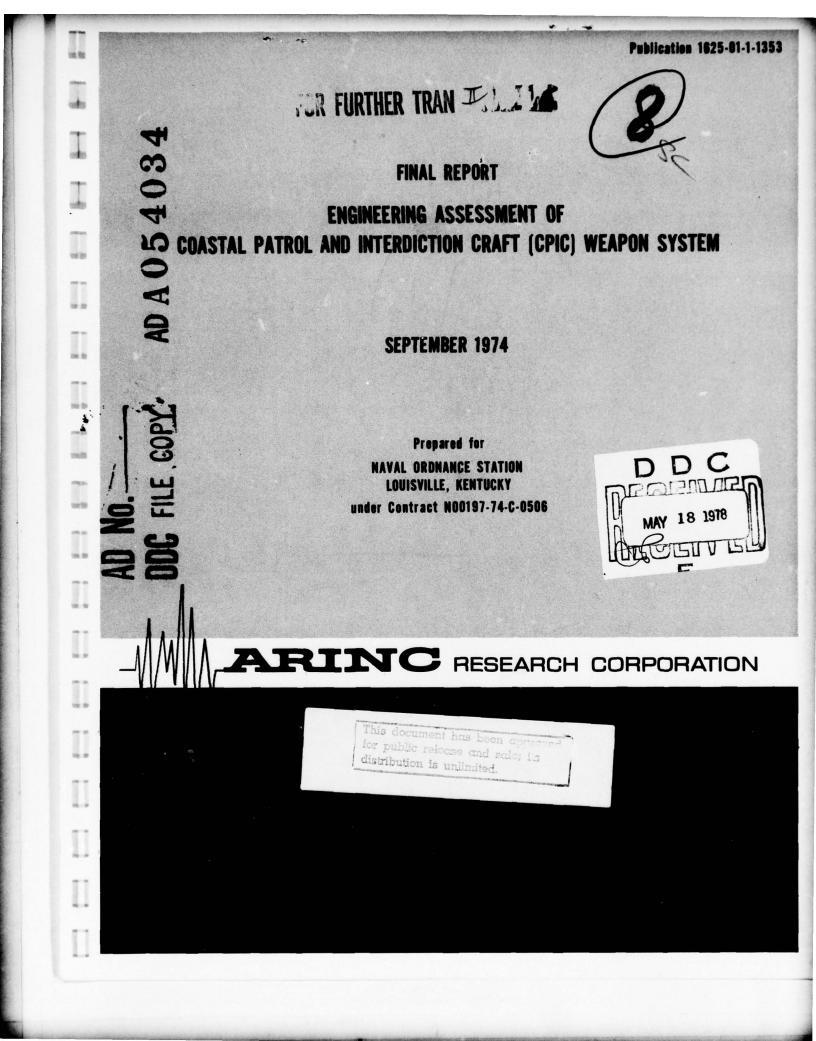
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ENGINEERING ASSESSMENT OF COASEAL PATTOL AND INVERDICTION CRAFT (CFIC) WIAPON SYSCIM

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ABSTRACT

ARINC Research Corporation conducted an engineering assessment of the EX 30 Mod 0 30mm Weapon System aboard the Coastal Patrol and Interdiction Craft (CPIC). The system was examined, both by subsystem and as a complete entity, from a reliability and maintainability perspective. Potential reliability and maintainability problems were identified; and recommendations were developed for design changes that might improve the reliability, maintainability, and performance of the production systems.

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SUMMARY

Under Contract N00197-74-C-0506, Tasks 1, 2, and 3, with the Naval Ordnance Station, Louisville (NOSL), ARINC Research Corporation assessed the EX 30 Mod 0 30mm Weapon System installed in the prototype Coastal Patrol and Interdiction Craft (CPIC), which is being developed for delivery to the Republic of Korea Navy (ROKN). This report summarizes the results of the work conducted in these three tasks.

The weapon system design, interface and installation documentation, and available test data were reviewed. ARINC Research personnel accompanied NOSL personnel to Korea to review the CPIC Ordnance Plan for Maintenance and the present maintenance practices and concepts employed by the ROKN. In addition, they observed the CPIC Weapon System night evaluation tests conducted in San Diego.

ARINC Research analyzed each subsystem and the weapon system in its entirety, predicting the reliability of the overall system and its constituent components. Maintainability was assessed in the light of the ROKN organization and capabilities observed during the ROK visit. Potential reliability and maintainability problems were identified.

Recommendations for improving the reliability, maintainability, and performance of the production systems were developed. These recommendations encompass design changes, alignment procedures, maintenance procedures, periscope improvement, power sources, stabilization, change control, and documentation.

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CHAPTER ONE

INTRODUCTION

Under the provisions of Contract N00197-74-C-0506 Tasks 1, 2, and 3 of 15 April 1974, ARINC Research Corporation assessed the EX 30 Mod 0 30mm Weapon System installed in the prototype Coastal Patrol and Interdiction Craft (CPIC), which is being developed for delivery to the Republic of Korea Navy (ROKN).

An in-depth review of the design, interfaces, and installation of the equipment and subsystems comprising the CPIC Weapon System was performed to provide an engineering assessment of the system. The reliability and maintainability aspects of the system were also examined in order to provide an indication of the probability that the weapon system would successfully complete various assigned missions.

The CPIC Weapon System comprises the following subsystems:

- Mk 93 Mod 0 Radar Gun Fire Control System, consisting of the Honeywell System Control Console (including the Honeywell H-316R computer) and KAAR LN66HP Radar
- Kollmorgen Mk 35 Mod 0 Remote Optical Director
- · Emerson Electric Mk 74 Mod 0 Twin 30mm Gun Mount
- · Oerlikon Hispano-Suiza HS 831 A/L 30mm Machine Guns
- Two VARO Frequency Converters: a three-phase, one kW; and a onephase, five kW
- Sperry Mk 5 Mod 0 Gyro Stabilizer

An ARINC Research engineer accompanied U.S. Government representatives to the Republic of Korea to review the maintenance practices and concepts employed by the ROKN. These practices were analyzed to develop recommendations concerning the support of the CPIC Weapon System in Korea.

This study provides information necessary for reliability and maintainability decisions that must be made before a production CPIC Weapon System is developed.



CHAPTER TWO

WEAPON SYSTEM DESCRIPTION

The Coastal Patrol and Interdiction Craft Weapon System was designed to provide a lightweight, rapid-fire, modern weapon system for use in the coastal areas of the Republic of Korea (ROK). The anticipated threats are small combatant surface craft and moderate-speed aircraft.

The CPIC EX 30 Mod 0 30mm Weapon System consists of the following subsystems:

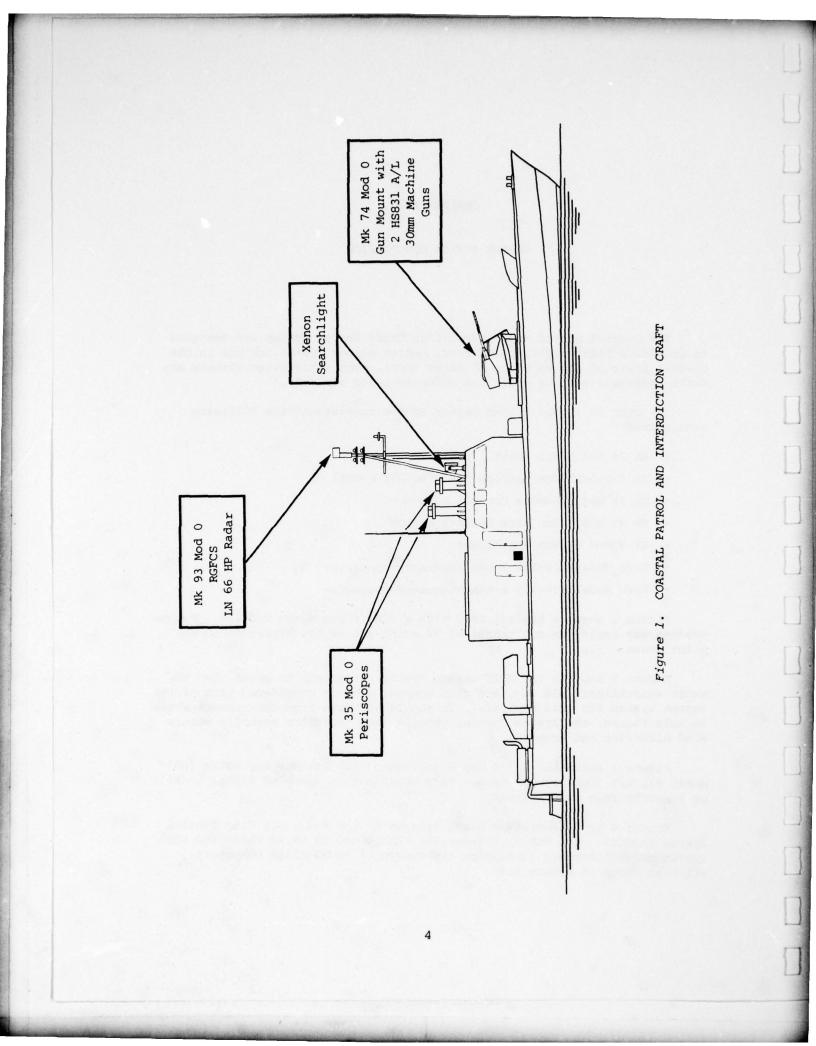
- Mk 74 Mod 0 Gun Mount
- HS 831 A/L 30mm Machine Gun (two per mount)
- Mk 35 Mod 0 Remote Optical Director
- Mk 93 Mod 0 Gun Fire Control System
- Mk 5 Mod 0 Gyro Stabilizer
- Varo Model 100-152 1-kVA Frequency Converter
- Varo Model 100-153 5-kVA Frequency Converter

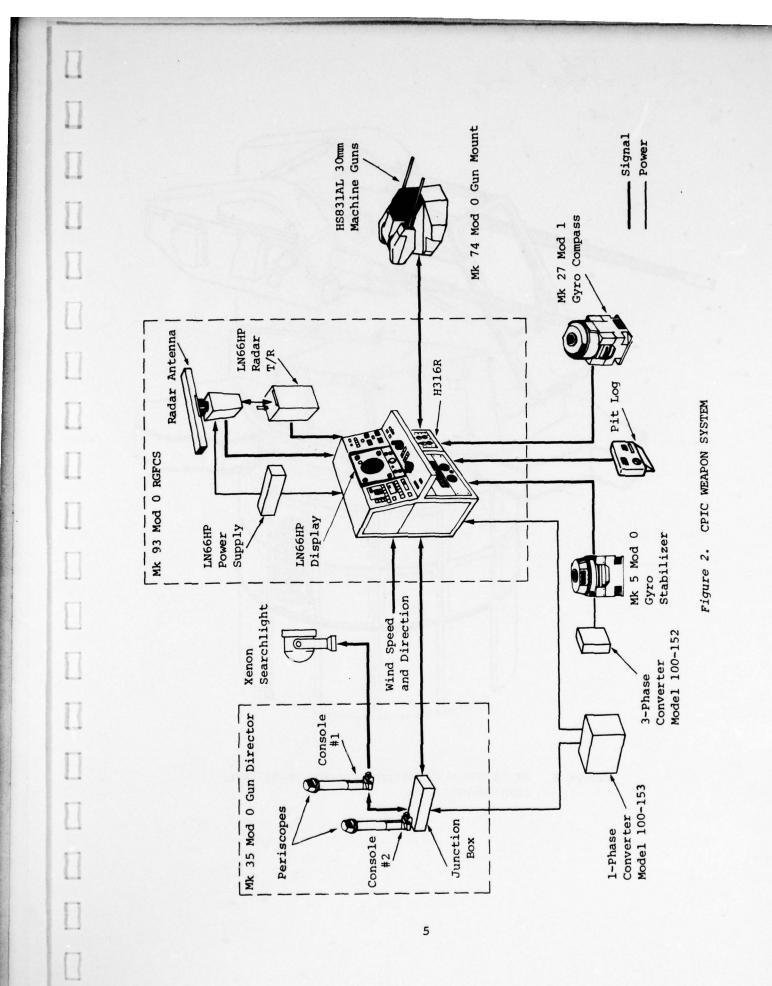
Figure 1 shows a typical CPIC with a single gun mount forward. Future systems may employ an additional Mk 74 mount aft of the directors on the pilot house.

Figure 2 depicts the CPIC weapon system; it should be noted that the xenon searchlight, pit log, and gyro compass are not considered part of the weapon system for this analysis. To supplement data from the sensors shown in this figure, the System Control Console (SCC) operator manually enters wind direction and speed.

Figure 3 shows the Mk 74 Mod 0 gun mount with two Hispano Suiza (HS) model 831 A/L 30mm machine guns. This mount can be operated either locally or remotely from the director.

Figure 4 is a simplified block diagram of the Radar Gun Fire Control System (RGFCS). The RGFCS includes the KAAR model LN 66 HP Radar and the system control console (including the Honeywell model H316R computer), which is shown in Figure 5.





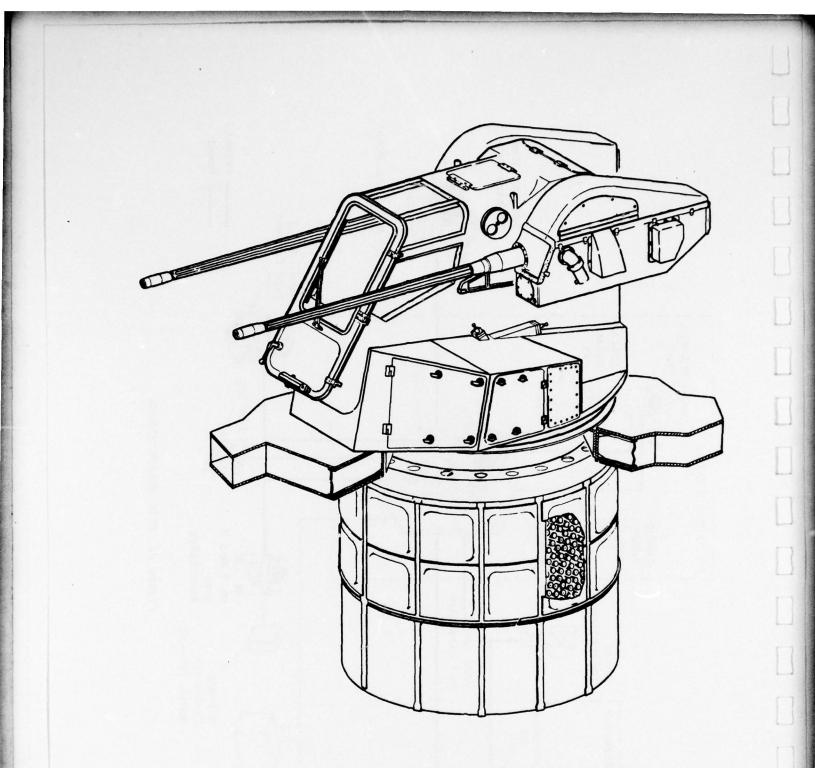


Figure 3. MK 74 MOD 0 GUN MOUNT WITH TWO HS-831 A/L 30MM MACHINE GUNS

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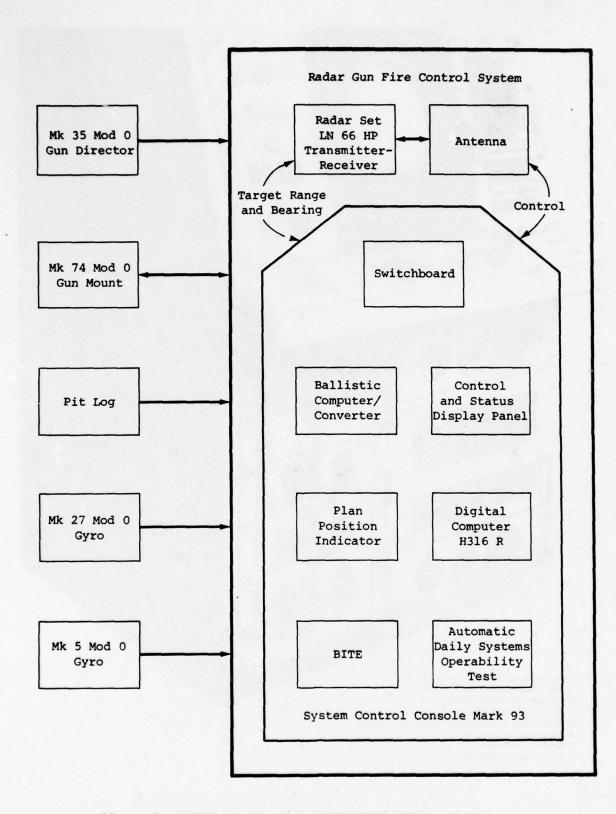


Figure 4. RGFCS MK 93 MOD 0 SIMPLIFIED BLOCK DIAGRAM

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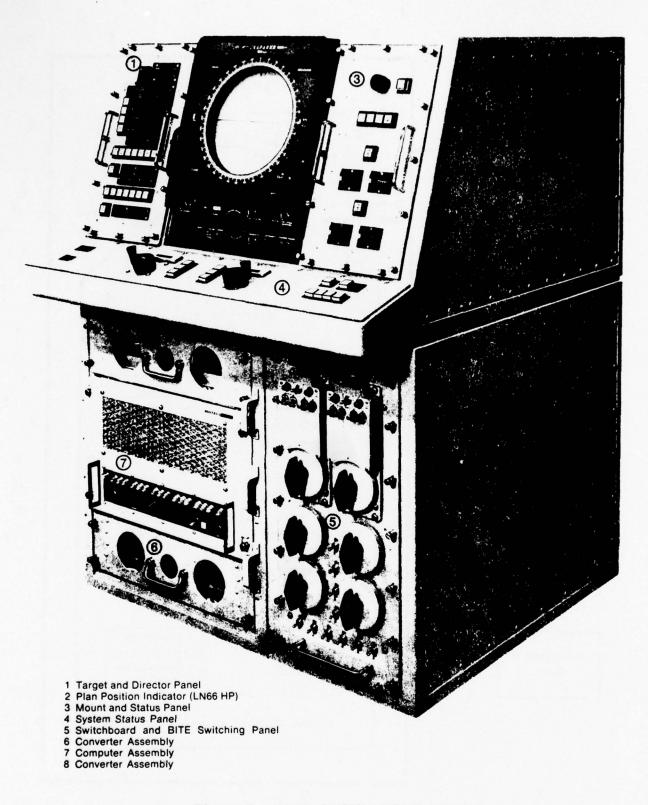


Figure 5. RGFCS SYSTEM CONTROL CONSOLE

Figure 6 illustrates the Mk 35 Mod 0 Gun Director System. The system shown here consists of two consoles and periscopes with a junction box. This is the two-director system installed in the prototype CPIC. Either console operator can control the single gun mount. Only director number one (forward) can control the xenon searchlight.

The EX 30 Mod 0 30mm Weapon System employs the Mk 5 Mod 0 gyro stabilizer and two frequency converters (power supplies). The Mk 5 Mod 0 gyro stabilizer provides pitch and roll data to the RGFCS for gun mount stabilization. The 1-kVA frequency converter supplies 3-phase 400-Hz power for the Mk 5 gyro. The 5-kVA converter supplies 1-phase 400-Hz power to the gun mount, the directors, and the RGFCS.

The weapon system can be operated in any of four modes:

- <u>Navigation (NAV)</u> Radar and director are used for surveillance and navigation. The SCC computer conducts target-motion analysis (T*A) and determines designated target course and speed, and the range, bearing, and time of the closest point of approach (CPA) on the basis of radar/optical-supplied target data.
- <u>Track-While-Scan (TWS)</u> Gun control orders are generated by the SCC computer, using radar range and radar bearing. Two TWS tracks can be handled simultaneously by the RGFCS.
- <u>Split</u> Range data are supplied by the radar; azimuth and elevation data are supplied by the director. When the system is operated in the split mode, radar range, optical bearing, and optical elevation are used by the SCC computer to generate gun control orders. This mode, which is expected to be the primary engagement mode, also employs TWS operation.
- <u>Optic</u> Optical target bearing and elevation are used to compute gun orders. The range necessary to resolve the fire control problem results from the director operator's manually entering target range at the director. The director operator can obtain range from the radar operator via sound power phones, or he can estimate it by means of the reticle in the periscope.

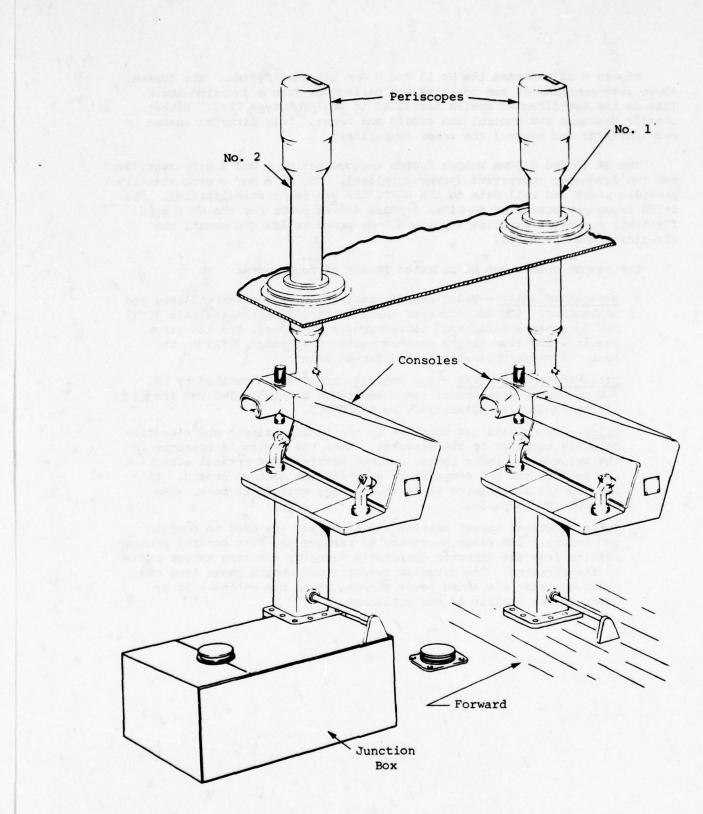


Figure 6. MK 35 MOD 0 GUN DIRECTOR

CHAPTER THREE

SUBSYSTEM DISCUSSIONS

3.1 MK 74 MOD O GUN MOUNT WITH TWIN HISPANO SUIZA TYPE 831 A/L 30MM GUNS

This section presents discussions of the mounts and the guns as separate entities.

3.1.1 Mk 74 Mod O Gun Mount

3.1.1.1 Subsystem Description

The Mk 74 Mod 0 gun mount is an electrically powered platform that supports two lightweight 30mm automatic weapons. The mount is capable of ±360 degree rotation in train and -15 to +80 degree rotation in elevation. Rotational velocities in either axis are 80 degrees per second, and accelerations are 80 degrees per second per second for either axis. Electrical and mechanical stops are provided for limiting train and elevation travel. Electric firing interrupts are provided to protect the hull and superstructure from self-inflicted gun-fire damage.

Included as part of the mount are a ready-service ammunition magazine and an ammunition feed system. The magazine, which is below deck, provides storage for approximately 1900 rounds of ammunition (950 for each gun).* The feed system comprises flexible chutes, magazine ammunition drive, ammunition booster drive, and feed control circuitry for each gun.

The mount is designed for both remote operation by the director subsystem and for local control from the on-mount operator's cabin either in a powered local mode or in a manual mode. For remote operations, all train and elevation data are provided to the mount by the RGFCS and the optical directors through the SCC. Gun fire can be initiated at either optical director.

The on-mount cabin is equipped with day and night sights for local-mode operation. A local control unit and an auxiliary control panel in the cabin provide display and control information for the mount operator. The train and elevation movements can also be powered by two hand cranks.

*Exact number of rounds in the modified magazine is not known at this time.

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An on-mount battery currently provides electric power for the ammunition feed subsystem, the charging/cocking mechanism, and the solenoidoperated sear release in all operating modes. The battery is charged from ship's power when the guns are not being fired. The on-mount cabin is equipped with a heating and ventilation system to provide operator comfort. A de-icing subsystem for cold-weather operations is provided.

3.1.1.2 Discussion

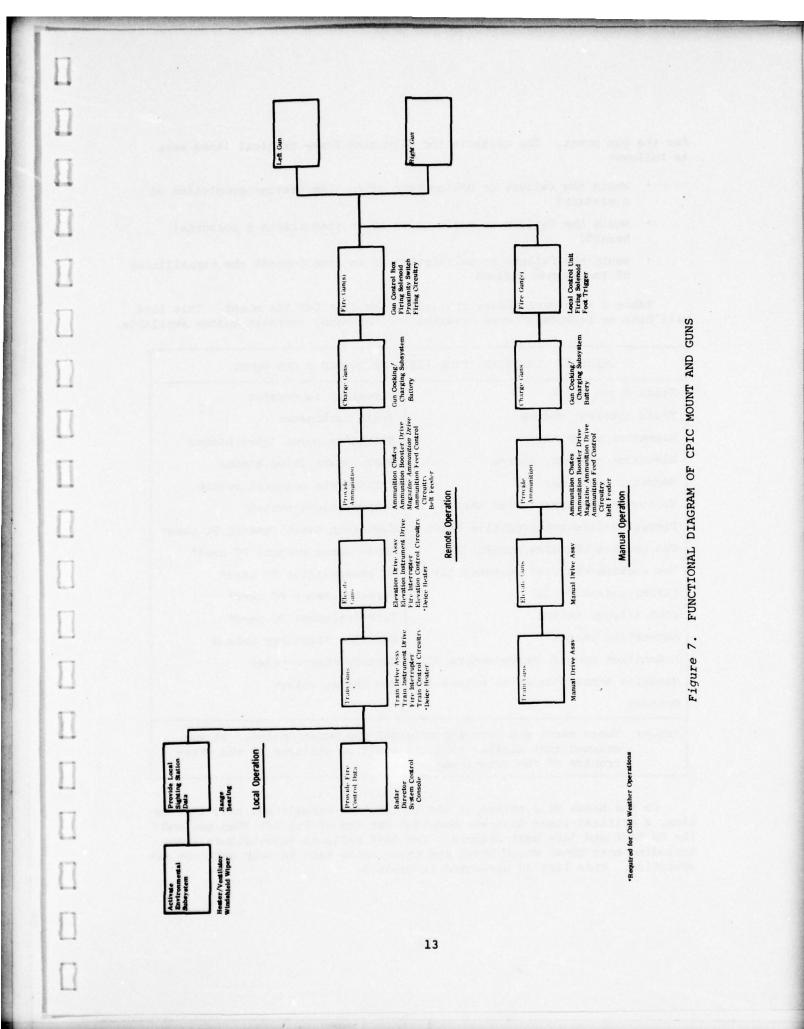
The Mk 74 Mod O gun mount is being redesigned to accommodate the HS 831 A/L guns and to eliminate problems identified during testing. Present documentation does not reflect these changes. Therefore, a detailed analysis of the overall mount could not be performed. Elements that are being changed include the following:

- Magnetic clutch in elevation drive
- Grease seals on main train and elevation bearings
- Local-sight support brackets
- Blower for heater and air distribution
- Cabin-access-door hinges and fasteners
- Elevation spool and gun cradles
- Ammunition feed subsystem from magazine to belt-feeder
- Sponson
- Elevation servo drive
- Train and elevation drive electronics
- Elevation fire interrupter
- Equiliberator
- Gun fairings
- Gun control box

The following items are being added:

- Gun cocking/charging mechanism
- · Firing solenoid
- · Proximity switch
- Link alignment mechanism and oiler

The approach used in the preliminary review of the mount was first to develop a diagram that identified the functions required to train, elevate, and fire the guns, and then determine the hardware required to perform each of these functions. Because of numerous equipment changes, generic names were used for these equipments; they may differ slightly from those presented on the engineering drawings to be released. The diagram is presented in Figure 7. When this figure was completed, a critical-items list was developed



for the gun mount. The criteria for selecting these critical items were as follows:

- Would the failure or malfunction of an item prevent completion of a mission?
- Would the failure or malfunction of an item create a personnel hazard?
- Would the failure or malfunction of an item degrade the capabilities of the weapon system?

Table 1 is a preliminary critical-items list for the mount. This list will have to be updated when drawings for the mount redesign become available.

Table 1. CRITICAL-ITEMS LIST	F, MK 74 MOD O GUN MOUNT			
Train drive motor	Elevation tachometer			
Train synchro, coarse	Train tachometer			
Elevation drive motor	Elevation power drive blower			
Elevation synchro, coarse	Train power drive blower			
Magnetic couplings (2)	Firing-rate selector switch			
Train-fire-interrupt flex shaft	Weapon select switch			
Elevation-fire-interruptflex shaft	Elevation servo control PC card*			
Gun cocking/charging motors (2)	Train servo control PC card*			
Gun cocking/charging switches (2)	AC preamplifier PC card*			
Firing solenoids (2)	Current-sensor PC card*			
Foot trigger switch	Fire-interrupt PC card*			
Ammunition chutes	Gun fire circuitry relays			
Ammunition booster drive motors (2)	Battery charge relay			
Magazine ammunition drive motors (2)	Gun charge relays			
Battery				
*Note: These cards are from the original gun mount design. It was assumed that similar circuits would be utilized in the elec- tronics of the redesigned mount.				

On the basis of a review of the instruction manuals and test information, a critical-items list was compiled for the HS 831 A/L 30mm gun and the HS 567A and 568A belt feeders. The list reflects high-failure items, including both those which break and those which tend to wear out from gun operation. This list is presented in Table 2.

Table 2. CRITICAL-ITEMS	LIST, HS 831 A/L 30MM GUN
HS 831	A/L Guns
Barrel assembly	Extractor
Gas ports (2)	Extractor spring
Sear buffer springs (3)	Extractor pivot pin
Sear block slide	Breech block lock
Sear	Firing pin
Sear pin	Firing pin springs (2)
Trigger unit (complete)	Inertia pin springs (2)
Breech unlocking push rods (2)	Ejector
Return spring assembly	Ejector springs (3)
Belt Feeder, HS	Type 567A/568A
Torsion bar (part number 245.434)	Extractor lever, forward
Extraction level springs (2)	Extractor lever, rear
Pulling springs (3)	Torsion bar (part number 245.746)
Last-round sp	oring assembly

3.1.1.3 Reliability and Maintainability

Both on-shore system-integration tests (OSSIT) and at-sea tests were conducted on the mount. The total test time accumulated was 108 hours. During the tests a total of 12 failures occurred. Only one of these failures was considered applicable in the calculation of a point estimate of the mount's reliability. Redesign should prevent the recurrence of seven of the failures. Two failures were caused by assembly and installation errors. One failure was caused by a maintenance error, and one was judged to be not critical to mount operation. A summary of these failures and their disposition is presented in Table 3. Appendix B summarizes CPIC weapon system failures.

Assuming that the failure characteristics of the systems in this report, other than the guns, can be represented by the mathematical model

 $R(t) = e^{-\lambda t}$

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(1)

where

R(t) = reliability (expected percent of success) in the time interval, t

- t = time interval
- e = Naperian base 2.71828
- λ = failure rate

then

 $\lambda = 1/\theta$

(2)

where

 θ = mean time between failures (MTBF)

By definition

MTBF = the total measured functioning time of a population divided by the total number of failures within the population during the measured period

or

-	_	Total Operating Time	(2)
MTBF	-	Total Number of Failures	(3)

If the redesign is well conceived and executed, then the point estimate of the reliability of the mount for four hours' operation could go as high as 0.9636.

The four hours of operation is an estimate of the time the mount would be in use during a 60-hour mission.

Maintainability of the guns and gun mount is discussed in Section 3.1.2.3.

3.1.2 HS 831 A/L Gun

3.1.2.1 Subsystem Description

The guns are Hispano Suiza Type 831 A/L 30mm automatic weapons. The belt feeders are Hispano Suiza Type 567A (left-hand) and Type 568A (righthand). The maximum firing rate of each gun is approximately 600 rounds per minute. Controls permit the selection of guns and firing rate: single shot, 150 rounds per minute, or maximum rate -- with left gun, right gun, or both guns.

A motor-driven charger/cocking mechanism initiates the operation of each gun. This mechanism cocks the weapon and causes the belt feeder to position the first round in the gun chamber for firing. Firing is accom-

Subsystem/Equipment	Casualty Description	Test Location	Remarks and Description
Train Drive Mechanism	Excessive bearing friction	OSSIT	Installation error
	Magnetic clutch problem	OSSIT	Design change
Ammunition Feed	Booster motor miswired	OSSIT	Assembly error
	Burned-out booster motor	OSSIT	Low voltage caused booster motor to burn out at 108 operating hours (failure rate is 9,259 failures per million hours)
Electronic Components	Power amplifier and supply	OSSIT	Design change
	Power amplifier	OSSIT	Design change
	Power amplifier	OSSIT	Design change
Battery (NICAD)	Discharged	OSSIT	Maintenance error
Cabin	Door fasteners broke	OSSIT	Not critical
	Broken door hinges	At sea	Design change
Local Sighting Station	Support bolts sheared	At sea	Design change
De-Ice	Circuit breaker opened when de-ice circuit was energized	At sea	Design change

plished by a solenoid that actuates a mechanical trigger unit. Recoil of the gun removes the fired casing, recocks the weapon, and operates the belt feeder. The belt feeder de-links ammunition and positions the next live round in the gun chamber. This is a recurring sequence of events during gun operation.

3.1.2.2 Discussion

The following series of test-firing reports on the HS 831 30mm guns was reviewed and evaluated to estimate the reliability of the weapon:

- Component Durability Test Firing of the 30mm HS-831 (SL) Automatic Cannon, Fifth Phase of Firing, Report Number W50/67, dated 28 September 1967
- Component Durability Report (first follow-up test) of the 30mm HS-831 (SLM) Automatic Cannon Testing Station 91, Report Number 52/71, dated 12/5/71
- Comparison Test Firing to Determine the Barrel Life of the 30mm HS-831 (SL) Automatic Cannon, Fourth Phase of Firing, Report Number W15/67

Mini-Mod Firing Tests conducted at NWL/D during 8 November 1973 to 8 January 1974
Summary of Emerson Firings through 21 June 1974

From data contained in these reports, the probability of successfully accomplishing a 500-round engagement over a 15- to 20-minute time period was calculated. It was assumed that the guns were firing in parallel, that either gun could complete firing the 500 rounds if one failed, that during any given burst no more than 40 rounds per gun would be fired, that there would be a one- to two-minute pause between bursts, and that stoppages clearable by recharging the guns would not constitute a failure.

3.1.2.3 Reliability and Maintainability

The point estimate for the probability of success under these conditions is

$$R_s = (R_{250})^2 + 500 R_{500} (1 - R_1)^*$$

where

 R_{250} is the probability of one gun firing 250 rounds R_{500} is the probability of one gun firing 500 rounds R_{1} is the probability of one gun firing 1 round

Then

 $R_{s} = 0.815$

This equation represents the probability of firing 500 rounds without failure from guns in a like-new operating condition. A constant failure rate was assumed for these guns.

It appears that the ROKN will be capable of performing adequate preventive and corrective maintenance on the gun mount and the HS 831 A/L guns. The condition of present ROKN gun systems, as observed during the trip to Korea on 3-14 June 1974, indicates that excellent preventive maintenance is being performed. On-board corrective-maintenance capability is limited by the lack of required skill levels; thus shipyard assistance is required for most corrective maintenance. The shore facilities for gun system corrective maintenance were assessed as adequate to maintain the 30mm gun if sufficient training is provided. The present plan for the crew to perform only preventive maintenance while in port is consistent with the present ROKN gun-maintenance program. However, the 30mm HS-831 A/L gun will require greater attention to detail and a closely monitored preventive-maintenance program to ensure gun availability and reliability. In addition, the gun mount contains the feed system, which, because it is a compact system

*The derivation of this equation is given in Appendix A.

cycling at a high rate, will also require a well developed and closely monitored preventive-maintenance program.

The nature of the craft and its mission profile precludes performing any corrective maintenance while under way except that which is absolutely essential. The replacement of gun barrels and similar actions would be within the crew's capability, but in-depth troubleshooting and replacement of electrical or electronic components in the mount are beyond expected operational maintenance capability. It is essential, therefore, that the craft depart on any mission with an operating mount and guns that have been maintained at a level that will ensure the best possible chance of completing the mission without gun failure.

Interim Maintenance Index Pages (MIP) and Maintenance Requirements Cards (MRC) were reviewed. These pages and cards cover the gun mount and feed system, but no cards are available for the guns themselves. In addition, the MRCs for the mount are to be changed to reflect the modification made to accommodate the HS 831 A/L guns. Since maintenance procedures and documentation provided with the craft will be major factors in the maintainability of the gun system, it is essential that the updated MRCs for the mount and a complete set of MRCs for the guns be available as soon as possible.

3.2 MK 35 MOD O GUN DIRECTOR

3.2.1 Subsystem Description

The Mk 35 Mod 0 gun director installed in the CPIC consists of two periscope director assemblies, two console assemblies, and one junction box. The system is located in the pilot house, with the periscopes projecting through the roof; periscope director number one is forward, and number two is aft (see Figure 6). The director operator can select and fire the guns, and direct and select operating modes for the searchlight. Either director is capable of controlling one or two twin 30mm Mk 74 Mod 0 gun mounts. The directors can be operated in any of the four modes described in Chapter Two. The subsystem characteristics are as follows:

- Train Unlimited rotation
- Elevation +80° -30°
- Magnification Low power, 1.3 X; high power, 5.2 X
- Field of View Low Power, 32°; high power, 8°
- Night Viewing Image intensifier with four levels of filter available
- Periscope Assembly
 - Weight 455 pounds
 - Length 93 inches
 - Diameter 17-1/2 inches

3.2.2 Discussion

An investigation of the system based on available documentation and discussion with Navy and contractor personnel has identified a number of areas of concern. These areas should be considered as possible operational and maintenance problem areas.

