -460	CONT
	OPIENTATION IN THE COLUMN TARREST NOTE COLUMN TO COLUMN THE COLUMN TERM TO COLUMN THE COLUMN TERM TO COLUMN TERM TERM TO COLUMN TERM TERM TERM TERM TERM TERM TERM TERM	NDUCTIVE							MAINTAI Maintai								
COMP I	CP-244 COMPUTER GENERAL ELECTRIC THE CP-244 IS DO THE UNIT THERMAI UNIT IS PAINTED OUIREMENTS. IN S CABLE LENGTH IS REQUIREMENTS TO ###### NOTE CO	17.2 (38.0) ESIGN TO CONTROL BLACK BY STAND BY 15 METER THE VEHT	RECT MEET TH IS RY IT CAN B MODE UN S (50° F ICLE+ OP HEAT LO	4461. { 4.8} E REQUIR CONDUCTI E FINISH IT DISST EET). UN EPATIONA SSES MUS	Z0106. (.71) EMENTS (ON TO CO ED PER (PATE 75 IT HAS (L WITHII T EXCEE	.90/ .90 OF SPAC OLD PLA CUSTOME WATTS. NO SPEC N 300 N D 27.	94/ 94 E MISS TE MOU R THER MAXIM IAL MO ANOSEC AND	211/211 (19/ 19 IONS. NTING. MAL RE- UM UNTING ONDS. 0. TO	1.17	6 12 N THE	6 12 MIN	14.5 7.7	-0 -460	320 117	-0 -460 TEMP		CONT
COMP (***** NOTE COP OCP-32A COMPUTER GENERAL FLECTRIC THE CP-32 IS DES SPACECRAFT USE. VERTED-TO CONDUC PAINT AT PRESENT MODE UNIT DISSID (50 FEET). NO SE	18.9 (41.7) SIGNED FO IT HAS CTION COO T USAGE F	RECT A FORCE: BLING, UI BUT IS AI WATTS.	5101. (5.5) AFT USE D AIR CO NIT IS P PPLICATI MAXIMUM	22642. (.80) IT CAN I OLING S' AINTED ON DEPE CABLE EI	.90/ .90 RE MODI YSTEM A WITH A NDENT. ENGTH I	365/ 365 FIED F ND CAN GRAY E IN STA S 15 M	715/715 (66/ 66 OR BE CON POXY ND BY ETERS	.89	24 43	24 43	15.9	-0	90 -297	-0		CONT

•	DESCRIPTION MANUFACTURER AND REMARKS		SHAPE		CUBIC CM (FT)	ALPHA/ EMISS	WATTS -MIN/ -MAX	DENSITY Q/A	CONST. HOURS MIN MAX	RISE F DEG KA DEG FA MIN	RATE /HR /HR MAX	W-HR/K BTU/F	TEMP DESI	P. DEC [GN	3 K/(I QU,	F) AL	OP MODE
COMP 10	SCP-234 COMPUTER. PCA THE STANDARD CON USAGE: IT IS DEV WILL BE LANNOH I BY RADIATION. PEND ON UNIT SPE IS INDEPENDENT CONVERTER FROM 2	(11.7) ITROL PRO IELOPED F IN THE FU JULIT IS F EED AND (DE MEMORY	DCESSOR FOR A DO JTURE. PAINTED CABLE CA / SIZE.	D PROGRA IT IS DE WITH BLA PACITANC UNIT PO	PUTER D M THAT SIGN FO CK PAIN E. UNI WEN DOE	.90 ESIGN F IS CLAS R A PAS T. CAB T STEAD	3 OR SPA SIFIED SIVE C LE LEN Y STAT	(1/ 1 SE . UNIT DOLING GTH DE- E POWER	, .83	0		4.5 2.4	259	331 136		331 136	CONT
COMP 11	RAC+261 COMPUTER RAYTHEON COMPANY, THE RAC-261 IECA PASSIVE THERMAL SURFACE IS IRIDI EMENTS. UNIT CAN BASIC MODE. 804404 NOTE COM	A CMPUTER CONTROL [TED BUT A BE MOD]	> IS DES OF COND CAN BE IFIED FO HEAT LO	UCTION T FINISH P R SPACE SSES MUS	(33) AN AIRC HRU SID EH CUST USE WIT	RAFT US E WALLS OMER TH HOUT CH D 163.	200 E IT H OF UN ERMAL I IANGING	IT. REQUIR- ITS 0. TO		33 N THE !	33 MIN .	6.0 AND MAX	-460 ·	-10B -	-460		CONT
COMP 12	AP-101 COMPUTER IRM THE AP-101 COMPUTER AIR CIRCULATION, UNIT POWER CAN E DUTY CYCLE TO 20 DEPENDENT ON DES MYLAR BUT CAN BE ***** NOTE COM ****** NOTE COM ****** NOTE COM	26.1 (57.5) JTER IS I UNIT (BE REDUCE 10 KOP/S SIGN CONS FINISHE NDUCTIVE	RECT DESIGN F CAN BE M FPOM 50 SIDERATI ED PER C HEAT LO	7385. (7.9) OR ACTIV ODIFIED O WATTS O KOP/S. ONS. S USTOMER SSES' MUS	35220. (1.24) E COOLI TO PASS STEADY UNIT C UHFACE THERMAL T EXCEE	.90/ .90 NG HY M IVE THE STATE H ABLE LE PROPERT REQUIR D 253.	340/ 340 IEANS OF IRMAL CONTROL IY REDUINGTH INTES ARI IEMENTS	F FORCE ONTROL. CING 5 E GOLD 0. TO	98	28 N THE (28 MIN		-460 OPEH	OS ONITA	-460	20	CONT
COMP 13	ADVANCE TECH COMPIRM THE ABOVE DATA INTHE 1977 TIME PERMEMORY, AND USIN PHYSICAL PARAMETO DIMENSION IS BASSUMED A PASSIVE THERMAN ************************************	(20.0) (S FOR A (RIOD) TH (G A CMOS (ERS ARE (ED ON UN (TO BE DE (L CONTRO (DUCTIVE	PROJECT (E COMPU) (E LSI / BASED O (IT VOLU) (SIGN TO ()L IN TH ()HEAT LO	TER IS A MONOLITH N EXPECT ME OF 59 MEET MI E FORM O SSES MUS	(.21) CED TEC SSUMED IC NONV ED TECH 50 CC. L-E-540 F RADIA T EXCEE	HNOLOGY TO BE A OLATILI NOLOGY (363 O CLASS TION AN D 55.	80 COMPU 64K W 14 MEM OF 197 CUBIC 2: AN ID COND AND	ORDS ORY. 7. INCHES) D HAVE UCTION 0. TO		19 N THE :	19 MIN	AND MAX	-460 OPER	52	-460		CONT