The periscope optical/mechanical portion of the director appears to merit special attention at this time since failure predictions for the electrical portions of the system have already been made. These predictions are discussed in Section 3.2.3.

The periscope assembly will present maintenance, repair, and overhaul problems, some of which may be alleviated in the production models through modifications or design changes.

The periscope is pressurized with dry nitrogen gas. The pressurized section contains a number of electrical components in addition to optical and mechanical components. The manufacturer recommends purging the periscope with dry nitrogen gas for 30 minutes each time the periscope seal is broken. The nitrogen-gas inlet valve assembly is located at the base of the periscope inside the pilot house, while the bleed screw is at the head of the periscope outside the pilot house. This configuration, coupled with the purge-time requirements and the compactness of the optical and mechanical system, appears to add significantly to the MTTR of the periscope. Removal of the electrical components from within the periscope, as recommended by the Kollmorgen Corporation, may alleviate the problem, but, since some components cannot be removed and the mechanical and optical components would remain, this action may not be warranted. Elimination of the drynitrogen pressurization requirement appears to be desirable from a maintenance standpoint. The seriousness of any fogging or other problems associated with eliminating the nitrogen pressurization must be determined before any action is taken in this area. If the dry-nitrogen pressurization feature is retained, a pressure gauge should be permanently installed in the periscope to monitor the gas pressure.

One recorded failure (slipped derotation synchro) brought to light the need for special tools to work on components inside the periscope. This problem has been solved by changing the type of screw used to retain the synchro, but assurance must be provided that any other special tools required for inspection or repair of the periscope will be supplied with the system.

Specifications for the production models should include the requirement for providing alignment marks or points on the assembly wherever mechanical adjustments must be made to facilitate installation and alignment.

The two periscope gyros, located in the head of the periscope, have a high predicted failure rate, and their replacement will be difficult. Because of their location, it will be necessary to break a seal and lift the shroud assembly from the periscope for removal. Removal of the shroud may require a lightweight lifting device (crane, tripod, etc.), and provisions should be made for mounting such a device. A lifting-bolt insert is available in the shroud. The manufacturer recommends removing the shroud only at ambient temperatures of 50°F or greater. Protection of the exposed (outside the pilot house) portion of the periscope from moisture will also be required. Removal of the entire periscope assembly to perform maintenance is undesirable, because of the size and weight of the unit and the probable requirement to perform battery alignment after the periscope is reinstalled.

It would be worthwhile to investigate the possibility of eliminating the periscope gyros and utilizing the ship's pitch and roll gyro (Mk 5 Mod 0) to supply stabilization, or using computer-aided tracking to eliminate the need for gyros in the periscope.

The night image intensifier tube is located in the pressurized portion of the periscope assembly. To remove this tube, it is necessary to depressurize the unit. The possibility of relocating the image intensifier outside the pressurized section should be considered.

The present system has a protective shutter to protect the image intensifier from gun flash. This shutter is activated by the firing key on the console. No provisions are made for a cross-connect of this shutter to protect the image intensifier from gun flash if the gun is fired by the second console operator. It may be advisable to actuate the shutter only when the gun-to-periscope alignment is within a specified limit. In addition, it should be determined whether reflected light from the search light will interfere with the image intensifier's operation. This situation can occur when director number one is using the search light and director number two is employing the image-intensifier mode.

Some method of clearing spray and other contaminants from the outer surface of the periscope window will be necessary when the craft is under way. Rain may also have to be cleared. Windshield wipers do not appear to be practical, since they can scratch the glass, especially if there is a salt residue on the glass. There is no fresh water currently available at the periscope head for flushing the windows. Consideration should be given to the possibility of using a single-surface window (vs. two surfaces currently used), with a spinning port to clear rain and spray, and making provisions for fresh-water flushing of the window.

Existing battery-alignment procedures (NAVORD OD 45528) recommend using director number one as the reference element. Since the optical director may be removed or exchanged during maintenance and the director is not difficult to align, it appears that a more logical method of battery alignment in the prototype craft with a single mount would be to use the mount as a reference.

The console assembly does not appear to present any unusual maintenance problems, but the following items should be considered:

• All of the control switches are physically identical, which requires the operator to look at the panel to perform routine functions such as search-light operation. The switches should have unique shapes to assist the operator.

- Search-light control circuits are available at both consoles, but only director number one can control the search light. Consideration should be given to permitting control of the search light by either console on a first-come basis. This would provide redundancy and improve the versatility of the system.
- Both prototype consoles have experienced failures in the lighting dimmer circuits. This appears to be a design problem, and it should be corrected prior to production.
- The present magazine low-limit bypass switch (MAG OVRD) bypasses all magazines. This is not a problem on a single-mount installation, but if future craft are developed with two mounts, a method of alerting an operator that the magazine low-limit stop has been overridden by the other console operator will be necessary.
- Search-light train limits and stops should be displayed or otherwise indicated to the console operator.

The periscope has no horizon reference; thus locating the horizon on a dark night would be difficult. An artificial horizon should be provided.

The principal problem associated with the junction box appears to be its location and access for testing and repair. Although no underway maintenance is planned, any work on the box will require evacuation of both director consoles.

3.2.3 Reliability and Maintainability

The Mk 35 director is a unique combination of electronic, optical, and mechanical subassemblies; as such, it will present a unique set of requirements to the user.

Total system reliability and maintainability analysis is hampered by the inability to predict mechanical failure rates accurately. The heart of the Mk 35 is the periscope assembly, which is primarily an optical/ mechanical device.

Preliminary data on failures of the Mk 35 system both in the on-shore system integration tests (OSSIT) and the at-sea testing over the period November 1972 through February 1974 indicate a total of ten failures, five of which were mechanical/optical.

Table 4 is a detailed failure breakdown of the Mk 35 Mod 0 for this period. Appendix B summarizes CPIC weapon system failure data.

The Kollmorgen Corporation Gun Director Mk 35 Mod 0 Reliability and Maintainability Analysis, Report Number ER 877.10, Revision A, of 1 January 1974, was reviewed. The report is based on predicted electrical failures and appears to be reasonable. As discussed in Section 3.2.3, the Mk 35 may experience as many mechanical/optical failures as electrical failures,

Number	Subsystem	Failure	Date	Remarks	Mechanical or Electrical (M or E)
1	Optic #1	Elevation binding	11/16/72	Installation error	м
2	Optic #1	Night-day handle	12/18/72	+	м
3	Optic #1	Window cracked	12/23/72	Design deficiency; changed	м
4	Director #2	On/NAV switch	1/17/73	•	E
5	Director #2	Bad resistor/broken connector	2/18/73	•	E
6	Director #2	Dimmer circuit potentiometer	3/6/73	Not critical	E
7	Optic #1	Leaking window	6/19/73	Excessive environmental conditions	м
8	Optic #2	Slipped derotation synchro	10/25/73	Not critical	м
9	Director #2	Elevation amplifier MA-1	1/16/74	*	E
10	Director #1	Limmer circuit transistors	11/13/73	Not critical	E

or more. No estimate of nonelectrical failure rates is considered in the cited report, and it is emphasized here that the total system MTBF will be somewhat lower than predicted in the report.

In predicting failure rates for the two console assemblies, it was assumed that they were identical. This is true from a mechanical standpoint. However, in the prototype two-console system, there are nine searchlight function switches and indicators in both consoles, but they are employed only in director number one. This results in the number two director's having a slightly better MTBF than number one. The effect is considered too slight to justify changing the prediction.

The MTTR predictions for items located in the pressurized portion of the periscope (requiring opening, resealing, purging, and repressurizing the periscope) are the same for both organizational-level and depot-level maintenance. It is questionable if organizational-level maintenance will be performed on the pressurized section of the periscope. However, if organizational maintenance is required, the MTTR of the periscope will probably be significantly longer than at the depot level because of personnel and equipment limitations. The depth of periscope maintenance to be performed at the organizational level is an area worthy of investigation, since it appears that it may not be practical to work on items in the pressurized portion of the periscope at the organizational level. The Kollmorgen analysis resulted in a predicted MTBF of 419 hours for a single-director system and an MTBF of 629 hours for a two-director system. Analysis of the limited failure data available (see Table 4) at this time resulted in a best-case MTBF of 459 hours for a single-director system. This is equivalent to a mission reliability of 0.985 for a 60-hour mission with two directors in parallel. These limited data include both electrical and mechanical failures, while only the electrical-failure data were used for the predicted MTBF.

The components of the Mk 35 Mod 0 that exhibit a predicted failure rate of 50 failures per million hours or greater are as follows:

- Gyroscope, P/N 877B035858 (two each located in the elevation and azimuth drive assembly of the periscope)
- Relay, P/N 877B036169 (six each in the power control module assembly of the junction box)
- DC Servo Amplifier, P/N 877B036276 (console -- panel assembly)
- Relay, P/N 877C036194 (console -- shroud drive and radar optical range assembly)

No component failure in the Mk 35 would make the weapon system inoperable in all modes of system operation.

As discussed in the Kollmorgen analysis, the predicted reliability of the system could be improved by upgrading the integrated circuits (ICs) from MIL-STD-883 Class D parts to Class B. This would increase the cost of the system. In addition, it has been pointed out that much of the director is optical/mechanical, and this is not addressed in the anlysis. Of the ten recorded failures that occurred during test, only one was due to an IC (elevation amplifier MA-1), and five of the failures were mechanical. Cost trade-offs involved in upgrading the ICs should be analyzed prior to any upgrading decision.

Maintainability of the director may present a problem for that portion of the system within the periscope assembly. Whether or not the ROKN should establish optical maintenance facilities for the periscope assembly will depend to some extent on the total number of CPICs to be operated and maintained. The recommended interim procedure is to stock a complete spare periscope assembly for replacement and return the defective periscope to the manufacturer for repair. Preventive-maintenance procedures for the Mk 35 as set forth in the interim MRCs should present no problems.

3.3 MK 93 MOD 0 RADAR GUN FIRE CONTROL SYSTEM (RGFCS)

3.3.1 Subsystem Description

As configured aboard the CPIC, the Radar Gun Fire Control System Mk 93 Mod 0 consists of a System Control Console (SCC), including a Honeywell H316R computer, and a KAAR Electronics Corporation LN66HP commercial radar set (see Figure 4). Inputs from Gyro-Compass Mk 27 Mod 1, Gyro Stabilizer Mk 5 Mod 0, and an electromagnetic ship's log system are required for solution of the fire control problem. In addition, manual input of estimated wind speed and direction is required since there is no wind-sensing device aboard the CPIC.

The system is capable of the following functions:

- Detecting and displaying targets through 360° of azimuth and ranges up to 36 miles if they are within the radar horizon.
- Simultaneously tracking two targets at ranges up to 10 miles, using two Track-While-Scan (TWS) modules within the SCC.
- Performing Target Motion Analysis (TMA) on four targets, utilizing input data on two simultaneous targets from the LN66HR Radar and one target from each Mk 35 Mod 0 Director.

The RGFCS may operate in any one of the four modes described in Chapter Two, depending on the source of target data entering the system computer. In addition, the system is capable of functioning in two "coast" modes:

- <u>Director Coast</u> Prior optical target position and rate information results in the generation of an appropriate slew rate to position the director optics in the event the target is lost optically. The guns may be fired in this mode. In the event the target is regained, the original mode of operation may be restored.
- <u>RGFCS Coast</u> Target position and rate data prior to loss of the TWS target track result in the SCC computer's automatically maintaining the target track and displaying it on the Plan Position Indicator (PPI) for three sweeps (approximately 8 seconds) after target loss. The guns may be fired in this mode. In the event the target is not regained after three sweeps, the TWS symbol will disappear from the PPI and the NO TRACK indicator will light on the SCC. Should the target be regained, the original mode of operation can be restored.

3.3.2 LN66HP Radar

The LN66HP Radar is an off-the-shelf marine radar manufactured by KAAR Electronics Corporation, modified to make it electronically compatible with the RGFCS TWS capability. The radar set consists of four basic elements:

• <u>Antenna Unit</u> - radiates RF pulses received from the transmitter into space. The element also receives signals reflected from the target for transmission back to the receiver. <u>Transmitter/Receiver</u> - the unit's magnetron, operating at 9375 \pm 30 MHz, generates 75-kW peak power output pulses of RF energy for radiation by the antenna with the following characteristics:

Range (Miles)	PRF (pps)	Pulse Width (Seconds)	Average Power Output (W)
4, 14, 3	1000	0.1	6.5 (minimum)
12, 24, 36	500	1.0	32.5 (minimum)

The T/R unit also receives and detects reflected target signals. Power supplies, internal to the T/R unit, generate the necessary voltages for operation.

- <u>Display Unit</u> provides the SCC operator a visual presentation of reflected target signals and houses all of the controls and switches necessary to operate the LN66HP Radar. It is an integral part of the SCC.
- <u>Power Supply</u> separate transistorized regulator and inverter circuits supply the voltages required for operation of the display and antenna units. The supply requires an input of ±28 Vdc.

3.3.2.1 Radar Reliability

The LN66HP Radar for the CPIC was in operation undergoing On-Shore System Integration Test (OSSIT) for 1234 hours and At-Sea Trials for 589 hours, a total of 1823 hours.* The one radar failure occurred at sea in the T/R unit when the pulse trigger was not disabled during the switching cycle from narrow to wide pulse, causing the relay contact to become welded (see Appendix B).

An MTBF of 1823 hours is established for the LN66HP Radar, and λ equals 548.546 × 10⁻⁶ failures per hour. It is emphasized that the majority of operational hours were accumulated under nearly ideal operating conditions -- the OSSIT. The one failure experienced by the radar occurred during the 589 hours of At-Sea Trials. For this number of operating hours in the environment in which it will be operated, the MTBF is 589 hours, and λ is 1698 × 10⁻⁶ failures per hour. From the total number of operating hours accumulated during OSSIT and At-Sea Trials, i.e., MTBF

*Data supplied by NWL/D.

= 1823 hours, the probability of the radar's completing a 60-hour mission (t = 60 hours) without a failure is found to be

R(60) = 0.9676

Considering only the hours of operation during At-Sea Trials (MTBF = 589 hours), we obtain

R(60) = 0.9032

A summary of LN66HP Radar reliability for several mission durations and MTBFs is shown in Table 5.

Table 5. LN66HP RADAR RELIABILITY					
Mission	Reliability, R(t)				
Length, t hours	MTBF = 1823 hours $\lambda = 548.546 \times 10^{-6}$	MTBF = 589 hours $\lambda = 1698 \times 10^{-6}$			
0	1	1			
15	0.9918	0.9749			
30	0.9837	0.9503			
45	0.9756	0.9264			
60	0.9676	0.9032			

Some additional data on the LN66HP Radar, as employed in the Navy LAMPS Program, were provided to ARINC Research by NOSL. The data were in the form of Reports 3M006, dated 13 April 1974, for the SH-2F and SH-2D type aircraft. Analysis of these data indicates that for an accumulated 8354 flight hours in 1973, considering all radar system failures, the failure rate for the LN66HP Radar in an airborne environment is 40475×10^{-6} failures per flight hour and the MTBF is 24.71 hours.

The difference between this MTBF and that determined earlier for the radar as used in CPIC may be attributable to differences in (1) quality of data analyzed, (2) physical construction of the radar sets, and (3) the operational environment. The LN66HP installed in CPIC differs from that in the LAMPS installation. Differences in the antenna system, display unit, and other subsystems could not be completely identified because of the lack of documentation. The LAMPS operational environment differs from that of the CPIC in a number of ways, some of which are:

• <u>Mission Operate Times</u> - LAMPS missions are normally less than four hours, while the CPIC missions will be 15 to 60 hours.

- <u>Temperature Ranges</u> LAMPS radar can experience more rapid changes in ambient temperature because of flight profiles.
- <u>Operating Procedures</u> CPIC can normally be expected to place radar in standby and to be on craft power for a much longer period prior to radar operate than the LAMPS, which will not have craft power until after the helicopter is started immediately prior to flight.

Efforts to obtain additional amplifying or substantiating data through NAVAIRSYSCOM, the 3M System, and the Government and Industry Data Exchange Program (GIDEP) were unsuccessful.

Little concrete information regarding potential failure modes can be extrapolated from the radar test data of one failure in 1823 total hours of radar system operation. However, parts usage information supplied to NAVAIRSYSCOM by Kaman Aerospace Corporation, Bloomfield, Connecticut, and forwarded to ARINC Research by NOSL indicates potential problems in the power supply. The number of power transistors replaced in the power supply is shown in Table 6. (The additional part-replacement data provided are summarized in Table 6, reflecting only those parts in an element that required ten or more replacements. It is noted that the given information does not include a time frame, so that frequency of replacement cannot be 'extrapolated -- only the number of replacements.)

Table 6.	SUMMARY OF PARTS REL	PLACED
Element	Part	Number Replaced
Power Supply	Power Transistors SP-2274-2	104 104
	2N-4899 2N-4910	20 16
Display Unit	PRF PCB Lamp Number 350	23 12
	VRM PCB Video PCB	11 10
T/R Unit	Pulse Transformer	28
Antenna	Motor	13

The LAMPS failure data were not directly integrated with the CPIC data, because of the foregoing considerations. The LAMPS data are presented here as a possible indication of areas that should be pursued if similar failure patterns occur in CPIC as additional operational time is accrued.

3.3.2.2 Radar Maintainability

The maintenance philosophy for the LN66HP Radar aboard the CPIC has not been established, although it is envisioned that there will be three levels of maintenance, with emphasis on the intermediate and depot levels.

The LN66HP radar system as used in the LAMPS program is not dependent on depot-level maintenance, since the system is totally supported by the Intermediate Maintenance Activity. In this environment, the system is supported by the kit concept, and printed circuit boards are considered as consumable since they are low-cost items and it is uneconomical to repair them.

A commercial-style manual, "Maintenance Instructions with Illustrated Parts Breakdown for LN66HP Radar Set", NAVAIR 16-45-1691, was made available to ARINC Research by NOSL. Some discrepancies between the parts lists and the schematic diagrams were noted. Two examples are:

- Klystron 2K25 is shown in the Group Assembly Parts List, page 4-11, and Receiver Circuit Schematic, page 5-48/49, but not in the Numerical Index or Reference Designation List.
- Power Supply Resistors R208, R217, and R225 are not listed in the Reference Designation List.

Since modifications have been made to the radar to ensure compatibility with SCC TWS, it is recommended that a maintenance manual for the CPIC LN66HP Radar Set be developed that accurately reflects the parts breakdown and schematic for the CPIC installation.

ARINC Research has insufficient data to develop a list of LN66HP Radar components and lowest-level assemblies that exhibit a failure rate of 50 failures per million hours of operation or greater. Failure of the radar subsystem will not make the EX 30 Mod 0 30mm Lightweight Gun System inoperative in the optic mode. It is recommended, however, that efforts be continued to obtain amplifying data on the high number of power transistors replaced in the LAMPS radar power supply. Until the data can be verified and an actual rate determined, these power transistors should be considered as potentially high-failure items.

3.3.3 System Control Console (SCC)

The major subsystem of the GFCS is the SCC. It provides CPIC with the information capabilities of a surface Combat Information Center (CIC). Computed target data, generated in and displayed on the SCC, include the following:

- Target bearing
- Target range
- Target course

- Target speed
- · Range, bearing, and time of closest point of approach (CPA)

The SCC is composed of ll assemblies designated AO1 to All (assembly location within the SCC is depicted in Figure 5):

- A01 Target and Director Assembly. A01 houses the digital logic cards that constitute the Track-While-Scan and Input/Output control circuits. Its front panel holds the controls, readouts, and switches for control of the interface with the directors and display of ownship data, target data, and director data.
- <u>A02 Plan Position Indicator (PPI) Assembly</u>. A02 provides the SCC operator a visual presentation of all radar targets acquired by the LN66HP Radar. It houses all of the controls and switches necessary to operate the LN66HP Radar.
- <u>A03 True North Assembly</u>. A03 houses a torqsyn and a synchro transmitter (MAGSLIP), which, in combination with the control differential transmitter (CDX) in the radar antenna, keeps the PPI display oriented so that all target bearings are true bearings.
- A04 Mount and Status Assembly. A04 contains the test and control panel and those analog and digital circuits necessary for SCC interface with the LN66HP Radar. The front-panel controls and indicators provide control of SCC panel illumination and capability for monitoring the operational status of the computer, own-ship's sensors, gun mounts, and Built-In Test Equipment (BITE) switches.
- A05 System Status Assembly. A05 contains the controls and indicators required for control of power to the SCC, computer, and radar. Included are those controls, indicators, and circuits required to accomplish the following:
 - •• Input radar range and bearing and wind direction and velocity information into the computer
 - Designate and assign TWS circuits
 - •• Display TWS and radar status
 - ·· Control tracking windows and false-target position
 - · Display relative bearing and range of false target
- <u>A06 Upper Converter Assembly</u>. A06 provides the interface for all synchro and analog signals between the SCC and director one and for synchro control signals from the SCC to mount one. The assembly also provides synchro-to-digital conversion for ship roll and pitch.
- <u>A07 Computer Assembly</u>. A07 is programmed to solve the fire control problem. It uses the data provided to conduct a target-motion analysis and to generate gun orders.

- <u>A08 Lower Converter Assembly</u>. A08 provides the interface for all synchro and analog signals between the SCC and director two, and for synchro control signals from the SCC to mount two. It also provides synchro-to-digital conversion for own-ship heading and antenna position.
- <u>A09 Switchboard and Power Supply Assembly</u>. A09 contains two dc power supplies, BITE switches, switchboard switches, and the encoding relay matrix. It provides power within the SCC for logic, amplifier, and converter power.
- Al0 Right Rear Connector Assembly. Al0 contains RFI filters and input/output connectors.
- <u>All Left Rear Connector Assembly</u>. All contains input/output connectors.

3.3.3.1 SCC Reliability

The System Control Console (SCC) was in operation undergoing On-Shore System Integration Test for 1234 hours and At-Sea Trials for 589 hours -a total of 1823 hours.* An additional 149 hours' operation time was accumulated on the H316R Computer, Assembly A07, while programming operations and tests were being conducted during the At-Sea Trials. Consequently, Assembly A07 has an accumulated 1972 hours under test.

SCC casualties are itemized in Appendix B. Assembly casualties considered as failures are described as follows:

- <u>A01 Target and Director Assembly</u>. The target-motion analysis switch for director two failed on 16 July 1973 during OSSIT.
- <u>A04 Mount and Status Assembly</u>. A TWS threshold potentiometer failed during OSSIT on 30 May 1973.
- <u>A06 Upper Converter Assembly</u>. A high-speed synchro-to-digital converter failed during At-Sea Trials, causing erratic gun orders to be generated.
- <u>A07 Computer Assembly</u>. During OSSIT, there were three card failures (line driver card, 23 June 1973; priority PAC card, 25 June 1973; and M-register card, 11 July 1973) and four intermittent casualties of more than four hours' duration in the period 4 April through 3 July 1973. Two card failures (PC card CMO 22, 25 October 1973; PC card TG335, 30 October 1973) occurred during At-Sea Trials, preventing the input and output of data to and from the computer.

Assembly and SCC failure rates and MTBFs were determined by using Equations 1 through 3, Subsection 3.3.2.1. The results are tabulated in Table 7.

*Data supplied by NWL/D.

Tal	ble 7. SUMM	ARY OF SCC	FAILURE RATES	5
Assembly	Operating Hours	Failures	λ (x 10 ⁻⁶)	MTBF (Hours)
A01	1823	1	548.55	1823
A04	1823	1	548.55	1823
A06	1823	1	548.55	1823
A07	1972	9	4563.89	219
SCC			6209.54	161

A stress-analysis prediction of the reliability of the SCC was performed. Parts count was attained by using a combination of NAVORD OP 4219 (Interim Issue), and Honeywell Incorporated's Reliability and Maintainability Prediction Report for CPIC RGFCS SCC, dated 15 November 1973. These two sources present some discrepancy in parts count since the OP reflects the prototype version of the SCC and the prediction report was stated by Honeywell to represent their best estimate of the productionmodel configuration.* Discrepancies are noted on the prediction worksheets, Appendix C.

MIL-HDBK-217A was used as the primary source for piece-part failure data. When data were unavailable from this source, the manufacturer's data were used. All base failure rates and stress and environmental factors used are tabulated in Appendix C.

Since a piece-part breakdown was unavailable for Assembly A07 (Computer), Cable Harness, Door, or RF Plumbing, the manufacturer's failure rate data were used.

Results of the reliability stress-analysis prediction are tabulated in Appendix C and summarized in Table 8.

Table 9 summarizes the probability of completing missions of varying durations based on MTBFs determined from prediction and trial data.

The reliability prediction summarized in Table 8 indicates that the greatest potential for SCC failure is in the upper and lower converter assemblies (A06 and A08), with an MTBF of 366 hours; and then in the target and director assembly (A01), with an MTBF of 425 hours.

Assemblies A06 and A08 contain 48 logic, converter, or multiplexing cards of varying complexity. A failure in either of these assemblies could prevent properly training or elevating the gun mount and cause improper operation of the remote optical sight in slaving to the target or coasting.

*From 21 May 1974 meeting at Honeywell, Inc., West Covina, California.

to see the residence contract to	Failures Per Million Hours					
Assembly	Honeywell		Research iction			
	Prediction	T _a = 30°C	$T_a = 65^{\circ}C$			
A01 - Target and Director	330.95	2350.53	2463.22			
A02 - Plan Position*	-	- 20	-			
A03 - True North	13.53	13.53**	13.53**			
A04 - Mount and Status	63.166	215.03	279.39			
A05 - System Status	48.42	60.34	60.34			
A06 - Upper Converter	413.37	2732.09	3658.82			
A07 - Computer H316R	540.18	540.18**	540.18**			
A08 - Lower Converter	413.37	2732.09	3658.82			
A09 - Switchboard and Power Supply	124.17	192.36	225.06			
A10 - Right Rear Connector	2.74	2.74	2.74			
All - Left Rear Connector	0.08	0.09	0.09			
Door	4.58	4.58**	4.58**			
Cable	1.29	1.29**	1.29**			
RF Plumbing	28.389	28.39**	28.39**			
Total System	1984.235	8873.24	10936.45			

Table 9.	SCC RELIABILITY FOR	SEVERAL MTBFS AND	MISSION LENGTHS
		Reliability, R(t)	
Mission Length	meial Seta	Predi	ction
(t hours)	Trial D∢ta MTBF = 161 hours	$MTBF = 113 hours$ $(T_a = 30^{\circ}C)$	$MTBF = 91 hours$ $(T_a = 65°C)$
15	0.9110	0.8757	0.8487
30	0.83	0.7668	0.7203
45	0.7562	0.6715	0.6113
60	0.69	0.588	0.5188

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Assembly AOl contains 17 TWS, I/O buffer, and multiplexing cards of varying complexity. If this assembly fails, it is possible that no information, or incorrect information, will be processed through the RGFCS, affecting gun and director orders, FCS tracking capability, and data display.

The observed MTBF for assemblies A01 and A06, based on trial data, is 1823 hours. No failure was recorded for assembly A08 in 1823 hours of operation.

On the basis of the trial data, assembly A07, the H316R computer, appears to offer the greatest potential for failure. It demonstrated an MTBF of 219 hours (9 failures in 1972 hours of operation). The MTBF predicted by Honeywell is 1851 hours, which makes the H316R first in criticality in the Honeywell prediction but third in ARINC Research's prediction. Since the computer is the heart of the RGFCS, its reliability is critical to the reliability of the system.

3.3.3.2 SCC Maintainability

A consideration that has not been treated in this report but should eventually be treated is the physical location of the SCC aboard the craft. An investigation should be conducted to determine whether the SCC can be located so that there is ready access to all assemblies for testing and component replacement.

The system maintenance concept has not yet been established in final form. Before it is, consideration must be given to the system integrated test capability, qualifications of operating crew members, on-board storage capacity, and those components which constitute potentially high-failure items. A brief discussion of these items follows.

Integrated Test Capability

The SCC is designed so that its operability and readiness can be checked through a daily system operational test (DSOT), false target and TWS test, and system interface test.

The DSOT uses the computer to verify proper operation of the following:

- The pit log interface board, A01A10
- · Display indicators
- Synchro/Digital, Digital/Synchro, Analog/Digital, Digital/Analog converters in assemblies A06 and A08
- Assembly A03, true north module, antenna switch, and video signals

False Target and TWS Test

By generating and moving a false target, it is possible to check proper operation of certain I/O and TWS logic boards in Assembly AO1, as well as a portion of the radar computer interfaces.

System Interface Test

The System Interface Test verifies proper operation of the status indicators (TWS1, TWS2, Cursor, Mount SYNC, and TRUE-REL) on the director panels and the SCC.

Operating Maintenance Personnel

Personnel assigned to the SCC operating station aboard CPIC must be thoroughly familiar not only with system operation but also with all of the system components. It does not appear economically feasible for the craft to have the luxury of separate operating and maintenance personnel to carry out a 60-hour mission.

As described above, the computer is an integral part of the DSOT. Consequently, SCC personnel assigned must be capable of interpreting the computer output when running DSOT as well as determining trouble in the I/O and TWS logic boards during a false-target test. They should be capable of isolating and replacing a faulty logic board (if one is carried as "on board" spare) while under way to minimize the probability of aborting the mission and returning to port.

On-Board Storage

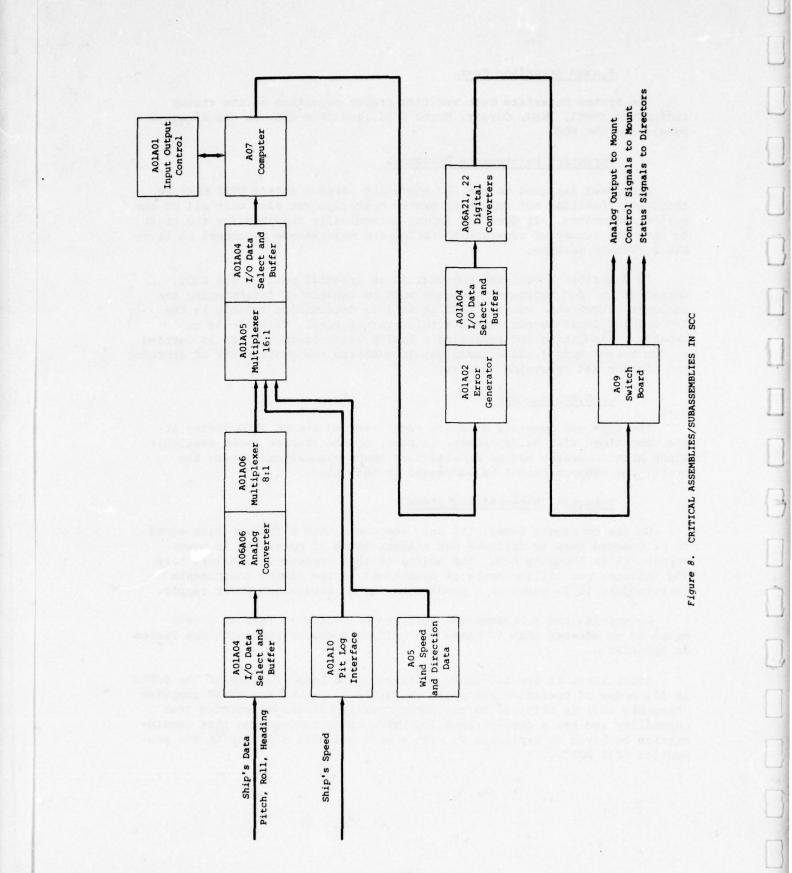
The type and quantity of spare parts carried aboard CPIC during atsea operations will be dependent, in part, on the storage space available. Since ARINC Research has no knowledge of space allocations aboard the craft, the subject cannot be addressed at this time.

Potential High-Failure Items

On the component level, the only component with a failure rate equal to or greater than 50 failures per million hours of operation is power supply PS1 in Assembly A09. The source of this component's failure rate (54 failures per million hours of operation) is the Almond Instruments Corporation; it is based on a prediction for an equivalent power supply.

Assemblies and subassemblies that are predicted to fail at a rate equal to or greater than 50 times per million hours of operation are listed in Appendix D.

Those items of the SCC whose failures could cause failure of the RGFCS in all modes of operation are shown in Figure 8. Since the H316R computer (Assembly A07) is critical to the RGFCS operational and integrated test capability and has a demonstrated low MTBF, it is recommended that consideration be given to replacing it with a more reliable computer in the production CPIC RGFCS.



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3.4 FREQUENCY CONVERTERS

3.4.1 Subsystem Description

The Coastal Patrol and Inderdiction Craft employs two VARO frequency converters: a 5-kVA, 400-Hz, 1-phase Model 100-153; and a 1-kVA, 400-Hz, 3-phase Model 100-152. The 1-phase converter supplies power for the SCC, Mk 74 Mod 0, and Mk 35 Mod 0. The 3-phase converter supplies power for the Mk 5 Mod 0 Gyro Stabilizer. Figure 9 shows the CPIC 400-Hz power distribution.

3.4.2 Discussion

The prototype craft has experienced no failures in the 3-phase converter.

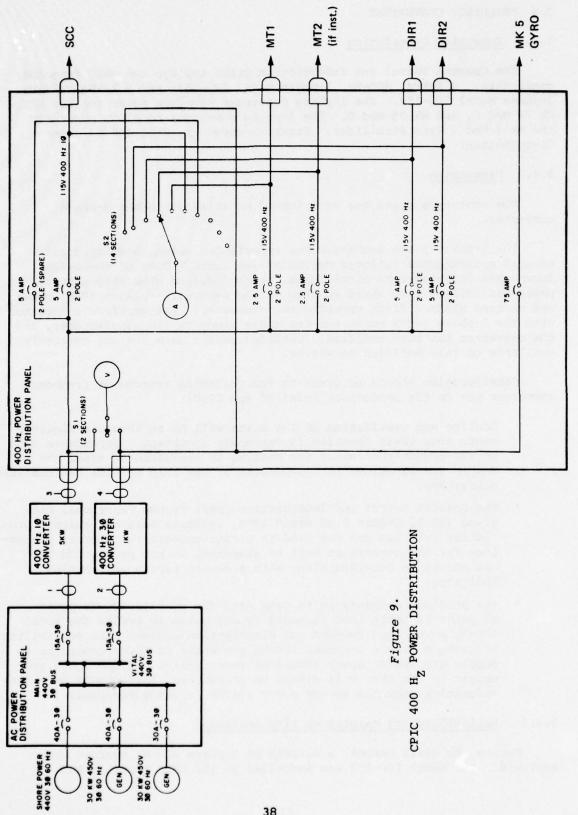
The 1-phase 5-kVA converter has experienced seven documented and several undocumented failures during at-sea tests. Five of the seven documented failures were blown fuses, which occurred when ship service power was shifted from shore to ship or the 440-Vac, 3-phase, 60-Hz power was secured without first securing the converter. The problems associated with the 1-phase 5-kVA converter are under study by the manufacturer, and the converter has been modified. Detailed design data are not currently available on this modified converter.

Consideration should be given to the following aspects of frequencyconverter use in the production model of the CPIC:

- Cooling and ventilation of the units will be an absolute requirement; thus their location is extremely important. Dependence upon an air-conditioned space for cooling is unadvisable, since the weapon system should be independent of the ship service habitability subsystems.
- The Coastal Patrol and Interdiction Craft System Functional Diagrams (SFD), Change 1 of March 1973, indicate that the thermal protective switches are not used in either converter. Thermal protection for the converters will be essential in the production CPIC and should be provided, along with a remote bypass and warning indicator.
- The problems encountered to date with the craft's 400-Hz power supplies indicate that it would be advisable to review the total 400-Hz power requirements and distribution system. The possibility of using a single 3-phase, 400-Hz converter or motor generator to supply all 400-Hz power should be investigated. Since space and weight in the CPIC will always be of concern, this should be a consideration when the 400-Hz power system is being reviewed.

3.4.3 Reliability and Maintainability Analysis

During the OSSIT period, a variety of 1-phase 400-Hz sources were employed. The Model 100-153 was installed in the CPIC after it had



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accumulated a total of 672 operating hours divided between the manufacturer and the OSSIT. There are no records of failures during this first 672-hour period. During the at-sea period the Model 100-153 operated a total of 589 hours, during which the seven recorded failures discussed above occurred. Since it appears that the failures can be directly attributed to the CPIC installation and operating conditions, a point estimate of MTBF for the CPIC installation can be calculated to be 84 hours, with a 60-hour mission reliability of 0.4901. It must be emphasized that these figures are based on incomplete failure data and the fact that the converter was modified during this period. A new analysis and prediction will be required when the firm configuration of the 1-phase converter is established. Appendix B contains details of the failures discussed above.

Failure of the 3-phase converter would result in loss of the Mk 5 gyro, with accompanying loss of gun mount stabilization. The weapon system would still be operable, but capability would be reduced, especially in moderate to heavy seas.

Failure of the 1-phase converter would result in serious degradation of the weapon suite, and the mounts would have to be operated locally.

The converters should present no serious maintenance problems for the ROKN personnel, since they are less complex than the SCC or the radar.

Both converters are straightforward solid-state units that should require a minimum of preventive maintenance beyond cleaning filters and periodic output check.

3.5 MK 5 MOD O GYRO-STABILIZER

3.5.1 Subsystem Description

The Mk 5 Mod 0 Gyro-Stabilizer consists of a gyro unit and a controller unit. The gyro-stabilizer furnishes pitch and roll data to the Mk 93 Mod 0 Radar Gun Fire Control System (RGFCS) for stabilization of the gun mounts. The gyro-stabilizer requires inputs from the Mk 27 Mod 1 Gyro-Compass in addition to 115V, 400-Hz, 3-phase power and 110V, 60-Hz, 1-phase power.

3.5.2 Discussion

The Mk 5 Mod 0 is a standard gyro-stabilizer system that has been in use for a number of years for stabilization of shipborne equipment, such as degaussing systems. The Mk 5 was analysed for interface problems only.

3.5.3 Reliability and Maintainability

As directed by NOSL, no analysis of the Mk 5 reliability and maintainability was performed. No previous use of the Mk 5 to stabilize a weapon system could be ascertained. The available CPIC data do not give any indication of failures, nor do they indicate system performance. There are no apparent interface problems with the Mk 5 as currently installed.

Failure of the Mk 5 would result in loss of mount stabilization. The weapon system would still be operable, but capability would be reduced, especially in moderate to heavy seas.

CHAPTER FOUR

SURVIVABILITY AND RELIABILITY

4.1 SURVIVABILITY

Survivability is "the measure of the degree to which an item will withstand hostile man-made environment and not suffer abortive impairment of its ability to accomplish its designated mission".* The survivability of the CPIC Weapon System, then, will be a measure of its ability to withstand battle damage and continue to engage surface and air threats.

The CPIC is not armored, and the weapon system is vulnerable primarily to topside battle damage. Its physical location isolates it from all damaging effects of underwater explosives except shock.

The CPIC's defense lies in its high speed and maneuverability, along with its limited radar cross section and nondeterminative radar signature.

The CPIC Weapon System, with the exception of the magazine, is located in the central one-third of the craft above the main deck. The 30mm magazine is approximately 30 feet aft of the bow below the main deck but above the design water line.

To a great extent, weapon system survivability is a subjective assessment. The approach used was to identify and group the various major components of the weapon system according to their physical location. The next step was to identify three possible situations under which the CPIC might be required to operate after encountering hostile-action damage:

Surface engagement with a hostile combatant attempting infiltration

- Self defense from air attack while conducting anti-infiltration patrol (The air threat may be either missile or manned aircraft, and these will be engaged with the weapon system in local-powered mode.)
- Navigating and evading detection while transiting from an engagement that resulted in weapon system damage

*MIL-STD-721B.

Each of these three situations was further addressed from the point of view of day or night encounter. Finally, a coding system was developed to indicate the weapon system level of degradation that would result from the loss of a major component to enemy action. In each case it was assumed that the damage to a major component would totally disable that particular component. The coding system is as follows:

- A Would have no effect on the situation, as the component is not required.
- B Would have minimal effect on the situation because of the availability of an alternate mode of operation. Mode-selection options would be limited.
- C CPIC performance would be seriously degraded (estimated that less than 50-percent weapon system capability would remain).
- D Assigned-mission continuation would not be advisable, and the mission would have to be aborted (break engagement; discontinue patrol and request assistance; depart area if possible).

In all cases it was assumed that the battle damage was limited to the weapon system and that the craft mobility and ship service power were unimpaired.

Survivability assessments could be carried to lower levels and could be further developed to include mixes of systems involved, but it would be of questionable value at this time to carry the study to such lengths.

The survivability assessment should be viewed as one of the items to be considered in the development of the production CPIC.

The installation of redundant subsystems or the inclusion of additional emergency modes of operation may increase the CPIC's ability to withstand damage to the weapon system and continue its assigned mission, but the nature of the craft precludes heavy armor and multiple weapon systems. The CPIC has minimal casualty-control capability; thus it must be assumed that in most cases damage to the weapon system would result in discontinuing the engagement and leaving the operating area.

Assessment of the survivability of the weapon system with respect to self-inflicted damage will require measurement of CPIC operationalenvironmental characteristics (shock, vibration, etc.), which are not available at this time. The end result will not change; the loss of a subsystem, regardless of the cause, will result in the same mission degradation.

Figure 10 is a CPIC survivability matrix showing the result of the loss of any one subsystem in the three possible situations. The loss of more than one subsystem is not addressed, but the result can be surmised by using this matrix. It can be seen that the redundancy of subsystems and the multiple modes of operation permit the CPIC to continue its interdiction mission as long as the mount is functioning. Since in the prototype system the gun mount has no redundancy, it is the major critical item in the weapon system.

-			Situ	Situation									-
Subsystem	Sur	Surface Engagement	Def	Air Defense*	EV. EV.	Navigate, Evade, Transit							-
0	Day	Night	Day	Night	Day	Night			Code				
Gun Mount	0	۵	٩	Q	A	A	A - Wou	ild have n	Would have no effect on the situation,	on the si	tuation,		
Magazine	υ	υ	D	Q	A	A		cue compo		Inhai no	• Da		1
Mast-LN66 Ant.	<u>е</u>	υ	. œ	Ø	æ	υ	B - Wou sit	uld have n uation be	Would have minimal effect on the situation because of the availability	fect on t the avail	the ability		
LN66 R/T	B	υ	B	æ	ß	υ	Mod	an alterr le-selecti	or an alternate mode of operation. Mode-selection options would be limited.	or operat s would k	lon. Je limite	.bé	
No. 1 Periscope	B	Ø	В	Ø	щ	Ø	C - CPI	C perform	CPIC performance would be seriously	1 be seri	ously		
No. 2 Periscope	æ	В	æ	Ę	B	æ	Der Der	percent weap	degraded (esclinated tide tess tide) 30- percent weapon system capability would	capabili	ty would		
Mk 35 J/B	υ	υ	B	Ø	В	æ		. (111 P	Leuminj. Projemoj mjenio postimntionj2 mot		on Floor		
SCC/H316R	υ	υ	A	A	В	υ		be advisable,	Assigned mission continued to a would have	and the mission would h	would ha	ive	
1 Phase Conv.	υ	υ	D	Q	υ	υ	CON	tinue pat		enyayemen equest as	sistance		
3 Phase Conv.	æ	B	B	B	A	A	125						
Mk 5 Gyro	B	В	B	æ	A	A							
*Local-powered mode would be	nom		used for	Air	Defense.								

In all of the foregoing, it has been assumed that the assigned mission is patrol and interdiction and that the surface threat is one with a less capable weapon system than the CPIC. If the CPIC is faced with a threat with equal or greater weapon system capability, the decision to break the engagement, if possible, may be different from that in Figure 10.

4.2 RELIABILITY

Reliability is "the probability that an item will perform its intended function for a specified interval under stated conditions".*

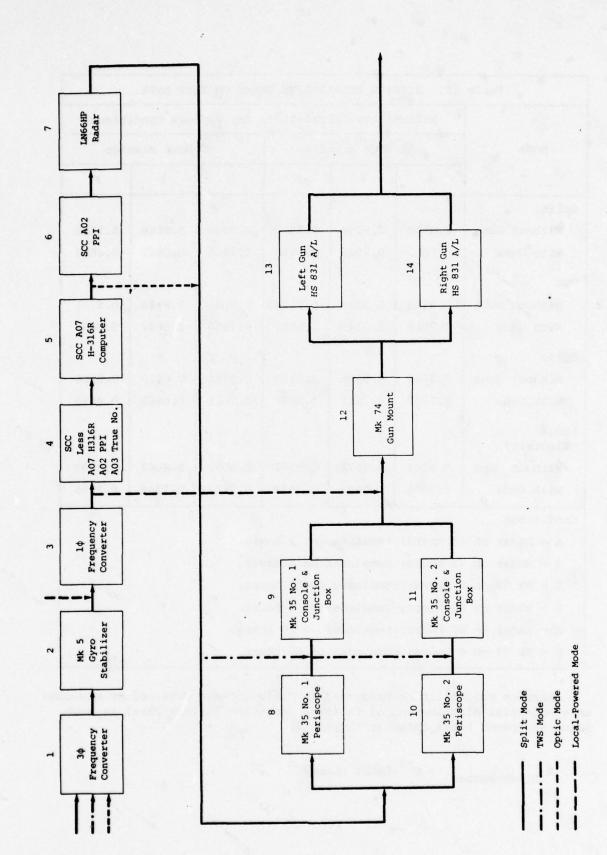
The first assessment of total weapon system reliability was developed from failure rates derived by measuring the performance of each major subsystem, both during On-Shore System Integration Test (OSSIT) and at sea. Because each major subsystem is fairly complex and comprises many component parts, each subsystem was assumed to have an exponential failure distribution (a constant failure rate). The failure rate for each subsystem, based on test results, is developed in Appendix B of this report, which also shows the derived MTBF for each subsystem.

Figure 11 presents the CPIC Weapons System Reliability Block Diagram depicting the various mission modes. The system configuration evaluated one LN66HP Radar, one System Control Console (SCC), one Mk 74 30mm Gun Mount, one Mk 5 Gyro Stabilization Unit, one three-phase Frequency Converter, one single-phase Frequency Converter, two Mk 35 Optical Directors, and two HS 831 A/L 30mm Guns. The Split Mode is the most complex and utilizes all of the component blocks. Therefore, this mode is depicted in Figure 11 by the solid black arrows. Other modes of operation are illustrated by dots, dashes, or dots and dashes, as shown in the legend. (Block 1 is the input terminal for all modes except for "Local Powered", which begins with its input to Block 3.)

Table 10 presents mission reliabilities for various system modes and for two different mission durations (15 and 60 hours). The reliability calculations are based on test data presented in Appendix B, except for the single-phase frequency converter, which experienced seven failures. The manufacturer is reported to have redesigned portions of the converter, which should substantially reduce the failure rate. Therefore, for these calculations only a single failure of that unit was assumed ($\lambda = 1698 \times 10^{-6}$).

Gun reliability was calculated for three separate modes of operation. The probability that the guns will complete an uninterrupted 20-round burst was calculated to be 0.965461. The probability that either or both guns could complete a 20-round burst, not counting clearable stoppages, is 0.999498. The probability that the two guns will complete a 500-round mission, not counting clearable stoppages, is calculated to be 0.81523640, from the equation derived in Appendix A.

*MIL-STD-721B.



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Figure 11. WEAPON SYSTEM RELIABILITY BLOCK DIAGRAM

Table	10. MISS	SION RELIA	BILITY B	ASED ON TH	EST DATA	
	Reliat	bility Cal	culations	s for Var:	ious Cond:	itions
Mode	15-	15-Hour Mission				sion
	A	В	С	D	E	F
Split						
Without Guns	0.9583	0.9259	0.8480	0.9033	0.8146	0.5715
With Guns	0.7812	0.7548	0.6913	0.7364	0.6641	0.4659
TWS						
Without Guns	0.9583	0.9259	0.8483	0.9033	0.8148	0.5751
With Guns	0.7813	0.7549	0.6919	0.7364	0.6642	0.4688
Optic						
Without Guns	0.9662	0.9336	0.8550	0.9336	0.8419	0.5906
With Guns	0.7877	0.7611	0.6970	0.7611	0.6863	0.4815
Local (Electric)						
Without Guns	0.9783	0.9571	U.9394	0.9571	0.8962	0.8703
With Guns	0.7976	0.7803	0.7658	0.7803	0.7306	0.7095
Condition:		L			L	L
A = Radar on						
B = Radar on						
C = Mk 74 on						
D = Radar on						
E = Radar on						
F = Mk 74 on 4	4 hours; 1	remainder	on 60 hou	urs.		

Mission reliabilities presented in Table 10 were obtained by assuming an exponential distribution of failures (constant failure rate) in each major equipment block shown in Figure 11:

^R(Block number) = $e^{-\lambda}$ (Block number)^t

where

 λ (Block number) = $\frac{1}{\text{MTBF}}$

t = mission time for that block

The $\lambda_{(Block number)}$ for each equipment block except Blocks 3, 13, and 14 is developed in Appendix B. Block 3, the single-phase converter, was assumed to have one failure in 589 hours of operation. The reliability for the guns (Blocks 13 and 14 combined) was assumed to be 0.8152364 (for 500 rounds). Table 10 presents mission reliabilities, with and without the guns included. The reliability equations for the four modes are as follows:

$$R_{\text{Split}} = R_{1} \cdot R_{2} \cdot R_{3} \cdot R_{4} \cdot R_{5} \cdot R_{6} \cdot R_{7} \cdot [(R_{8} \cdot R_{9}) + (R_{10} \cdot R_{11})] - (R_{8} \cdot R_{9} \cdot R_{10} \cdot R_{11})] \cdot R_{12} \cdot (R_{13}, 14)$$

$$R_{\text{TWS}} = R_{1} \cdot R_{2} \cdot R_{3} \cdot R_{4} \cdot R_{5} \cdot R_{6} \cdot R_{7} \cdot [R_{9} + R_{11} - (R_{9} \cdot R_{11})] \cdot R_{12} \cdot (R_{13}, 14)$$

$$R_{\text{Optic}} = R_{1} \cdot R_{2} \cdot R_{3} \cdot R_{4} \cdot R_{5} \cdot [(R_{8} \cdot R_{9}) + (R_{10} \cdot R_{11}) - (R_{8} \cdot R_{9}) \cdot R_{10} \cdot R_{11})] \cdot R_{12} \cdot (R_{13}, 14)$$

$$R_{\text{Local}} = R_{3} \cdot R_{12} \cdot (R_{13}, 14)$$

Many managers are often more familiar with Mean Time Between Failures (MTBF) values as a means of evaluating system performance. Mission reliability for a system that has an exponential failure rate is

$$R = e^{-\frac{t}{MTBF}}$$

System MTBFs based on the test results are presented in Table 11. This table is based on a system that would have only one director, since redundancy cannot be easily accounted for by this method. The redundant optical director should make system performance even better than that reflected in the reported MTBFs. The guns are never accounted for in these MTBF calculations, since their dominant failure mode involves rounds fired and is expressed as Mean Rounds Between Failures (MRBF).

	MTBF	in Hours
System Configuration	OSSIT and At-Sea Tests Combined	At-Sea Tests Only
LN66HP Radar, SCC, and one Mk 35 Optical Director	112	140
Same as above plus 1¢ Frequency Converter, 3¢ Frequency Con- verter, and Mk 5 Gyro	94	113
Same as above plus the Mk 74 Gun Mount	50	113

The only subsystem for which sufficient data were available to perform a prediction was the System Control Console (SCC). The prediction results for this major unit are presented in Table 8 in Section 3.3.3.1 for temperatures of +30°C and +65°C, as required under terms of the contract. The mission reliability was calculated by using the test data for all assemblies except the SCC; the +30°C predicted failure rate was used for the SCC. These results are presented in Table 12. Each mode and condition is slightly less successful than that shown in Table 10, in which only test results are used (except for the last, Local-Powered Mode, which is unchanged because the SCC is not used in this mode).

Table 13 is based on these same data, except that the predicted failure rates for the SCC are based on +65°C. As would be expected, the mission reliabilities involving the SCC are slightly less successful at the elevated temperatures.

From the data in Appendix B it can be seen that the SCC was a major failure source during the tests. However, of a total of 12 experienced failures, nine occurred in the A07 Computer (H316R). Of the remaining three failures, only one, a synchro-to-digital converter, occurred at sea. Therefore, the performance of the SCC, excluding the A07 Computer, is good.

The computer has not proven itself reliable during these tests. The manufacturer states that the test failure rate is substantially higher than that experienced on the commercial H316 computers. There are no firm reliability data on commercial units to substantiate that claim. However, the claim seems reasonable, since continued failures at this rate would have been disastrous for a commercial program. There is a possibility that the A07 used in the test was a singularly bad computer, a "lemon". Changing computers at this time would involve great technical risk; not changing the computer represents a significant reliability risk. No recommendation can be made on the basis of the available data.

Mode		-Hour Miss	lculations		-Hour Miss	
			<u> </u>			1
	A	В	С	D	E	F
Split						
Without Guns	0.9533	0.9163	0.8153	0.8939	0.7935	0.4883
With Guns	0.7772	0.7470	0.6646	0.7287	0.6469	0.3981
TWS						
Without Guns	0.9533	0.9163	0.8156	0.8939	0.7938	0.4914
With Guns	0.7772	0.7470	0.6649	0.7288	0.6470	0.400
Optic						
Without Guns	0.9612	0.9238	0.8220	0.9238	0.8201	0.504
With Guns	0.7836	0.7531	0.6701	0.7531	0.6686	0.4114
Local (Electric)						
Without Guns	0.9783	0.9571	0.9394	0.9571	0.8962	0.870
With Guns	0.7976	0.7803	0.7658	0.7803	0.7306	0.709
Condition:						a ser la

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C = Mk 74 on 4 hours; remainder on 15 hours. D = Radar on 60 hours; remainder on 4 hours. E = Radar on 60 hours; remainder on 10 hours. F = Mk 74 on 4 hours; remainder on 60 hours.

	Relial	oility Ca	lculations	s for Var	ious Cond:	itions
Mode	15-	-Hour Mis:	sion	60.	-Hour Miss	sion
	A	В	, c	D	E	F
Split						
Without Guns	0.9494	0.9087	0.7904	0.8865	0.7773	0.4315
With Guns	0.7740	0.7408	0.6444	0.7227	0.6337	0.3517
rws						
Without Guns	0.9494	0.9083	0.7908	0.8866	0.7775	0.4342
With Guns	0.7740	0.7409	0.6447	0.7228	0.6338	0.3540
Optic						
Without Guns	0.9572	0.9162	0.7970	0.9162	0.8033	0.4459
With Guns	0.7804	0.7470	0.6497	0.7470	0.6549	0.3635
Local (Electric)						
Without Guns	0.9783	0.9571	0.9394	0.9571	0.8962	0.8703
With Guns	0.7976	0.7803	0.7658	0.7803	0.7306	0.7095
Condition:						1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-
A = Radar on 1						
B = Radar on 1 $C = Mk 74 on 4$						
D = Radar on 6						

F = Mk 74 on 4 hours; remainder on 60 hours.

The tests show that the most frequently failing unit was the singlephase frequency converter. The performance of the test unit was not acceptable. However, the manufacturer has identified problem areas and redesigned portions of the unit. There are no representative data on the redesigned unit.

The Mk 74 gun mount was the second least reliable unit during the tests. Portions of the mount were redesigned by the manufacturer. It is expected that the redesigned unit will reduce the number of failures experienced. However, no data on the redesigned areas have been received by ARINC Research for analysis. One area of improvement potential is the battery, the primary power source for mount operation. Failure of the battery would prevent the mount from functioning. It is recommended that ship power be made the primary source of mount power and that the battery be retained as an alternate power source.

The next most frequently failing unit was the Optical Director No. 2 Console Assembly. However, this assembly has the same design as the No. 1 Console, which had a low failure rate. Averaging the two like units' failure rates results in reasonable performance. Further, the operational redundancy of the two optical directors yields a performance expectation that would not warrant any major expenditures of funds for improvements at this time.

Increased mission reliability could be obtained for the weapon system if an operational mode were incorporated that would allow direct control of the mount from either optical director. (A failure of the SCC would not prevent operation of the mount from the bridge.) Such a mode would require modifying the system to utilize the Mk 5 to stabilize the mount while bypassing the SCC, or the present optic system could be operated in the GYRO BYPASS mode, with the result that the system would be unstabilized. This mode would lack the computer-generated gun orders available in the present optic mode but would offer the advantage over the manually powered mode of making two directors available in the pilot house, with their improved optics and better command and control by the OIC. Range data would be estimated as in the present manually powered mode. The proposed mode would use all of the blocks in Figure 11 except the SCC and the Radar. The expected mission reliability in this mode, based on the same test data used for developing Table 10, is presented in Table 14. The reliability equation for this mode is

 $R_{\text{Proposed}} = R_1 \cdot R_2 \cdot R_3 \cdot [(R_8 \cdot R_9) + (R_{10} \cdot R_{11}) - (R_8 \cdot R_9 \cdot R_{10}) \\
 Optic \cdot R_{11}) \cdot R_{12} \cdot (R_{13}, 14)$

	Relial	bility Ca	s for Var	ious Cond	itions		
Mode	15-	-Hour Miss	sion	60-	-Hour Mis:	sion	
	A	A B C D E					
Proposed Optic Mode					Andreas Inc. e.t.de Inc. e.t.de		
Without Guns	0.9783	0.9570	0.9384	0.9570	0.8958	0.8573	
With Guns	0.7976	0.7802	0.7651	0.7802	0.7303	0.6989	
Condition:	Del Galero de la			11000000	(*	that with	
A = Radar on 1	15 hours;	remainder	r on 2 hou	urs.			
B = Radar on 2	15 hours;	remainder	r on 4 hou	urs.			
C = Mk 74 on 4	4 hours;	remainder	on 15 hou	urs.			
D = Radar on (60 hours;	remainder	r on 4 hou	urs.			
E = Radar on (60 hours;	remainder	r on 10 h	ours.			
F = Mk 74 on 4	4 hours:	remainder	on 60 hou	irs.			

It is recognized that for such a mode, additional circuitry would be required to allow one director or the other to take control of the mount. However, it is apparent from Table 14 that the reliability attainable in this mode would approach that realized when the mount is used in the Local-Powered mode, and mount control from the bridge would be retained. A cost-effectiveness study of this mode is recommended.

Consideration was given to possible configurations of the equipment other than those which existed at OSSIT and in the prototype CPIC. Specifically, a system with only one optical director and one gun mount and a system with two optical directors and two gun mounts were considered.

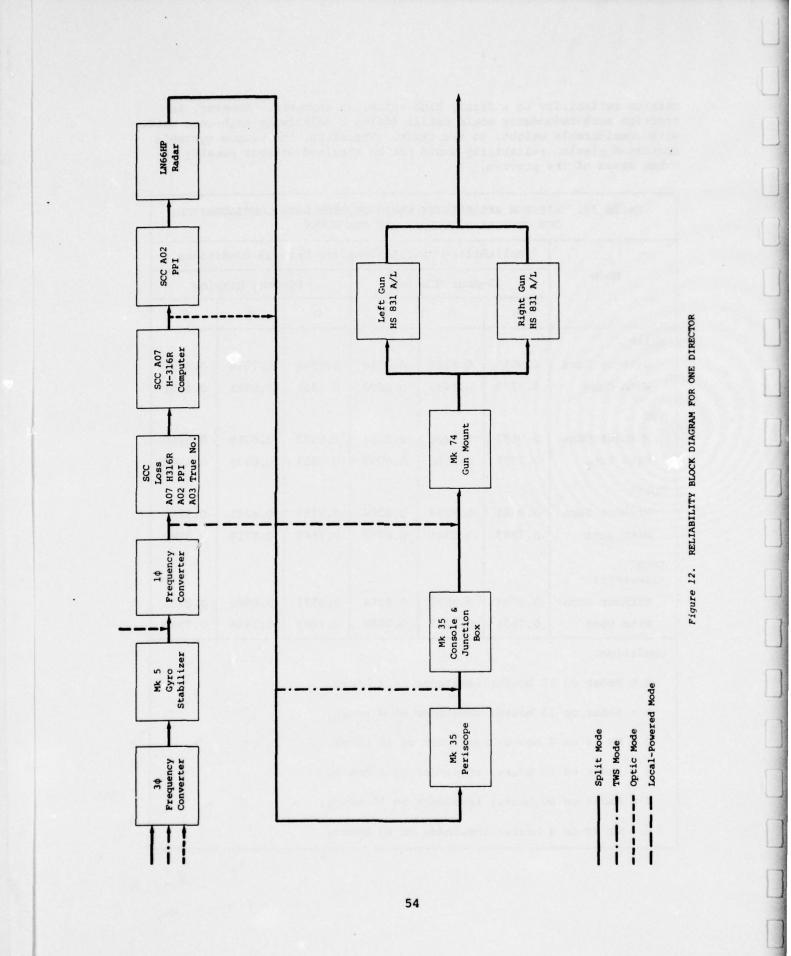
Table 15 shows the system reliabilities based on test data exactly as presented in Table 11, except that only one optical director is considered, as shown in Figure 12. The mission reliabilities are slightly reduced, as would be expected, since the redundancy of the second optical director no longer exists.

Table 16 shows the system reliabilities based on test data exactly as presented in Table 11, except that a second Mk 74 Gun Mount with dual guns has been added, as shown in Figure 13. Both the gun mount and the guns are relatively low-reliability items, and this redundancy brings the mission reliability to a fairly high value, as expected. However, in practice such redundancy would entail adding a relatively high-cost unit, with considerable weight, to the craft. Therefore, the weapon system's increased mission reliability would not be attained without penalty to other areas of the program.

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Table 15. MISSION RELIABILITY BASED ON TEST DATA CONFIGURATION: ONE OPTICAL DIRECTOR, ONE GUN MOUNT								
	Reliat	oility Cal	lculations	for Vari	ious Condi	ltions		
Mode	15-	-Hour Miss	sion	60-	-Hour Miss	sion		
	A	В	с	D	Е	F		
Split								
Without Guns	0.9542	0.9180	0.8216	0.8956	0.7974	0.5091		
With Guns	0.7779	0.7484	0.6698	0.7301	0.6501	0.4151		
TWS		· · · · · · · · ·						
Without Guns	0.9552	0.9200	0.8283	0.8975	0.8018	0.5260		
With Guns	0.7787	0.7500	0.6753	0.7317	0.6536	0,4288		
Optic								
Without Guns	0.9621	0.9255	0.8284	0.9255	0.8241	0.5262		
With Guns	0.7843	0.7545	0.6753	0.7545	0.6719	0.4290		
Local (Electric)								
Without Guns	0.9783	0.9571	0.9394	0.9571	0.8962	0.8703		
With Guns	0.7976	0.7803	0.7658	0.7803	0.7306	0.7095		
Condition:	•							
A = Radar on 1	.5 hours;	remainder	r on 2 hou	irs.				
B = Radar on 1	5 hours;	remainder	r on 4 hou	urs.				
C = Mk 74 on 4	hours; 1	remainder	on 15 hou	irs.				
D = Radar on 6	0 hours;	remainder	r on 4 hou	irs.				
E = Radar on 6	0 hours;	remainder	r on 10 ho	ours.				
$\mathbf{F} = \mathbf{M}\mathbf{k} \ 74 \ \mathbf{on} \ 4$	hours; 1	remainder	on 60 hou	urs.		TT		



	Hour Miss B		s for Vari 60- D	ous Condi Hour Miss E	
A	В				
		с	D	E	F
0.9759					r
.9759			and the second se		
	0.9596	0.8788	0.9362	0.8866	0.5922
.9373	0.9167	0.8395	0.8943	0.8347	0.5658
.9759	0.9596	0.8792	0.9362	0.8868	0.5960
.9373	0.9167	0.8399	0.8943	0.8348	0.5694
.9840	0.9675	0.8861	0.9675	0.9163	0.6121
.9450	0.9243	0.8464	0.9243	0.8626	0.5847
					·
.9963	0.9919	0.9736	0.9919	0.9755	0.9019
.9569	0.9476	0.9300	0.9476	0.9183	0.8616
))	.9373 .9840 .9450 .9963	.9373 0.9167 .9840 0.9675 .9450 0.9243 .9963 0.9919	.9373 0.9167 0.8399 .9840 0.9675 0.8861 .9450 0.9243 0.8464 .9963 0.9919 0.9736	.9373 0.9167 0.8399 0.8943 .9840 0.9675 0.8861 0.9675 .9450 0.9243 0.8464 0.9243 .9963 0.9919 0.9736 0.9919	.9373 0.9167 0.8399 0.8943 0.8348 .9840 0.9675 0.8861 0.9675 0.9163 .9450 0.9243 0.8464 0.9243 0.8626 .9963 0.9919 0.9736 0.9919 0.9755

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A = Radar on 15 hours; remainder on 2 hours. B = Radar on 15 hours; remainder on 4 hours. C = Mk 74 on 4 hours; remainder on 15 hours. D = Radar on 60 hours; remainder on 4 hours. E = Radar on 60 hours; remainder on 10 hours. F = Mk 74 on 4 hours; remainder on 60 hours.

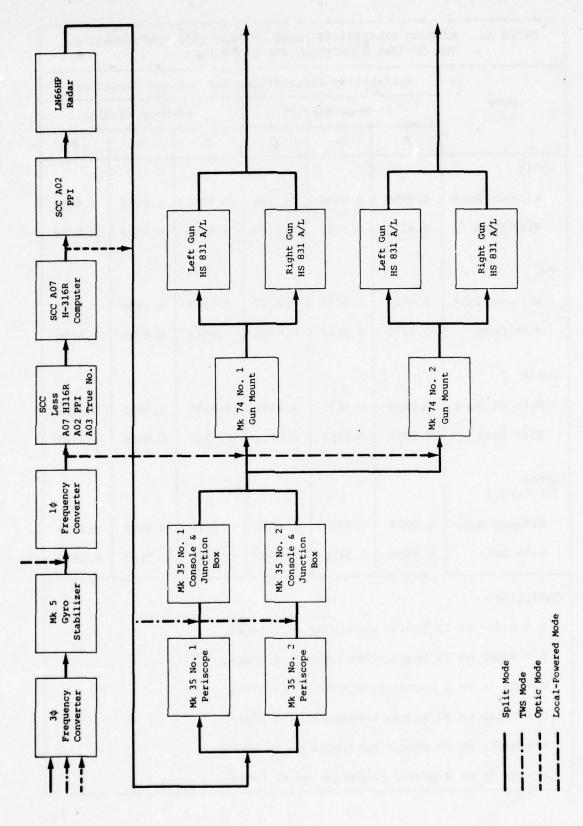


Figure 13. RELIABILITY BLOCK DIAGRAM FOR TWO DIRECTORS AND TWO MOUNTS

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CHAPTER FIVE

PRODUCTION-WEAPON-SYSTEM CONSIDERATIONS

The various subsystems of the weapon suite have been discussed and their individual and collective reliability and maintainability assessed. The general items discussed in the following paragraphs are related to the CPIC and will affect the final weapon system's reliability/maintainability/ availability (RMA) and influence the Plan for Maintenance (PFM). These items are considered worthy of further discussion and future investigation.

5.1 MISSION SCENARIOS

The definition of the primary employment of the CPIC should be reevaluated and updated as necessary. To establish the probability of mission success it will be necessary to define the mission clearly. The two extremes would be (1) lengthy (60-hour) patrols with gun action possible once at any point in the mission, and (2) a quick-reaction back-up mission in which the craft is deployed for short periods where gun action is highly probable and the area of action is well defined. In addition, cycle-time estimates are necessary to predict the probability of a craft's being available for a number of missions in a definite time period.

A predicted threat environment will assist in production-system definition; in particular, the cross section area, speed, and engagement range of both surface and air threats are essential. In addition, the expected and required reaction times for single and multiple threats are needed. These times could be best defined by developing a set of Tactical Operational Requirements (TOR) for the CPIC Weapon System.

The following additional items are important to the mission scenarios:

- A prediction of the number of craft required to assure a long period of operation should be developed.
- The search area that a CPIC can be expected to patrol should be established, with definition of the required revisit time.
- Plans and equipages are required to assist weapon system operators in identifying hostile craft when operating in an area where friendly units are deployed (ESM, IFF, etc.).

- A method is required for keeping track of non-hostile and previously investigated contacts in a search area that will be patrolled for up to 60 hours (status boards, vertical plots, etc.).
- Early warning of pending surface-to-surface missile attack is critical to CPIC survivability. This will require an ESM warning device as a minimum.

5.2 MANNING AND ORGANIZATIONAL MAINTENANCE

The following questions should be answered before a PFM or a spareparts requirements allocation plan is developed:

- Will the CPIC have a permanent crew with an assigned CO/OIC for each craft, or will the CPIC be operated on a rotating-crew basis?
- What level of actual underway casualty correction is anticipated?
- Will any routine maintenance checks be performed at sea, or is it envisioned that the at-sea patrols are Condition I/II and the crew will be unavailable for non-patrol/non-combat type effort?
- What specialized technical assistance will be available at the CPIC home base? Will the division or unit commander have direct access to maintenance specialists (similar to U.S. Navy MOTU)?
- Will the operating crew have additional housekeeping support in port, or will the craft's cleanliness and preservation be the operating crew's responsibility?
- What system availability is required for CPIC to perform its assigned mission? (Will CPIC ever go on patrol with the weapon system less than fully operational?)

5.3 OVERHAUL CYCLE

It is anticipated that the weapon system will require depot-level overhaul approximately every five years. Present plans call for the craft to undergo a three-week annual overhaul (every 2,500 operating hours).

A lower-level overhaul of the weapon system is planned during the annual craft overhaul. In order to obtain a better parts usage prediction, a detailed plan for this overhaul should be made; in addition, items that can be overhauled and returned to the craft in three weeks and those which must be replaced with like-new systems must be identified. A complete five-year weapon system overhaul plan would permit a more realistic parts-procurement program.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

On the basis that the CPIC operations schedule will require patrols of from 15 to 60 hours with the gun mount used for four hours, it appears that the installed weapon system will fulfill its requirements. A clearly defined threat has not been available; thus it was assumed that the craft would not start an operation for patrol without a completely operational weapon system.

6.2 RECOMMENDATIONS

The following recommendations should be considered prior to the development and delivery of the production model of the CPIC. All recommendations are such that they could be implemented independently, but all are considered necessary to helping the system perform its mission more effectively.

6.2.1 Primary Power Source

At present, the 24-volt battery in the Mk 74 Mod 0 Gun Mount is the primary source of power for charging the guns, operating the feed subsystem motors, firing the guns, and performing other 24-volt mount functions. The circuitry should be changed so that ship's power will be the primary source for performing these functions and the battery can be used as a standby supply if ship's power to the mount is lost. The battery should be located below deck rather than in the mount to provide additional protection from possible battle damage.

6.2.2 HS-831 Maintenance

A variety of failures were encountered during the firing tests performed with the HS-831 30mm guns. These failures ranged from feeder stoppages to broken components. Since the guns are off-the-shelf items of foreign manufacture, there is little that can be done to enhance their reliability for this application. By implementing a program of inspections

and preventive maintenance, the probability of gun downtime due to wearout or misalignment of parts can be reduced. The HS-831 A/L instruction manual provides details for disassembly and reassembly of the gun and feeder. On the basis of available test results, the following items should receive special attention:

- Regular replacement of closing springs and tubes.
- Regular replacement of the extractor.
- Regular inspection of oil level in the recoil absorbers.
- Field stripping, cleaning, and inspection of gun and feeder for bent parts, wear, or breakage after each firing. Special attention should be given to determining the presence of foreign materials in the working mechanisms of the gun. A number of stoppages were a direct result of this problem.
- Regular inspection, to quality-control standards, of belt links prior to use in the feed system.

Since the gun design cannot be changed, the mission availability of the gun can most readily be improved by a closely controlled maintenance program. The present instruction manual may have to be supplemented by specific maintenance procedures to be performed at specified intervals.

6.2.3 Periscope Improvement

Certain mechanical elements of the Mk 35 Mod 0 Director periscope assembly can be improved in the production model with minimum design and cost impact. This is especially true with regard to pressurization and component access. A change to a nonpressurized periscope should be investigated.

6.2.4 Alignment Procedures

Weapon system alignment procedures should be refined to ensure the availability of a reliable system under less than ideal conditions, especially the ability to conduct quick, periodic alignment checks.

6.2.5 Optical System Maintenance

Optical system maintenance methods and levels of maintenance must be clearly established on the basis of the user's projected ability, and the necessary special tools must be provided.

6.2.6 H316R Computer Replacement

Consideration should be given to replacing the H316R computer with a more modern computer that will be more reliable and more easily supported (AN/UYK-20 or similar). A cost-trade-off analysis of the computer change would be required prior to such a decision since reprogramming would almost certainly be necessary if another computer were used.

6.2.7 Wind-Measurement Capability

Wind speed and direction are required inputs for the fire-control solution; yet the CPIC has no wind indicator or measuring device. A relative-wind-measuring device should be installed in the CPIC, with read-out available at the SCC.

6.2.8 Technician Theoretical Depth

All organizational/intermediate/depot-level maintenance technicians should have a good background in electronic theory, with an emphasis on radar theory.

6.2.9 Power Supply Reliability

The criticality of the 400-Hz power to the operation of the weapon system requires the highest level of reliability for the power supply. Since the space and weight requirements of the craft will probably preclude redundant/back-up 400-Hz sources, the production-craft source must be selected with care. The total craft power requirements should be reviewed and an optimum source and distribution system identified. This source may be the present two converters or possibly a single three-phase converter.

6.2.10 Stabilization

The Mk 5 Mod 0 presents no apparent problems for use in the CPIC, but it may be advisable to consider a more modern stabilizer system in order to conserve space and weight. The Mk 5 occupies approximately five cubic feet and weighs 106 pounds. In addition, the electronic tube controller unit could be replaced by a solid-state unit, which might be more easily maintained at the organization level. In addition, as discussed in the director analysis (Section 3.2.2), it may be desirable to use this stabilizer to stabilize the director optics in lieu of a separate director gyro system.

6.2.11 Change Control

In the weapons system specifications for the production CPIC, close control must be exercised over any equipment changes and a system of monitoring change proposals instituted early in the program to ensure the interchangeability of subsystems and the availability of repair parts.