	DESCRIPTION MANUFACTURER AND REMARKS	· WEIGHT KG (LBS)		SURFACE AREA SQUARE CM (FT)	CUBIC	RAD. ALPHA/ EMISS	WATTS MIN/	DENSITY	CONST. HOURS MIN	RISE DEG K	RATE /HR /HR	THERMAI MASS W-MR/K BTU/F	TEM	P. DEG IGN	K/(F QUA	L L	OP MONE
COMP 14	MILLICOMPUTLER WESTINGHOUSE THE MILLICOMPUTE MENT. IT IS COOL IRIDITE AUT CAN ABOVE DATA IS BE SEMICONDUCTOR ME CLUDE THE 28 VOI WILL INCREASE TO	(10.0) ER IS DES LED BY CO BE FINIS ASED ON A EMORY AND C POWER S	RIGN FOR ENDUCTION SHED PER MILLICH MILLICH MENER SUPPLY.	N AND IT CUSTOME OMPUTER RAL PURP THE ADDI	(.18) RCRAFT // S SURFACE R THERM WITH CPI OSE I/O TION OF	.85 AND SPA CES ARE AL REGU U ROM 3 IT DOE THE PO	B CE ENV BLACK IREMEN SK WOR S NOT WER SU	TS. D IN-	•65) •65	2 3	2 3			394 250 -			CONT
COMP 15	MAGIC IV COMPUTE DELCO ELECTRONIC THE UNIT IS COO (COLD PLATE). (160 DEGREES F PROTOTYPE CUMPU PRODUCTION PLANI PRESENT IS BLACK OUIREMENTS. UN ***** NOTE COI	S (10.8) LED BY HE COLD PL THE MA TER SCHET NED FOR (K PAINT F IT IS BET NOUCTIVE	FAT COND LATE MAX AGIC IV NULED TO LATE 197 RUT CAN ING DESI HEAT LO	(1.7) UCTION T IMUM TEM IS IN DE BE AVAI 4. THE RE FINIS GN FOR S SSES MUS	(.14) O AN EX PERATUR VELOPME LABLE I UNIT SU MED PER PACE EN	.90 TERNAL F 15 71 NT AT P N MID RFACE P CUSTUM VIRONME D 21.	39 HEAT S DEGRE RESENT 1974 A ROPERT ER THE NT AND	ES C WITH ND IES AT RMAL RE	, .96 Maintai	N THE:	MIN		OPER	96 -	-0 -460 TEMP		CONT
COMP 16	MAGIC 362 COMPUT DELCO ELECTRONIC UNIT IS COOLED IS DESIGN TO QU RLACK BUT CAN B MAGIC 362 IS AN HAS NO MOUNTING LENGTH REQUIREM 4***** NOTE CO	S (11.5) BY HEAT (ALIFY FOR E FINISHE OFF-THE- LIMITAT: ENTS. CA	ONDUCTI R SPACE FD PER C -SHELF C ION ON V ABLE LEN HEAT LO	ENVIRONM USTOMFR OMPUTER EHICLE A GTH WILL SSES MUS	(.15) COLD PL IENT. T THERMAL THAT IS IND HAS DEPEND T EXCEE	ATE. THE UNIT REQUIR IN PRO SPECON COM	58 HE MAG IS PA EMENTS DUCTIO IFIED PONENT AND	INTED IN THE IN UNIT CABLE S. 0. TO) .92	N THE	MIN		-460 OPER		-460	289 61	CONT
COMP 17	MICRO-D 1808 ARMA DIV. OF AMB THE MICRO D COM AIRCRAFT FORCED LIMITED TO APPR WHETHER UNIT CA ARE PAINTED BLA MENTS. THE ABO DOES NOT INCLUD ***** NOTE CO	PUTER IS AIR AS OX. 2.5 I N BE MOD CK BUT C VE DATA E A POWE! NDUCTIVE	AN AIRC THE UNIT METERS (IFIED FO AN BE FI IS FOR A P SUPPLY HEAT LO	(4.6) RAFT DES COOLING 8 FT). R A SPAC NISHED F 32K X 1	(.53) GIGN COM G SYSTEM THERE I CE ENVIR PER CUST (8 BIT W	.90 PUTER T . CABL S NO IN ONMENT. OMER TH ORD COF	106 'HAT US 'E LENG IDICATI 'SURF IERMAL RE MEMO	TH IS ON FACES REQUIRE ORY IT	1.14	14	14 MIN	13.7 7.2 AND MAX	-460 OPEF	98 RATING	-460		CONT

	MANUFACTURER AND	KG SH (LBS)	KAGE SURFAC APE AREA SQUARE CM (FT)	CUBIC CM (FT)	ALPHA/ EMISS	WATTS MIN/ MAX	DENSITY Q/A W/ M2 (W/FT2)	HOURS MIN	RISE	RATE ZHR ZHP	M-HK\K	TEMP DES:	P. DE(IGN	G KZ(F QUA	i) AL	0P MODE
COMP 19	*· *- *- *	14.1 RE (31.0) RD PROCESS A GODDARD HAS A COMP ADIATION A DESCRIBED PLETE T/O	CT 5355. (5.8) OR IS A PRO SPACE FLIGH LETE PASSIV ND CONDUCTI ABOVE INCLU AND A 28 VD	22712. (.80) TOTYPE UT T CENTER E THERMAL ON. UNI DES A CPU	.85/ .85 NIT THA FOR US DESIG T SUPFA 3, A 37	13/ 13 T IS BE E ON SE N WITH CE IS E K PLATE	25/ 25 (2/ 2) EING PACE COOL- BLACK ED	.91	5	5	11.8 6.2			244 -19		CONT
COMP 19	HDC-301 COMPUTER HONEYWELL THE HDC-301 COMPU ED TO THE MOUNTIN WORD MEMORY+ UNIT CONFORMAL COATING ##### NOTE COND	(1.5) TER HAS A G EDGES. T TS EXPAND OCTIVE HEA	THE ABOVE UN DARLE TO 32K AT LOSSES MU	(.03) RMAL CON IT SIZE WORD ME	TROL HE IS BASE MORY. U D 7.	16 AT IS D ON A NIT HA	4K S 0. TO	75. (N THE	29 52 MIN MIN	.6 .3 AND MAX	-460 OPER	109 ATING	-0 -460 TEMP	109	CONT
COMP 20	HDC-402 COMPUTER HONEYWELL THE HDC-402 COMPU PASSIVE THERMAL C PAINTED WITH BLAC (140 DEG F) FOR S DEG F) FOR MARS O POWER WHILE CONTR THE DUAL REDUNDAN	(47.0) TER IS DESONTROL OF K PAINT. THE HORT TIME PERATION.	6.3) SIGN FOR THE RADIATION A THE UNIT IS DURING ENTH UNIT AT ENTH	ND CONDU QUAL. TE RY, AND T IRY DISSI ENTRY. T	.90 PROGRAM CTION. STED TO 0 40.6 PATE 40 HE ABOV	25 THE U 60 DE DEG.C(WATTS	NII 15 G.C 115 OF IS FOR	1.41	1 2	1 2	18.0 9.5	225 -54	318 113	225 -54	327 129	CONT
COMP 21	HDC-601C COMPUTER HONEYWELL THE HDC-601C IS A WITH AN ACTIVE CO UNIT CAN HE MODIF APPLICATIONS. THE BUT CAN HE FINISH PANDABLE TO 32K W WITHIN THE COMPUT ****** NOTE COND	(35.0) IN RK X 16 ILD PLATE (IED TO USE I HDC-601C I PER CUST JOPD MEMOR ER MAINER BUCTIVE HE	(5.2) BIT CORE ME COOLING SYSTE E A PASSIVE IS PAINTED OMER THERMAL Y WITH THE A AME. AT LOSSES ME	TEM UTILI THERMAL WITH A'G REQUIRE ADDITIONA JST EXCEE	.90 PUTER. ZING FO CONTROL RAY ENA MENTS. L MEMOR	160 IT IS PROCED A FOR S MEL PA UNIT I RY HOUS	PACE INT S EX- SED	, 95	IN THE	MIN 22	13.5 7.1 AND MAN	-460 C OPE	ONITAS	-460	295 71	CONT