6.2.12 Documentation

The maintainability and, ultimately, the reliability of a complex weapon system are highly dependent upon the documentation and maintenance procedures provided. The CPIC prototype weapon system includes interim MIPs and MRCs for the Mk 35 Director, Mk 93 SCC, and Mk 74 Gun Mount. It is essential that MRCs be developed for the remainder of the weapon system, in particular the HS-831 A/L guns, which will require proper preventive maintenance to ensure reliability. APPENDIX A

DERIVATION OF GUN RELIABILITY EQUATION



APPENDIX A

DERIVATION OF GUN RELIABILITY EQUATION

The reliability equation was derived as follows: assuming that both guns are firing simultaneously, determine the probability that a 500-round firing mission can succeed. One mode of success is that each gun fires 250 rounds, and the probability that this will occur is expressed by

 $R = R_{250} \cdot R_{250}$

where R_{250} is the probability that one gun fires 250 rounds.

Throughout this discussion R_i represents the probability of a single gun's completing the firing of i rounds; for example,

 R_{500} is the probability that one gun fires 500 rounds R_1 is the probability that one gun fires 1 round

The other modes of success are:

$$R = R_{250} \cdot R_{249} \cdot (1 - R_1) \cdot R_{500} - (500 - 1)]$$

$$R = R_{249} \cdot R_{248} \cdot (1 - R_1) \cdot R_{500} - (498 - 1)]$$

$$\vdots \cdot \vdots$$

$$R = R_1 \cdot R_0 (1 - R_1) \cdot R_{500} - (2 - 1)]$$

Since either gun is assumed to be able to complete the total 500-round firing mission, given that the other gun failed prior to 250 rounds, this series can occur in two ways. The general expression then becomes

$$R = (R_{250})^{2} + 2 (1 - R_{1}) \sum_{i=1}^{250} R_{i}R_{i-1} R_{500} - (2i - 1)$$

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Since

$${}^{R_{i}R_{i-1}}$$
 ${}^{R_{i-1}}$ ${}^{R_{i-1}}$ ${}^{R_{i-1}}$ ${}^{R_{i-1}}$ ${}^{R_{i-1}}$ ${}^{R_{i-1}}$

for all i under the assumption that the probability of any single successful firing remains constant, the equation becomes

$$R = (R_{250})^2 + 500 R_{500} (1 - R_1)$$

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APPENDIX B

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SUMMARY OF CPIC WEAPON SYSTEM FAILURE DATA Π Π. Π 0 0 0 0 0 []

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Subsystem/Element	Failures	Operating Time (Hours)	MTBF (Hours)	(Failures/Operating Hours, x 10 ⁻⁶)	Casualty Description and Remarks	Date	Location
SYSTEM CONTROL CONSOLE			161	6209.54	Includes AØ1 thru All $(\mathbf{A} = \mathbf{\Sigma} \mathbf{A}_1)$		
AØ1 (TGT and Director)					Switch (Dir. 2/Off TDS) - Not Critical Switch (Dir. 2 TWS 1) - Not Critical Switch (Dir. 2 TWA) Broken Wire Computer Interface Cable -	1-15-73 5-14-73 7-16-73	OSSIT OSSIT OSSIT
						11-1-73 1-21-74	At-Sea At-Sea
Total AØ1	1	1823	1823	548.55			
AØ3 (True North)					Spoking on PPI - Maintenance Problem		At-Sea
AØ4 (Nount and Status)	. 1	1323	1823	548.55	TWS Threshold Pot	5-30-73	OSSIT
AØ6 (Converter)	1	1823	1823	548.55	Synchro to Digital Converter	1	At-Sea
	•				Register Switch/Power Supply - Not Gritical	4-9-73	DISSO
	•				Back Plane Pins Touching - Not Critical	4-27-73	DISSO
	1				Line Driver Card	6-23-73	DISSO
	1				Priority PAC Card	6-25-73	OSSIT
AMT	1				M-Register Card	7-11-73	DISSO
(Computer)	4				Intermittent Failures of Greater Than Four Hours Duration	4-7-73	OSSIT
	1				PC Card CM022	10-25-73	At-Sea
	1				PC Card TG335	10-30-73	At-Sea
	1				Unable to Load Program Using Paper Tape Reader - Not Critical	10-31-73	At-Sea
	•				Broken Ground Wire at Connector Paper Tape Reader - Not Critical	11-1-73	At-Sea
Total AØ7	6	1972	219	4563.89			
AØ9 Swbd & Power Sup.)	•				5V Logic Power Supply-Cooling System Changed	5-19-73	TISSO

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Location		At-Sea	11-11-73 0SSIT 1-28-74 At-Sea			At-Sea	At-Sea	At-Sea	At-Sea	At-Sea	At-Sea	At-Sea	
Date		1-28-74	11-11-73 0SSIT 1-28-74 At-Se			10-26-73 At-Sea	10-27-73 At-Sea	11-2-73	11-5-73	11-6-73	12-1-73	1-29-74	
Casualty Description and Remarks	Excluding PPI (AØ2 of SCC)	Intermittent Ships Head Marker - Maintenance Error	Radar Detector Crystal - Maintenance Error Pulse Change Relay Hangs in Wide Pulse Position		1¢, 5KW, 400 H. Converter	Blown Fuse, F-1 (PCB A-2)	Blown Fuse, F-1 (PCB A-4, L1-4)						
<pre>A Failures/Operating fiours, x 10⁻⁶</pre>	548.55			548.55	11884.55								11884.55
MTBF (Hours)	1823			1823	84								84
Operating Time (Hours)	1823			1823	539								589
Failures	1		1 7	1	7	1	1	1	1	1	1	1	2
Subsystem/Element	LN 66 HP RADAR	Antenna	T/R Unit	Total T/R Unit	Frequency Converter 100-153	Converter							Total Converter

SUMMARY OF FAILURE DATA (continued)

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	Failures	Operating Time (Hours)	MTBF (Hours)	<pre>k (Failures/Operating Hours, x 10⁻⁶)</pre>	Casualty Description and Remarks	Date	Location
108	108		103	9259.26			
					Excessive Train Bearing Friction - Installat- ion Problem	9-11-72	OSSIT
					Magnetic Clutch - Redesigned	5-23-73	DISSO
					Power Amp. and Power Supply - Redesigned	2-19-73	OSSIT
					Power Amplifier - Redesigned	2-23-73	DISSO
					Power Amplifier - Redesigned	2-27-73	OSSIT
					On-Mount Battery (NICAD) - Maintenance Problem	1 6-27-73	OSSIT
					Door Fasteners - Not Critical	8-12-72	DISSO
					Broken Door Hinges - Redesigned	i1-7-73	At Sea
					Local Sighting Station 2 Support Bolts Sheared in High Sea State Operations - Redesigned	1-10-74	At Sea
					440 V, 60H, , 36 Circuit Breaker Activated - Redesigned		At Sea
					Booster Motor Miswired - Assembly Error Burned Cut Motor Due to Low Voltage	12-19-72 12-19-72	DSS IT 0SS IT
103	103		108	9259.26			

SUMMARY OF FAILURE DATA (continued)

Subsystem/Element	Failures	Operating Time (Hours)	MTBF (Hours)	<pre>(Failures/Operating Hours, x 10⁻⁶)</pre>	Casualty Description and Remarks	Date Lo	ocation
35 Director No. 1	1	1083	1083	923.36	Includes Periscope, Console and $\frac{1}{2}$ Junction Box		
Periscope	1 14				Elevation Binding - Installation Error Day-Night Mode Handle	11-16-72 OSSIT 12-18-72 OSSIT	SSIT
					Head Window Cracked - Design Change 12-23-72 Leaking Head Window - Excessive Environmental 6-19-73 Condition	12-23-72 OSSIT 6-19-73 OSSIT	OSSIT
Total Periscope	1	1083	1083	923.36			
Console Assy.	1				Lamp Dimmer CKT. Transistors - Not Critical	11-13-73 At Sea	t Sea
35 Director No. 2	3	452	251	3978.78	Includes Periscope, Console and $\frac{1}{2}$ Junction Box		
Periscope					Slipped Derotation Synchro - Not Critical	10-25-73 At Sea	t Sea
Console Assy.	7				ON/NAV Switch	1-17-73 0 2-18-73 0	OSSIT
	- 1				Data Resistant/ Diversi Contactor in Joy Dota		TISSO
	1				Elevation Operational Amplifier MA-1	1-16-74 A	At Sea
Total Console	3	452	521	3978.78			

SUMMARY OF FAILURE DATA (continued)

APPENDIX C

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RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE

Condition	1:	Ta	=	30°C	(86°F)
Condition	2:	Ta	=	65°C	(149°F)

		FP	FAILURE DATA USED	
COMPONENT	NUMBER	$\begin{array}{c} \text{CONDITION I} \\ \textbf{X} \times 10^{-6} \\ \textbf{T}_{a} = 30^{\circ}\text{C} \end{array}$	$\begin{array}{r} \text{CONDITION 2} \\ \therefore \text{ X 10}^{-6} \\ \text{T}_{a}^{=} 65^{\circ}\text{C} \end{array}$	SOURCE
Amplifier				
Differential	HA-2-2520	6.00	6.00	Hdbk-217A;pg. 7.14-6A; (Note 1)
Operational	SN72741L SN72301L M38510/10101CCB	6.00 6.00 6.00	6.00 6.00 6.00	
Assembly, Readout		0.350	0.350	Honeywell Estimate
Backwire Plane	1047	1.2	1.2	
Blower	ST682-YS	2.25	2.25	
Board				
PC	160801	.17	.17	
Stitchwire		.17	.17	
Terminal	37TB16			
Breaker, Circuit	M39019/3	• 5	· 5	Hdbk-217A; pg. 7.12-3 (Note 2)
Capacitor				
15 HF	CSR13E156KM CS13B	• 33	.65 .65	Hdbk-217A; pg. 7.6-77 (Note 3)

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APPENDIX C

RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE

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		FI	FAILURE DATA USED	
COMPONENT	NUMBER	CONDITION I A X 10 ⁻⁶ T _a = 30°C	$\begin{array}{r} \text{CONDITION 2} \\ \lambda \times 10^{-6} \\ T_a = 65^{\circ}C \end{array}$	SOURCE
18 JE /50V	M39003/01-2619	•33	.65	
100 MF /10V	M39003/01-2502	.33	.65	
.033µF	СКО6ВХ333К	0.109	0.32	Hdbk-217A; pg 7.6-57 (Note 4)
.0022 MF	CK06BX22K	0.109	0.32	
.1µF/100V	CK06BX104K	0.109	0.32	
.OlMF	CKR06CW103MP	0.109	0.32	
	CK05	0.109	0.32	
	CK06BX472K	0.109	0.32	
5PF	CM05CD050DP3	0.024	0.039	Hdbk-217A; pg 7.6-21 (Note 5)
10 PF	CMO5CD100DP3	0.024	0.039	
47PF	CMO5ED470JP3	0.024	0.039	
Circuit, Delay	7119	0.15	0.15	Honeywell Estimate
Circuit, Integrated				
	SN52510AJ	6.0	6.0	Hdbk-217A; pg. 7.14-6A (Note 1)
	SN5400J	6.0	6.0	
	SN5404J	6.0	6.0	
	sN5406J	6.0	6.0	
	SN5410J	6.0	6.0	

APPENDIX C

RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE

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COMPONENT	NUMBER	$\begin{array}{r} \text{CONDITION I} \\ \lambda \times 10^{-6} \\ T_a = 30^{\circ}C \end{array}$	$\begin{array}{r} \text{CONDITION 2} \\ \lambda \text{ X 10^{-6}} \\ T_a = 65^{\circ}C \end{array}$	SOURCE
Circuit, Integrated				
	SN5437J	0.0	0.0	
	sn5440J	6.0	6.0	
	SN5483AJ	6.0	6.0	Hdbk-217A;pg. 7.14-6A (Note 1)
	SN54L85J	6.0	6.0	
	SN54107J	6.0	6.0	
	SN54123J	6.0	6.0	
	SN54154J	6.0	6.0	
	SN54157J	6.0	6.0	
	SN54161J	6.0	6.0	
	sn54164J			
	SN54174J	6.0	6.0	
	SN54175J	6.0	6.0	
	SN54191J	6.0	6.0	
	SN54197J	6.0	6.0	
	SN54S112J	6.0	6.0	
	SN55107J	6.0	6.0	
The second se	SN55110J	6.0	6.0	
	SN7404J	6.0	6.0	

RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE

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		FA	FAILURE DATA USED	
COMPONENT	NUMBER	$\begin{array}{c} \text{CONDITION I} \\ \lambda \times 10^{-6} \\ T_a = 30^{\circ} \text{C} \end{array}$	$\begin{array}{l} \text{CONDITION 2} \\ \lambda \text{ X 10^{-6}} \\ T_a = 65^{\circ}\text{C} \end{array}$	SOURCE
Circuit, Integrated (Cont'd)	C 2007	6.0	6.0	
	SN7410J	6.0	6.0	
	SN7416J	6.0	6.0	
	SN7474J	6.0	6.0	
	SN74193J	6.0	6.0	Hdbk-217A; pg. 7.14-6A (Note 1)
	DM7214D	6.00	6.0	
	ITT9465D	6.00	6.0	
	U6A7741393	6.00	6.C	
	U6A993659X	6.00	6.4	
ISI	TMS3112JC	4.84	4.84	Honeywell Estimate
Connector				
	1081	0.06	0.06	Honeywell Estimate
	1856	0.06	0.06	
	202515-3	0.008	0.008	
	202516-3	0.008	0.008	
	204259-2	0.021	0.021	
	204260-2	0.021	0.021	

RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE

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APPENDIX C

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		Ŀ	FAILURE DATA USED	
COMPONENT	NUMBER	$\begin{array}{l} \text{CONDITION I} \\ \lambda \times 10^{-6} \\ T_a = 30^{\circ} \text{C} \end{array}$	$\begin{array}{r} \text{CONDITION 2} \\ \lambda \text{ X 10}^{-6} \\ T_a = 65^{\circ}\text{C} \end{array}$	SOURCE
Connector (Cont'd)				
	MS3402D20-27	0.008	0.008	
	MS3402D28-21	0.006	0.006	
	MS3402D36-10	0.003	0.003	
	MS3402D40-56	0.015	0.015	
	MS 90335-5	0.003	0.003	
100 Pin ELCO		0.06	0.06	
41 Pin Type		410.0	0.014	
Connector, Relay	VBB/1PA/1-45	100.0	0.001	
Converter				•
A/D	ADC40-12-BIN	16.8	16.8	Honeywell Estimate
D/A	DAC40-12U-CB1	20.0	20.0	
Counter	4 Y- 8829 - 6	0.254	0.254	
Degree	3 Y- 9992 - R	0.254	0.254	
Rounds	EVS15.11	4.20	4.20	
Diodes				
Light Emitting	2LRSRTLFL5/15	1.0	1.0	ARINC Estimate
Silicon Signal	JANIN645	3.16	4.33	Hdbk-217A;pg.7.4-11 (Note 6)

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RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE

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		FP	FAILURE DATA USED	
COMPONENT	NUMBER	$\sum_{T_a}^{CONDITION I} 30°C$	$\sum_{T_a}^{CONDITION 2} = 65^{0}C$	SOURCE
Diodes (Cont'd)				
	JANIN4245	3.26	6.43	Hdbk-217A;pg 7.4-11 (Note 7)
	JANIN4454	1.86	2.77	(Note 8)
Switching	JANIN914	1,86	2.95	(Note 9)
Zener	JAN751A	3.08	4.92	(Note 10)
	JANIN753A	3.08	4.92	
	JAN1N3022A	3.71	5.73	(Note 11)
	JAN1N3022BS	3.71	5.73	
	JAN1N3826A	3.71	5.73	
Encoder, BCD Shaft	SNB-13P20	3.0	3.0	Honeywell Estimate
Filter, RFI	GF-4500-13,14,17	0.438	0.438	Honeywell Estimate
Flasher	F945	12.5	12.5	
Gear Train				
Range	1099	0.9	0.9	
Bearing	1098	0.9	0.9	
Indicator	800-5-A2C2-J3-L2- N2	1.631	1.631	
Jack, Test	M37010035			
Magslip	314-188888-001	2.4	2.4	

APPENDIX C

RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE

				FAILURE DATA USED	
COMP	COMPONENT	NUMBER	$\begin{array}{l} \text{CONDITION 1} \\ \lambda x & 10^{-6} \\ T_a = 30^{\circ}C \end{array}$	$\begin{array}{l} \text{CONDITION 2} \\ \mathbf{A} \times 10^{-6} \\ \mathbf{T}_{\mathbf{a}}^{=} 65^{0} \text{C} \end{array}$	SOURCE
Meter. Time	me				
Totalizing	ng	MS17325-5	1.48	1.48	Hdbk-217A;pg.7.8-9 (Note 12)
Panel, Edge Lit	ge Lit	1050/1051	1.0	1.0	Honeywell Estimate
Power Supply	ply				
2901-1		37656742-01	54.0	54.0	
2901-2		37656742-02	27.0	27.0	
Relay					
Time Delay	lay	D0C-2-A-3-A-1	11.44	11.44	Hdbk-217A;pg.7.10-5 (Note 13)
Reed.		PRME1A005B	0.00215	0.0215	(Note 14)
		M5757/9-031	.572	.572	(Note 15)
		M5757/16-003	.572	.572	
		M5757/19-019	.572	.572	
		M5757/23-004	.572	.572	
		M5757/23-005	.572	.572	
		MS27418-1B	.572	.572	
Resister					
Network					
1000	I	D14M-01-102J	.65	.65	Honeywell Estimate

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RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE

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		42	PATLIRE DATA USED	
		$\lambda x 10^{-6}$	XX 10-6	
OMPONENT	NUMBER	T _a = 30°C	$T_a = 65^{\circ}C$	SOURCE
Resistor, Fixed Cont d	d			
3300	D14M-01-332J	.65	.65	Honeywell Estimate
Fixed				
	RBR52	.87	1.03	Hdbk-217A; pg.7.5-19 (Note 16)
1000 0, 1/8W	RCR05G102JS	.0742	e.	(Note 17)
ιοκΩ	RCR05G103J	.0742	ë.	
1500 A	RCR05G152J			
150K N	RCR05G154J	.0742	e.	
1600 Ω	RCR05G162J			
16K n, 1/8W	RCR05G163J	.0742	е.	
200 0	RCRO5G201J	0.0742	0.3	
ZKA	RCR05G202J	0.0742	0.3	
2.2KJ	RCR05G222J	0.0742	0.3	
300 U	RCR05G301J	0.0742	0.3	
3300 D	RCR05G332J	0.0742	0.3	
39 U	RCR05G390J	0.0742	0.3	
t70 Ω	RCR05G471J	0.0742	0.3	
t700 D	RCR05G472J	0.0742	0.3	

RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE

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		E1	FAILURE DATA USED	
COMPONENT	NUMBER	$\begin{array}{l} \text{CONDITION I} \\ A \times 10^{-6} \\ T_a = 30^{\circ}C \end{array}$	$\begin{array}{r} \text{CONDITION 2} \\ \mathbf{\lambda} \mathbf{X} \ 10^{-6} \\ \mathbf{T}_{a}^{=} \ 65^{\circ} \mathrm{C} \end{array}$	SOURCE
Resistor,Fixed Contd				
5K N	RCR05G502J	0.0742	0.3	
510G, 1/8W	RCR05G511J	0.0742	0.3	
5100 N	RCR05G512J	0.0742	0.3	
5600 n	RCR05G562J	0.0742	0.3	
62 0, 1/8W	RCR05G620JS	0.0742	0.3	
7500 0, 1/8W	RCR05g752J	0.0742	0.3	
2.7 Ω	RCR07G2R7J	0.0742	0.3	
10 N	RCR07G100J	0.0742	0.3	
100Ω	RCR07G101J	0.0742	0.3	
100 0, 1/4W	RCR07G101JS	0.0742	0.3	
120 A	RCR07G121J	0.0742	0.3	
130 n	RCR07G131J	0.0742	0.3	
150 0	RCR07G151J	÷		
15K U	RCR07G153J			
220 A	RCR07G221J			
2.7Mft, 1/4W	RCR07G275JM			
47 Ω	RCR07G470J			

RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE

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		FP	FAILURE DATA USED	
COMPONENT	NUMBER	$\begin{array}{l} \text{condition 1} \\ \mathbf{A} \times 10^{-6} \\ \text{T}_{a} = 30^{\circ}\text{C} \end{array}$	$\begin{array}{r} \text{CONDITION 2} \\ \mathbf{A} \text{X 10}^{-6} \\ \mathbf{T}_{a}^{=} 65^{\circ}\text{C} \end{array}$	SOURCE
Resistor, Fixed (Contd				
62 n, 1/4W	RCR07G620J			
68 n	RCR07G680J			
2.70	RCR20G2R7J			
15011, 1W	RCR32G151J			
	RLRO7	0.2898	0.52	Hdbk-217A; pg.7.5-33 (Note 18)
10K n, 1/4W	RLR07103JM			
110K n, 1/4W	RLR07104JM			
27KΩ, 1/4W	RLR07C273JM			
	RN65	0.1005	0.15	Hdbk-217A; pg.7.5-25 (Note 19)
	RN C55			
5110Ω	RNC55J5111FM			
	RNG5			
4.02 Ω	RWR74S4R02FM	0.56	0.78	Hdbk-217A; pg. 7.5-15 (Note 20)
1.62 a	RWR78S1R62FM	0.56	0.78	
2.37 a	RWR78S2R37FM			
0.1470	RWR80SR147FM			
0.187 n	RWR80SR187FM			

RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE APPENDIX C

		FP	FAILURE DATA USED	
COMPONENT	NUMBER	$\sum_{a=30°C}^{CONDITION I}$	$\begin{array}{r} \text{CONDITION 2} \\ \mathbf{\hat{A}} \times 10^{-6} \\ \text{T}_{a}^{=} 65^{0}\text{C} \end{array}$	SOURCE
Resistor, Fixed (Cantu)				
0.590	RWR80SR590FM		•	
0.787 0	RWR80SR787FM			
0.226 Ω	RWR89SR226FM			
0.332 A	RWR89SR332FM			
Variable				
ιοκΩ	RT26C2P103	0.924	1.18	Hdbk-217A; pg 7.5-35 (Note 21)
500 D	76PR500(RTR)			
2K N	76pr2k rtrl2dp202r			
Switch				
Linear	1853048	4.756	4.756	Honeywell Estimate
Push Button	800-5-A3C2E4-L2	0.192	0.192	Hdbk-217A; pg.7-10-7 (Note 22)
Rota y				I de state specie de la la la serie
	JV9032	0.216	0.216	Hdbk-217A; pg. 7-10-7 (Note 23)
	S2JM-15	0.216	0.216	
	S3JR-15	0.216	0.216	Hdbk-217A; pg.7-10-7 (Note 23)
Thum wheel	7-н-г19,220	3.0	3.0	Honeywell Estimate
	RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE	ICTION FOR SYSTEM	M CONTROL CONSO	4

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			FAILURE DATA USED	
OMPONENT	NUMBER	$\begin{array}{c} \text{CONDITION I} \\ \lambda \times 10^{-6} \\ T_a = 30^{\circ}C \end{array}$	$\begin{array}{l} \text{CONDITION 2} \\ \lambda \text{ X 10}^{-6} \\ \text{T}_{a}^{=} 65^{\circ}\text{C} \end{array}$	SOURCE
Switch (Cont'd)				
Toggl> 357	MS27718-23	0.144 0.144	0.144 0.144	Hdbk-217A; pg. 7.10-7 (Note 24)
Torgsyn	VTSN23	11.12	11.12	Honeywell Estimate
Transformer	PAB-619	0.194	0.194	Hdbk-217A; pg. 7.7-9 (Note 25)
	HSM-200	0.194	0.194	
Transistor, Si				
NFN	JAN2N2219	0.45	0.70	Hdbk-217A; (Note 26)
	JAN2N2222A	0.45	0.70	Hdbk-217A; (Note 27)
-	JAN2N3501	0.45	0.66	Hdbk-217A; (Note 28)
PNP	JAN2N2905	1.38	3.15	Hdbk-217A; (Note 29)
	JAN2N2907A	1.38	3.15	Hdbk-217A; (Note 30)
	JAN2N4007	1.38	3.15	<u>e</u>
Power Jl	JAN2N3766	0.459	0.77	Hdbk-217A; (Note 31)
Wind Data Input Module		3.0	3.0	income and the second sec

RELIABILITY PREDICTION FOR SYSTEM CONTROL CONSOLE

APPENDIX C

SOURCE DATA NOTES

NOTE:
$$1 - \lambda_{B} = 0.4$$
; K= 3.0; QF=5
2 - Table VII - XXVI; CB - Magnetic
3 - Level M; SR= 0.5, $T_{a} = 30^{\circ}C$, $\lambda_{B} = 0.33$, K= ---;
SR = 0.5, $T_{a} = 65^{\circ}C$, $\lambda_{B} = 0.65$, K = ----
4 - SR = 0.5, $T_{a} = 30^{\circ}C$, $\lambda_{B} = 0.0065$, K = 16.8;
SR = 0.5, $T_{a} = 65^{\circ}C$, $\lambda_{B} = 0.0021$, K = 11.5
SR = 0.5, $T_{a} = 65^{\circ}C$, $\lambda_{B} = 0.0034$, K = 11.5
6 - $\theta_{J-A} = 3.2 \text{ mW/}^{\circ}C$, $P_{J \max} = 0.6W$, $T_{J \max} = 150^{\circ}C$,
 $\lambda_{B} = 0.73$, K = 4.33
7 - $\theta_{J-A} = 0.1875^{\circ}C/mW$, $P_{J\max} = 0.6W$, $T_{J\max} = 175^{\circ}C$,
 $\lambda_{B} = 1.0$, K = 3.26
8 - $\theta_{J-A} = 2.85 \text{ mW/}^{\circ}C$, $P_{J\max} = 0.5W$, $T_{J\max} = 200^{\circ}C$,
 $\lambda_{B} = 0.43$, K = 4.33
9 - $\theta_{J-A} = 1.67 \text{ mW/}^{\circ}C$, $P_{J\max} = 250 \text{ mW}$, $T_{J\max} = 175^{\circ}C$
 $\lambda_{B} = 0.43$, K = 4.33
10 - $\theta_{J-A} = 3.2 \text{ mW/}^{\circ}C$, $P_{J\max} = 0.4 \text{ W}$, $T_{J\max} = 175^{\circ}C$
 $\lambda_{B} = 1.12$, K = 2.75
11 - $\theta_{J-A} = 6.67 \text{ mW/}^{\circ}C$, $P_{J\max} = 1.0 \text{ W}$, $T_{J\max} = 175^{\circ}C$
 $\lambda_{B} = 1.35$, K = 2.75
12 - Table VII - XXIII, AC, $\lambda_{E} = 20$, K = 0.148,
 $T_{a}/T_{\max} = 0.5$
13 - Type N, $\lambda_{B} = 0.02$, K = 286, GF_c = 2.0
14 - Type F, $\lambda_{B} = .05 \times 10^{-4}$, K = 286, GF_c = 1.5
15 - Type J, $\lambda_{B} = 0.001$, K = 286, GF_c = 2.0

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SOURCE DATA NOTES

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Note:	16 - SR = 0.5, $T_a = 30^{\circ}C$, $\lambda_B = 1.00$, K = 0.87;
	a = B = 1.19, K = 0.87 SR = 0.5, $T_a = 65^{\circ}C, \lambda_B = 1.19, K = 0.87$
	17 - SR = 0.5, $T_a = 30^{\circ}C$, $\lambda_B = 0.0035$, K = 21.2;
	SR = 0.5, $T_a = 65^{\circ}C$, $\lambda_B = 0.014$, K = 21.2
	18 - SR = 0.5, $T_a = 30^{\circ}C$, $\lambda_B = 0.210$, K = 1.38;
	SR = 0.5, $T_a = 65^{\circ}C$, $\lambda_B = 0.38$, K = 1.38
	19 - SR = 0.5, $T_a = 30^{\circ}C$, $\lambda = 0.15$, $K = 0.67$.
	19 - SR = 0.5, $T_a = 30^{\circ}C$, $\lambda = 0.15$, K = 0.67; SR = 0.5, $T_a = 65^{\circ}C$, $\lambda_B^B = 0.23$, K = 0.67
	20 - SR = 0.5, $T_a = 30^{\circ}C$, $\lambda_{B} = 0.020$, $K = 28$.
	20 - SR = 0.5, $T_a = 30^{\circ}C$, $\lambda_B = 0.020$, K = 28; SR = 0.5, $T_a = 65^{\circ}C$, $\lambda_B = 0.028$, K = 28
	21 - SR = 0.5, $T_a = 30^{\circ}C$, $\lambda_B = 46.2$, K = 0.02;
	SR = 0.5, $T_a = 65^{\circ}C$, $\lambda_B = 59.0$, K = 0.02
	22 - Type A, $\lambda_{B} = 0.1$, K = 0.96, GF _C = 2.0
	23 - Type H, $\lambda_{B} = 0.075$, K = 0.96, GF _C = 3.0
	24 - Type F, $\lambda_{B} = 0.03$, K = 0.96, GF _C = 5.0
	25 - Class A, $T_{max} = 75^{\circ}C$, $\lambda_{B} = 0.20$, K = 0.97
	26 - $\Theta_{J-A} = 5.33 \text{ mW/}^{\circ}C$, P = 0.8W, T = 175°C; $\lambda_{B} = 0.44$, $K^{J} = 1.03$
	$27 - \Theta_{J-A} = 3.33 \text{ mW/}^{\circ}\text{C}, P_{Jmax} = 0.5 \text{ W}, T_{Jmax} = 175^{\circ}\text{C}$
	$\lambda_{\rm B} = 0.44, \ {\rm K} = 1.03$
	$28 - \Theta_{J-A} = 5.71 \text{ mW/}^{\circ}\text{C}, P_{Jmax} = 1.0\text{W}, T_{Jmax} = 200^{\circ}\text{C}$
	$\lambda_{\rm B} = 0.44, \ {\rm K} = 1.03$

SOURCE DATA NOTES

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Note 29 - $\Theta_{J-A} = 3.43 \text{ mW/}^{\circ}\text{C}$, $P_{Jmax} = 0.6\text{W}$, $T_{Jmax} = 200^{\circ}\text{C}$ $\lambda_{B} = 1.34$, K = 1.03 30 - $\Theta_{J-A} = 2.28 \text{ mW/}^{\circ}\text{C}$, $P_{Jmax} = 0.4\text{W}$, $T_{Jmax} = 200^{\circ}\text{C}$ $\lambda_{B} = 1.34$, K = 1.03 31 - $\Theta_{J-A} = 16 \text{ mW/}^{\circ}\text{C}$, $P_{Jmax} = 2.0\text{W}$, $T_{Jmax} = 150^{\circ}\text{C}$ $\lambda_{B} = 0.9$, K = 0.51

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INHERENT RELIABILITY ANALYSIS WORKSHEET

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in the second	S PEC ECS	FOULPMENT	3	GROUP		TINU			ASSEMBLY		SUBASSEMBLY	MBLY	2	Sfleer	8
1	CE IDENTIFIC	VIION		Lo	PART	ACTUAL	STRESS	TEMP	BN	COND	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION	IN FPM HO COULD	PM HOURS		
2	NOMENCLATURE AND CARO/CIRCUIT SYMBOL		PART NUMBER	=	RATING	STRESS	RATIO	°	K		TOTAL	BASE	TOTA .	PERCENT	SOUNCE
401	Et € Dir (1. Dawer)										2350.		24:3.	14.00	
402	Idd														
403	True North										13. 528		13.		
404	404 Mt. \$ Status (R.Damer	(r)									215.		279.		•
405	405 Sys. Status (Cantral.	Buch									60. 343.		343		•
106	406 Upper Converter										2732.		3658.		
107	407 Computer										540. 18		540.		
108	488 LOWER CONVERTER										2752.		3658.	0.	
108	409 X61 5 POWER SUPPI	4									112.		225.		
10	410 R. Rear Com. (L. Ipla	(ini									2.2		2.2		
411	L. Rest Com. (R. 1/0 Brei)	(in									510		0.43		
	Door Assembly										4, 579		579		
	Coble Horness						•				299		249	1	
	RF Plumbing										28. 389		264		1
CONDITION 1	1 10		CONDITION 2	Z NOI						SUM OF NKA	RE 73. 2806	SUM OF NKA			
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DEVICE IDENTIFICATION		~10	PART	ACTIM	STRFSS	TEMP	BNV	NO	FAILURE RATE	FAILURE RATE IN FPM HOURS	2 10		
NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	;=	RATING	STRESS	RATIO		FACTOR		IOTAL	BASE	TOTAL	PERCENT	SOURCE
Bas/							•		94. 543		113. 263		
I'D Control Devener	,								7722		102		
Director Bry Error									189. 3264		197.		
1.1/Bu									100. 6704		103.		
I/D 16 Rit 4 to 1 Mutholexor									54.		55.		
Sel se and									54. 867		2.2		
Sum 1: 125									54. 887		55.		
Sund Jos ADS									54.		55.		
404 I/6 Test Inter 202									135.		30215	·	
Alo Pit Loy Interfuc									126. 4056	•	137.		
TWS Bro. Cursor & Test Et. Jenerator									194. 2512		216.		
PUSS Target									130.		34.		
Pasition Computer									190.		197. 34		
Tecks Shar									157. 5108	-	160.		1
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INHERENT RELIABILITY ANALYSIS WORKSHEET

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INHERENT RELIABILITY ANALYSIS WORKSHEET

Ser C	CPIC NESTERS / FOULPMENT	UIPMENT	CROUP		TINU			ASSEMBLY		SUBASSEMBLY	EMBLY	SWEET	2	0 2
	DEVICE IDENTIFICATIO	N	6		ACTUA	STRESS	TEMP	BW	COND	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION	E IN FPM HO	PM HOURS CONDITION 2		
	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	=	RATING	STRESS	RATIO		FACTOR	RASE A	TOTAL	BASE	TOTA	LINGDUG4	Sounce
R	1451 Range & BRIE INJ MINISH GENINTE	i i								199. 3276		201.		
410 71	Generatio	71								3276		39.		
5	419 Stroke Butter		-	0						18.		10.		
14	ARD ID Stary Buter	~								140.	·	145.		
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CONDITION 1		CONI	CONDITION 2						SUM OF	2356.	SUM OF	2463.		

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INHERENT RELIABILITY ANALYSIS WORKSHEET

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2122	25.223			101		Jane -				AILURE RATE IN FP	FAILURE RATE IN FPM HOURS	URS SHEET	4	+
-	DEVICE IDEMIFICATION		AP I	PART	ACTUAL	STRESS	TEMP	EACTOR	COND	CONDITION 1	COND	CONDITION 2		DATA
	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	2	RATING	STRESS	RATIO	•	×	ASE A	TOTAL	RASE A	TOTAL NKX		Sounce
421-	Assembly Realout	35/-255-19	11						0.35		3.85 0.35	3.85		
to t	Assist Switch	800-5- 43C2E4-12.	14					0.96	261.0	2.688	2.688 0.HZ	2.699		
22	Connector .	2047/38-2	1						0.014	0.014	0.014	100		
0/61	. 1017 . 1110	M530335-5	53						0.003	0.003 0.009	6.003	0.009		
Bid	Conne. Tor	2-642402	N						0.0/4	0.028	0.0:4	0.025		
84	Connector	301-535	-36						0.003	0.003 9.108		0.030.108		
53	sarticitation	BCO-5-A2C2- J3-L2-N2	9						1.631	9766	1.631	1.631 9.786 1.631 9.786		
-727-	Diodes	JANING 15 16	2					4.33	3.16		4.33	50.56 4.33,69.20	•	
	Burl Edue Lit	1020/1021	ì						1.00		3.00 1.00	3.00	•	
KJ2	Rely, Time Dury	2-1-1-1-1-	3					286	11:44	22.08	11.44	286. 11.44 22.88 11.44 22.86		
	Brekiwine Plune	1047	1						1.2	1.2	1.2	1.2		
2-1-5	Centerter	6-2042-6	67						0.06	0.42	0.06	0.06 0.42 0.06 0.42		
CONDITION 1	11	COND	CONDITION 2						SUM OF	8.5	_	sun or //3.	ľ	

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1	DEVICE IDENTIFICATION		10		ACTIN	STRFCS	THE	BIN	COND	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION	COND COND	PM HOURS		1
	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	=	RATING	STRESS	RATIO		FACTOR	3	TOTAL	BASE	TOTA	1)GDIG4	Sounce
A M	549 Circuit Intrynaka	tel SN54007	N					3	6.0	42.00	6.0	42.00		
82	Circuit, Integrate / SN54401	SN5440]	M					3	6.0	6.00	6.0	6,00		
1.1	BARR Ciruit. Interrited SN5404J	SN5404J	7					ю	6.0	42.00	6.9	42.00		
9.2	Plancuit Intear 2 Sw54107	CT018312	5					ю	6.0	30.00	6.0.	30.00		
20	Party Circuit, Internal	SN54197J	2					3	6.0	36.00.	6.0	36.00		
. +	X	SN541577	2					m	6.0	12.00 6.0	6.0	12.00		
24	Circuit, Integrate	N SNSABST	11					m	60	6.00	6.0	6.00		
NA	16 Orcuit, Integrated SN54154J	SN54154J	3					3	6.0	18.00	6.0	18,00		
N'	P-BRESistor, Fixed 1,820	ACPOSS 6201	ହ			.5		212	.0742	.0742 1.409B	0.3	5.70		
A	Razhesistar, Fixed 10000	*	N			5		21.2	5H2.	0742 .1484 0.3	0.3	0.60		
57	CI Capacitar Fixed 1545	CSR 13E 156KM	M			.5		1	0.33	.33		0.65 0.65		
N	C2-7 Capacitar, Fixed, 03345	CKOBX	9			.5	Χ.	16.8	0.109		654 0.32	1.42		
	Beard, Stitchwicz		X						0.17	.17.	17 0.17 0.17	210		
	Connector	100 Pin ELCU	M						0.06	90.	0.06	0.060.06		1
NO	CONDITION 1	CONDITION 2	ZNO						SUM OF NKA	194.	SUM OF MKA	501.1		

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INHERENT RELIABILITY ANALYSIS WORKSHEET

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	CPIC 1257CS SCC		×-	~	2	2D. 2 B	Gen. & Bherer	Ĩ		FAILURE RATE IN FPM HOURS	IN FPM HO	ILS I	1	1
			È	PART	ACTUAL	STRESS	TEMP	FACTOR	COND	CONDITION 1	COND	CONDITION 2		DATA
	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	2					×	RASE A	TOTAL	ANSK	TOTAL INCX		sounce
BS	Circuit, Integrated	SN54107J	71					ю.	6.0	6.00	0.9	6.00		
	Mark Circuit, Integrated	SW54047	78					w.	6.0	48.00	9.0	48.00		-
	235 Circuit, Integrated	SN541747	04					w.	6.0	24.00 6.0	0.9	24.00		
-	DI,7 Circuit, Integrated	SN5485J	32					ŝ	6.0	12.00 6.0.		12.00		
4K	DELET Circuit Integrated SN54837 6	1 SN5483.	76					e.	6.0	36.00	6.0	36.00		•
-010	22-2 Circuit, Integrated	1 SN54157710	710				•	er.	6.0	60.00 6.0	6.0	60.00		
N	RI-24 Resistor Fixed, 620	ACR056	26			5			2420.	0742 19292 0.3	0.3	2.8		
N	R27 Resistor Fixed 1000	\mathbf{a}	N			5			ZHO	.0742 0.3	0.3	0.3		
	C1 Capacitar, Fixed, 15 MF	-CSRBE	M			5			0.33	.33	0.65	D.65		
6	C2-B Capacitar, Fixed .033, A	ACK068X	7			5			601.0	.763	0.32	2.24		
	Beind Stitchwinz		M						0.17	17.	0.17	0.17 0.17		
	Connector	100 Pin	M		•				0.06	.06	0.06	0.06		
										•				
Ē	CONDITION 1	COND	CONDITION 2						SUM OF NKA	183.	SUM OF NKA	26/		

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いたい	NOUCE INEWTIEICATION		¥_	HOLACH		Jelact/Burte	Butter			FAILURE RATE IN FPM HOURS	IN FPM HO	URS	1	1
			F	PART	ACTUAL	STRESS	TEMP	BN	COND	CONDITION 1	CONDI	CONDITION 2		DATA
	NOMENCLATURE AND CARD/CIRCUIT SYMBOL	PART NUMBER	2	RATING	STRESS	RATIO		-	RASE A	TOTAL NKA	RASE A	TOTAL	INCOM	SOURCE
		I SNEAI57J	00					3.	6.0	6.0 48.20	6.0	48.20		
	Bashe Circuit, Internated	SN5404J	00					n	6.0	48.00	6.0	49.00		
	H, 2 Resister, Fixed, 1000 D.	DIAM-01-	N			5	30		0.65	1.3	0.65	/3		
	PI-16 RESISTOR Fixed 62.02	RCR056	10			r's	R	212	21.2 0.0742 1.1872 0.3	1.1872	03	4.8		
	RIT-32 Resistor Fixed, 1900	REROSG	2			5	30	21.2	2420.0	0,0742 1.1872 0.3	0.3	4.8		
	Capacitar, Fixed, 15mF	U.	2			5	30	1	0.33	033	233 0.65	0.45		
1 4	22-5 apocitor Fixed, 0331	CLO6BY	A			5	R	16.8	0.109	0.109 0.436 0.32	0,32	1.28		
	Board, Stitchwire		7						0.17	0.17 0.17	0.17 0.17	0.17		
1 1	Connector	100 Pin ELCO	×						0.06	0.00	0.06	0.06	•	
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CONDITION 1		CONDITION 2	ION 2						SUM OF NKA	SUM OF 100.	SUM OF NKA	104.		

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	OTY PAR	T ACTUAL	STINESS	ANGL	M	CONDI	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION	E IN FPM HO	PM HOURS CONDITION 2		
NOMENCLATURE AND CARDICIRCUIT SYMBOL	N BATING	NG STRESS	RATIO	ę	K.	A SAG	TOTAL	ASE A	TOTAL	-BOB	
ircuit, Integrated DM7214D	80					6.00	6.00 48.00	6.0	48.00		
Circuit Integrated SW54045	N				3	6.00	6.00 6.0	6.0	6.00		
apocitor, Fixed ISHF CSRIZE	N		is	30	!	0.33	a marine in the second	0.45	0.65		
2-1 apocitor Fixed, 03345 CKOLBY	m		.5	30	8.%	0.109	0.327	0.377 0.32	0.96		
Board, Shitchwire	7					0.17	71.0	0.17	71.0 71.0 Tr.0	_	
POP In ELCO	N			•		0.06	0.06	0.06 0.06	0.06	-	
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CONDITION 2	2					SUM OF	54.7	Sum of	53		

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_		· DEVICE IDENTIFICATION		6	PADT		CTBECC	-	M	COND	FAILURE RATE IN FPM HOURS	E IN FPM HC	PM HOURS COMDITION 2		
	ONI	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	;z	RATING	STRESS	RATIO		FACTOR K		TOTAL	BASE	TOTAL NKA	PERCENT	SOURCE
N	13'20	DZ,EI Circuit, Integrated	SN5400J	2					З,	6.0	12.00	6.0	12.00		
34	121	Circuit, Integrated	1 SN54407	5					8	6.0	18.90	0.9	10.00		
NK	A 14	Alla Circuit, Integrated	1 SN5485J	4					3.	6.9	24.00	6.0	24,00		
- N	Z,F2	EZFZ Circuit, Integrated	5N54107J	12					e.	6.0	12.00	6.0	12.00		
10 1	1.7	Circuit, Integrated	SN5404J	14					e.	6.0	24.00	6.0	24.00		
144	ESFS	Circuit, Integrated	SN5406J	m					ю.	6.0	16.00	0.9	18.00		
NU V	E6 FL	Circuit, Integrated	SN54174J	T M					3.	6.0	18.00	6.0	18.09		
-	0	Circuit, Integrated	I SN5437J	TT					ю	6.0	6.00	6.0	6.00		
N	SiB	DI 13 Resistar, Fixed, 1000-02	D14M-01-	N	-		5.			34.0	1.30	0.65	1.30		
	H3	Reby (Read)	PRMETA	Z					286.	286 2215	1227.5	21200. 21237.	21202. 2	10	
*	22	Resistor, Fixed, 1000	ACROSS	22	<u> </u>		5		21.2	.0742	6324 0.3	0.3	6.6		
	5	Capacitar Fixed 15m	F CSRIJE	1	_		.ح			0.33	0,33	0.65	0.65		
	12-6	C2-6 Coparitar Fixed, 03345	IF CKOLBX	5			5		16.8	0.101		.5550.32	1.6		
*		Board, Stitchwire	-	M						0.17	0.17 0.17 0.17 0.17	0.17	C17		1
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$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		DEVICE IDENTIFICATION		1					BW	-	AILURE RAT	IN FPM HO	URS		
Circuit Integrated SW3107J 3 3: 6.00 (8.00 6.0 Circuit Integrated SW54007 1 3: 6.00 (8.00 6.0 Circuit Integrated SW54047 4 3: 6.00 (8.00 6.0 Circuit Integrated SW54047 4 3: 6.00 (8.00 6.0 Circuit Integrated SW541747 2 3: 6.00 (8.00 6.0 Circuit Integrated SW541747 2 3: 6.00 (8.00 6.0 Circuit Integrated SW541747 2 3: 6.00 (8.0 6.0 Circuit Integrated SW541747 2 3: 6.00 (8.0 6.0 Circuit Resistor Fixed Reson DHM-01 3: 6.00 (8.0 6.0 Resistor Fixed Reson Rescan DHM-21 5: 5: 2.042 (8.0 6.0 Resistor Fixed Reson Rescan DHM-21 5: 5: 2.042 (9.3 Resistor Fixed Reson Rescan DHM-21 5: 5: 2.0742 (9.45 0.45 Resistor Fixed Reson Rescan Res	N	NOMENCLATURE AND CARDICIRCUIT SYMDOL	PART NUMBER	5 z	BATING	STRESS	RATIO		FACTOR	BASE	TOTAL	BASE	TOTAL	PBCBI	Sounce
Circuity Integrated SW54001 2 3 6.00 6.00 6.0 Circuity Integrated SW55107 6 3 6.00 6.00 6.00 6.0 Circuity Integrated SW55107 6 3 6.00 3 6.00 6.00 6.0 Circuity Integrated SW55107 6 3 6.00 24.00 6.0 6.0 Circuity Integrated SW54047 4 3 6.00 24.00 6.0 6.0 6.0 6.0 Circuity Integrated SW54047 4 3 6.00 6.00 6.0 6.0 Circuity Integrated SW54077 4 3 6.00 6.00 6.0 Circuity Integrated SW54077 1 3 6.00 6.00 6.0 Circuity Integrated SW54077 1 3 6.00 6.00 6.0 Circuity Integrated SW54077 1 1 3 6.00 6.00 6.0 Resistor/Fixed/Bau SW64000 1 1 3 6.00 6.0 <	305	Circuit, Integrated	ELOIPSNS						m	6.00	18.00		18.00		
Circuit Integrated SV5440T I 3. 6.00 6.00 6.0 Circuit Integrated SV5510T 6 3. 6.00 8.00 6.0 6.0 Circuit Integrated SV5510T 6 3. 6.00 8.00 6.0 6.0 Circuit Integrated SV540T 3 5.00 3. 6.00 6.0 6.0 Circuit Integrated SV540T 3 5.00 3. 6.00 6.0 6.0 Circuit Integrated SV54173T 3 3. 6.00 6.0 6.0 6.0 Circuit Integrated SV54173T 3 3. 6.00 6.0 6.0 6.0 Circuit Integrated SV54174T 3 3. 6.0 3.0 6.0 6.0 Circuit Integrated SV54174T 1 5 3. 6.0 7.0 6.0 6.0 Circuit Integrated SV54174T 1 5 3. 6.0 7.0 6.0 6.0 Circuit Integrated SV54174T 1 5 3. 6.0 6.0 6.0 6.0 Resistor Fixed Ward Nabout 20404T 5	54	Circuit, Integrated	SN54007	_					3.	6.00	12.00	6.9	12.00		
	5	Cricuit, Integrated	SN540J	~					m	6.00	6.00	6.0	6.00		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	1-3	Circuit, Integrated	SN55ID7J						Б.	6.00	36.00		36.00		•
$SWS4IZ3J$ Z S δ	4-6	Circuit Integrated	SN5404J	4					3.	6.00	24.00		24.20		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	6:	Circuit, Integrated	LESIPENS						ъ.	6.00			6,00		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	50	Circuit, Integrated	CATAZ						3.	6.00	12.00		12.00		
DIAM-01-3 1.5 0.65 1.95 0.65 1.95 0.65 RCR056 7 .5 21.2 0742 .594 0.3 RCR326 2 1.5 21.2 .0742 .484 0.3 RCR326 2 1.5 21.2 .0742 .484 0.3 RCR326 2 1.5 21.2 .0742 .484 0.3 RCR056 2 1.5 21.2 .0742 .484 0.3 RCR056 5 1.5 21.2 .0742 .484 0.3 RCR056 5 1.5 21.2 .0742 .495 0.3 RCR056 5 2 21.2 .0742 .495 0.3 RCR056 5 5 21.2 .0742 .0742 0.3 RCR056 5 5 21.2 .0742 .0742 0.3 RCR056 1 5 21.2 .0742 .0742 0.3 RCR056 1 5 21.2 .0742 .0742 0.3	2	Resistar Fixed 330	DAM-01- 332J	Z			N			0.65			0.65		
RCROSS 7 .5 21.2 .0742 5194 6.3 RCR326 2 .5 .5 .0742 .1484 0.3 RCR326 2 .5 .5 .0742 .1484 0.3 RCR326 2 .5 .5 .0742 .1484 0.3 RCR056 2 .5 21.2 .0742 .1484 0.3 RCR056 2 .5 21.2 .0742 .1484 0.3 RCR056 2 .5 21.2 .0742 .03 RCR056 1 .5 21.2 .0742 0.3 RCR0565 1 .5 21.2 .0742 0.3 RCR0565 1 .5 21.2 .0742 0.3	25	Resistor, Fixed, 1000	and the second s	3			5		7	0.65					
RCR32G 2 15 21.2 0742 1484 0.3 RCR05G 2 1,5 21.2 0742 1482 0.3 RCR05G 1 5 21.2 0742 0.3	1-K	Resistor Fixed New		2			.5		212	.0742		0.3	2.1.		
RCROSG 2 1,5 21,2 0742 1454 0.3 RCROSG 2 1,5 21,2 0742 4452 0.3 RCROSG 6 .5 21,2 0742 4452 0.3 RCROSG 1 .5 21,2 0742 0.452 0.3 RCROSG 1 .5 21,2 0742 0.32 0.33 RCROSG 1 .5 21,2 0742 0.32 0.34 RCROSG 1 .5 21,2 .0742 0.33 0.33 RCROSG 1 .5 21,2 .0742 0.34 0.34 Recreation .5 21,2 .0742 0.33 0.33 0.34 Recreation .5 21,2 .0742 0.34 0.34 0.34 Recreation .5 .5 .21,2 .0742 0.34 .042 .042 .042	68	Resistor, Fixed 1502	8	2			5		21.2		.1484		6.6.		_
R. RCROSG 6 .5 21.2 0742 4452 0.3 A. RCROSG 1 .5 21.2 0742 0.3 A. RCROSG 1 .5 21.2 0742 0.3 M. Schot 21.2 0742 0.3 M. Schot 21.2 0142 0.3 M. Schot 21.2 0.34 9000	2	Resistor, Fixed 16KA	Y	2			.5		21,2	- nd/	1-841.	0.3	0.6		
M 21,2 21 5 21.2 6742 072 6.3 W 5/13 COMDITION 2 11.2 6142 0742 6.3	-212	a Resistor Fixe		9			5		212		.4452	0.3	1.6		
CONDITION 2 SUM OF NKA	18	43	RCR056	M			5		21.2	.0742	SHO.	0.3			1
	LIGNO	118	CONDITI	2 NO		0		10.00		SUM OF NKA	\backslash	SUM OF NKA	1		

* RIT, RIB not listed in Honey well Prediction

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INHERENT RELIABILITY ANALYSIS WORKSHEET

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R6FCS	SCC	Aun	A01 A10		Interne	5	ASSEMBLY		SUBASSEMBLY	EMBLY	TEHS		2
DEVICE IDENTIFICAT	VION	AT0		ACTUAL			NB	CONDI	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION	E IN FPM HO	PM HOURS CONDITION 2		-
NOMENCLATURE AND CARD/CIRCUIT SYMBOL	PART NUMBER		RATING	STRESS	RATIO		K OR	BASE	TOTAL	RASE A	TOTAL	MENER	Sounce
Fried 15	WF CSRIBE	m			5		1.	0.33	0.33 0.79	0.65	1.95		
911,12 Cooscitor, Fixed, 0334	ACKOLBY 333K	5			is		16.9	0.109	186:	.38/ 0.32	2.88		
CIS Capacitar, Fixed, 023	EZA-CKOGB	7 3			.s	~	6.8	16.8 0.109	601.	0.32	0.32		
CRIZ Diode, Zener	JANINT	2			.5		2.75 3.08	3.08	6.16	4.92	9.84		
Board, Stitchwiz	2	r						0.17	0.17 0.17 0.17	0.17	0.17		
Connector	100 Pin ELCO	7						0.06	0.06	0.06	0.06 0.06		
		-				1							
		·											
		-											
		+				1							
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	-					· ·							
	CON	CONDITION 2	1			1	T	SUM OF	126.	NIN S	137.	L	

* Not listed in DP4219

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INHERENT RELIABILITY ANALYSIS WORKSHEET

があっ	LE RUSSYSTEM SQUIPMENT		KINONS	CROUPAULA 12		WITTHS BY CURANSSEMBLY	Sunday Report	KSSEMBLY		SUBASSEMBLY	MBLY	SWEET	n Z or	1
	DEVICE IDENTIFICATION				1			1		FAILURE RATE IN FPM HOURS	IN FPM HOL	URS		
QNI			ŝ	PART	ACTUAL	STRESS	TEMP	FACTOR		CONDITION 1	CONDI	CONDITION 2		DATA
1	NOMENCLATURE AND CARD/CIRCUIT SYMBOL	PART NUMBER	2		STRESS	RATIO	þ	×	ense A	TOTAL	RASE A	TOTAL NKX		SOURCE
89 E47FI	SEATER Circuit, Integrated	SNSADAJ	- 13					м.	6.00	6.00 78.00	6.0	78.20		
1-0°	Circuit, Interroted	1 SN5485J	76					ю.	6.00	25.00 6.0		36.00		
C 2 D 7	Circuit Integrated	SN54007	マレ					З.	6.00	12.00	6.0	12.00		
G3 B	Circuit.	SN54107J	5	•				ŝ	6.00	18.00	6.0.	18.00		
07-60	Circuit Integrated	SN548.37	m					ŝ	6.00	18.00	6.0	18.00		
4-6	Circuit, Integrated	SN154197J	4					ю.	6.00	24.20 6.0	6.0	24.00		
ES		19183161	71					З.	6.00	6.00	6.0	6.20		
100	Circuit, Integrated	SW5440J	5					3	6.00	6.00 18.00	6.0	18.00		
1-5	R1-5 Resistor, Fixed, 1000 D	RCROSS	00			5	R	21.2	27-27	6.742 .57.26 0.3	0.3	2.4	•	
6,9	Resistor, Fixed, VBW	RCROSS	m			5	30	21.2	5742.	.2226 0.3	0.3	0.9		
17	cy7 Capacitar, Fixed, 1541	- CSRIZE	2			5	30	:	6.33		0.66 0.65	1.3		
C2-6	Copacitor Fixed, 033	Ú t	5			.5	R	16.8	0.109	16.8 0.109 ,545 0.32 1.6	0.32	1.6		
	Board, Stitchwinz		Z			•			0.17	6.17	6.17 0.17 0.17	0.17		
	Connector	100 Pin	M						0.06	0.06 006	21.4	0.06		
CONDITION 1	1.80	COND	CONDITION 2						SUM OF NKA	194.	SUM OF NKA	216.		

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* Not listed in OP4219

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どろっ	C REFESS CUINMENT		GROUP	414	Side and	BRITION ONDUTER	ama	ASSEMBLY ASSEMBLY		SUBASSEMBLY	ABRA	SHEET	1 0	N
	DEVICE IDENTIFICATION		2	2010		CYDECC	T	BN	UND J	FAILURE RATE IN FPM HOURS	COMUL	PM HOURS		
	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	5=	RATING	STRESS	RATIO		FACTOR	-	TOTAL	BASE	MUT	PERCERT	Sounce
TT I	Circuit, Integrated	SN5440J	m					m	6.00	6.00 18.00 6.0	6.0	18.20		
C1-4	Cricuit, Integrated	SN5483J	0					m	6.00	36.00 6.0		36.20		
A.L	45-7 Circuit, Integrated	SN541747	5					ŝ	6.00	6.00 30.00 6.0		30.00		
C6,50	Circuit Interrated	SW5495.7	m					e.	6.90	6.90 18.00	0.5	18.20		
C7,DB	Scient Integrated	SN5404J	10					3.	6.00	6.00 36.00 6.0	6.5	36,20		
	Circuit, Integrated	SN5400J	M				•	З.	6.00	6.00 6.00	6.0	6.00		
D67 E6.7	ELT Circuit, Integrated	SN54167J	4					3.	6.00	6.00 24,00 6.0	6.0	24.00		
59	Circuit, Integrated	SN54107J	M					ſċ.	6.00	6.00 6.0	6.0	6.00		
5	H. 3 Crewit Integrate 1 (251) TUS3 12 TC	THSBURK	N					1	1.84	9.68	4.84	9.46	·	
10	CR1 Diade (Zener)	JANIN 3022BS	Z					2.75	3.71	3.71 2.71 5.73	5.73	5.73		
H	RI, 16 Resister, Fixed, 1000.0	REROSS	N			5.		21.2	24-29.	E.0 1484 0.3	0.3	0.6		
NO	RZ- Resistor, Fixed, 75wn, RCR056	RCR05G	12			5		21.2	.0742	£7040.3	0.3	3.6		
2in	Resistor Fixed 1900	RCR076	N			5.		21.2	542	1484	.1484 0.3	6.6		
10	* CI,6 Capacitor, Fixed, 154F	CSR/3E IS6KM	2			6		1	0.33	0.33 6.66	0.65	1.3		1
CONDITION	104 1	CONDITION 2	ION 2						SUM OF NKA	/	SUM OF	1		

* Not listed in Honeywes! Prediction

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INHERENT RELIABILITY ANALYSIS WORKSHEET ADI 413

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8		Sounce	-			•	-		 	<u> </u>				-	<u> </u>	1
N		PERCENT														
SHEET	RS Inter 2	IOTA	160	6.17	9.06											197.
ABLY	IN FPM HOURS	BASE	0.37	21.0	0.06	:										SUM OF
SUBASSEMBLY	FAILURE RATE IN FPM HOURS	TOTAL	.545 0.32	17	8.									·		\$6. 0122
	FAILUR	EASE	6.109	0.17	0.06			•								SUM OF PD. NKA 0122
SEMBLY	M	FACTOR	16.8													
Wir 7452/1 797 ASSEMBLY	ATTAL		30													
WSZ/I	cracee	RATIO	5													1
Asir	ACTIN	STRESS														1
AIG	DADT	RATING														1
CROUP		; z .	5	N	N											2 10
		PART NUMBER	CKO6BX 333K		POPIN ELCO											CONDITION 2
C ZEFES EQUIPMENT	DEVICE IDENTIFICATION	NOMENCLATURE AND CARDICIRCUIT SYMBOL	Copocitor, Fixed, 03314 333K	Board, Stitchwire												110
い記		2	5-20													CONDITION 1

* Not listed in OP4219

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212	C REFES ENTRA		Kinn	CINION	100	& Ranse Aris 30.	(Second	A336MULT		SUBASSEMBLY		SWEET	4	1-1
	DEVICE IDENTIFIC		_	-						FAILURE RATE IN FPM HOURS	H WAL HO	URS		5
2	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	<u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u>	RATING	STRESS	RATIO		FACTOR	-	A NKA	BASE	ASE TOTAL	PERCENT	BATA
D1-3	Circuit, Integrated	4 L'ENENS	A					ŝ	6.00	6.00 24.00	6.0	24.00		
DA ES	Circuit, Integrated	SN5400J	m					3	6.00	18.20 6.0	6.0	18.00		
E1-3	ELS Circuit, Integrated	SN5416156	6					<i>w</i> .	6.00	36.00 6.0	6.0	3.00		
45	EAFTCircuit, Integrated	SN54SII2J	2					3	6.00	6.00 12.00 6.0	6.0	00.21		
6.FI	Hest Circuit, Integrated	SN5404J	1		•			<i>w</i>	6.3	6.20 42.00 6.0	6.0	42.00		
m	F3 Circuit, Integrated	SN54157J	N					3.	6.20	6.00 6.0	6.0	6.00	_	
E	FSHA Circuit, Integrated	SN54407	N			•		w.	60.7	12:00	6.0	12.00		
	Circuit Integrated	CROIPENS	X					З.	i.0.)	6.00	6.0	6.00		
1,2	070	ACR05	2			5	R	21.2	.0742	1464	0.3	0.6		
34	BA Resistor, Fixed, 62.0	RCROS	2			5	30	21.2	SMO.	.14810.3	0.3	0.6		
1	C1 Copacitor, Fixed, 15 pt	CSRIBE	Z			.5	30))))	0.33	0.33	0.65	0.65		
2-7	C2-7 Capacitar, Fixed, 433 un	CKOGBX	9		•	5	R	16.8	0.10)	.654	0.33	1.92		
	Board, Stitchwine		Z						6.0	0.17 0.17	0.17	6.17		
	Connector	100 Pin ELCO	M						0.06	0.06 9.06	0.46	0.16		
CONDITION	I NOI	CONDITION 2	Z NOIL						SUM OF NKA	157.	SUM OF	160.	1	

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INHERENT RELIABILITY ANALYSIS WORKSHEET

3 1223	PLE PCS EQU	FOULPMENT	GROUP	ROUP AIB		WIT THO 1/2 ADM DASSEMBLY	S Rong	NSSEGRBLY		SUBASSEMBLY	EMBLY	SHEET	1	¢ 2
	DEVICE IDENTIFICATION	X	AN		ACTUAL	STRESS	TEMP	BN	COND	FAILURE RATE IN FPM HOURS CONDITION 1 COMDITION	CONDI	PM HOURS COMDITION 2		ATA
	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	=	RATING	STRESS	RATIO	÷	FACTOR K	PASE A	TOTA	BASE A	TOTAL	PENCENT	Sound
2	Circuit, Integrated	EN54SII2J 1	ND					m	6.00	6.00 6.00	6.0	0019		
2	ircuit, Integrated	LOCKENS !	75					w.	6.3	6.0030.00 6.0	6.0	30.20		
	234 Circuit, Integrated	UCHASNS 1	5					З.	6.9	0.0 00.81 00.9	0.0	18.20		
	C5 Circuit, Integrated	LYOIPSNS !	11					m.	6.00	6.00 6.0	6.0	6.00		
\sim	She Circuit Integrated	SN5404J5	75					m.	6.20	6.0 30.00 6.0	6.0	30.00		
-	eins Circuit, Integrated SN5485J	1 SN5485	05					ß.	6.00	6.00 30.00 6.0	6.0	20.05		
	Circuit Integrated	1 SN54157J	11					3	6.00	6.00 6.00 6.0	6.0	6.00		
	El-3 Circuit, Integrated	1 SW54191J3	50					w.	6.00	6.00 18.00 6.0	6,0	18.00		
	HAS "Circuit, Integrated	1 SNGA1745 6	50					w.	6.00	6.00 36.00 6.0	6.0	36.00	·	
	F5-7 Circuit, Integrate.	121 SN54837	STA					З.	6.00	0.00 10.00 00.0	5.0	18.00	•	
	C1 Capacitar, Fixer, 15/1F	- CSRIJE	M			5	30		0.33	0.33 0.33 0.65	0.65	0.65		
	02-6 Oparitar, Fixed, 233 ur	JFCKOG BY	5			.5	30	16.8	101.0	0.109 0.5150.32	0.32	1.6		
	R1,2 Resistor, Fixed, 62 A		2			.5	30	21.2	.0742	21.2 .072.14846.3	6.3	46		
	R3 Resistor, Fixed 10000		N			.5	R	21.2		.0742.0742 6.3	6.3	6.3		İ
	CONDITION 1		CONDITION 2						SUM OF NKA	1	SUM OF NKA	/		

* Not listed in UP42:3 ** Not listed in Honeywell Prediction

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い話	LE PCS	EDUI PMENT	GROUP	418	28°	WITTHS 1/2/BIDDASSEMBLY	A DIAN	SSEMBLY		SUBASSEMBLY	EMBLY	SHEET	N	2
1	DEVICE IDENTIFICATION	CATION	ATP		ACTUAL	STRESS	TEMP	N	COND	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION	E IN FPM HC	PM HOURS CONDITION 2		ATA
2	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	-	RATING	STRESS	RATIO	ç	5	BASE A	TOTA	RASE A	TOTAL NKX	PBC081	SOURCE
	Baard, Stitchwire		M					•	0.17	0.17 0.17 0.17 0.17	0.17	0.17		
	Connector	100 Pin ELCO	Y						0.06	0.06 0.06 0.06	0.06	0.06		
			-											
									•					
			-											
			-											
			-											
						4								
														1
CONDITION 1	CM I	60	CONDITION 2						SUM OF	199.	SUM OF	201.	1	

* Not listed in OP4219

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INHERENT RELIABILITY ANALYSIS WORKSHEET

ATION CATO
PART NUMBER
SN5437J 3
CSR/3E 156KM 1
CKO6BX 333K
100 Pin ELCO
CONDITION 2

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* Not listed in OP4219

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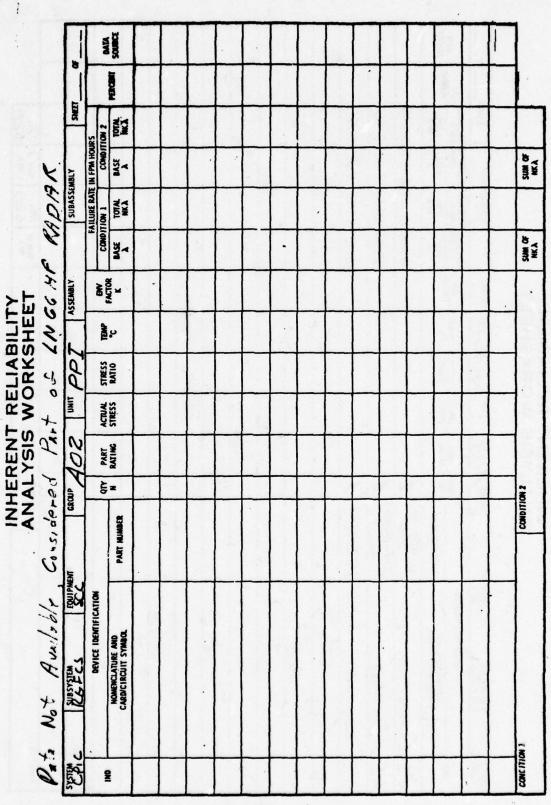
CPIC	R6F		R	ADIACO		Starage	Buffet			FAILURE RATE IN FPM HOURS	IN FPM HO			JL.
-	DEVICE IDENTIFICATION		Ł	PART	ACTUAL	STRESS	TEMP	BN	CONDI	COMPITION 1	CONDI	COMPITION 2		ATA
1	NOMENCLATURE AND CARD/CIRCUIT SYMBOL	PART NUMBER	2	RATING	STRESS	RATIO	•	-	BASE A	TOTAL	BASE A	TOTAL		SOUNCE
85	Circuit, Integrated	SN5400J	1					ы.	6.00	6.00	6.00	6.00		
151	Sul Circuit, Integrated	SN5404J	2	•				Э.	6.00	42.006.00	6.00	42.00		
24	APER HE CITCUIT Integrated SW54174J 9	1SN54174J	5					er.	6.00	29.00 6.00	6.00	54.00		
19	Circuit Inteurstad	SN5406J	2					ŝ	6.00	6.00 12.00	6.20	12.00		
3 FC	Circuit, Integrated	SN5437J 4	A					e.	6.20	24.30	6.80	6.00 24.30 6.00 24.00		
56	HERE REAV (RELY)	PRME14 0058	N					286.		.00215 02365		.0215.02%		
1-1	R1-16 Resistor, Fixed, 1/8 W	RCR 056	16			0.5	39	2:2	2474.	1. 1872	0.3	4.8		
1/212	RITHE RESISTOR, FIXEL, 1000-1	- RCROSS	2			0.5	30	2.12	.0742	1484	0.3	0.6		
5	Capaciter, Fixed, 15 ut	5	N			0.5	30	1	0.33	0.33	0.65	0.65	•	
-2.	02-6 Capacitor, Fixed, 0334	F 333K	5			0.5	R	16.6	0.109	•	545 0.32	1.6		
7	Boord, Stitchwirz		1						0.17	6.17	5.17 0.17	21.0		
	Connector	100 Pin ELCO	2						0.06	9.06	0.06	c.ce		
										•				1
CONDITION 1	1 101	CONDITION 2	N						Sum of	40.	Sum of	145.	1	

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INHERENT RELIABILITY ANALYSIS WORKSHEET

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IND REVICT IDENTIFICATION J.L. CONNECTOR NUMBER AND J.L. CONNECTOR NO. 521-800-L M.L. MJ. MJ. School 10-521-800-L T.L. Torgship 314-196888 T.L. Torgshn VTSN23 1 T.L. Torgshn VTSN23 1				in manya	f	1	-				
Noncolocial and marked and carboclicult symbol 277 Connector 314-19388 Magship -001 Torgsyn VTSN23	_	ACTUAL	STRESS		N	CONDITION 1	TION 1	FAILURE RATE IN FPM HOURS	PM HOURS CONDITION 2		VIN
Connector 10-521-810- 27P Magship 314-19688 Torgsyn VTSN23	RATING	STRESS			N N	BASE	TOTAL	ASE A	TOTAL	HEDILL	Sound
Magship Joo- Torgsyn VTSN23 VTSN23						900.0	0.008	800.0	0.008 0.008 0.008 0.008		
Torgsyn VTSN23						2.40	2.40	2.40 2.40 2.40 2.40	2.40		
						11.12	11.12	11.12 11.12 11.12 11.12	11.12		
				-				•			
				-							
							•				
CONDITION 1 CONDITION 2						SUM OF	J3. 528	SUM OF NKA	13.	1	

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IPMENT C	Croth	404	記事	Startus Chant Drawer	AND CO H		SUBASSEMBLY	MBLY	SHEET	7.07
0	2	PART				COND	TION 1	FAILURE RATE IN FPM HOURS	~	
PART NUMBER		RATING	STRESS	RATIO °C	K K	-	TOTAL	ASK.		PENCENT SOUNCE
							15.		17.	-
EVS 15.11	1					4.20	4.20 4.20 4.20		4.20	
EVSIS.II	1					4.20	4.20	4.20	4.20	
EVS 15.11	1					4.20	4.20 4.20	4.20	4.20	
EV5/5.11	Z					420	4.20	4.20	4.20	
							129.		756	
							6.72		9.3%	
							45.		6!. 44	
										•
								:		
										1
CONDITION 2						CIM OF	245	SUM OF	279	

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INHERENT RELIABILITY ANALYSIS WORKSHEET

UNI							TEMP		Cinet L	CONTINUE I	Crew	COMPITION 9		-
1	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	;=	RATING	STRESS	RATIO		FACTOR	BASE	TOTAL	anse A	TOTA	MENCEN	Sounce
S1	Switch (Med.) (Retury)	JV9032	1					%	0.216	0.216	0.216	0.216 D.216 0.216 0.216		
71	T1 Transformer	P18-617	1					- 47		0.194	P.194 0.194 0.194 0.194	0.194		
782	* TBZ Board, Terminn		1						0.17	0.17	0.17 0.17 0.17 0.17	0.17		
2-1	1-7 Indicator	800-5- 12-12-12-	2						1.631	11.	11.631	111.17		-
K1		M5757/23-	Z					286	0.572	0.572	0.57	0.572 0.572 0.5720.572		
CKI	CKI Disk	11645	1				4	4.33	3.16	3.16	4.33	3.16 3.16 4.33 4.33		
74	Convestor	2-857952	7			•			6.014	0.014	0.014	0.014 0.014 0.014		
35,	JE, Connector	00-7008- 41-156-203	2						0.06	0.12	0.06	0.12		
					•									-
													•	
			-											ľ
CONDITION 1		CONDITION 2	2 NOI						SUM OF NKA	15.	SUM OF NKA	17.		