	DESCRIPTION MANUFACTURER AND REMARKS	KG	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	WATTS	POWER DENSITY G/A W/ M2 (W/FT2)	CONST. HOURS MIN	RISE DEG K	RATE ZHR ZHR	THERMAI MASS W-HR/K BTU/F	TEM: DES	P. DEG IGN	K/{F QUA	1). L	OP MODE
COMP 22	HDC-601P COMPUTER HONEYWELL THE HDC-601P IS DESIGN WITH AN A AIR. UNIT CAN BE SPACE APPLICATION PAINT. BUT CAN BE IS EXPANDARLE TO PY HOUSED IN THE ***** NOTE COE	(37.0) AN 9K X ACTIVE COMMITTEE MODIFIE MODIFI	16 BIT OLD PLAT ED TO US HDC-601 H PER CU RDS MEMO FP MAINE	(5.2) PLATED W E COOLIN E A PASS P IS PAI ISTOMER T IRY WITH FRAME+AND SSES MUS	IRE MEMO G SYSTE IVE THEO NTED WI HERMAL UP TO 1 HEST I T EXCEE	.90 ORY COM M UTILI RMAL CO TH A GR REQUIRE 6K PLAT N AUXIL D 64.	120 PUTER. ZING FOUTER NTROL AY ENA MENTS. ED WIR ARY ME AND	FOR MEL UNIT E MEMO- MORY. TO		B 15 N THE N THE	MIN	7.5	OPER	97 - ATING	460	309.	CONT
COMP 23	HDC-602 COMPUTER HONEYWELL THE HDC-602 DIG ED THERMAL SYST WILL BE USED IN +602 IS AN HERM URETHANE PAINT. THE HDC-602 DES MEMORY. UNIT IS	70.4 (45.0) ITAL COM EM. THE THE SPA ETICAL S BUT CAN CRIBED A FXPANDA	RECT PUTER IS UNIT IS CE SHUTT FALED UN BE FINE BOVE HAS BLE TO	8781. (9.5). 5 DESIGN PRESENTL TLE MAIN ISH PER C S A 16K X 32K WOPOS	51482. (1.82) WITH A Y IN DE ENGINE S PAINT USTOMER 17 BIT MEMORY	.25/ .85 PASSIVE VELOPME CONTROL ED WITH THERMA WORDS	170 E PADIA ENT STA LER. T A WHI AL REGU PLATED	HE HDC TE POLY IREMENT WIRE	.68) .68		10 18		-460	343 158 -		147	CONT
COMP 24	D216 COMPUTER AUTONETICS P.I. THE D216 DIGITA MISSILES. THE U ING TO A COLOPL FINISH PEP CUST COMPUTER IS A 7	NOUCTIVE 7.3 (16.0) L COMPUT NIT THER ATE. UNI OMER THE	RECT RECT RECT RECT RAL CON T HAS A RMAL REC	2387. (2.6) ESIGN FOR THOL IS B IRIDITE QUIREMENT CLUDING T	7571. (.27) E USE FO IY MEANS ALUMINU IS. THE	.90/ .90/ .90 R BOTH OF CO! IM FINI: ABOVE I	65 AIRCRA NDUCTIV SH BUT D216 DI ER SUPP	0. TO 272/272 (25/ 25 FT AND E COOL CAN BE	MAINTAI	N THE	MÍN 11 20	AND MAX	(JUAL	305		305 90	CONT
	PACKAGED IN ONE WIRE MEMORY AND ###### NOTE CO	BOX. TH MEMORY NOUCTIVE	IE D216 I STZE CAI MEAT LI	HAS A 32K N VARY FE OSSES MUS	C X 16 E POM BK T ST EXCEE	111 WORI 10 65K 1 10 37	US PLAI	0. TO	MAINTAI Maintai	N THE	MIN MIN	AND MA	C QUAL	RATING TEMP	TEMP		
COMP 25	nt216 COMPUTER AUTONETICS R.I. THE DI216 COMPU CIPATED QUALIFI DESIGN WITH A P PLATE. UNIT SUR CUSTOMER THERMA 32K WORDS MEMOR	TER IS I CATIONS ASSIVE I FACE IS L REQUIR Y.	N THE F TESTS CO HERMAL O IRIDITES REMENTS.	INAL STAG OMPLITION CONTROL C O ALUMINU THE DISI	(,27) SE OF DE DURING SE HEAT JM BUT C (6 IS A	EVELOPM 5 1974. CONDUC COULD H MODULA	75 ENT WIT THE U TION TO E FINIS	A COLD SH PER WITH		IN THE	21 23 85	S.E	-0 -460	PATING	-0 -460	77	CUNT

	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LAS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	ALPHA/	WATTS MIN/	POWER DENSITY Q/A W/ M2 (W/FT2)	CONST. HOURS MIN	RISE RA	IR W-HR IR BTU/	S TEN	IP. DE(SIGN	S KZ(F QUA) (L	OP MOD€
			0001		16143	004	1404	370/370	1.01	12 1	2 11.	i - 0	287	-0	287	CONT
COMP 25	D232 COMPUTER AUTONETICS R.I THE D232 COMPUTE TO BE OPERATIONA SIGN WITH A PASS THE UNIT SURFACE PENDENT. THE D23 HAS A 65K X 16 F	R IS IN L NEAR T IVE THEF IS IRIF IS COMPUTE	FINAL 5 THE END PMAL CON DITE ALU TER IS 5	(4.1) TAGE OF 1 OF 1973. TROL OF 1 MINUM BU IMILAR T	(.53) DEVELOP THE D CONDUCT FINIS OTHE D	.90 MENT AN 232 COM ION TO H IS AP 1216 CO	140 D IS S PUTER A COLD PLICAT MPUTER	(34/ 34 CHEDULE IS DE- PLATE. ION DE- BUT) 1.01	23 2	2 114	0 -460			57	CONT
	POWER. ###### NOTE CON ###### NOTE CON						AND AND			N THE MI				TEMP		
	TDY-300 COMPUTER LEDYNE THE TDY-300 IS ETHE DELTA LAUNCH CONTROL IN SPACE ES AIR CONDITION AIR TEMPEHATURE WITH AN AVERAGE	(47.5) DESIGN FOR THE PROPERTY MEAN A AIR FOR BETWEEN CONVECT	F. UNIT NS OF RA R PRELAU 22.2 AN IVE HEAT	(8.0) ENVIRON IS DESIG DIATION NCH OPER D 29.9 D TRANSFE	MENT IT N WITH AND CON ATION W EG C (7 H COEFF	.26 IS THE A PASSI DUCTION ITH THE 2 TO 85 ICLENT	143 COMPU VE THE UNIT COMPA DEG.F BETWEE	RMAL REGUIR RTMENT) AND N 0.5	2.47) 2.47	8 14	8 18. 4 9.		180 ~135	-460 -		CONT
	AND 2.0 RTU/HR-F	DUCTIVE	HEAT LO	SSES MUS	T EXCEE	D 98.	AND	0. TO		N THE MI N THE MI						
COMP 28	TDY-310 CENTAUR TELEDYNE THE TDY-310 IS TO VEHICLE. UNIT IS DISSIPATING HEAT ON THE GROUND BY COOLING. UNIT ISH PER CUSTOMER CENTAUR IMU. AB	S DESIGN THY RAD THEQUIR THERMAL THERMAL	FOR A PIATION AING AIR FO WITH L REQUIR T IS A 1	(5.9) PUTER ON ASSIVE T ND CONDU CONDITIO A WHITE EMENTS. 6K X 24	BOARD THERMAL CTION A NAIR FAINT SUNIT IBUTS CO	.92 HE CENT CONTROL ND AN A OR CONV -13G+ 8 S COUPL RE MEMO	235 AUR LA IN SP CTIVE ECTIVE UT CAN EN TO RY COM	ACE BY CONTROL BE FIN THE PUTER.	1.28	16	18 12.	5 -4 60	26	-460 ·	58	CONT
	***** NOIE COM	DUCTIVE.	HEAT LO	SSES MUS	T EXCEE	D 97.	AND	O. TO	MAINTAI Maintai	N THE M. N THE M	IN AND M IN AND M	AX OPE AX QUA	RATING L TEMP	TEMP		
COMP 29	SKC2000 COMPUTER SINGER COMPANY THE SKC-2000 IS CONTRUL OF CONDU- ED FOR A PASSIVE COMPUTER APPLICA APPROX. 100 WATT ORY COMPUTER. UN ED BLACK, OR PER	(*0.0) DESIGN (JCTION A) COOLING TIONS A) S OF DIS HIT SURF	FOR AIRC ND FORCE G SYSTEM ND IT IN SSIPATED ACES ARE	(6.2) RAFT USE D AIR CO . ABOVE CLUDES S POWER. ANODIZE	IT HAS OLING: POWER PECIAL UNIT IS D ALUMI REMENTS	.90 AN ACT UNIT CO IS BASE B1 TYPE A 32K NUM THA	790 IVE THULD BE D ON T I/O W WORD C T ARE IS IN	MODIFI HE B1 HICH IS ORE MEM PAINT- 2 BOXES	. 1.52	39		1 -460	-460	- 460		CONT
	##### NOTE CON	DUCTIVE	HEAT 10	SSES MUS	I FXCEE	D 724.	ΔND	378. TO	MAINTAI MAINTAI	N THE M N THE M	IN AND M In and M	AX QUA	RATING L TEMP	TEMP		