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* Not listed in Honey well Frederician ** Not listed in OP 4219

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INHERENT RELIABILITY ANALYSIS WORKSHEET

8		SOURCE						_				1		
		PERCENT									·			
SHEET	-	I dia	4.20											120
MBLY	FAILURE RATE IN FPM HOURS	EASE A	4.20 4.20	•					1					SUM OF
SUBASSEMBLY	ILURE RATE	TOTAL	4.20											CAC D JANS
	FAILURE CONDITION 1	BASE	4.20 4.20											Sun of
ASSEMBLY	N	K			•									
1		°.												
GROUPADA WINCOUNTER	STRESS	RATIO										•		18.12
/ WIK	ACTUAL	STRESS.												
440	PART	RATING												10
A	Ł	2	Z											-
		PART NUMBER	EVS 15.11											CONDITION 2
SC C	FICATION		2											
Le FCS	DEVICE IDENTIFICA	NOMENCLATURE AND CARD/CIRCUIT SYMBOL	Counter Rounds				•			•				1
とろう	1	2	1											CONDITION 1

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INHERENT RELIABILITY ANALYSIS WORKSHEET

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\$ A		Sounce	-			·									-	-	
1		PBCBI															
SHEET	SS SN	TOTAL		11.05		6.4	0039	0.64	0.037	0.078	4.20	3.45	4.92	5.73	8.85	6/1/	
(BLY	N FPM HOURS	BASE		0.65			0.039	0.32	0.039	0.039	0.70	3.15 9.45	4.42	5.73 5.73	2.45 8.85	5.73/7/9	2 110
SUBASSEMBLY	FAILURE RATE IN FPM HOURS	TOTAL		5.61 0.65		2.18 0.32	0.0240.039 0.039	J.218 D.32	1.024	0.040	2.70		3.06		5.58		
	FAILURE	BASE		0.33		0.109	0.024	101.0	0.224 0.024 0.039 0.033	0.024 0.040.039 0.078	0:15 2.70 0.70 4.20	1.38 4.14	5.05 3.06 4.42 4.92	5.71 3.71	1.86	3.71 11.13	
ASSEMBLY	ß	FACTOR K	•	1		16.8	11.5	16.8	11.5 6	11.5 4	1.03	1.03	2.75	:75	-1.33	2.75	T
•	ant	. .															
10-1405 miles	CTBFCC	RATIO		5		10	5	10	5	5.	5	10	5	.5.	5	w	
らどう	ACTIN	STRESS															
0-1 AC.	PART	RATING															
AC		2		17		R	Z	2	Z	3	9	3	Z	1	3	3	2 10
		PART NUMBER		156 L.1'		CXCLBX 333K	CMCSCD	CKO6BX 104K	CN105CD 100 DP3	27005FD	JAN2N 2222.4	TANZN 296.7A	753.4 753.4	24N1N 3022A	74N4N 9/4	JAN 1N 3826	CONDITION 2
J	IFICATION		2	17	20,23,	24	U U	0	-	pHa		<u> </u>	5	5.0	1		
ZG PCS	DEVICE IDENTIFICATION	NOMENCLATURE AND CARD/CIRCUIT SYMBOL	C1, 3, 5, 8, 9, 12, 14, 17, 19, 25- 35, 87, 39, 42, 42	Hartine	16, R	OCTUTER Fixed . 03	Capacitor, Fixel, 5p!	221 Copacitur Fixed, - Int	Copacitar Fixed, 100.5	Capacitor Fixed 47p	3 Transister, NPN	92,6 Transistor, P.N.P.	CR1 Diode, Zener	CR2 Diode, Zener	56' Diade, Switching	28% Diode, Zener	
		CAR	5, 8, 9, 1	Copoci	25, 29, 30, 33, 34.	ac set	apacit	apuci	pocit	apacit	Trans	Transi	Diode,	Dioce	Dieck,	Diode	1
2193	•	2	35,8		25,4	2	C/I	122/		32/ C	79-62	12,6	R14	SR2 .	563	18	CONDITION 1

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INHERENT RELIABILITY ANALYSIS WORKSHEET

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SUN C	C REFER		Ř	GROUPO4A05	10 million (1997)	There's	2	ASSEMBLY		SUBASSEMBLY	EMBLY	SMEET	N	4
	DEVICE IDENTIFICATION		2	DADT		CTBECC	-	M	- UNUC	FAILURE RATE IN FPM HOURS	E IN FPM HO	PM HOURS		
2	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	=	RATING	STRESS	RATIO	! .	FACTOR	BASE	TOTAL	BASE A	NICIA	PERCENT	SOURCE
00	Real Resistor Fixed 2.7.0	RCR076 ZR7J	4	STU.		5		212	20742	3962.	0.3	1.2		
m	R3 Resistor, Fixed, 5000	RCR059	M			5		31.2	242.	2470.	0,3	0.3		
R3, 12,13	12/13 Resistor Fixed 4700.0	RCR056	3			5		21.2	242	.2226	0.3	6.0	•	
10	RS RESISTOR Fixed, 10000	RCR056	7			5		212	2420.	.0742	0,3	0.3		
P6, 1	Resistor, Fixed 47.02	RCR075	2			5		212	542	1484	0.3	0.6		
22	Resistor, Fixed, 2000	RCR059	2			5		21.2	2420'	1484	0.3	0.6		
F 8	Resister, Variable, 2Km	KATRIZUPEZK	Y			10		0.02	924	,924	1.18	1.18		
8`m	Resistor Fixed, 220-12	RCR076 221J	2			p.		21.2	542	1954	0.3	9.0		
2	Proph Resistor Fixed 33000	PCR059 332J	m			5		212	2420	,2226	0.3	6.0	·	
12H	Resistor, Fixed, 39.0	RCR05G	2			6		212	0:12	1434	0.3	0.6		
2.2	5	RCR055	7			5		21.2	5420	514	0.3	2.1		
22	Rink Resister, Fixed 2KD	RCR055	5			5		21.2	2HC?	.371	0.3	1.5		
2	RZI Resistor, Fixed, 120.0	RCR079	M			.5		212	542	.0742	0.3	0.3		
A-B	232 Resistor, Fixed /20-02	PLOADA	3			5		212	242	7222.	0.3	6.0		
E	collartion 1	CONDITION 2	Z NOI						SUM OF	\backslash	SUM OF	\backslash		

* Not listed in Honeywell Rediction.

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IN CONTREMON NO NORMELAND ANT NUMBER NO CONTREMON NO NUMBER PER SENSTED FIXED	ŝ	STSTEM C SUBSYSTEM SQUIPMENT		7Kino	GROUP 10-1405		WIT PERCENT		ASSEMBLY		SUBASSEMBLY	ABUY	SMEET	m	4
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	_	DEVICE IDENTIFIC		20	DADT		CTDECC	TWO	BW	CONDI	AILURE RAT	COMD1	URS TION 7		-
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	;=	RATING	STRESS	RATIO	ې ۱	FACTOR	BASE	TOTAL	A Ska	TOTAL	PERCENT	Sounce
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	*	9	RCR056 1525	N			1.2.		21.2	0742		0	0.3		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	43	Resistar, Fixed, 2.240	RCK 056	5			5		21.2	2120	•	0.3	1.5		
$ \begin{array}{c c} \hline \mathbb{C}^{3} :: Struct Fixed / Bark a \ \ \ \ \ \ \ \ \ \ \ \ \$	R	29 Resister, Fixed, 470-12	RCF056	Z			\vec{r}		21.2	5,270.	.0742	0.3	9.3		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	R	34 Revistor Fixed 150K.0	RCR059	N			5		2.2	5H2	.0742		0.3		
$ \frac{Resisting Fixed (3002 KCS 074 L)}{(302 KCS 074 L)} \frac{1.5}{(502 S12 K12 0.42 0.3)} \frac{1.5}{(502 S12 S12 S12 S12 S12 S142 0.42 0.3)} \frac{1.5}{(502 S12 S12 S142 S142 S142 S12 S142 S142 S$	R	35 Resistor Variaties Seal	TEPRSOO-URTED	1			5		0.02	426.	.924	1.18			
Resister Fixed Zoud Reross 10 15 21.2 2742 742 0.3 Resister Fixed Start Soud Exits 20.1 50.2 16 0.3 16 0.3 Resister Fixed Start Struct Scort Scort 50.2 2 2 21.2 042 14 Resister Fixed Start Scort Scort 50.2 2 2 21.2 042 0.3 Resister Fixed IDK11 RCR055 1 .5 21.2 042 0.3 Resister Fixed IDK12 RCR055 1 .5 21.2 042 0.3 Resister Fixed IDK12 RCR055 1 .5 21.2 042 0.3 Resister Fixed IDK12 RCR055 1 .5 21.2 042 0.3 Resister Fixed JOBL2 RCR055 1 .5 21.2 042 0.3 Resister Fixed JOBL2 RCR055 1 .5 21.2 042 0.3 Resister Fixed JOBL2 RCR055 1 .5 21.2 042 0.3	1¢	36 Resistor Fixed 1300	KERD7G	M			5		21.2	1742	242	0.3			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	24	5-4 Resistor, Fixed, 2200	RCR056	8			5		21.2	5742	742	0.3	3.0		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	64		RCA-50	N			.5		21.2	OH2.	1484	d	0.6		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	250	Revistor, Fixed, 5K	RUP050 502J	2			12		21.2	1742	1494	0.3	0.6		
ARCR055 1 .5 21,2.0742.0742 0.3 5627 1 .5 21,2.0742.0142 0.3 12R2555 1 .5 21,2.0742.0142 0.3 RCR07G 2 .5 71,2.0142.1404 0.3 RCR07G 2 .5 71,2.0142.1404 0.3	R	Resistor, Fixed, 10.	RCR055	M			5		21.2	2420	.0742		0.3		
21,2.0742.0742 0.3 4725 1 .5 21,2.0742.0742 0.3 RG807G 2 .5 71,2.0742,1404 0.3 CONDITION 2 .5 71,2.0742,1404 0.3	R	57 Resistor Fixed Scoul	RCRUSG	N			5		21.2	242	.0742	0.3	0.3		
RCR07G 2 .5 71.2.5742.1484 0.3	LE.	273	RUR C54	N			10		21.2	.0742	0/42	0	0.3		
CONDITION 2 SUM OF NKA	2-0	65 Resistor Fixed 68,2	RCROTG				5		21.2	242	.1484	5	0.6		
CONDITION 2 SUM OF NKA	_														İ
	8	NDITION I	CONDIT	CN S						SUM OF NKA	\backslash	SUM OF NKA	\backslash		

* Not listed in Honeywell Placiation

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INHERENT RELIABILITY ANALYSIS WORKSHEET

5	CPIC REFES ISC		×	RU4HU5	5	Interfoce	8			FAILURE RATE IN FPM HOURS	IN FPM HO	URS	Н	
5	DEVICE IDENTIFICATION		UTY	PART	ACTUAL	STRESS	TEMP	BN	COND	CONDITION 1	CONDI	CONDITION 2		DATA
	NOMENCLATURE AND CARD/CIRCUIT SYMBOL	PART NUMBER	z	RATING	STRESS	RATIO	ç	×	BASE	IOTAL	BASE	TOTAL NKX	INCOM	SOURCE
II	Amplifier Differential	HA-Z-2520 1	Z					Э.	6.20	6.20 6.20	6.0	6.00		
14	Ut Circuit, Integrated	SN 52510	1					e,	6.00	6.00	0.9	6.00		
112	UL Circuit, Integrated	CHORDAN	2					m.	6.00	12.00	6.0	12.00		
(13	13 Circuit, Integrated	SN5400J	1			-		er,	6.00	6.00	6.0	6.00		
14	44 Cricuit, Integrated SN54105	SN54107	M					m	6.00	6.00	6.0	6.00		•
ne	US6 Circuit, Integrated	SN54123J	N				•	m	6.00	6.00 12.00	6.0	12.00		
17-5	17-9 Circuit, Integrated	SNSSIIDJ	3					e.	6.00	6.00 18.00 6.0	6.0	18.00		
-011	1/2 Circuit, Integrated SN551071	INUSSION	m					m	0.3	6.0 18.00 6.0	6.0	18.00		
	PW Bound		2						0.17	0.17 0.34	0.17	0.17 0.34	·	
	Connector		2						0.06	6.12	0.06	0.06 6.12 0.16 0.12		
12	U2 Delay Circuit	2119	Y		•				0.15	2.15	0.15	0.15		
í.														
	-													
CONDITION 1	101	CONDITION 2	2 NO	N.S.Y.					SUM OF NKA	129.	SUM OF NKA	174.		

* Not listed in 0P4219

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78. 0.52	-	DATIO -	DATIME CTOCCE DATIO	CTOCCC DATIO
28. 0.8		KATIO	RATING STRESS RATIO	RATING STRESS RATIO
		<i>i</i> v	رمر	1 5
28. 0.5		5		
ZB. 0.S	10	5		
28. 0.5	3	5		
B. D.S.	N	5	.5	
28. 0.5	N]	.5		
ZE, 0.56	2	.5 2		
8.0.8	28.	.5 2		
S. 0.56	<i>2</i> 8,	5 2	.5	
-				
	-			
SUM OF NKA		-		

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INHERENT RELIABILITY ANALYSIS WORKSHEET

	25/1 25/201 3	SCC.		044	un A04406 un Fest Brel	test l	Jane	ASSEMBLY		SUBASSEMBLY	CMBLY	EBR	1	3
	DEVICE IDENTIFICATH	IOI	F	PANT	ACTUAL	STRESS	TEMP	NB	CONDI	CONDITION 1	FAILURE RATE IN FPM HOURS	URS ITION 2		DATA
	NOMENCLATURE AND CARD/CLACUIT SYMBOL	PART NUMBER	-			RATIO	ۍ ۲	-	BASE A	IOTAL NKA	ANN ANN ANN ANN ANN ANN ANN ANN ANN ANN	TOTAL NKCA	PERCENT	SOURCE
	Connector	204738-2	12					•	0.014	0.014	0.04	+12.2 HO.0 \$10.0 \$10.0		
-150	Diode, Light Emitting	PA LFLS/15	16	1		5			1.0	16.00	1.0	1.0 16.00 1.0 16.00		
123 1515	•)		5					0.36	0.144	0.72	0.144	0.72 0.144 0.72		
S	szsswitch	357	2	0				0.%	0.144	0.205	0.144	9.2000.144 0.200		
m	S23 Switch (Push Button) MS25089-	on) M525085	H H					0.76	0.192	0.192	0.192	2.192 0.192 0.192 0.192		
-45	Switch (Toggle)	MSZ7718-16	-11					0.76	0.144	2304	0.14	0.144 2.304 0.144 2.304		
1														
1			-											
1														
			-											
1		-	-											
1		-	-											
E	CONDITION 1	CONFC	CONDITION 2						Sum of		Sum of	Ν		

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	UPIC ILUBECS XC	and the second sec	1	OF TOT		Pulse Forming		TOWNER		Townervane		SHEET	V	n a
-	DEVICE IDENTIFICATION		ATY	PART	ACTUAL	STRESS	TEMP	BN	CONDI	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITIO	IN FPM HOC	PM HOURS CONDITION 2		NTA
	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	2	RATING	STRESS	RATIO	•	K	RASE A	TOTAL	BASE A	TOTAL	Mana	Sounce
C1-	Capacitar, Fixed, 15 µF	CSR13E 156 1.41	m			5	30	1 1	D.33	0.99	0.65	1.95		
S.S.	apacitor, Fixed, OluF	CKROGCIN	2			5	30	16.8	0.109	0.218	Q. 32	0.64		
5,781	Diode	JAN1N 4454	4			5	30	4.33	1.86	7.44	2.77	11.08		
	Dioue	JY1V1V 4245	2			.5	30	3.26	3.26	6.52	6.43	12.86		
93, 5	Transistar (NPN)	J.4N.2N 22224	N			.5	30	1.03	0.45	0.9	5.7	1.4		
12.	Transis for (APAC)	JAV2N 3501	N			5.	30	1.03	0.45	6.0	0.66	1.32		
IN	Reloy	1/5757/9	N					286.	0.572	1.144	0.57	1,144		
K3,	K3, Relay	M5757719	N					ZEK.		0.572 1.144 0.572	0.572	1.144		
R127	PIST Resistor Fixer / 190-2.	RUR079	9			5	R	21.2	.0742	.4452	6.3	1.8	·	
53	** P3 Resistor Fixed, 2.7.1	PCR20S	Z			.5	30	21.2	.0742	542	0.3	0.3		
F4	Resistor Fixed, 15410	RCROX5	2			.5	3	21.2	.0742	.1484	0.3	0.6		
R6, 1	Resistor Finer, 150.0	RCR075	50			.5	30	21.2	5742	.1484	0.3	8.6		
P.S.	RS, RESistor Fixed, 10-2	AUROJ4	()			5	30	212	.0742	1484	0.3	0.6		
P101	Plo Resistor Final, 1024	RCROTJ	7			.5	30	21.2	2420.	2420	0.3	0.3		
CONDITION	1	CONDITION 2	2 NOI						SUM OF NKA	/	SUM OF NKA	/		

* Not listed in Honeywell Presiden, (MDiodes lumped or 8, 44545) ** In Honeywell Prediction, all R's lumped us 15, RUROTC's.

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INHERENT RELIABILITY ANALYSIS WORKSHEET

EQ.	C NEFESS BUIL	FOULPMENT GI	Hano	2A6	R Par	and 2406 Purst Forming		ASSEMBLY		SUBASSEMBLY	EMBLY	SHEET	m	3
	DEVICE IDENTIFICATION		~	PART	ACTUAL	STRESS		DW	CONDI	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION	COMD	PM HOURS COMDITION 2		VIN
	NOMENCLATURE AND CARD/CIRCUIT SYMBOL	PART NUMBER	2	RATING	STRESS	RATIO	۶,	-	A A	TOTA	BASE A	TORM.	FEICEN	Sound
21	Circuit, Integrated	SW541237	M					3	6.00	6.00 6.00	6.0	6.0		
	PC Board		N						0.17	71.0 71.0 71.0 71.0	5.17	0.17		
1	Connector	41 Pin Type	M						0.014	0.014	9.014	0.014 0.014 9.014 0.014		
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2	CONDITION 1	CONDITION 2	ION 2						SUM OF	\$5. 89.09	SUM OF	61.		

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* Not listed in OP4219

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1	DEVICE IDENTIFICATION		Lo	PART	ACTUAL	STRESS	awat	NO	COND	FAILURE RAT CONDITION 1	FAILURE RATE IN FPM HOURS	PM HOURS CONDITION 2		PATA
	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	2	RATING	STRESS	RATIO	÷	K	BASE	IOTAL	BASE	TOTAL NKX	FBCBI	SOURCE
36	BCD Shaft Encoder	SNR11- 13 P20	2					•	3.0	6.0	3.0	6.0		
1-3	\$1-34-7 Switch (Pash)	800-5-	20					0.76		1.92	261.0 26.1 261.0	1.92		
31,2	* SY, 2 Switch, Thumbuked	7-H-21923 2	2						3.0	6.0	3.0	6.0		
18/2	TB12 Terminal Board	377.816	2						0.17	0.34	0.17	0.34 0.17 0.34		•
259×	Indicator	800-5-33-133	m						1.631	4.893	1.631	1.631 4.893 1.631 4.893	Na	
	Counter	6268-14	N						0.254	0.254	0.259	0.254 0.254 0.259 0.257		
	Counter, Dayrez	34- 3992	Z						0.259	0.254	10.29	0.2540.2540.254254		
	Range Jeur Trin	401	Y						6.0	6.0	0.9	6.9		
	Bearing due Train	8601	7		•				0.4	0.9	0.9	0.7		
	Wind Data Input Madule		N						3.0	3.0	3.0	3.0		
	Indicator		2						1,63,	35. 882	1.631	35.		
1														
	-													
CONDITION 1	041	CONDITION 2	2 10						SUM OF	60.	SUM OF	60.		

* Not listed in Honoywell Prediction

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INHERENT RELIABILITY ANALYSIS WORKSHEET

STEM STEPA STEPA STEPA	EQUIPMENT CROUP		406	E C	The Action	1	ASSEMBLY		SUBASSEMBLY	AIRW	SHEET	4	4 0
E IDENT						1	BIN		FAILURE RATE IN FPM HOURS	IN FPM HO	Sal		
NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	<u></u>	RATING	STRESS	RATIO	2.5	FACTOR	BASE TOT	TOTAL	BASE A	ASE TOTAL	PERCENT	SOURCE
Analos (Card A1)		1						1	% . \$725		135.		
Looic (Card A2)									80. 724		B . 764		
									56.		114		
Diffacintial Ame.							•		14. 798		57.		•
tar									21,24		26.		•
1.0									21, 24		26.		
									81. 0702		121		
		-							64. 692		106.		
References Quadrant Switching (and A3)		-							57. 9577		71. 038	·	
RE Amplifice									33.	•	56.		
									4. 2725	:	135.		
Same as AO2									80. 764		86.4		
418 Sone JS A03.		-			•				56.		102.		
D/A Converter									42. 2586		46.		
	CONDITION 2	2						SUM OF	\backslash	SUM OF			

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J lands	SUBSYSTEM EQUIPMENT		CROUP	100	LING	Toop In	12	ASSEMBLY		SUBASSEMBLY	EMBLY	SHEET	2	1 10
-	DEVICE IDENTISIC		L					1		FAILURE RATE IN FPM HOURS	E IN FPM HO	URS		
ONI			F	PART	ACTUAL	STRESS	TEMP	EACTOR		CONDITION 1	CONDI	CONDITION 2		DATA
	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	z	RATING	STRESS	RATIO	•	*	BASE A	TOTAL	BASE	TOTAL		Sound
423	Sank in A21									42.		46.2		
I TY	Polm 10.			1.						12.11		16.		
1	1 DIT 1 1 1 1 1 1 1		T							F.R.		32.		
6	424 16 DII 4 tol Multiplex									9894	•	399		
5	425 Sume un 424									38.4		32.		
1	Same All									18		20		
0	ALLE JUNE US AIL									0102	1	127		
7	427 Same 35 A12						•			64.		8.00		
Q	129 Some 15 113									57.7		71.		
1										33		56.		
0	430 Jame as A 15									8906		078		
1	431 Sank as Aol									8725		135.		
To	And when and and									18.		6 6'		
Tr	133 Sum as 103									56.		103		
TU	Della Prata									35		- Mil		
2										8.3		88.		
01	H36 LOVIC \ -010 130									56.		102.		1
5	ASTIBILITY (UN AS)							_		280		114		
CONDITION 1		CONDITION 2	Z NOI						SUM OF	1	SUM OF	1		

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	E IDENTIFIC		ě			CTBECC	-	M	100	FAILURE RATE IN FPM HOURS	IN FPM HO	PM HOURS		
	NOMENCLATURE AND CARDICIRCUTT SYMBOL	PART NUMBER	*	RATING	STRESS	RATIO		FACTOR R	3	N NO	ASE A	TOTA	PECBIT	Sounce
438	Same as A23		•.							12.		16. 894		
2	39 Sank as A24									30.		32.		
440	Same as A24									N. N.		32.		
441	Some as All									81. 0702		87.		
42	42 Song 05 A12									64.		106.		
13.	H3 Sume as A13								-	57. 9577		71. 038		
35.	445 Sand as A15									33		54.		
10	the Some as Aol									8.5		135.		
17.	447 Same 35 402									80. 764		86. 764		
\$	448 Same as AO3									56.		102.		
18	456 Same as A35									250		131.		
5	ASI Same as A36									BC.1		86. 764		
N	152 Same as A37.	•								56.		114		
10	AG 18 BIT INVERTER		-							19.		23.		
CONDITION 1	1	CONDITION 2	2 14						SUM OF		SUM OF			

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INHERENT RELIABILITY ANALYSIS WORKSHEET

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							-		0		+	-	-			96
	URS	CONDITION 2	TOTAL	23.	23.	124	106.	71.	56.	0.96						3656.
NRLY .	IN FPM HO	COND	BASE A				*									SUM OF
SUBASSEMBLY	FAILURE RATE IN FPM HOURS	I NOI	TOTAL	A. 6224	A. 4	81. 0702	269	57. 9577	33. 8406	0.96					·	2732.
	FA	CONDITION 1	NA A								1					Sum of
ASSEMBLY		NIG	-													
		TEMP	ç													
Litit and		STRESS	RATIO													-
39		ACTUAL	STRESS													1
406		PART	RATING													-
T		NO	2													CONDITION 2
			PART NUMBER													CONDI
NUL NIL	TIELCATION			2	B		0							•		
LE FCS	NOVICE INENTIFICATIO		NOMENCLATURE AND CARD/CIRCUIT SYMBOL	Sund 35 453	455, Same 35 A53	456 Suns 25 All	457 Same Jo Ald			Thussis .						
いたい	+	-	1	454 5	53.	52	157	123	1605	-	+		-			CONDITION 1

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INHERENT RELIABILITY ANALYSIS WORKSHEET

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NJA	
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Analog Card Al	
101 (A16, 31, 46) An	
31,4	
(AK	
V	
A06,	
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N	ATTA	SOURCE															
1 1 00		PBCBIT															
SHEET	PM HOURS COMDITION 2	TOTAL NKX	3.25	1.60	2.64	6.00	12.90	24.00	00.21	41.30	7.50	0.75	0.368	18.30	6.30	0.70	/
WBLY	IN FPM HOL	BASE	0.65	.545 0.32	218 2.32	6.00 6.00	6.00	24.00 6.00	6.00		0.3	.50250.15	388 6.194	8.28 3.15	3.15	0.70	SUM OF NKA
NBADSCHOLT	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION	IOTAL XXM	1.65	and the	.218	6.00	6.0 12.00 6.00		6.0 12.00 6.00	1.86 2.04 2.75	,0742 1.855 0.3	.5025	•	8.28	1.38 2.76	0.45 0.45	\backslash
	CONC		0.33	60.09	0.109	6.0	6.0	6.0	6.0	the second second second second second second second second second second second second second second second s	.0742	500/.	,194	1.38			SUM OF NKA
Converter 261 400Hz	BN	FACTOR K	1.	16.8	16.8	E)	3	3	ñ	4.33	21.2	0.67		1.03	1.03	1.03	
- 261	TEMP	•						•									
werter	STRESS	RATIO	5	.5	5												
0	ACTUA	STRESS											•				
~	PART	RATING															
	Ğ	*	5	5	3	N	2	4	2	14	3	5	2	9	2	M	CONDITION 2
		PART NUMBER	CS/3B	CKER	CKOS	ITT 946 SD	U649936 592F	SN72741L	SN 7230/AL	VINEL SIA	R	RNGS		JAN ZN 4007	74NZN 2907	JAN2N 2222	CONDI
5 16 FCS SCC	DEVICE IDENTIFIC	NOMENCLATURE AND CARDICIRCUIT SYMBOL	apacitor, Fixed,	Capacitor, Fixed,		Circuit Integrated	Circuit, Integrated	Amplitizer Op.	Amplitier, Op.	Diades	Resistor, Fixed	/	Transformer	Transistor (AVP)	Transister		
いない		R.													1		

* * Components not itemized in OP4219.

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ij . N RAILURE ANE AN PAR HOURS CONDITION 1 AND HOURS ANG TONY AND THE 0.014 0.014 0.014 0.014 217 0.17 0.17 0.17 1 W. 8725 W. 512 . . A THIRDS STATION Anglog (Cird AI)* NUM Y INHERENT RELIABILITY ANALYSIS WORKSHEET 4 STRESS RATIO ACTUAL 406401(416,31,46) PART 5= M N CONDITION 2 PART MUMBER AI Pin DEVICE IDENTIFICATION NOMENCLATURE AND CARD/CIRCUIT SYMBOL Presenter S PW Bound Connector CONDITION 1 SUN.C 1

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* Components not itemized in OP4219.

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INHERENT RELIABILITY ANALYSIS WORKSHEET

"Ente	LE FCS	SULPMENT GROUP CHOUP ASSEMBLY SUBASS	ROUP	•	ANN		5	ASSEMBLY		SUBASSEMBLY	EMBLY	IBMS	1	1 3
	DEVICE IDENTIFICATION		6	PADT	ACTIN	CTBCCC	-	M	- UNO	FAILURE RAT	FAILURE RATE IN FPM HOURS	PM HOURS		
2	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	:=	RATING	STRESS	RATIO		FACTOR	3	TOTAL	ASE A	TOTAL	PERCENT	Sounce
	Capacitar, Fixed	CSIEB	2			5.			0.33	0.66	0.65	1.30		
	Capacitar, Fixed	CK06	A			.5		16.0	601.0	0.436	0.32	1.28		
	Circuit, Integrated	SN7406J	3					w.	6.00	18.00	6.00	18.20		
	Circuit, Integrated	SNHOAT	1					e.	6.00	6.00	6.00	600		
	Circuit, Integrated	SN7416J	M					ŝ	6.00	.00.2	6.00	6.00		•
	Circuit, Integrated	CE6127NS	3					w.	6.8	18.00	6.20	18.00		
	Circuit, Integrated	SW7410J	M			•		m.	6.00	6.20	6.00	6.00		
	Circuit, Integrated	ITT 946SD	N					m.	6.00	12.00	12.00 6.00	12.00		
	Circuit, Integrated	~	N					m	6.00	6.00 2.00	6.00	12.00		
	Resistor Fixed NW	, R	00			Ņ		21.2		.0742 .5936 0.3	0.3	2.4		
	Resistor, Fixed, ISW	, R	12			.5		21.2	.0742	.0742.89040.3	0.3	3.60		
	PW Board		M						0.17	0.17	210	0.17		
	Connector	41 Pin	M						0.014	0.014	0.014 0.014 0.014	0,014		
														i
CONDITION 1	1001	CONDITION 2	LION 2						SUM OF	66.	SUM OF	86,		

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* Components not itenized in OP4219.

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	1		Sounce			
	SHEET / OF /		Parcent sound			
	SHEET	RS ION 2	TOTAL NKX	2.60	9.96	
	MBLY	FAILURE RATE IN FPM HOURS	BASE	0.65	0.32	
	SUBASSEMBLY	FAILURE RATE	TOTAL	1.32	0.327	
*		CONDI	BASE	0.33 1.32 0.65 2.60	16.8 0.109 0.327 0.32 5.46	
2nd/A	ASSEMBLY	BN	K	. 1 1	16.8	
25		TEMP	•			
Bris	P		RATIO	5	5	-
52).	UNIT	ACTUAL	STRESS			
37,46			RATING			
33,0	GROUP	20	2	4	3	
406 A03 (A18,33,37,48,52) Bring (Cond A3)*	ENT		PART NUMBER	CS13B	CKOS	
406Ac	FOUL PINENT	DEVICE IDENTIFICATION	ge ge	1	· ra	
,	LE RESYSTEMS	DEVICE II	NOMENCLATURE AND CARDICIRCUIT SYMBOL	Copusition	Capacitor, Fixed	
	'share	1	2			

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$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	UNI			F	PART	ACTUAL	STRESS	TEMP	ENTINE	CONDITION 1	TION 1	CONDI	CONDITION 2		MIN	
doustrikestCS13B4.5doustrikestCK053.5doustroc FixestCK062.5doustroc FixestCK062.5doustroc FixestCK062.5doustroc FixestRN65.2.5doustroc FixestRN65.5.5doustroc FixestRN65.5.5doustroc FixestRN65.5.5doustroc FixestRN655.5.5doustroc24N.5.5doustroc2902716.5DM Bount11.5Dinkertor74, Pin1.5Dinkertor74, Pin.5.5Dinkertor74, Pin <th></th> <th>NOMENCLATURE AND CARD/CIRCUIT SYMBOL</th> <th>PART NUMBER</th> <th>z</th> <th>RATING</th> <th>STRESS</th> <th>RATIO</th> <th>y</th> <th>*</th> <th>BASE</th> <th>TOTAL</th> <th>BASE À</th> <th>TOTAL</th> <th>PERCENT</th> <th>SOUNCE</th> <th>*</th>		NOMENCLATURE AND CARD/CIRCUIT SYMBOL	PART NUMBER	z	RATING	STRESS	RATIO	y	*	BASE	TOTAL	BASE À	TOTAL	PERCENT	SOUNCE	*
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		Copscitegrixed		V			5		1 1	0.33	1.32	0.65				-
Separitor, FixedCX-062 $:5$ Dork $33/4$ 2 $:5$ $:5$ Dork $33/4$ 2 $:5$ $:5$ Sensition, Fixed $RN65$ $:: :5$ Sensition, Fixed RC 3 $:5$ Sensition, Fixed $RR52$ 21 $:5$ Sensition $2MN2N$ 4 $:5$ Public Flor $2MR2N$ 4 $:5$ DM Bound 2367 4 $:5$ DM Bound 1 1 $:5$ DM Bound 1 1 $:5$ Dimeder 41 , Pin 1 $:5$ Dimeder 41 , Pin 1 $:5$ Dimeder 1 20000000 $:5$ Dimeder 1 $2000000000000000000000000000000000000$		Capacitar, Fixed .	CK02	3			<i>v</i>			0.109	0.327	0.32				
No.KJANJA215Esister, FixedRN651215Esister, FixedRC315Esister, FixedRC315Esister, FixedRC315EsisterZANZN415EnsisterZANZN415OministerZ3ez115Ominister23ez115Ominister74Pin1 <t< td=""><td></td><td>Coparitor, Fixed</td><td>24.00</td><td>2</td><td></td><td></td><td>5</td><td></td><td>16.8</td><td>0.109</td><td>0.218</td><td>0.32</td><td>0.61</td><td></td><td></td><td></td></t<>		Coparitor, Fixed	24.00	2			5		16.8	0.109	0.218	0.32	0.61			
Seister, Fixed RN65 4: 3 5 5 Besister, Fixed RC 3 5 5 Besister, Fixed RC 3 5 5 Pesister 244007 16 5 Fransister 2244007 16 5 Fransister 23907 4 55 DW BOURT 23907 1 5 DW BOURT 24 6 55 DW BOURT 24 6 55 DW BOURT 24 7 1 6 5 DW BOURT 24 7 1 6 5 DW BOURT 24 7 1 6 5 DW BOURT 27 1 7 1 5 DW BOURT 24 1 1 5 DW BOURT 24 1 1 5 DW BOURT 24 1 1 5 DW BOURT 24 1 1 5 DW BOURT 24 1 1 5 DW BOURT 24 1 1 5 DW BOURT 24 1 1 5 DW BOURT 24 1 1 5 DW BOURT 24 1 1 1 5 DW BOURT 24 1 1 1 5 DW BOURT 25 1 5 DW BOURT 25 1 1 5 DW BOURT 25 1 1 1 5 DW BOURT 20 1 1 1 1 5 DW BOURT 25 1 1 1 1 1 1 1 1 1 5 DW BOURT 20 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			JANIN	0			10		433	1.8%	3.72	2.95	590			-
esister, Fixel RC 3 15 Esister, Fixed RBR52 21 15 Fransister 244007 16 15 Fransister 22027 16 15 Mu Bourd 2307 1 1 15 Oniverter 41, Pm 1 15 Oniverter 41, Pm 1 15 Oniverter 41, Pm 1 15 Converter 41,		Resistor, Fixed		1			12		0.67	5001.	4,221	0.15	6.30			-
Zesister, Fixed RBR52 21 15 Fransister 244007 16 15 Fransister 2307 4 15 DW BOURT 2307 4 15 DW BOURT 2307 4 15 DW BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 41 Pm 1 DM BOURT 5200 7 DM BOURT 5000 00000000000000000000000000000000		Resistor, Fixel	ec.	m			5		21.2	SHO.	.2226	6.3	0.90			-
ransister ZAN 2007 16 15 ransister ZN 4007 16 15 720051 2307 4 55 00118011 2 71, Pm 1 001180405 41, Pm 1 001180405 41, Pm 1 0011804 15 0011804		Resistor, Fixed		12			5		0.87	0.87	18.27	1.03	21.63			
ransister JANZN 4 5 7900 2907 1 71, Pin 1 Onixerter 41, Pin 1 Onixerter 41, Pin 1 Constructor 200 1 Co		Transister	JAN 2N4007	19			6		1.03	1.38	22.08	3.15	50.40			
OWBOJRI 1 1 Onivertor 41.Pm 1 Onivertor 7402 1 Control 1002		Transistor	JAN 24 2907				5		1.03	1.38	5.52	3.15	12.60	·		
Connector 41 Pin 1 Connector 7402 1 Controns		PWBOJA		N						0.17	5.17	0.17	e.17			-
CONDITION 2 CONDIT		Connector.	41 Pin TYDS	N						0.014	0.014	0.014	0.014			
CONDITION 2 CONDIT																
CONDITION 2 CONDITION 2 NKA DE26																
CONDITION 2 CONDITION 2 CONDITION 2 DE26																1
	LIQNO	I NOI	CONDITIO	2 1						SUM OF NKA	56.90		114	2		1

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* Components not itemized in OP4219

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1	NOMENCLATURE AND		; =	RATING ST	STRESS	RATIO	 FACTOR	BASE TOT	TOIN	BASE	ASE TOTAL	FBCBF	Sound
	CARDICIRCUIT SYMBOL		_	1					NKA	*	NKX.	and and	
1-2-10	Conscitns Fixed Por	20/ 100EH	2			5	<i>k</i> .0	6.109	2,616	0.32	2.69		
00	CapacitarFixed	10/2003/01	N			j,	1	0.33	0.66	0.65	1.30		
1,76	HET RESISTER FIX		1			5	1.38	28482.	3. 1878	3, 1878 0.52	5.72		
2.5	9-12 K-19 SISTER FIXED	RNCSSJS	3			5	9.67	9.67,10052.412 0.15	2.412	0.15	3.60		
R 13	the Resistor Fixed & W	20	2			N	1.38	8482.	2010 1368 0.52	0.52	3.12		
[a'm	Jack, test	M370/0085	m					1	1	1	!		
10-19	Amplifier, Operational	M38510/	10				r.	6.30	36.00	36.00 6.00	36.00		
	PW Bard		N					0.17	0.17	0.17	0.17		
	Connector		N					0.014	0.014	40.04	0.014 0.014 0.014 D.04	• • •	
1				-		-				-			
1.													
CONDITION 1	1 101	CONDITION 2	CN S	e				SUM OF NKA	7966	SUM OF NKA	57.	•	

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BATA Sounce 1 . LIGD VAL SIET 0.30 16.8 0.014 0.514 0.014 0.014 SUM OF 26. 0.33 0.33 0.65 0.65 1.30 |,2819,2846 | 0.52 | 0.52 0,67 .1005 .402 0.15 0.60 1.35. 2010 7396 0.52 3.12 0.17 0.17 2.17 0.17 0.33 0,66 0.65 1.30 16.8 0.109 0.5450.32 1.60 1.39 .2878 .57% 0.52 1.04 TOTAL 1 CONDITION 2 FAILURE RATE IN FPM HOURS 16.8 16.8 16.8 BASE 21.2 .0742 .072 0.3 SUBASSEMBLY 21.34 TOTAL CONDITION 1 BASE TOTAL SUM OF FACTOR 1 ASSEMBLY de. UNIT A/D S 5 STRESS RATIO 5 5 5 5 5 5 407 ACTUAL 501 201 PART 100/5 405406 A 2 F. 2 3 0 N N CONDITION 2 CROUP 40.40-12 Coparity Fixed O. lat Mayord/02 370/0035 FIDZ aparity Fixed under -2502 RIO RESISTER FIXEJ 27M2 REROTS RIS, RESISTER FIXEJ 110K22 REROTS RIS RESISTER FIXEJ 10K22 REROTS RIS RESISTER FIXEJ 10K22 REROTS RESISTOR Fixed 274.0 R2ROTC PART NUMBER AL Pin PNC55 FOULFMENT Copocitor, Fixed, 184F DEVICE IDENTIFICATION Converter, A/D NOMENCLATURE AND CARDICIRCUIT SYMBOL Resistor, Fixer PW BUJET LA PCS CONNECTOR -3 Jack, Tart CONDITION 1 C/3/ STER'S 6-9 3 2 R34 7,8 17 R 本 * C-62

* R9 apportantly dropped in their wel Frediction ** Not listed in OF 4203 1

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AN ALTING ALTING ANALYSIS WORKSHEET

い 認	Alex FCS	C C	CROUP		INI	UNIT CORIAL ASSEMBLY	(TT)	ASSEMBLY		SUBASSEMBLY	EMBLY	SHEET	-1	1
1	DEVICE IDENTIFICATION	8	27	PART	ACTUAL	STRESS	TEMP	- BN	COND	CONDITION 1	COMBI	COMDITION 2		DATA
2	NOMENCLATURE AND CARD/CIRCUIT SYMBOL	PART NUMBER	2	RATING	STRESS	RATIO	.	*	BASE A	TOTAL	BASE	TOTAL	PERCENT	SOURCE
	Capacitar Fixed	CS13B	5			5	30	. - -	0,33	0.66	0.65	1.30		
	Copyriter, Fixed	CKUS BX 472K	2			5	30	16.9		0.109 0.218	2.32	0.69		
	Circuit, Integrated		5					ю.	6.20	30.00	ó. 20	30.00		
	Circuit Interiored	SEFERAD .	4					3	6.00	24.20	6.00	22,00		•
	Circuit, Interrated		14					e.	6.5	24.00	6.00	24.00		
	Resistor Fixel 12W	1 80	21			Ņ	30	21.2		POP8. 240.	0.3	3.60	•	
	RESISTOR FIXED AW RC	N. R.	J			5	R	21.2	242	.6.18 0.3	0.3	2.70		
	Transistor	JAN 2N 2222	1			,5	30	1.03	0.45	0.45	0.7	02.0		
	PWBourd		M						0,17	0.17	0.17	1.1%		
	Connector-	41, P.0	M						0.014	0.0140.014	0.014	10:014 0.014		
		.,												
1	•													
		-												1
CONDITION 1	1 10	COND	CONDITION 2						SUM OF	51.	SUM OF NKA	87.		