EQUIPMENT ITEM TAPE RECORDERS

REF. NO.		AND	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE	CM CORIC AUTOWE	RAD. ALPHA/ EMISS		DENSITY Q/A	CONST.	RISE	RATE	MASS	TEM	P. DE		F)	OP MODE
					CM (FT)	(FT)		MAX	. W/ M2 (W/FT2)	MIN MAX	DEG MIN		BTU/F	MIN	MAX	MIN.	MAX	
TR	I EREP TAPE RE	CORDE	R 40.8	RECT	8768.	54569.	.85/	187/	213/213	.: 2.67	5	5	34.5	-0	216	-0	185	CONT
	MARTIN MARIE								(19/ 19	2.67	10	10	18.2	-460	- 70	-460 °	-124	
	THE EREP TA IS ONBOARD	_	•		,													
	THERMAL CON																	
	FINISH PER																	
,	TION OF 35	WATTS	IN STA	NDBY MOD	E+173 WA	TTS IN 9	SLOW SPI	EED RE	CORD.									
	AMD 187 WAT	TS FO	R HIGH :	SPEED RE	CORD.								•					
	AGGGG NOTE	CON	DUCTIVE	HEAT LO	SSES MUS	T EXCEED	14,	AND	0. TO	MAINTAI	N THE	MIN	AND MAX	OPER	ATING	TEMP		
	##### NOTE	CON	DUCTIVE	HEAT LO	SSES MUS	T FXCFF!	39.	AND	O. TO	MAINTAT	N THE	MIN	AND MA	(QLEAT	TEMP	*		

EQUIPMENT ITEM TRANSPONDERS, PM

	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)		ALPHA/	WATTS	POWER DENSITY Q/A W/ M2 (W/FT2)	CONST. HOURS MIN	RISE DEG N	RATE C/HR T/HR	THERMAI MASS W-HR/K BTU/F	TEM DES	P. DE IGN	G KZ() QU,	F" } A L	OP MODE
TPM]	S-BAND TRANSPONDE PHILCO FORD CORP THE S-BAND TRANS A PASSIVE THERMAL RADIATION TO THE FOR SPACE TUG AL ARE NO CABLE LIM IREMENTS.	(3.8) PONDER I L DESIGN ENVIRON THOUGH F	S DESTG F CON IMENT. UI	(1.3) N FOR THI DUCTION NIT IS AS NG IT IS	(.08) VACUUM SSUMED (.85 G PROGR TING SU TO BE P GOLD P	6 AM. IT RFACES AINTED LATED.	AND BLACK There	• • • • • • • • • • • • • • • • • • • 						219 -63		[NT
TPM Z	S-BAND SGLS TRANSI MOTOROLA INC. THE MSR-101 S-BAI UNIT IS DESIGN W UNTING POINTS ANI WITH BLACK PAINT MENTS. UNIT HAS 101 IS THE HECEL MST-201 OR MST-5	(3.0) ND RECE! ITH A PA D RADIAT HUT CA A STANDR VER/DEMO	VER IS (ISSIVE T) ION FROM IN BE FIN IY INPUT OULATOR	HERMAL CI M CASE SI NISH PER POWER MI UNIT UF	(.02) S-BAND ! ONTROL (UHFACES CUSTOMI ODE OF (THE TR	SGLS TR OF COND • UNIT ER THER O•9 WAT ANSPOND	2 ANSPON UCTION IS PAI MAL RE T. THE ER AND	TO MO- NTED QUIRE- MSR- THE	1	2	2 4			-	218 -66		INT .
TPM 3	S-BAND SGLS THANSOMOTOROLA INC. THE MST-201 S-BAND SER. UNIT IS DESTITE MOUNTING POINTED WITH ALACK PAREMENTS. UNIT IS DESTITED WITH SERVICE CONTRACTOR OF THE MOUNTE CONTRACTOR OF THE MOUNT IS CONTRACTOR OF THE MOUNTE CON	(3.1) ND TRANS IGN WITH NTS AND INT. HUT DESIGN F 22 TO 32 TO THE M DUCTIVE	MITTER A PASS RADIATIO CAN BE OR SPACE VDC AND ISR-101 OF HEAT LOS	IVE THERI ON FROM I FINISH I E ENVIROI D 1.2 AMI RECEIVER SSES MUS	(.03) OF THE ! MAL CON' CASE SUF PER CUS' NMENT. P.+MAXI! T EXCEE	S-BAND TROL OF RFACES. TOMER T ITS INP MUM INP	31 SGLS T CONDU UNIT HERMAL UT POW UT CUR	CTION IS PAIN REQUIR ER RENT.	3 .66	N THE			460 OPER	ATING	-460 TEMP	247 -13	IN T
TPM 4	S-BAND SGLS TRANS	P 1.4 (3.1) ND TRANS IGN WITH IS AND R INT BUT DESIGN F 22 TO 32 TO THE M DUCTIVE	RECT MITTER A PASS ADIATION CAN BE OR SPACE VDC ANT SR-101 F HEAT LOS	524. (.6) IS PART (IVE THER! N FROM (E ENVIRO! D 2.0 AM RECEIVER: SSES MUS	803. (.03) OF THE ! MAL CON' ASE SURI PER CUS' NMENT. P., MAX'	.90/ .90 S-BAND TROL OF FACES. TOMER I ITS INP IMUM IN	51/ 51 SGLS T CONDU UNIT I HERMAL UT POW PUT CU	973/973 (90/ 90 RANSPON CTION S PAINT REQUIR ER RRENT.	.57) .57	45 81 N THE	45 81	1.2 .6	-0 -460	-0 -460	-0 -460	·	Ţ n Ţ