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* Components not itemized in OP4219.

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SER! C	Le PCS EQUIPMENT GROUP UNIT ASSEMBLY SUB	C C C	ROUP		5		ASSEMBLY		SUBASSEMBLY	EMBLY	SHEE	SHEET OF	1
	DEVICE IDENTIFICATION						BN		FAILURE RATE	FAILURE RATE IN FPM HOURS	IRS		
	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	5=	RATING	STRESS	RATIO	 FACTOR	BASE	TOTAL	BASE	TOTAL	1900au	SOURCE
1 (S	apointer Fixed	CS13B	2			ŗ	1	0.33	0.66	0.33 0.66 0.65	1.35		
120	appuiter Fixed	CK'06	0			5	16.8	PO1.0	0,219	16.8 2. 1090.218 0.32	9.64		
1(1	ircuit, Integrated	FU6477 41393	0				m	6.0	12.00	12.00 6.00	12.00		
1×	Resistor, Fixed	RW65	8			5	0.67		.1005 4.02 0.15	0.15	6.00		
4	Resistor Fixed	RBC-52	23			5	9.87	0.97	9.87 0.97 20.01 1.03		23.69		
N	Transister Phip	2N4007	10			5	 1.03	1.38	22.08	1.03 1.38 22.08 3.15 52.40	52.40		
N	Transister	JANZN 2907	A			5.	1.03	1.38	5.52	1.03 1.38 5.52 3.15 12.60	12.60		
Y	PW Burd		M					5.17	5.17	0.17 0.17	0.17		
$\mathbf{\nabla}$	Connector	41 Pin Troc	1					0.04	0.04 0.04	0.0140.014	0.014	·	
			-										
			-										
			-									1	
CONDITION 1		CONDITION 2	LION 2					SUM OF NKA	64.	SUM OF NKA	106.		

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いたい	Le FCS	BUIPHON B	GROUP		TINU			ASSEMBLY		ANDASSEMBLY	ANBRA	TIME	4	10
	DEVICE IDENTIFIC							1		FAILURE RATE IN FPM HOURS	IN FPM HO	- Sau		
2	1	F	È=	PART	ACTUAL	STRESS RATIO	2.	FACTOR	1	CONDITION 1	COMPITION	THOM 2	PERCENT	-
T	CARDICIACUIT SYMBOL	PART NUMBER	_					¥.	A		N N	NKX.		
	Copicitor, Fixed	C513B	m			.5			D. 33	0.77	0.65	1.95		
	Copacitar, Fixed	CKO6B.	3			.5		16.8	0.109	0.327 0.32	0.32	0.%		
	Circuit, Integrated	F46477 41333	4					З.	6.00	24.00	24.00 6.00	24.00		
	Cricuit, Integrated	FULA39 3659X	Z					З,	6.00		6.00 6.00	6.00		:
	Circuit, Integrated	5N7474J	N					Э.	6.00		6.00.6.00	6.00		•
	Circuit, Integrated	5N7406 J	M					З,	6.00	90.9	6.00	6.00		
	Circuit, Integrated	177 9465D	Z			•		G.	6.00	6.00 6.00		6.00		
	Resistor, Fixed	KWES	Z			5		2.67	5001.	1005/0.15	0.15	1.65		
	Resistor, Fixed	£	16			.5		21.2	.0742	.0742 /872 D.3		4.80	•	
	Transformer		X						0.14	0. 14 0. 14 0. 14 0. 194	0.94	0.194		
	Transister	2N2222	1			5		1.03	1.03 0.45	0.45 0.70 0.70	0.70	0.70		
	Transister	JANZN VSNAT	4			N.		1.03	1.03 1.38	5.52	5.523.15 12.40	12.60		
	PW Board .		Y						0.17	0.17 0.17 0.17	6.17	0.17		
	Connector		M						0.014	0.014 0.014 0.014 0.014	0.014	0.014		
CONDITION	145	CONDITION 2	ION 2						Sum OF	57.	SUM OF	71.		

* Components not itemized in OP4219.

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* ADGA15 (20) POWER Amplifier (30)

MATING ACTUNE STRESS TEAM ALLIORE ANT MATING STRESS TEAM TEAM COMUNITION I MATING STRESS TEAM TEAM TEAM TEAM MATING STRESS TEAM TEAM TEAM TEAM MATING STRESS TEAM TEAM TEAM TEAM STRESS STRESS TEAM TEAM TEAM TEAM STRESS STRESS STRESS STRESS TEAM TEAM STRESS STRESS STRESS TEAM TEAM TEAM STRESS STRESS STRESS TEAM TEAM STRESS STRESS <th></th> <th>Reviet Identification Normentation Normentation Normentation Amplifies Operational SN 7214/1 Country Fixed Country Fixed Country Fixed Country Fixed Country Fixed Country Fixed Country Fixed Resistor Fixed Resistor Fixed Resistor PWP Transistor PWP Soco</th>		Reviet Identification Normentation Normentation Normentation Amplifies Operational SN 7214/1 Country Fixed Country Fixed Country Fixed Country Fixed Country Fixed Country Fixed Country Fixed Resistor Fixed Resistor Fixed Resistor PWP Transistor PWP Soco
Marine Strates Number		T NUMER 274/12 25 25 14 14 14 14 14 14 14 14 14 14 14 14 14
3. 6.00 12.00 .5 0.33 1.78 .5 .5 0.33 1.78 .5 .5 58 0.107 .78 .5 58 0.107 .78 .5 58 0.107 .78 .5 58 0.107 .78 .5 58 0.107 .74 .5 1.33 1.86 7.44 .5 21.2 D742 .335 .5 21.2 D742 .335 .5 21.2 D747 .194 .5 1.005 .104 .194 .5 1.03 1.38 2.76 .5 1.03 0.194 .194 .5 1.03 0.195 .95 .5 1.03 0.194 .194 .5 1.03 0.195 .95 .5 1.03 0.195 .95	N D D N A & A N N N	274/L 55 14 14 12 12 12 12 12 12 12 12 12 12 12 12 12
.5 0.33 .5 '5.8 0.109 .5 '5.8 0.109 .5 '5.8 0.109 .5 '5.8 0.109 .5 '5.8 0.109 .5 '5.8 0.109 .5 '5.8 0.109 .5 '5.8 0.109 .5 '5.8 0.109 .5 '1.2 1.005 .5 '1.03 1.38 .5 '1.03 1.38 .5 '1.03 0.145 .5 '1.03 0.136 .5 '1.03 0.136 .5 '1.03 0.136	0 7 N 4 8 4 N VS	55
.5 '5.8 0.109 .5 .5 '5.8 0.109 .5 .5 '5.8 0.109 .5 .5 '5.8 0.109 .5 .5 '5.8 0.109 .5 .5 '5.8 0.109 .5 .5 '5.8 0.109 .5 .5 .21.2 2742 .5 .5 .21.2 2742 .5 .5 .1005 .5 1.03 1.38 .5 1.03 1.38 .5 1.03 0.45 .5 1.03 0.45	501454100	NAN SS.
.5 5.8 0.109 .5 5.8 0.109 .5 2.12 2742 .5 2.12 2742 .5 2.12 2742 .5 1.05 1.005 .5 1.03 1.38 .5 1.03 1.38 .5 1.03 1.38 .5 1.03 1.38	N 4 8 4 1 0 05	14 X 22
.5 4.33 1.86 .5 21.2 2742 .5 21.2 2742 .5 2.67 .1005 .9.67 .1005 .745 .1.03 1.38	4 5 4 4 0 05	14N 14N 12N 12N
.5 .21.2 .2742 .5 .21.2 .2742 .5 .5 .21.2 .5 .5 .21.2 .5 .21.2 .2742 .5 .21.2 .2742 .5 .21.2 .2742 .5 .21.2 .2742 .5 .21.3 1.382 .5 .21.3 .382 .5 .233 .382 .5 .233 .382 .5 .233 .382 .5 .233 .382	27400	2X 25. 25.
.5 2.67.1005 .9.67.1005 	71002	55 12N 12N
1.03 1.38 1.03 1.38 1.03 0.45 1.03 0.45	NOW	12N 25
.5 1.03 1.38 2.76 .5 1.03 0.45 .9 	00	12N 25
.5 1.03 0.45 .9	65	2N
120000000000000000000000000000000000000		13
C1.6 01.7 DC.1 2011 C'	01	JAN2N 2307
.5 1.03 0.45 .9 0.7	N	1W2N22224
.5 0.459	4	2N3766
21.0 21.7 0.17 0.17	Y	
SUM OF SUM OF NICA	TION 2	CONDITION 2

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ADE AIS (A30,45,60) POWER Amplitier (Card A)*		
	INHERENT RELIABILITY ANAI YSIS WORKSHEFT	ADG A15 (A30,45,60) POWER Amplifier (and AN)*

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1													1
	PM HOURS CONDITION 2	NCN N	410.0	•									56.
	IN FPM HOL	ASK A	0.04 D.014 D.D.14							•			NKA R
_	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION	N N	QOH								•		33.
	CONDI	MSK	HO.O				1						SUM OF NKA
	M	FACTOR 1											
		8											
	STRESS	RATIO									•		
-	ACTUAL	STRESS											
	INA	RATING											
	ALC .	=	Y										CONDITION 2
		PART NUMBER								•			
	IFICATION												
1010	BEVICE IDENTIFICATION	NONENCLATURE AND CARDICIRCUIT SYMBOL	binactor										
	1				-					2.4	1	-	CONDITION 1

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* Components not itemized in OP4219.

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BATA Sound 1 10 TIME 0.04 0.014 0.014 D.014 0.330.330.650.65 6.00 18.00 6.00 18.00 MA 294 1.38 .2898 528 0.52 3.64 20.020002 0.02 0.02 0.67 .1005 .402 0.15 0.60 0.17 0.17 0.17 0.17 TOTAL MKX 659 0.32 1.92 --- 0.33 0.66 0.65 11.30 ľ 1 FAILURE ANTE IN FPM HOURS CONDITION 2 1 1 SUM OF 42. ۱ 1 601. ۱ 1 FACTOR F 16.8 ASSEMBLY m 2.0 5 STRESS RAILO 5 5 P 5 5 D/A Converter ACTUAL RATING 5= 2 3 2 4 0 9 M M N 2 M CONDITION 2 RLR07C CKR DK P2-M390 M P2-CSR J3E M390 -RI,5 Resister, Variabie, 10K0 PT 26-22P TP Jock, Test M370-100 22 Converter, D/A 24-20-120 Circuit Integrated SN 541751 PART NUMBER 41 Pm Type RWC55 ADGAZI, AZZ C6 Copacitary Fixed 100 115 apscript, Fixed, 1004 C2,4 Coportar, Fixed 18 45 R36 Resistar, Fixed 10K.A. 9-13 Resistar, Fixed 14 W R34 Resistar, Fixed DEVICE IDENTIFICATION NOMENCLATURE AND CARD/CIRCUIT SYMBOL LA PCS Connector PW BOUNT CONDITION 1 "Price £22 5.52 2 ** * * C-68

* Apparently not used in preduction in back

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a / -		SOURCE												6
1		PBCBI												
SHEET	RS .	TOTAL	13.85	2.86	0.17	10.04								11
MBLY	FAILURE RATE IN FPM HOURS	BASE A	1-	2.86 0.572		0.04 0.014 0.014								
SUBASSEMBLY	VILURE RATE	TOTAL	9.3	2.86	0.17 0.17	D.DI4						•		17
	COM	3	1.8%	.572	0.17	0.014		-						
ASSEMBLY	M	FACTOR	4.33	286.										
-								•						
	CTBECC	RATIO	5											
TINUT .		STRESS												
	TOTO	RATING												
GROUP	-	;=	5	5	M	N								- 10
SC C C		PART NUMBER	JAN1N 4454	M5757-	1609-801		-							CONDITION 9
	FICATION												-	
LE PCS	DEVICE IDENTIFICATION	NOMENCLATURE AND CARDIC PROVINT SYMBOL	Diode	Relay	PC Board	Connector								
いいい		8	CR1-		-									CONDITION 1
					*	*		-69					4	

* Not listed in OP 4219

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BATA PERCENT SHEET 0.33 0.33 0.65 2.65 0.60 6.00 6.00 6.00 6.00 6.00 6.00 6.00 6.00 6.00 18.00 6.00 18.00 a17 0.17 0.17 0.17 0.214 0.014 0.014 0.014 Mar 32. .3270.32 0.96 TOTAL FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION 2 BASE TOTAL BASE TOTAL NKA A KKA 21.2 .0742.1484 0.3 SUBASSEMBLY NKA 30. 601.0 8.9 RASE A 406 A24 (A25, 33, 40)16 BIT 4 to 1 Multiplexer m FACTOR K 1 ASSEMBLY m m INHERENT RELIABILITY ANALYSIS WORKSHEET de la RATIO 5 5 5 UNIT ACTUAL PART 5. N m Y M Circuit, Integrated SN540HT DW7214J3 M 22 Circuit, Interched SN542071 CROUP CONDITION 2 CZ-Copacity, Fixed, Ozur CKOGBX RIZ RESISTOR, Fixed, 124 RX 076 166-5-291 PART NUMBER Opening Fixed, 15 ur CSRIFE DEVICE IDENTIFICATION 23-Circuit, Integrared NOMENCLATURE AND CARDICIRCUIT SYMBOL PLA PCS Connector PC Bard CONDITION 1 いたい Z QNI US * *

* Not listed in OF-4219

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INHERENT RELIABILITY ANALYSIS WORKSHEET

0	C KEFCS SC	5		and the second se	5		100					ľ	+	
1	E IDENTIFI			PART	ACTUAL	STRESS		BN	CONDI	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION	IN FPM HO COND	1		ATA
	NOMENCLATURE AND CARD/CIRCUIT SYMBOL	PART NUMBER	=	RATING	STRESS	RATIO	۶.	FACTOR K	A A	10TAL NK A	A Ska	124	PBrcBit	Sounce
	Amplifier Operation	716221NS	A					e.	6:0	24.00 6.00	6.00	24.00		
	Amplifier Operational	SN723014L	2				-	m	6.0	12.00	12.00 6.00	00:21		
	Gepseiter, Fixed	C5/3B	5			5			033		1.65 0.65	3.25		
	Copyciter, Fixed	Cree	Ν		~	5		16.8	0.109		7630.32	2.24		
	Circuit, Integrated	FU649936	2					ŝ.	6.00	12.00 6.00	6.00	12.00		
	Circuit, Integrated	177 9465D	Z					m	6.00		6.00 6.00	00.3		
	Dióde	JANIN 314	13			.5		4.33		1.86 24.18 2.95	2.95	38.35		
	Resister, Fixed	RN65.	9			5		0.67	Sapl.	1005 .9045 0.15	0.15	1.35		
	Resister, Fixed	R.	8			5		21.2	242	21.2 .0742 1.484 0.3	0.3	6.00		
	Transformer		2						0.194	0.144 .368	9.194	3.194 0.385		
	Transistor	214007	9			5		1.03	1.38	8.28	315	06.81		
	Transistor	JAN 2N 2907	N			5		1.03	1.36	2.76	3.15	6.30		
	Transistor	JAN2N 2222	1			5		1.03	0.45	0.45 0.45 0.70	0.70	0.70		
	PW Board		N						.21.0	0.17 0.17 0.17 0.17	0.17	2.17		1
E	CONDITION 1	CONDITION 2	ION 2						SUM OF NKA	\backslash	SUM OF NKA	1		

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PATA SOUNCE SHET 2 0° 2 PERCENT 0.014 0.014 0.014 0.014 NKX N NKA 0435 NKA 662 BASE TOTAL FAILUPE RATE IN FPM HOURS CONDITION 1 CONDITION 2 BASE TOTAL BASE TOTAL SUBASSEMBLY • FACTOR UNIT S/D ALLEN ASSEMBLY INHERENT RELIABILITY ANALYSIS WORKSHEET Anglog (CordAl) SC TEMP STRESS RATIO ACTUAL PART 5= V CONDITION 2 PART NUMBER 41 P.10 A06 435, 450 FOULPMENT DEVICE IDENTIFICATION NOMENCLATURE AND CARD/CIRCUIT SYMBOL Converter LE PCS CONDITION 1 ってい INO

* Components not itemized in orders

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INHERENT RELIABILITY ANALYSIS WORKSHEET	5) 18 BIT Inverte	

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Junit Assemuty Assemuty Assemuty Assemuty Assemuty Acrum, stress Ratio "C K MAR Falling RATE IN FPM H Acrum, stress Ratio "C K As Total H As Stress Ratio "C K As Total H As D. D. D. D. D. D. D. D. D. D. D. D. Z/.2 D. D. </th <th>PART ACTUAL STRESS TEAM FRACTIONS RATING STRESS RATIO C.S. C.S. KATION C.S. KA</th> <th>OT PART ACTUAL STRESS TEAP FART N RATING STRESS RINIO T F F Z E Z Z </th> <th>Interview Interview <t< th=""><th>Math Math Actual Stress Ratio Actual PART MUMBER 011 PART Actual Stress RATIO Ress RATIO PART MUMBER N PART Actual Stress RATIO TEMP RATIO PART MUMBER N PART Actual Stress RATIO TEMP RATIO CSR V3E Z Actual Stress RATIO TE K K CSR V3E Z IS IS IS IS K K CSR V3E Z IS IS IS IS Z/IS Z/IS CSR V3E Z IS IS IS IS Z/IS Z/IS</th><th>Let bernification the and and and and and and and an and an and an and an and an and an and and</th></t<></th>	PART ACTUAL STRESS TEAM FRACTIONS RATING STRESS RATIO C.S. C.S. KATION C.S. KA	OT PART ACTUAL STRESS TEAP FART N RATING STRESS RINIO T F F Z E Z Z	Interview Interview <t< th=""><th>Math Math Actual Stress Ratio Actual PART MUMBER 011 PART Actual Stress RATIO Ress RATIO PART MUMBER N PART Actual Stress RATIO TEMP RATIO PART MUMBER N PART Actual Stress RATIO TEMP RATIO CSR V3E Z Actual Stress RATIO TE K K CSR V3E Z IS IS IS IS K K CSR V3E Z IS IS IS IS Z/IS Z/IS CSR V3E Z IS IS IS IS Z/IS Z/IS</th><th>Let bernification the and and and and and and and an and an and an and an and an and an and and</th></t<>	Math Math Actual Stress Ratio Actual PART MUMBER 011 PART Actual Stress RATIO Ress RATIO PART MUMBER N PART Actual Stress RATIO TEMP RATIO PART MUMBER N PART Actual Stress RATIO TEMP RATIO CSR V3E Z Actual Stress RATIO TE K K CSR V3E Z IS IS IS IS K K CSR V3E Z IS IS IS IS Z/IS Z/IS CSR V3E Z IS IS IS IS Z/IS	Let bernification the and and and and and and and an and an and an and an and an and an and and
D.17 D.17 D.17 D.17 0.04 0.04 0.04 0.04	·0			1604-801 <u>L</u>	1604-801 <u>L</u>
v		2 80 14 14	2 8 1 4 5 8 5 8	6207 4C SN54047 3 1604-801 [6207 4C SN54047 3 1604-801 [
	PART ACTUAL BATING STRESS.	ar part actual a	I ACTUAL	ART NUMBER OTV PART ACTINA CSSR/3/E N RATING STRESS CSSR/3/E L N RATING STRESS CSS/3/S L N RATING STRESS SAUS-404.7 S N SAUS-404.7 S I/604-60/ L I I I	ART NUMBER OTV PART ACTINA CSSR/3/E N RATING STRESS CSSR/3/E L N RATING STRESS CSS/3/S L N RATING STRESS SAUS-404.7 S N SAUS N I/604-60/L L I I I
	PART ACTUAL RATING STREES	ANTING STRESS	NATI NUMBER PART NUMBER SR 13E SR 13E SR 13E SR 13E SR 13E SSR	FCC Description Descrinteaction Description <	ICEFES SC MARK ACTUM DEVICE IDENTIFICATION ON PART ACTUM NOMENCLATURE AND ACTUM ACTUM ACTUM NOMENCLATURE AND ACTUM ACTUM ACTUM CARDICIRCUT SYNBOL ACTUM ACTUM ACTUM ACTUM ACTUM ACTUM ACTUM ACTUM ACTUM ACTUM ACTUM ACTUM ACTUM ACTUM ACTUM
	PART RATING	A L L L L L L L L L L L L L L L L L L L	PART NUMBER PART NUMBER PART NUMBER PRE PART PRE PART SSR / 3 SSSS / 3 SSS / 3 SSS / 3 SSSS / 3 SSSS / 3 SSS /	FC PART OT PART IFCUID PART OT PART ISFUL CSR (3E) L PART ISFUL CSSA (3E) L PART ISFUL CSR (3E) L PART ISFUL CSR (3E) L PART ISFUL CSR (3E) L PART ISFUL CSR (3E) L PART IST CSR (3E) L PART	ICEFES SC MAR DEVICE IDENTIFICATION ON PART MUNIER MOMENCIATURE AND CARDICIRCUT SYNBOL CARDICIRCUT SYNBOL CARDICICTURE A DESCHART 2 CARDICICTURE A DES

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SETTING REFECT		SCC.	GROUP	400	LINN	Chas-is	15	ASSEMBLY		SUBASSEMBLY	SUBASSEMBLY FAILINE BATE IN FPM HOUDS	SMEET	4	7-0
DEVICE IDENTIFICATION	FICATION		10	Y PART	ACTUAL	STRESS	TEMP	BN	COND	CONDITION 1	COND	CONDITION 2		MIA
NOMENCLATURE AND CARD/CIRCUIT SYMBOL		PART NUMBER						-	BASE A	TOTAL	6ASE A	TOTAL	INGONAL	SOUNCE
Connector M	141	-1:5%	00-7008- 14/-1:54-05260	0					P10.0	0.84	P10.0	0.014 0.84 0.014 0.94		
Connector 6-		201	6-204692	2					0.06	0.06 0.12	0.00	0.06 0.12		
					-	-								
					-							•		
consistion 1			CONDITION 2						SUM OF NKA	0.%	SUM OF NKA	0.96		
													-	

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INHERENT RELIABILITY ANALYSIS WORKSHEET

	16 FCS 8	SCC.		401	X	407 × Haichpurd	121	ASSEMBLY		SUBASSEMBLY	TIMOL	SHEE		
	DEVICE IDENTIFICATION		PP PP				TEMP	BN	CONC	FAILURE RATE IN FPM HOURS CONDITION 1 CONDITION 2	COND	DURS ITHON 2		-
	NOMENCLATURE A	PART NUMBER	2	RATING	STRESS	RATIO	ູບ	× ×	BASE	TOTAL	BASE	TOTAL	PERCENT	Source
	Main Frame With 4K Mamory	3168-0100 1	M						350.	350.		350.		
~	Power Supply	3168-0100	N						98.co	98.28.a		38.20		
V .	4K Memory	3168-02	N						57.75	57.75 57.75		57.75		
	High Jew I Arith.	. 316. R-11	M						28.69	28.69 28.90		28.80	ŀ	
	Real Time Clack	3168-12	Y						5.06	5.06		5.06		
							•							
										•				
	•													
CONDITION 1		CONDITION 2	N						SUM OF NKA	540.	SUM OF	540.	1	

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	SUBASS
1 AS A06	GROUP AND UNIT LOMET ASSEMBLY
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YUC	Z TINU
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y Sheet - Sann ,	CROUP
V)	EQUIPMENT
A08-Summary	WatsAsaft
AC	whish

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		TOTAL PERCENT SOURCE								
ANBASSEMBLY	FAILURE RATE IN FPM HOURS	ASK9	•							
SVBNS	FAILURE RA CONDITION 1	BASE TOTAL A MKA								
ASSEMBLY	-	C FACTOR						-		
UNIT LOWER	STRESS	RATIO								
		ING STRESS								
GON 408	-	N RATING								
		PART NUMBER								
USYSTEM EQUIPMENT	IDENTIFI	NOMENCLATURE AND CARDICIRCUIT SYMBOL				-				
Ser.	-	2								

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	251 257 251	SCC.		FOR		POWER SUPOL	NOON A	VISION		SUBASSEMBLY	EMBLY	SHEET	1	N
	DEVICE IDENTIFICATION		è	_	ACTUAL	STRESS	AMEL	N	CONIE	FAILURE RATI	FAILURE RATE IN FPM HOURS	PM HOURS CONDITION 2		
	NOMENCLATURE AND CARD/CIRCUIT SYMBOL	PART NUMBER	=	RATING	STRESS	RATIO	ş	K	BASE	TOTAL	BASE	TOTAL NKX	PERCENT	Source
-190 191-	Breaker, Circuit	E/6106EW	3 20					•	0.5	500 0.5	0.5	5.00		
-	Connector	2-652102	5						120.0	0.105	0.021 0.105 0.021	201.0		
	Kaph	M57571	40					286.	0.572	22.66	0.572	266. 0.572 22.680.572 22.68		
	42,45, Re. Ky	M5757/ 16-003	A					286.	0.572	2.200	0.572	286. 0.5722.2000.5722.288		
	K44 Flasher	F945	1						12.50	12.50	12.50	12.50 12.50 12.50 12.50		
	MI Meter, Time Totalizing MS17325-51	M517325-	N			.5	•	0.148	1.48	1.48	0.148 1.48 1.48 1.48 1.48	1:48		
5-1-	Connector	204260-25	5						0.021	0.105	120.0	0.021 0.105 0.021 0.105		
and the second se	PSI Pawer Supply	37656742	N						54.00	54.00	54.00	54.00 54.00 54.00 54.00		
and the second sec	952 Rower Supply	37656742 - 002	M						27.00	27.00	27.00	27.00 27.00 27.00 27.00		
	S1,2 Switch, Linear	1853048 2	0						4.756	9.512	4,756,9,512,4,756,9,512	9.512		
	S35 Switch, Retary	SZJM-153	5						0.216	0.648	0.216	0.216 0.648 0.216 0.648		
_	Switch, Rotary	53JR-151	N						0.216	0.216	0.216	0.216 0.216 0.216 0.216		
	TI Transformer	H511-2001	70			•		0.77	0.174	0.194	D.194	0.97 6.194 0.194 0.194 0.194		
_	** cgr Diode	2N914 30	R			.5		4.33	4.33 1.86	55.8	2.95	52:8 2.95 86.50		1
	CONDITION 1	CONDI	CONDITION 2						SUM OF NKA	\backslash	SUM OF NKA	\backslash		
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* Not listed in Honeywell Prediction ** Not listed in OP-1213

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KAFCS		- Yes	408	E -	E PURTSION ASSEMBLY	hin ad	ASSEMBLY		SUBASSEMBLY FAILURE DATE IN FPM HOURS	EMBLY	III SHEET	N	N
DEVICE IDENTIFICATIO	ICATION	Lo	PART	ACTUAL	STRESS	di	BW	COND	CONDITION 1	CONDI	CONDITION 2		VIN
NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	-	RATING	STRESS	RATIO	ę		NG N	TOTA	BASE	TOTAL	PEACENT	New York
	M527418-18 1	20					286	0.572	0.572	0.572	286 0.572 0.572 0.572 0.572		
Rely Conserver	- VBB/1PA	8						100.0	0.001 0.04 0.001 0.04	100.0	0.04		
Connectur		N						0.008	0.0000016 0.000000	0.00	0.016		
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	CONDI	CONDITION 2						SUM OF	.261	Sum of	225		

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0.4382.6285.4782.628
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DEVICE IDENTIFICATIO	I	an		ACTUAL	STRESS	TEMP	NO	CON	CONDITION 1	CONDITION 2	LION 2		MTA
NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER	=	RATING		RATIO	۶		NSK A	TOTA	EASE A	TOTAL		SOUNCE
Connector	M53402D - 36-10	N					•	0.003	0.003 0.003	0.003 0.003	0.003		
113 Connector	N53402D -28-21	M						0.000	6,00,0	0.000 6.000 0.000	0.006		
17 Connector	10-521-	1						0.04	10.01	0.04 0.014 0.014	0.014		
18 Connector	M53102A-	M						0.006	0.000	0.0060.00000.0000000	0.006		
19 Convector	453102A 36 - 10	1						0.003	0.003	0.003 0.003 0.003 0.003	0.003		
Januactor	10-521- 807-1	M						0.041	0.061	D. 061 0.061 D. 061	0.061		
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	CONDI	CONDITION 2						SUM OF	0,073	SUM OF	6.093	ŀ	

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INHERENT RELIABILITY ANALYSIS WORKSHEET

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	DEVIC	DEVICE IDENTIFICATION		-					N		FAILURE RATE IN FPM HOURS	IN FPM HO	SH		
2	NOMENCLATURE AND CARDICIRCUIT SYMBOL	E AND	PART NUMBER	5=	RATING	STRESS	RATIO		FACTOR	BASE	ISE TOTAL	BASE TOR	TOTAL		Sounce
	CONNECTOR AO	1832	204260-2	-							.021				
	ð	201808	204260-2								,021				
		1972	2-091402	-							170				
		401/2181	a la secondaria de la se Secondaria de la secondaria de	12							021				
				-		:					120'				
		1631	20254-3	-							100%			-	
		112 22 81	202516-3	-					•		\$00.				
		1832	204693-6	>							070.				
100		1832	204693-6	~							. 060				
		X 1872 Ao1 192		~							.060				
		mi		-							090.				
		1832	204693-6	~							.060				
	CO NINECTOR	212 100	2-967 HOL	-							+10.				34
	CONDITION 1		COND	CONDITION 2						Sum of		SUM OF			

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~ ~	1	Sound													!	
N		PERCENT														
SHEET	RS ION 2	NUM					•									
	FAILURE RATE IN FPM HOURS	RASE A														SUM OF
SULASSOURY	ILURE RATE	TOTA NOT														N
	FAILUR	MSE	410.	410.	+10.	+10.	090.	.060	.060	0 90 1	.0%0	090-	030-			SUM OF
ASSEMBLY	NO	L L L L L L L L L L L L L L L L L L L														
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		OLLY														1
		SSILS														7
	-														T	1
1110	-	;=	-				-				11	1	11			
		LOWING LIVE	204739-2	7-581 402			204 693-6	204693-6				204693-6	209695-6			CONDITION 2
225	IFICATION		32 4	4531	34	22	32	22	07124	7 225	17020	832	1832			
EFESS	BEVICE IBBRIEICATIO	HOMENCLATURE AND CARENCIRCUIT SYMBOL	CONNECTOR AD		Aok	Aor	408	, v	1 10	401	104		CONNECTOR AC			1
201c	-	8				İ								0		CONDITION 1

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« J		BATA Sound														1	
M		PERCENT															
SHEET	IRS	ASE TOTAL															
ALLY .	IN FPM HOL	BASE	•				·										SUM OF NKA
SUBASSEMBLY	FAILURE RATE IN FPM HOURS	TOTAL															1.299
	FA	BASE TOT	•	090.	060	410.	410.	.060	0 70.	800.	250.	·050					SUM OF
ASSEMBLY		FACTOR	T											T			
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0111		PART	T										Γ		T		
CHOUP 11	L	5=	T	-	-					-		-					NN
-		PART NUMBER		1856	1856			1801	1801	-810-275							CONDITION 2
SCC	WIEICATION		4281	318	7 19	A05 P26	120 5	1.		11		229					
Sarasa Sarasa	DEVICE IDENTIFICATIO	NOMENCLATURE AND		CONNECTOR	1	A0.	10.	,			1	CONMETOR A02					1 10
認い		Q	T								•				1		CONDITION 1

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INHERENT RELIABILITY ANALYSIS WORKSHEET

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1	NEVICE IDENTIFICATION		2	TAAT	ACTUAL	STRESS		8	COND	FARLINE RATE IN FPM HOURS CONDITION 1 CONDITIO	IN FPM HOU	PM HOURS CONDITION 2		1
1	NOMENCLATURE AND CARDICIRCUIT SYMBOL	PART NUMBER		RATING	STRESS	RATIO	¥	K	BASE	TOTAL	MSE	TOTAL	LENGEL	Sound
	SHORTING PLATE	. 769	-						100'	100.				
	LOAK TERMINATION	1 9020 NF	-						200'	2003 .003				
	WAVEGal) C	641	+					• .	1.1	4.400				
	WAYEGUIDE	642	7						1.1	2.200				
	WAVEGUIPE	643	3						11)	2,200				
	WAVE GUIDE	646	2						~	1.200				
	WAVEGUINE	647	2						1.1	2.2 00				
	WAVE GUIDE EL BOW	632	-						1.1	1.100				
		2 23	1						1.1	1.100				
	PUCK HEAD FLAND	668	1						1.1	1.100				
	3w17c#	1500	~					•	2.55	2.550				
	Loupler	1501	>						1.1	1.100				
•	DUMAY LOAD.	1502	1			•			3,23	3.23				
	7	E.							•					1
CONDITION 1		CONSITION 2	N						SUM OF	\backslash	Sum of			

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PART NUMBER IN Define STESS DATIO TC TAGE TAGE	DEVICE IDENTIFICATION	•	ATION	F		ACTUAL		ANGL	Na	COND	TION 1	COND	LION 2	_	DATA
1503 1 5.00 5.01 1 1504 1	NOMENCLATURE AND CARD/CIRCUIT SYMBOL		PART NUMBER			STRESS		ç	*	EASE A	TOTAL	EASE A	TOTAL NKX	PBICBIT	Sounce
1504 1 005 015 - 1 1 1 1 1 1 1 1 <	ECHO BOX		1503	1					·	5.000	5,010		1		
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Since 28.399 Suns				-											
200 C 26339 200 C		1.													
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2014 CC 26239 SUM CC				-									-		
2014 GC 26239 2014 GC									1						
SUM OF 26.379 SUM OF MEA										100	145				
SUM OF 26.379 SUM OF MEA				-						-					
SUM OF 28.379 SUM OF				-											
SUM OF 28,3PP		11													
	constrion 1		8	DITION 2						SUM OF NKA	28.399				

APPENDIX D

SYSTEM CONTROL CONSOLE ASSEMBLIES/SUBASSEMBLIES THAT ARE PREDICTED TO FAIL 50 OR MORE TIMES PER MILLION HOURS OF OPERATION