EQUIPMENT ITEM TRANSPONDERS. PM

	DESCRIPTION MANUFACTURER AND REMARKS		PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)			WATTS	DENSITY	CONST. HOURS MIN	RISE DEG	RATE K/HR F/HR	THERMA MASS W-HR/K BTU/F	TEMP DES:	DEC	a KZ(I	F) AL	OP MODE
TPM S	MSX-201S S-RAND MOTOROLA INC. THE MSX-201S TRA OF CONDUCTION TO FPOM THE OTHER S CAN BE FINISH PE EERING STAGE AND FOR PRODUCTION. TRANSPONDER. IF ##### NOTE CON	(4.9) ANSPONDER THE BUT SURFACES. IR CUSTOM WILL RE UNIT IS HE MSX-20 HDUCTIVE	IS DES TOM SURI UNIT HER THER GUIRE SOLLE A SINGLE HEAT LO	(.8) IGN WITH FACE AND IS PAINT MAL REQU OME FURT GLE PACK ACKAGED SSES MUS	A PASS MOUNITH ED WITH IREMENT! HER WORK AGE OF IN A SE T EXCER	.90 IVE THE NGS.AN A BLAC S. UNIT K BEFOR THE MSR ALED CA	34 RMAL C D RADI K PAIN IS IN E IT I -101/M SE. AND	ATION T BUT ENGIN- S READY ST-201	-			1.0	OPERA	53 ·	-0 -460 TEMP	285 53	INT
TPM 6	MSX-501S S-RAND MOTOROLA INC. THE MSX-501S TRA OF CONDUCTION TO FROM THE OTHER S CAN BE FINISH PE EERING STAGE AND READY FOR PRODUC ****** NOTE CON ****** NOTE CON	2.2 (4.9) NSPONDER THE BOT SURFACES. FH CUSTOM WILL RE CTION. TH	RECT IS DES TOM SUR UNIT I IER THER QUIRE S E MSX-5 HEAT LO	.752. (.8) IGN WITH FACE AND PAINTE NAL REGU OME FURT OIS IS P SSES MUS	1349. (.05) A PASS MOUNTIND WITH IREMENT HER WORL ACKAGED T EXCEE	.90/ .90 IVE THE NGS. AN A BLACK S. UNI K BEFOR IN A S D 40.	53/ 53 RMAL C D RADI PAINT T IS I E UNIT EALED AND	715/715 (66/ 66 ONTROL ATION BUT BUT IS UNIT. 0. TO	.69	30 54 N THE	30 54 MIN	1.9 1.0	-0 -460	199 -101	-460 ·		INT
TPM 7	TR-36 TRANSPONDE CUBIC CORPORATION THE TH-36 S-BANE RECEIVER. TRANSPORCE HAS PASEFACE. AND RADIAT SEALED CASE AND THERMAL PEQUIREM PROGRAM.	(5.1)) SGLS TR (ITTER, M SSIVE COOTION FROM IS PAINT	HANPSOND HULTICOU HING BY HREST OF ED BLAC	PLER AND CONDUCT F SURFAC K BUT CA	(.08) ILT FROM BASEBAI ION THRO ES. UNI N BE FI	M 4-SEP ND ASSE U MOUNT T IS HU NISH PE	6 ARATE MBLY. ING SU ILT IN R CUST	THE R- A OMER	1	3 6	3 6	-	218 -66	_			TNI
TPM 7	TR-36 THANSPONDER CURIC CORPORATION THE TRANSMITTER THERMAL CONTROL. RADIATION FROM O AND IS PAINTED HOUSEMENTS. UNIT ****** NOTE CON ******* NOTE CON	(4.0) OF THE T COOLING THER SUR LACK+ BU IS SPAC	R-36 TH IS BY (FACES. (T CAN BI E QUALIN HEAT LOS	(1.0) ANSPONDER CONDUCTION JNIT IS FINISH FIED AND SSES MUS	R IS DES ON THROUBUILT IN PER CUS IS USEN T EXCEEN	.90 SIGN WI UGH BAS N A SEA STOMER O ON A D 10.	Z5 TH A P E PLAT LED CA THERMA USAF P AND	E AND SE L RE- ROGRAM 0. TO	-	31 N THE		.8		90 ATING	-460	305 90	INT

EQUIPMENT ITEM .TRANSPONDERS. PM

REF NO	-	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SOUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	POWER WATTS MIN/ MAX	DENSI Q/A	T Y 2	TIME CONST. HOURS MIN MAX	RISE DEG DEG		THERMA MASS W-HR/K BTU/F	TE*	OWABL IP. DE IGN MAX	G K/(F)	OP MODE
TPM	7	TR-36 TRANSPONDER CUBIC CORPORATION THE RASEBAND ASS SIVE THERMAL CON ING SUFFACE AND WITH A SEALED PA CUSTOMER THERMAL USED ON A USAF R	V (2.8) SEBLY OF NTROL. U RADIAT ACKAGE A REQUIR	THE TR- NIT IS C ION FROM NO IS PA EMENTS.	(1+0) 36 TRANS OOLED BY REMAINI INTED BL	CONDUC NG SURF ACK BUT	.90 IS DESI TION TH ACES. U CAN BE	4 GN WIT ROUGH (NIT IS FINIS	MOUNT- BUILT H PER	4 j S	_	4 7	· 4 7	1.1	218 -67	338° 148	218	338 148	INT
ТРМ	7	TR-36 TRANSPONDER CUBIC CORPORATION THE MULTICOUPLER THERMAL CONTROL. FACE AND RADIATION SFALED CASE AND THERMAL REQUIREN USAF PROGRAM. UN PATION.	N (.8) R OF THE UNIT I ION FROM IS PAIN MENTS. U	TR-36 T S COOLED REMAINI TED BLAC NIT IS S	BY COND NG SUPFA K BUT CA PACE QUA	(.02) ER IS D UCTION CES. UN N BE FI LIFIED	ESIGN W THROUGH IT IS B NISH PE AND IS	MOUNT UILT W R CUSTO USED O	(0/ PASSIV ING SUITH A OMER N A	R	.29 .29	0	0	.2	238 -29	344 160	238 -29	344 ·160	INI

EQUIPMENT ITEM TRANSMITTERS. FM

REF.	DESCRIPTION MANUFACTURER AND REMARKS		PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS	WATTS	POWER DENSITY Q/A W/ M2 (W/FT2)	CONST. HOURS MIN	RISE RATE	THERMAL ALLI MASS TEM W-HR/K DES BTU/F MIN	P. DEG K/(F IGN QUA) MODE
TFM .	1 TWT4 S-BAND WATKINS- JOHNSON THE TRAVFLING WITHE VIKING PROG TO THE ROTTOM S SURROUNDING SUR BLACK ENAMEL PA MENTS- UNIT REG BEING OPFRATION ##### NOTE CO	AVE TUBE RAM. IT UPFACE A FACES AN INT BUT UIRF A M AL. NDUCTIVE	AMPLIFI HAS A PA ND MOUNT IN ENVIRO CAN BE F EAXIMUM O	SSIVE TH ING POIN INMENT. U INISH PE F 2 MINU	(.19) S-BAND EHMAL D TS AND NIT IS R CUSTO TES FOR	.85 AMPLIF ESIGN O SOME RA PAINTED MER THE WARM U	60 IER US F COND DIATIO WITH RMAL R P PRIO	UCTION N TO A Equire R To	, .74		3.7 -0 2.0 -460 AND MAX OPER AND MAX QUAL	13 -460 ATING TEMP	268 INT 22
TFM.	2 MIT-201 S-RAND F MOTOROLA INC. THE MIT-201 S-B DESIGN OF CONDU RADIATION FROM PAINT. BUT CAN IS PACKAGED IN ****** NOTE CO	M 1.0 (2.3) AND TRAN CTION TO OTHER SU BE FINIS A HERMET NDUCTIVE	RECT SMITTER THE BOT REFACES. H PER CU TICLY SEA	402. (.4) IS DESIG TOM SURF THE UNIT STOMER T LED CASE	531. (.02) N WITH ACE AND IS PAI HERMAL T EXCEE	.90/ .90 A PASSI MOUNTI NTED WI REGUIRE	25/ 25 VE THE NGS. A TH A B MENTS.	626/626 (58/ 58 RMAL ND LACK UNIT	E6. E6. (29 29 53 53 N THE MIN	.9 -0 .5 -460	239 -0; -27 -460:	
TFM	***** NOTE CO 3 MTT-501 S-RAND F MOTOROLA INC. THE MTT-501 S-B DESIGN OF CONDU- TATION FROM THE PAINT, RUT CAN IS PACKAGED IN ***** NOTE CO	M 1.0 (2.3) AND TRAN CTION TO REMAINI BE FINIS A HERMET NDUCTIVE	RECT ISMITTER THE BOT NG SURFA H PER CU TICLY SEA	445. (.5) IS DESIGNOSURF CES. UNI STOMER J LED CASE	605. (%02) N WITH ACE AND T IS PA HERMAL " EXCEE	.90/ .90 A PASSI MOUNTI INTED W REQUIRE D 52.	60/ 60 VE THE NGS, A ITH A MENTS.	*48/*48 (125/125 RMAL ND RAD- BLACK UNIT	.45 } .45 MAINTAI	71 71 128 128	•	-0 -0 -460 -460 -	-0 INT -460
TFM.	4 S-BAND TPANSMITT EMR THE S-BAND TRAN OF RADIATION AN ISH PER CUSTOME AND HAS BEEN SP UNIT CASE IS HE PRESSURE FOR EX RANGE OF 25 TO ****** NOTE CO	(14.4) SMITTER D CONDUC R THERMA ACE FLOW RMETICLY TENDED P 32 VDC. NDUCTIVE	TS DESIGNTON. UN THE REQUIR ON ONBOAR SEALED FRIODS.	IT IS PA EMENTS. ED THE TI AND MAIN UNIT OPE	PASSIVINTED BUNIT IS TAN III TAINS A HATE ON	E THERM LACK BU SPACE ON SEV TMOSPHE AN INF	205 MAL CON JT CAN GUÁLIF (ERAL F ERIC PUT VOL	BE FINIED LIGHTS. TAGE) .57			-94 -460	264 INT 15

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM POWER AMPLIFIERS

REF.	DESCRIPTION MANUFACTURER AND REMARKS	(FH2) ke keight	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CUBIC CM (FT)	RAD. ALPHA/ EMISS		POWER DENSITY Q/A W/ M2 (W/FT2)	CONST. HOURS MIN		ZHR Y ZHR E	MASS	TEM DES	P. DE	G KZ(F QU≀) -L	OP MODE
PA	1 S-BAND POWER AMP RADIATION INC THE UNIT IS DESI ING. UNIT IS MOU OUCTOR COMPONENT HAS AN AUMINUM THERMAL REQUIREM	(.3) GN WITH NTED TO S ARE SO ANODIZED	A HEAT COLD PL DET-SOLD FINISH	ATE FOR ERED TO BUT CAN	(.00) E PLATE COOLING THE HEA' BE FIN:	•90 FOR CO THE SINK ISH PER	16 NDUCTION UNIT SI PLATE. CUSTO	EMICON- UNIT MER		146 262		•1	-0 -460	-0 -460	≖0 460 ·	-0 -460	INT
	10-7 TORR. AMPLI ***** NOTE CON ***** NOTE CON	FIER WEI	GHT IS	LESS THA	N 150 GE T exceed	0) 2MA9 .El c	.33 LB	S). 3. TO	MAINTAI MAINTAI	N THE	MIN AM	XAM GI	OPER QUAL	ATING TEMP	TEMP		•
Pδ	S AMPLIFIERS MSC THE 91000 SERIES WAVE INTEGRATED USE IN S-BAND TE TED INTO A TOTAL MAL CONTPOL OF R ANODIZED ALUMINU REGUIREMENTS. UN ***** NOTE CON	(.6) S-BAND CIRCUIT LEMETRY SYSTEM ADIATION M FINISH IT DESIG	TELEMET POWER A SYSTEMS PACKAGE AND CO RUT CA N FOR S HEAT LO	MPLIFIER THE UN UNIT I NOUCTION HE FIN PACE APP SSES MUS	(.00) FIER IS SPECIF IT IS DESIGN TO SURE ISHED PERIORE ICATION	.90 A NON ICALLY ESIGN T N WITH FACES. ER CUST N. O 6.	10. TUNABL DESIGN O BE I PASSIV UNIT H	ED FOR NCOPORA E THER- AS AN HERMAL		n THE			-460 OPER	-59		- 59	ĪNĮ

COMMUNICATION SUBSYSTEM

EQUIPMENT ITEM RF MULTIPLEXERS

		DESCRIPTION MANUFACTURER AND REMARKS	₩EIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE	CMBIC	RAD. ALPHA/ Emiss	WATTS MIN/	DENSIT Q/A	FY C	CONST.	RISE DEG	RATE K/HR	THERMA MASS W-HR/K	TEM DES	IP. DE	G K/(F)	OP MODE
			**		CM (FT)	(FT) 		MAX	₩/ M2 (W/FT2		MIN MAX	DEG MIN		BTU∕F	MIN	MAX	MIN	<u>қа</u> м 	
RFM	1	RF MULTIPLEXER WAVECOM INC. THE VIKING RF MU LANDER. THE UNIT POWER. IT HAS A BOTTOM SURFACES SURFACES. UNIT I FINISH PER CUSTO	LTIPLEXE IS A PASSIVE AND MOUN S PAINTE	FR IS DE ASSIVE D THERMAL NTINGS A ED WITH	EVICE AN' CONTROL ND RADIA A BLACK	("09) UILT FOI D DOES (OF CONI TION FRI ENAMEL I	.85 R THE V NOT DIS BUCTION OM THE	U IKING U SIPATE TO THI REMAIN	ANY E Ing		.51 .51	0	0 0			324 125			INT
RFM	5	MULTIPLEXER EMERSON FLECTRIC THE MULTIPLEXER TION. THE UNIT I TION AND CONDUCT RLACK BUT CAN BE HAS A SEALED CAS III LAUNCH VEHIC	(2.0) IS A PAS S DESIGN ION FROM FINISH E AND HA	SSIVE ELI N WITH A M THE UN PER CUS	PASSIVE IT SURFA- TOMER TH	(.04) UNIT W. THERMAI CES. THI ERMAL RI	.90 ITH NO (CONTRI UNIT EQUIREM	OL OF I IS PAID ENTS. D	(0/ DISSIPA PADIA- NTED UNIT	0)	.56 .56	0	0	. 8 . 4	255 0	324 125		324 125	INT

COMMUNICATION SUBSYSTEM

EQUIPMENT IJEM DECODER

REF.	DESCRIPTION MANUFACTURER AND REMARKS	(FB2) kg meight	PACKAGE SHAPE	SURFACE AREA SOUARE CM (FT)	VOLUME CUBIC CM (FT)	-		DENSITY	CONST. HOURS MIN	ADIABATION RISE RATE DEG K/HR DEG F/HP MIN MAX	E MASS W-HR/K	TEM DES	OWABL IP. DE SIGN MAX	G K/(ผูป	F) AL	OP MODE
DEC 1	MCR-904 DECOUER MOTOROLA INC. THE MCR-904 COMM MAL DESIGN OF CO TION FROM THE OT FINISH BUT CAN E IS PACKAGED IN A COMMAND IS 15 MI	NDUCTION HER SUR NE FINIS N HERME	N TO THE FACES. T H PER CU TICLY SE	ROTTOM HE UNIT STOMER T ALED CAS	(.03) DESIGN MOUNTINHAS AN HERMAL	WITH A G SURFA IHIDITE REQUIRE	2 PASSI CE AND ALUMI MENTS.	RADIA- NUM UNIT	, 78	2 2 4 4		212 -77		212- -77		. 141