A04A05 A04A06Radar Interface Test Panel13 4A05System Status (Control Panel)6A06Upper Converter Analog (Card A1)273 9 9 A06A01A06A01 A06A02 A06A03Logic (Card A2) Differential Amplifier A06A05 Differential Amplifier A06A1255 57 68 406A12A06A12 Bridge, Sine-Cosine (Card A2)66	5 5128 9 5291 1 9901 5 18182 5 18182 5 18182 5 18182 5 18182 6 7353 6 7937 4 5155 0 5263 0 5263 9 5025 9 5025 0 7143 5 4651 0 7692 6 21739 0 16667 2 366	λ 2463 201 197 109 56 56 56 137 216 197 197 197 197 160 201 146 113 279 175 61 60 3659 136	MTBF 406 4975 5076 9174 17857 17857 17857 7299 4630 5076 6250 4975 6849 3584 5714 16393 16667 273
A01A01I/O Control Sequencer19A01A02Director Bearing Error Generator and Buffer18A01A03I/O Data Select/Buffer10A01A05I/O 16-Bit 4 to 1 Multiplexer55A01A06I/O 16-Bit 4 to 1 Multiplexer55A01A07I/O 16-Bit 4 to 1 Multiplexer55A01A06I/O 16-Bit 4 to 1 Multiplexer55A01A07I/O 16-Bit 4 to 1 Multiplexer12A01A08I/O 16-Bit 4 to 1 Multiplexer12A01A10Pit Log Interface13A01A11TWS 2 Target Position Computer19A01A13TWS 2 Target Position Computer19A01A14TWS 1 Range and Bearing Window Generator19A01A15TWS Clock and Range Ring Generator15A01A10I/O Storage Buffer14-Basic Panel21A04A05Radar Interface13A04A05Radar Interface213A04A05System Status (Control Panel)6A06A01Analog (Card A1)8A06A03Bridge (Card A2)6A06A04Storage Register and Driver (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)6A06A13Reference and Quadrant Switching (Card A3)5A06A14Same as A019A06A15Same as A019A06A16Same as A019A06A17Same as A019A06A18Same as A019A06A19Same as A019A06A11Same a	5 5128 9 5291 1 9901 5 18182 5 18182 5 18182 5 18182 5 18182 5 18182 5 18182 6 7353 6 7353 6 7353 0 5263 8 6329 9 5025 9 5025 9 5025 0 7692 6 21739 0 16667 2 366 7 10309	201 197 109 56 56 56 142 137 216 197 197 197 160 201 201 201 201 201 146 113 279 175 61 60 3659 136 87	4975 5076 9174 17857 17857 17857 17857 17857 7042 7299 4630 5076 5076 6250 4975 4975 6849 8850 3584 5714 16393 16667
A01A01I/O Control Sequencer19A01A02Director Bearing Error Generator and Buffer18A01A03I/O Data Select/Buffer10A01A05I/O 16-Bit 4 to 1 Multiplexer55A01A06I/O 16-Bit 4 to 1 Multiplexer55A01A07I/O 16-Bit 4 to 1 Multiplexer55A01A06I/O 16-Bit 4 to 1 Multiplexer55A01A07I/O 16-Bit 4 to 1 Multiplexer12A01A08I/O 16-Bit 4 to 1 Multiplexer12A01A10Pit Log Interface13A01A11TWS 2 Target Position Computer19A01A13TWS 2 Target Position Computer19A01A14TWS 1 Range and Bearing Window Generator19A01A15TWS Clock and Range Ring Generator15A01A10I/O Storage Buffer14-Basic Panel21A04A05Radar Interface13A04A05Radar Interface213A04A05System Status (Control Panel)6A06A01Analog (Card A1)8A06A03Bridge (Card A2)6A06A04Storage Register and Driver (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)6A06A13Reference and Quadrant Switching (Card A3)5A06A14Same as A019A06A15Same as A019A06A16Same as A019A06A17Same as A019A06A18Same as A019A06A19Same as A019A06A11Same a	5 5128 9 5291 1 9901 5 18182 5 18182 5 18182 5 18182 5 18182 5 18182 5 18182 6 7353 6 7353 6 7353 0 5263 8 6329 9 5025 9 5025 9 5025 0 7692 6 21739 0 16667 2 366 7 10309	201 197 109 56 56 56 142 137 216 197 197 197 160 201 201 201 201 201 146 113 279 175 61 60 3659 136 87	4975 5076 9174 17857 17857 17857 17857 17857 7042 7299 4630 5076 5076 6250 4975 4975 6849 8850 3584 5714 16393 16667
A01A04I/O Data Select/Buffer10A01A05I/O 16-Bit 4 to 1 Multiplexer5A01A06I/O 16-Bit 4 to 1 Multiplexer5A01A07I/O 16-Bit 4 to 1 Multiplexer5A01A08I/O 16-Bit 4 to 1 Multiplexer5A01A09I/O Test Interface13A01A10Pit Log Interface12A01A11TWS Dearing Cursor and Test Target Generator19A01A13TWS 2 Target Position Computer19A01A14TWS 1 Range and Bearing Window Generator19A01A15TWS Clock and Range Ring Generator19A01A16TWS 2 Range and Bearing Window Generator19A01A20I/O Storage Buffer14-Basic Panel21A04A05Radar Interface13A04A06AdvaceTest Panel4A05System Status (Control Panel)6A06A01Analog (Card A1)9A06A02Logic (Card A2)6A06A03Bridge, Sine-Cosine (Card A2)6A06A11Storage Register and Driver (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)6A06A13Reference and Quadrant Switching (Card A3)5A06A14Same as A019A06A15Same as A019A06A16Same as A019A06A26Same as A019A06A31Same as A019A06A32Same as A019A06A33Same as A019A06A34Same as A01 <t< td=""><td>1 9901 5 18182 5 18182 5 18182 5 18182 6 7353 6 7937 4 5155 0 5263 8 6329 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309</td><td>109 56 56 56 142 137 216 197 160 201 146 113 279 175 61 60 3659 136 87</td><td>9174 17857 17857 17857 17857 17857 17857 7042 7299 4630 5076 6250 4975 4975 6849 8850 8850 83584 5714 16393 16667</td></t<>	1 9901 5 18182 5 18182 5 18182 5 18182 6 7353 6 7937 4 5155 0 5263 8 6329 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	109 56 56 56 142 137 216 197 160 201 146 113 279 175 61 60 3659 136 87	9174 17857 17857 17857 17857 17857 17857 7042 7299 4630 5076 6250 4975 4975 6849 8850 8850 83584 5714 16393 16667
A01A05I/O 16-Bit 4 to 1 Multiplexer5A01A06I/O 16-Bit 4 to 1 Multiplexer5A01A07I/O 16-Bit 4 to 1 Multiplexer5A01A08I/O 16-Bit 4 to 1 Multiplexer5A01A09I/O 16-Bit 4 to 1 Multiplexer5A01A01Pit Log Interface12A01A12TWS Bearing Cursor and Test Target Generator19A01A13TWS 2 Target Position Computer19A01A14TWS 1 Target Position Computer19A01A15TWS 2 Range and Bearing Window Generator19A01A16I/O Storage Buffer14-Basic Panel9A04Mount and Status (Right Drawer)21A04A05Radar Interface13A04A06Test Panel9A06A01Analog (Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)5A06A04Same as A019A06A15Spree converter273A06A05Bridge, Sine-Cosine (Card A2)8A06A07Bridge, Sine-Cosine (Card A2)6A06A08Same as A019A06A17Same as A019A06A18Same as A019A06A19Same as A035A06A27Same as A035A06A31Same as A035A06A32Same as A126A06A33Same as A035A06A34Same as A035A06A35Analog (Card A1)9A06A36	5 18182 5 18182 5 18182 6 7353 6 7937 4 5155 0 5263 8 6329 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	56 56 56 56 142 137 216 197 160 201 201 201 201 146 113 279 175 61 60 3659 136 87	17857 17857 17857 17857 17857 7042 7299 4630 5076 5076 6649 8850 3584 5714 16393 16667 273
A01A06I/O 16-Bit 4 to 1 Multiplexer5A01A07I/O 16-Bit 4 to 1 Multiplexer5A01A08I/O 16-Bit 4 to 1 Multiplexer5A01A09I/O Test Interface13A01A12TWS Bearing Cursor and Test Target Generator19A01A13TWS 2 Target Position Computer19A01A14TWS 1 Target Position Computer19A01A15TWS Clock and Range Ring Generator15A01A17TWS 1 Range and Bearing Window Generator19A01A18TWS 2 Range and Bearing Window Generator19A01A20I/O Storage Buffer14-Basic Panel9A04A05Radar Interface13A04A06Test Panel4A04A07Andatof Card A1)9A06A01Analog (Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)5A06A11Storage Register and Driver (Card A1)8A06A12Same as A019A06A13Reference and Quadrant Switching (Card A3)5A06A14Same as A019A06A27Same as A019A06A31Same as A019A06A32Same as A019A06A33Same as A019A06A34Same as A019A06A34Same as A019A06A35Same as A019A06A34Same as A0355A06A35Same as A0355A06A36Same as A0355	5 18182 5 18182 5 18182 6 7353 6 7357 4 5155 0 5263 8 6329 9 5025 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	56 56 56 142 137 216 197 197 100 201 201 201 146 113 279 175 61 60 3659 136 87	17857 17857 17857 7042 7299 4630 5076 5076 6250 4975 6849 8850 3584 5714 16393 16667 273
A01A07T/O 16-Bit 4 to 1 Multiplexer5A01A06T/O 16-Bit 4 to 1 Multiplexer5A01A07T/O 16-Bit 4 to 1 Multiplexer13A01A10Pit Log Interface12A01A12TWS Dearing Cursor and Test Target Generator19A01A13TWS 2 Target Position Computer19A01A14TWS 1 Target Position Computer19A01A15TWS Clock and Range Ring Generator15A01A17TWS 1 Range and Bearing Window Generator19A01A18TWS 2 Range and Bearing Window Generator19A01A18TWS 2 Range and Bearing Window Generator19A01A17TWS 1 Storage Buffer14-Basic Panel21A04A05Radar Interface13A04A06Test Panel4A05System Status (Control Panel)6A06A01Analog (Card A1)9A06A03Bridge (Card A2)8A06A03Bridge (Card A3)5A06A11Storage Register and Driver (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)6A06A13Reference and Quadrant Switching (Card A3)5A06A14Same as A019A06A27Same as A028A06A31Same as A035A06A32Same as A135A06A33Same as A135A06A34Same as A035A06A35As as as A335A06A34Same as A035A06A35Same as A135 <td>5 18182 5 18182 6 7353 6 7937 4 5155 0 5263 0 5263 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309</td> <td>56 56 142 137 216 197 197 160 201 146 113 279 175 61 60 3659 136 87</td> <td>17857 17857 7042 7299 4630 5076 6250 4975 4975 6849 8850 3584 5714 16393 16667 273</td>	5 18182 5 18182 6 7353 6 7937 4 5155 0 5263 0 5263 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	56 56 142 137 216 197 197 160 201 146 113 279 175 61 60 3659 136 87	17857 17857 7042 7299 4630 5076 6250 4975 4975 6849 8850 3584 5714 16393 16667 273
A01A06I/O 16-Bit 4 to 1 Multiplexer5A01A09I/O Test Interface13A01A12TWS Bearing Cursor and Test Target Generator19A01A12TWS 1 Target Position Computer19A01A13TWS 2 Target Position Computer19A01A14TWS 1 Target Position Computer19A01A15TWS Clock and Range Ring Generator19A01A16TWS 2 Range and Bearing Window Generator19A01A17TWS 1 Range and Bearing Window Generator19A01A20I/O Storage Buffer14-Basic Panel21A04A05Radar Interface13A04A06Test Panel40A05System Status (Control Panel)6A06A01Angle Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)5A06A11Storage Register and Driver (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)8A06A13Reference and Quadrant Switching (Card A3)5A06A14Same as A035A06A15Same as A019A06A17Same as A019A06A27Same as A118A06A31Same as A0355A06A32Same as A118A06A33Same as A0355A06A34Same as A0355A06A35Ane as A0355A06A36Same as A1355A06A37Bridge (Card A3)55A06A33Same as A13	5 18182 6 7353 6 7937 4 5155 0 5263 0 5263 9 5025 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	56 142 137 216 197 160 201 201 146 113 279 175 61 60 3659 136 87	17857 7042 7299 4630 5076 6250 4975 4975 6849 8850 3584 5714 16393 16667 273
A01A09I/O Test Interface13A01A10Pit Log Interface13A01A12TWS Bearing Cursor and Test Target Generator19A01A13TWS 2 Target Position Computer19A01A14TWS 1 Target Position Computer19A01A15TWS Clock and Range Ring Generator15A01A17TWS 1 Range and Bearing Window Generator19A01A18TWS 2 Range and Bearing Window Generator19A01A10I/O Storaça Buffer14-Basic Panel21A04A05Radar Interface13A04A06Test Panel44A04A05System Status (Control Panel)6A05System Status (Control Panel)6A06Upper Converter273A06A01Analog (Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)55A06A04Sindeg (Card A3)55A06A05Differential Amplifier4A06A01Reference and Quadrant Switching (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)6A06A13Rafe as A0288A06A14Same as A0355A06A15Power Amplifier (Card A4)33A06A16Same as A1355A06A27Same as A1355A06A38Same as A1466A06A31Same as A0355A06A32Same as A1355A06A33Same as A1355A06A34Same as A1	6 7353 6 7937 4 5155 0 5263 8 6329 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	142 137 216 197 197 160 201 201 146 113 279 175 61 60 3659 136 87	7042 7299 4630 5076 5076 6250 4975 6849 8850 3584 5714 16393 16667 273
A01A10Pit Log Interface12A01A12TWS Bearing Cursor and Test Target Generator19A01A13TWS 2 Target Position Computer19A01A14TWS 1 Target Position Computer19A01A15TWS Clock and Range Ring Generator19A01A17TWS 1 Range and Bearing Window Generator19A01A20I/O Storage Buffer14-Basic Panel9A04Mount and Status (Right Drawer)21A04A05Radar Interface13A04A06Test Panel4A05System Status (Control Panel)6A06Upper Converter273A06A01Analog (Card A1)9A06A03Bridge (Card A2)8A06A04Storage Register and Driver (Card A1)8A06A13Reference and Quadrant Switching (Card A3)5A06A14Same as A013A06A15Same as A018A06A17Same as A028A06A18Same as A019A06A17Same as A028A06A18Same as A0355A06A26Same as A0355A06A31Same as A0355A06A32Same as A0355A06A33Same as A0355A06A34Same as A0355A06A35Same as A1355A06A36Same as A1355A06A37Same as A1355A06A34Same as A1355A06A35Same as A1355	6 7937 4 5155 0 5263 0 5263 8 6329 9 5025 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	137 216 197 197 160 201 201 146 113 279 175 61 60 3659 136 87	7299 4630 5076 6250 4975 6649 8850 3584 5714 16393 16667 273
A01A12TWS Bearing Cursor and Test Target Generator19A01A13TWS 2 Target Position Computer19A01A14TWS 1 Target Position Computer19A01A15TWS Clock and Range Ring Generator15A01A17TWS 1 Range and Bearing Window Generator19A01A18TWS 2 Range and Bearing Window Generator19A01A20I/O Storage Buffer14-Basic Fanel9A04Mount and Status (Right Drawer)21A04A05Radar Interface13A04A06Test Panel4A05System Status (Control Panel)6A06Upper Converter273A06A01Analog (Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)5A06A04Storage Register and Driver (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)6A06A13Reference and Quadrant Switching (Card A3)5A06A14Same as A019A06A15Power Amplifier (Card A4)3A06A17Same as A118A06A26Same as A126A06A31Same as A135A06A33Same as A035A06A34Same as A035A06A35Same as A135A06A36Same as A135A06A37Same as A035A06A33Same as A035A06A34Same as A135A06A35Same as A135 <t< td=""><td>4 5155 0 5263 8 6329 9 5025 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309</td><td>216 197 197 160 201 146 113 279 175 61 60 3659 136 87</td><td>4630 5076 6250 4975 6849 8850 3584 5714 16393 16667 273</td></t<>	4 5155 0 5263 8 6329 9 5025 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	216 197 197 160 201 146 113 279 175 61 60 3659 136 87	4630 5076 6250 4975 6849 8850 3584 5714 16393 16667 273
A01A13TWS 2 Target Position Computer19A01A14TWS 1 Target Position Computer19A01A15TWS Clock and Range Ring Generator19A01A17TWS 1 Range and Bearing Window Generator19A01A18TWS 2 Range and Bearing Window Generator19A01A17TWS 1 Range and Bearing Window Generator19A01A18TWS 2 Range and Bearing Window Generator19A01A18TWS 2 Range and Bearing Window Generator19A01A18TWS 2 Range Buffer14-Basic Panel9A04Mount and Status (Right Drawer)21A04A05Radar Interface13A04A06Test Panel4A05System Status (Control Panel)6A06Upper Converter273A06A01Analog (Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)5A06A04Storage Register and Driver (Card A1)8A06A15Fourge Register and Driver (Card A1)9A06A16Same as A019A06A17Same as A028A06A18Same as A035A06A26Same as A118A06A31Same as A035A06A33Same as A035A06A33Same as A035A06A34Same as A135A06A35Analog (Card A1)9A06A36Same as A135A06A37Same as A135A06A33Same as A14 <td>0 5263 0 5263 8 6329 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309</td> <td>197 197 160 201 201 146 113 279 175 61 60 3659 136 87</td> <td>5076 5076 6250 4975 6849 8850 3584 5714 16393 16667 273</td>	0 5263 0 5263 8 6329 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	197 197 160 201 201 146 113 279 175 61 60 3659 136 87	5076 5076 6250 4975 6849 8850 3584 5714 16393 16667 273
A01A14TWS 1 Target Position Computer19A01A15TWS Clock and Range Ring Generator15A01A17TWS 1 Range and Bearing Window Generator19A01A18TWS 2 Range and Bearing Window Generator19A01A120I/O Storage Buffer14-Basic Panel9A04Mount and Status (Right Drawer)21A04A05Radar Interface13A04A06Test Panel4A05System Status (Control Panel)6A06A01Analog (Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)5A06A04Reference and Driver (Card A1)8A06A05Differential Amplifier4A06A11Storage Register and Driver (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)6A06A13Reference and Quadrant Switching (Card A3)5A06A14Same as A019A06A15Same as A019A06A16Same as A118A06A27Same as A135A06A33Same as A028A06A34Same as A035A06A35Same as A019A06A36Same as A019A06A37Same as A028A06A33Same as A035A06A34Same as A035A06A35Same as A035A06A36Same as A136A06A37Bridge (Card A3)5A06A38Same as A13 <t< td=""><td>0 5263 8 6329 9 5025 9 5025 0 7143 10526 7692 6 21739 0 16667 2 366 7 10309</td><td>197 160 201 201 146 113 279 175 61 60 3659 136 87</td><td>5076 6250 4975 6849 8850 3584 5714 16393 16667 273</td></t<>	0 5263 8 6329 9 5025 9 5025 0 7143 10526 7692 6 21739 0 16667 2 366 7 10309	197 160 201 201 146 113 279 175 61 60 3659 136 87	5076 6250 4975 6849 8850 3584 5714 16393 16667 273
A01A15TWS Clock and Range Ring Generator15A01A17TWS 1 Range and Bearing Window Generator19A01A20T/O Storage Buffer14-Basic Panel9A04Mount and Status (Right Drawer)21A04A05Radar Interface13A04A06Test Panel4A05System Status (Control Panel)6A06Upper Converter273A06A01Analog (Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)5A06A04Storage Register and Driver (Card A1)8A06A11Storage Register and Driver (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)6A06A13Reference and Quadrant Switching (Card A3)5A06A15Power Amplifier (Card A4)3A06A16Same as A028A06A17Same as A019A06A26Same as A118A06A27Same as A126A06A33Same as A019A06A34Same as A028A06A35Same as A0355A06A36Same as A135A06A37Same as A0355A06A38Same as A0355A06A33Same as A0355A06A34Same as A0355A06A35Same as A0355A06A36Same as A1355A06A37Bridge (Card A3)55A06A38Same as A1355A06A34 </td <td>8 6329 9 5025 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309</td> <td>160 201 201 146 113 279 175 61 60 3659 136 87</td> <td>6250 4975 6849 8850 3584 5714 16393 16667 273</td>	8 6329 9 5025 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	160 201 201 146 113 279 175 61 60 3659 136 87	6250 4975 6849 8850 3584 5714 16393 16667 273
A01A17TWS 1 Range and Bearing Window Generator19A01A18TWS 2 Range and Bearing Window Generator19A01A20I/O Storage Buffer14-Basic Panel9A04Mount and Status (Right Drawer)21A04A05Radar Interface13A04A06Test Panel4A05System Status (Control Panel)6A06Upper Converter273A06A01Analog (Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)5A06A04Storage Register and Driver (Card A1)8A06A11Storage Register and Driver (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)6A06A15Power Amplifier (Card A4)3A06A16Same as A019A06A27Same as A028A06A31Same as A035A06A32Same as A135A06A33Same as A135A06A34Same as A019A06A35Analog (Card A1)9A06A36Same as A028A06A37Same as A035A06A33Same as A035A06A34Same as A035A06A35Analog (Card A1)9A06A36Same as A135A06A37Bridge (Card A3)5A06A33Same as A035A06A34Same as A135A06A35Analog (Card A1)9A06A46Same as A13<	9 5025 9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	201 201 146 113 279 175 61 60 3659 136 87	4975 4975 6849 8850 3584 5714 16393 16667 273
A01A18TWS 2 Range and Bearing Window Generator19A01A20I/O Storage Buffer14-Basic Panel9A04Mount and Status (Right Drawer)21A04A05Radar Interface13A04A06Test Panel4A05System Status (Control Panel)6A06Upper Converter273A06A01Analog (Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)5A06A04Strage Register and Driver (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)6A06A13Reference and Quadrant Switching (Card A3)5A06A15Power Amplifier (Card A4)3A06A16Same as A019A06A17Same as A028A06A30Same as A118A06A31Same as A126A06A32Same as A135A06A33Same as A035A06A34Same as A035A06A35Analog (Card A1)9A06A36Logic (Card A2)8A06A37Bridge (Card A3)5A06A33Same as A035A06A34Same as A126A06A35Analog (Card A1)9A06A36Logic (Card A2)8A06A37Bridge (Card A3)5A06A36Same as A035A06A37Bridge (Card A3)5A06A41Same as A126A06A41Same as A135 <td>9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309</td> <td>201 146 113 279 175 61 60 3659 136 87</td> <td>4975 6849 8850 3584 5714 16393 16667 273</td>	9 5025 0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	201 146 113 279 175 61 60 3659 136 87	4975 6849 8850 3584 5714 16393 16667 273
A01A20I/O Storage Buffer14-Basic Panel9A04Mount and Status (Right Drawer)21A04A05Radar Interface13A04A06Test Panel4A05System Status (Control Panel)6A06Upper Converter273A06A01Analog (Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)5A06A04Storage Register and Driver (Card A1)8A06A11Storage Register and Driver (Card A1)8A06A12Bridge, Sine-Cosine (Card A2)6A06A13Reference and Quadrant Switching (Card A3)3A06A16Same as A019A06A17Same as A028A06A28Same as A118A06A31Same as A135A06A32Same as A135A06A33Same as A035A06A34Same as A035A06A35Analog (Card A1)9A06A36Logic (Card A2)8A06A37Same as A135A06A38Same as A035A06A39Bridge (Card A3)5A06A31Same as A035A06A35Analog (Card A1)9A06A36Logic (Card A2)8A06A33Same as A035A06A34Same as A035A06A35Analog (Card A3)5A06A36Logic (Card A2)8A06A37Bridge (Card A3)5 <td< td=""><td>0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309</td><td>146 113 279 175 61 60 3659 136 87</td><td>6849 8850 3584 5714 16393 16667 273</td></td<>	0 7143 5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	146 113 279 175 61 60 3659 136 87	6849 8850 3584 5714 16393 16667 273
-Basic Panel9A04Mount and Status (Right Drawer)21A04A05Radar Interface13A04A06Test Panel4A05System Status (Control Panel)6A06Upper Converter273A06A01Analog (Card A1)9A06A02Logic (Card A2)8A06A03Bridge (Card A3)5A06A04Differential Amplifier4A06A12Bridge, Sine-Cosine (Card A2)6A06A13Reference and Quadrant Switching (Card A3)5A06A15Power Amplifier (Card A4)3A06A16Same as A019A06A17Same as A028A06A26Same as A118A06A31Same as A118A06A32Same as A135A06A33Same as A033A06A33Same as A033A06A34Same as A039A06A35Analog (Card A1)9A06A33Same as A033A06A34Same as A035A06A35Same as A035A06A36Logic (Card A2)8A06A37Bridge (Card A3)5A06A34Same as A118A06A42Same as A135A06A43Same as A135A06A44Same as A148A06A45Same as A153A06A46Same as A035A06A45Same as A035A06A45Same as A035A06	5 10526 5 4651 0 7692 6 21739 0 16667 2 366 7 10309	113 279 175 61 60 3659 136 87	8850 3584 5714 16393 16667 273
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A06A01 Analog (Card A1) 99 A06A02 Logic (Card A2) 88 A06A03 Bridge (Card A3) 55 A06A03 Bridge (Card A3) 55 A06A03 Differential Amplifier 44 A06A11 Storage Register and Driver (Card A1) 88 A06A12 Bridge, Sine-Cosine (Card A2) 66 A06A13 Reference and Quadrant Switching (Card A3) 55 A06A15 Power Amplifier (Card A4) 33 A06A16 Same as A01 99 A06A17 Same as A02 88 A06A18 Same as A01 99 A06A26 Same as A11 88 A06A27 Same as A12 66 A06A31 Same as A03 55 A06A32 Same as A03 55 A06A33 Same as A03 55 A06A33 Same as A03 55 A06A33 Same as A03 55 A06A35 Analog (Card A1) 99 A06A37 Bridge (Card A3) 5	7 10309	136 87	
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A06A13 Reference and Quadrant Switching (Card A3) 5 A06A15 Power Amplifier (Card A4) 33 A06A16 Same as A01 99 A06A17 Same as A02 8 A06A18 Same as A03 55 A06A26 Same as A03 55 A06A27 Same as A11 8 A06A28 Same as A12 66 A06A30 Same as A13 55 A06A30 Same as A13 33 A06A31 Same as A01 99 A06A32 Same as A02 8 A06A33 Same as A03 55 A06A34 Same as A03 55 A06A35 Analog (Card A1) 99 A06A36 Logic (Card A2) 8 A06A37 Bridge (Card A3) 55 A06A41 Same as A12 66 A06A42 Same as A13 55 A06A43 Same as A13 55 A06A45 Same as A15 33 A06A45 Same as A03 </td <td>1 12346</td> <td>87</td> <td>11494</td>	1 12346	87	11494
A06A15 Power Amplifier (Card A4) 3 A06A16 Same as A01 99 A06A17 Same as A02 8 A06A18 Same as A03 5 A06A18 Same as A03 5 A06A26 Same as A11 8 A06A27 Same as A12 6 A06A30 Same as A13 5 A06A31 Same as A13 3 A06A32 Same as A02 8 A06A33 Same as A02 8 A06A34 Same as A02 8 A06A35 Analog (Card A1) 9 A06A36 Logic (Card A2) 8 A06A37 Bridge (Card A3) 5 A06A36 Logic (Card A2) 8 A06A37 Bridge (Card A3) 5 A06A41 Same as A11 8 A06A42 Same as A12 6 A06A43 Same as A15 3 A06A45 Same as A01 9 A06A45 Same as A02 8	5 15385	107	9346
A06A16 Same as A01 99 A06A17 Same as A02 8 A06A18 Same as A03 55 A06A26 Same as A03 55 A06A27 Same as A11 8 A06A28 Same as A12 66 A06A28 Same as A13 55 A06A30 Same as A13 53 A06A31 Same as A01 99 A06A32 Same as A02 88 A06A33 Same as A03 55 A06A33 Same as A03 55 A06A34 Logic (Card A1) 99 A06A35 Analog (Card A2) 88 A06A36 Logic (Card A2) 80 A06A37 Bridge (card A3) 55 A06A43 Same as A11 80 A06A43 Same as A12 66 A06A43 Same as A13 55 A06A45 Same as A15 33 A06A45 Same as A03 55 A06A46 Same as A02 88	8 17241	71	14085
N06A17 Same as A02 8 N06A18 Same as A03 55 N06A26 Same as A11 88 N06A27 Same as A12 66 N06A28 Same as A12 67 N06A30 Same as A13 55 N06A31 Same as A01 97 N06A32 Same as A01 97 N06A33 Same as A02 88 N06A34 Same as A03 55 N06A35 Analog (Card A1) 97 N06A36 Logic (Card A2) 88 N06A37 Bridge (Card A3) 55 N06A41 Same as A12 66 N06A42 Same as A13 55 N06A43 Same as A12 66 N06A43 Same as A13 55 N06A43 Same as A15 33 N06A44 Same as A01 98 N06A45 Same as A02 88 N06A46 Same as A03 55 N06A47 Same as A03 55 <tr< td=""><td>4 29412</td><td>56</td><td>17857</td></tr<>	4 29412	56	17857
A06A18 Same as A03 5 A06A26 Same as A11 8 A06A27 Same as A12 6 A06A28 Same as A13 5 A06A30 Same as A13 3 A06A31 Same as A01 9 A06A32 Same as A02 8 A06A33 Same as A02 8 A06A34 Same as A03 5 A06A35 Analog (Card A1) 9 A06A36 Logic (Card A2) 8 A06A37 Bridge (Card A3) 5 A06A41 Same as A11 8 A06A42 Same as A12 6 A06A43 Same as A13 5 A06A43 Same as A13 5 A06A45 Same as A15 3 A06A45 Same as A01 9 A06A47 Same as A02 8 A06A46 Same as A03 55 A06A47 Same as A03 55 A06A46 Same as A03 55 A06A	7 10309	136	7353
A06A26 Same as Al1 8 A06A27 Same as Al2 6 A06A28 Same as Al3 5 A06A30 Same as Al3 3 A06A31 Same as Al5 3 A06A32 Same as A02 8 A06A33 Same as A02 8 A06A34 Same as A02 8 A06A35 Analog (Card Al) 9 A06A36 Logic (Card A2) 8 A06A37 Bridge (Card A3) 5 A06A37 Bridge (Card A3) 5 A06A37 Bridge as Al1 8 A06A37 Bridge as Al2 6 A06A43 Same as Al3 5 A06A43 Same as Al3 5 A06A45 Same as Al3 5 A06A45 Same as A01 9 A06A47 Same as A02 8 A06A46 Same as A03 5 A06A46 Same as A03 5 A06A46 Same as A03 5 <t< td=""><td>1 12346</td><td>87</td><td>11494</td></t<>	1 12346	87	11494
A06A27 Same as A12 6 A06A28 Same as A13 5 A06A30 Same as A13 3 A06A31 Same as A01 9 A06A32 Same as A02 8 A06A33 Same as A03 5 A06A35 Analog (Card A1) 9 A06A36 Logic (Card A2) 8 A06A37 Bridge (Card A3) 5 A06A43 Same as A12 6 A06A43 Same as A12 6 A06A43 Same as A13 5 A06A43 Same as A13 5 A06A43 Same as A13 5 A06A43 Same as A15 33 A06A44 Same as A15 3 A06A45 Same as A01 9 A06A46 Same as A02 8 A06A47 Same as A02 8 A06A46 Same as A03 5 A06A47 Same as A03 5 A06A46 Same as A03 5 A06A48		102	9804
A06A28 Same as A13 5 A06A30 Same as A15 33 A06A31 Same as A01 99 A06A32 Same as A02 8 A06A33 Same as A02 8 A06A33 Same as A02 9 A06A33 Same as A02 8 A06A33 Same as A02 8 A06A35 Analog (Card A1) 9 A06A36 Logic (Card A2) 8 A06A37 Bridge (Card A3) 5 A06A41 Same as A11 8 A06A42 Same as A12 6 A06A43 Same as A13 5 A06A45 Same as A15 33 A06A46 Same as A01 9 A06A46 Same as A02 8 A06A47 Same as A03 55 A06A48 Same as A03 55 A06A51 Same as A35 9 A06A51 Same as A36 8		87	11494
A06A30 Same as A15 3 A06A31 Same as A01 9 A06A32 Same as A02 8 A06A33 Same as A02 8 A06A33 Same as A03 5 A06A35 Analog (Card A1) 9 A06A36 Logic (Card A2) 8 A06A37 Bridge (Card A3) 5 A06A41 Same as A11 8 A06A42 Same as A12 6 A06A43 Same as A13 5 A06A43 Same as A13 5 A06A45 Same as A10 9 A06A46 Same as A01 9 A06A47 Same as A02 8 A06A47 Same as A03 55 A06A47 Same as A03 55 A06A48 Same as A03 55 A06A51 Same as A35 9 A06A51 Same as A36 8		107	9346
A06A31 Same as A01 99 A06A32 Same as A02 88 A06A33 Same as A03 55 A06A33 Same as A03 55 A06A35 Analog (Card A1) 9 A06A36 Logic (Card A2) 88 A06A37 Bridge (Card A3) 55 A06A41 Same as A11 88 A06A42 Same as A12 66 A06A43 Same as A13 55 A06A45 Same as A13 59 A06A45 Same as A15 33 A06A46 Same as A01 99 A06A47 Same as A02 88 A06A46 Same as A03 55 A06A47 Same as A03 55 A06A48 Same as A03 55 A06A50 Same as A35 99 A06A51 Same as A36 88		71	14085
A06A32 Same as A02 8 A06A33 Same as A03 55 A06A35 Analog (Card Al) 9 A06A36 Logic (Card Al) 9 A06A37 Bridge (Card A3) 5 A06A37 Bridge (Card A3) 5 A06A41 Same as Al1 8 A06A42 Same as Al2 6 A06A43 Same as Al3 5 A06A45 Same as Al3 9 A06A46 Same as A01 9 A06A47 Same as A02 8 A06A48 Same as A03 5 A06A48 Same as A03 9 A06A50 Same as A35 9 A06A51 Same as A36 8		56	17857
A06A33 Same as A03 5 A06A35 Analog (Card A1) 9 A06A36 Logic (Card A2) 8 A06A37 Bridge (Card A3) 5 A06A41 Same as A11 8 A06A42 Same as A12 6 A06A43 Same as A13 5 A06A44 Same as A13 3 A06A45 Same as A13 9 A06A45 Same as A10 9 A06A46 Same as A01 9 A06A47 Same as A01 9 A06A48 Same as A03 5 A06A48 Same as A03 5 A06A50 Same as A35 9 A06A51 Same as A36 8		136	7353
A06A35 Analog (Card Al) 9 A06A36 Logic (Card A2) 8 A06A37 Bridge (Card A2) 8 A06A37 Bridge (Card A3) 5 A06A41 Same as Al1 8 A06A42 Same as Al2 6 A06A43 Same as Al3 5 A06A45 Same as Al3 5 A06A45 Same as A01 9 A06A46 Same as A02 8 A06A47 Same as A03 5 A06A48 Same as A03 5 A06A50 Same as A35 9 A06A51 Same as A36 8	and a second sec	87	11494
A06A36 Logic (Card A2) 8 A06A37 Bridge (Card A3) 5 A06A41 Same as A11 8 A06A42 Same as A12 6 A06A43 Same as A12 6 A06A43 Same as A13 5 A06A45 Same as A13 9 A06A46 Same as A01 9 A06A47 Same as A02 8 A06A48 Same as A03 5 A06A50 Same as A35 9 A06A51 Same as A36 8		102	9804
A06A37 Bridge (Card A3) 5 A06A41 Same as Al1 8 A06A42 Same as Al2 6 A06A43 Same as Al3 5 A06A44 Same as Al3 5 A06A45 Same as Al3 3 A06A46 Same as A01 9 A06A47 Same as A02 8 A06A48 Same as A03 5 A06A50 Same as A35 9 A06A51 Same as A36 8		132	7576
A06A41 Same as Al1 8 A06A42 Same as Al2 66 A06A43 Same as Al3 5 A06A43 Same as Al3 5 A06A45 Same as Al3 5 A06A46 Same as A01 9 A06A46 Same as A01 9 A06A47 Same as A02 8 A06A48 Same as A03 5 A06A50 Same as A35 9 A06A51 Same as A36 8		87	11494
A06A42 Same as A12 6 A06A43 Same as A13 5 A06A45 Same as A13 3 A06A45 Same as A15 3 A06A46 Same as A01 9 A06A47 Same as A02 8 A06A48 Same as A03 5 A06A50 Same as A35 9 A06A51 Same as A36 8		102	9804
A06A43 Same as A13 5 A06A45 Same as A15 3 A06A46 Same as A01 9 A06A47 Same as A02 8 A06A48 Same as A03 5 A06A50 Same as A35 9 A06A51 Same as A36 8		87	11494
A06A45 Same as A15 3 A06A46 Same as A01 9 A06A47 Same as A02 8 A06A48 Same as A03 5 A06A50 Same as A35 9 A06A51 Same as A36 8		107	9346
A06A46 Same as A01 9 A06A47 Same as Λ02 8 A06A48 Same as A03 5 A06A50 Same as A35 9 A06A51 Same as A36 8	A CONTRACT NO. 1	71	14085
A06A47 Same as A02 8 A06A48 Same as A03 5 A06A50 Same as A35 9 A06A51 Same as A36 8		56	17857
A06A48 Same as A03 55 A06A50 Same as A35 99 A06A51 Same as A36 8		136	7353
A06A50 Same as A35 9 A06A51 Same as A36 8		87	11494
A06A51 Same as A36 8		102	9804
		132	7576
AUDAD2 Same as AJ/ 5		87	11494
	and the second sec	102	4804
	1 12346	87	11494
	5 15385	107	9346
	8 17241 4 29412	71 56	14085
A07 Computer H316R 54		540	1852
Main Frame with 4K Memory 35	0 1852	351	2849
		98	10204
	2849	58	17241
A08 Lower Converter 273 (Same Summary as A06)		3659	27:

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