ENSTRUMENTATION SUBSYSTEM

FOULPMENT ITEM PRESSURE TRANSDUCERS

REF.	DESCRIPTION MANUFACTURER AND REMARKS	WFIGHT KG (LBS)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)		RAD. ALPHA/ EMISS	WATTS	DENSI Q/A	7 7		RISE DEG DEG	PATE	THERMA MASS W-HR/K BTU/F	TEM DES	P. DE	G K/(F) AL	OP MODE
PRES	1 TRANSDUCER PRES. GULTON INDUSTRIES THE PRESSURE TRA PRESSURE UNIT H MOUNTING STRUCTU FROM STAINLESS S SPACE WUALTFIED	NSDUCER AS A PAS RE+ AND TEEL ANI	IS A PA SSIVE TH RADIATI HAS NO	8. (.0) SSIVE UN ERMAL DE ON TO EN PAINT O	(0.00) IT THAT SIGN OF VIRONMEI R FINISI	MEASUR CONDUC	0 ED ABSO Tion To It is a	(0/ DLUTE D THE MADE	-	25.77 25.77	0	0			344 160	233 -40	344 160	INT
PRFS	2 TRANSDUCER PRES. BALDWIN+LIMA THE PRESSURE TRA TION. UNIT IS M PADIATION TO ENV STAINLESS STEEL ON TITAN 111 LAU TEMPERATURE LIMI AND N204.	(.6) NSDUCER AINTAIN! IRONMEN CASE	ED WITHIN T AND CON TRANSDUCI TCLES PRI	N THE ABO NDUCTION ER IS SPO OGRAM. TO	(.00) IT WITH IT WITH TO MOUNT ACE QUAL RANSDUCE	NO POW PERATUR NTING. LIFIED ER HAS	ER DISS E.RANGS UNIT A AND IS VARIOUS	(0/ SIPA- E 9Y HAS A USED		3.93 3.93	0	0	.2	235 -34	394 250	235 -34	394 250	INT
PRES	3 TRANSDUCER PRES. GENISCO TECH CORP THE PHESSURE TRA DISSIPATION. UNI MAL RADIATION AN LESS STEEL CASE THAN STANDARD ST	.(.5) NSDUCER T IS MAI D CONDUC IS NOT F	IS A PAINTAINED CTION TO	IN ITS (ITS ENV) R FINIS	(.00) MPONENT JEMPERAT LRONMENT	WITH NOTE RAILS THE	0 REAL NGE BY UNIT ST	O/ POWER THER-	-	2.91 2.91	0	0				144		INT.
PRES	4 TRANSDUCER PRES. GULTON INDUS. INC THE DIFFERENTIAL SIGN TU INDICATE TO -5.0 PSID). UI TURE IS MAINTAINI UNIT IS MADE FROM HAS NO FINISH. TITAN ITTE LAUNCE	PRESSUR A PRESS NIT HAS ED BY CO M STAINL TRANSDUC	RE TRANSI SURE DIFF NO REAL INDUCTION ESS STEE ER IS SE	FERENCE (POWER DI N AND RAC EL AND IS	(.00) A PASSI JF + TO ISSIPATI DIATION S HERMET	VE UNI - 3.45 ON AND TO THE ICLY SI	T. IT I N/CM S ITS TE SURROU EALED.	(0/ IS DE= SQ (+ EMPERA INDING, UNIT	Õ	5.54 5.54	0	0		269 24	310 100		310 100	INT

INSTRUMENTATION SUBSYSTEM

EQUIPMENT ITEM TEMPERATURE TRANSDUCERS

	DESCRIPTION MANUFACTURER AND REMARKS		PACKAGE SHAPE		CABIC	RAD. ALPHA/ EMISS	WATTS MIN/ MAX	POWER DENSITY Q/A	TIME CONST. HOURS MIN	ADIA RISE DEG UEG	BATIC RATE K/HR	THERMA	L ALL TEM DES	OWABL IP. DE SIGN	E SIN	F)	OP MODE
TEMP	1 TRANSDUCER TEMP HY-CAL ENGINEERIN THE TEMPERATURE UNIT THAT HAS A CONTROL IS SIMPL LESS STEEL AND E SPACE QUALIFIED SUPPLING TEMPERA	G(1) TRANSDUM MAXIMUM Y RADIA DOES NOT AND SEVI	CER IS A WEIGHT TION AND HAVE AN	(.0) PLATINU OF 6 GRAI CONDUCT Y PAINT	(.00) M UNIT. MS. TRAI ION. UN OK FINI	.20 IT IS NDUCER IT CASE SH ON I	0 (A PASS THERMAL IS STA T. UNIT	IN- IS			0	•0			148 -193		INT
TEMP	2 TRANSDUCER TEMP. ROSEMOUNT ENGR. (THE SURFACE TEMP FACE TEMPERATURE CONTROL SYSTEM. 0.254 CM (0.10 1 THANSDUCER IS A SURROUNDING. UNI STEEL FINISH. UN	CO(.4) PERATURE OF THE UNIT IS (N) AND I PASSIVE IT HAS NO	TRANSOU PROPELL A SEMI- AN INSION UNIT TH D PAINT	CER IS DI ANT LINE CYLINDRI E DIAMETI AT CONDU OR OTHER	(.00) ESIGN TO S WHICH CAL WITO ER OF 0 CTS AND THAN S	O MEASU FEED T H A THI .32 CM RADIAT TANDARD	0 (RE THE ! HE ATTI CKNESS (0.125) E TO THI STAINLE	0/ 0 SUR- TUDE OF IN). E	22.38)22.38	_	0				144 -199		INT
TEMP	3 TRANSDUCER TEMP. ROSEMOUNT ENGR. (THE BULK PROPELL 12.7 CM(s.n IN) PROBE IS EXTENDE TIVE ELEMENT IS THERMAL DESIGN I DUCER IS HASICAL UNIT IS SPACE QU	CO(.6) ANT TEMP LONG AND D ALL TI THERMAL' IS TO RAD LY A PAS	PERATURE D IS .64 HE WAY IN Y ISOLATIONATE AND SSIVE DE	CM (0.29 NTO THE DED FROM DO CONDUC VICE WITO	(.00) CER HAS 5 IN) IO PROPELL THE UNI T TO THO H NO POO	A PROB V DIAME ANT TAN T BODY. E SURRO	O (E THAT : TER. THE ! K. THE ! THE UN! UNDING.	IS E SENSI- IT TRANS			0			310 100		310 100	INT
TEMP	4 TRANSDUCER TEMP. ROSEMOUNT ENGR. C THE TEMPERATURE DISSIPATION. UNI IS PLACED INSIDE TEMPERATURE. THE ATE TO THE SURRO NOT PAINTED. TRA TITAN VEHICLES	CO(.6) TRANSDUCT HAS A THE PROTECTION TRANSDUCTOR OUNDINGS	CER IS A PROBE TO PELLANT JOER THEF	(.0) PASSIVE HAT IS 4- TANK AND RMAL DESI	(±00) UNIT W 6 CM(1) D MEASUR IGN IS ROM STA	.20 ITH NO .8 IN) RES THE TO COND INLESS	0 (REAL POI LONG THI PROPELI UCT AND STEEL AI	AT _ANT _RADI= ND IS	9.20			.2	219 -65	355 179	219 -65	355 179	INT

INSTRUMENTATION SUBSYSTEM

EQUIPMENT ITEM CURRENT MEASUREMENTS

REF.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (L8S)	PACKAGE SHAPE	SURFACE AREA SQUARE CM (FT)	VOLUME CURIC CM (FT)		POWER WATTS MIN/ MAX		TY 12	CONST. HOURS MIN		RATE C/HR F/HR	W-HR/K	TEM DES	P. DE		F) AL	OP MODE
CURR 1	SHUNTS-CURRENT MARTIN MARIETTA THE CURRENT SHUNT FLOW. THE SHUNT ASSEMBLY MADE OU DISSIPATION: AND PASE: UNIT IS A	BASE I T OF NI CONTAC	S MADE FI CKEL CHRI T STUDS	DEVICE US ROM A FIS DME ALLO ARE ISOL	(.00) SED TO (BERGLAS: Y. UNIT ATED FRO	MEASURE S WITH HAS NO DM REST	THE ELI REAL I OF SH	U O/ NT EMENT POWER INT		_	0	0	•1	223 -58	378 220	223 -58	378 220	INT

ELECTRICAL POWER SUBSYSTEM

EQUIPMENT ITEM FUEL CELL POWER SYSTEMS

REF.	DESCRIPTION MANUFACTURER AND REMARKS	WEIGHT KG (LUS)	SHAPE	SQUARE	CUBIC	ALPHA/ EMISS	WATTS MIN/	POWER DENSITY W/A W/ M2 (W/FT2)	CONST. HOURS MIN	RISE RAT DEG K/HR DEG F/HR MIN MAX	E MASS W-HR/K BTU/F	L ALLOWABLE TEMP. DEG DESIGN MIN MAX	QUAL	OP MODE
FC 1	TUG FUEL CFLLS PRATT AND WHITNEY THE FUEL CFLLS F NASA-LERC AND TH IVF COULING SYST BLANKET AROUND I TEMPERATURES, WI ING TEMPERATURE. RATURE RANGE IS ***** NOTE CON	(33.0) OR SPACE E USAF. EM. IN A T. ABOVE TH B2.2 THE LIN THE FREE	TUG AR. UNIT IS ADDITION E TEMPER DEG C(1 MITING F EZING PO	(-4.8) E 47 PRE DESIGN UNIT HA ATURES A 80 DEG.F ACTOR ON INT OF W SSES MUS	(.64) SENT IN TO USE S A MUL RE THE: J BEING THE LO ATER. T FXCEE	.05 DEVELOR A RADIA TI-LAYER FUEL CER THE NOR W END OR	322 PMENT TOR FO R INSU LL INT RMAL O F THE	(172/ 67 FOR R ACT- LATION ERNAL PERAT- TEMP- 800. TO	; 3.57	N THE MIN	6.6	-460 -460 -	-460 -460 TEMP	CONT
FC a	FUEL CELLS GENERAL ELECTRIC THE FUEL CELLS F STAGE* THE DATA FOR SPACE SHUTTL CIRCULATING COOL TEMPERATURE AT 6 COOLANT SYSTEM T BLANKET. FREEZIN ***** NOTE CON	26.3 (57.9) FOR SPACE IS BASEL E. THE (ANT TO) S TO 82 HE UNIT IG POINT	HECT TUG AP TON A N INIT HAS MAINTAIN DEG C (IS COVE OF WATE	9529. (10.3) E AT PRE ASA TECH AN ACTI THE FUE 150 TO 1 RED WITH R IS THE	61779. {2.18} SENT IN NOLOGY VE THER L CELL 80 DEG. A MULT TEMPER T EXCEF	.20/ .05 THE DE STUDY O MAL CON INTERNA F). IN I-LATURE L D 15.	30/ 30 VELOPM F FUEL TROL O L OPER AODIT INSUL IMIT O	31/ 31 (2/ 2 ENT CELLS F ATING ION TO ATION N UNIT.	12.72 12.72	1 1 2 2	20.4 10.8	-0 -0 -460 -460	0. 288 -460 60	CONT

ELECTRICAL POWER SUBSYSTEM

* EQUIPMENT ITEM BATTERIES

	DESCRIPTION MANUFACTURER AND REMARKS		PACKAGE SHAPE	SURFACE AREA SOUARE CM (FT)	COBIC	RAD. ALPHA/ EMISS	WATTS	POWER DENSITY Q/A W/ M2 (W/FT2)	CONST. HOURS MIN	RISE DEG +	RATE (/HR F/HR	THERMA MASS W-HR/K BTU/F	TEM DES	P. DE IGN	6 KZ(I QUI	F) AL	0P MODE
BAT 1	25 AM PRI. BATTER ELECTRIC STORAGE THE 25 AH RATTER TION AND CONDUCT A POLISHED TITAN HAS REEN USED ON BATTERY HAS AN A DISSIPATION IS A AGE RANGE IS 25	(36.0) Y IS DES ION TO T IUM FINI BOAPD TH PPROXIMA FUNCTIO	IGN FOR HE SURRI SH. THE E TITAN ITE 90 PI ON OF THI	(3.9) PASSIVE DUNDING BATTERY III FOR RECENT E	(.49) THERMAN ENVIRON IS SPAN SEVERAN FFICIEN	.13 CONTRI MENT. UI CE QUAL L YEARS CY: AND UNIT OP	28 OL OF NIT HA IFIED THE UNIT ERATIN	S AND POWER G VOLT-	9.09	0	2 4		-460	289	-460	289 61	CONT
	###### NOTE CON ###### NOTE CON	DUCTIVE	HEAT LO						IATRIAM IATRIAM								
RAT 2	165 AH PRI BATTER AGLE-PICHEP INDUS THE 165 AM-HR BA TO MOUNTING SURF IS PAINTED WITH MAL REQUIREMENT. THE BATTERY LOAD EFFICIENT, UNIT TRANSTAGE IN UP-	(91.0) TTERY HA ACE AND A HLACK THE BAT S WITH T IS SPACE	S A PAS RADIATIO PAINT BO TERY DI THE UNIT	(4.9) SIVE THE ON FROM UT CAN H SSIPATED BEING A	(.69) HMAL CO THE OTH E FINIS POWER PPROXIM	.90 NTROL O ER SURF H PER C IS A FU ATELY 9	70 F COND ACES. USTOME NCTION 0 PERC	(9/ 14 UCTION UNIT R THER- OF ENT	3 3.48 3 3.30	1	2 4	31.3 16.5				304 88	CONT
BAT 3	EAGLE PICHER THE ABOVE 15 AMP AN EXISTING 4 AM CONTROL OF RADIA SEALED AND PAINT UNIT IS ASSUMED ERY DISCHARGE PO TURE RANGE IS BA ***** NOTE CON	(19.0) -HR BATT P-HR BATT TION AND ED BLACK TO BE 90 WER GENE SED ON U	TERY IS TTERY. TO CONDUCTOR PERCEN PRECEN TRATED A INIT BEIL HEAT LO	(1.4) ONLY CAP HE UNIT TION. IN CUSTOME T EFFICI S INTERN NG USED SSES MUS	(.11) ABILITY WILL HA ADDITI R THERM ENT WIT AL HEAT ONCE. T EXCEE	DATA B VE PASS ON UNIT AL REGU H 10 PR BATTE D 53.	96 ASED 0 IVE TH WILL IREMEN ECENT	ERMAL BE TS. OF BATT PERA- 0. TO		19 N THE	MIN	AND MA	ОРЕЯ	89 ATING	-460 TEMP	. 89	CONT