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RELIABILITY, AVAILABILITY, MAINTAINABILITY DATA TRACKING PLAN IMPROVED GUARDRAIL V

June 1982

Prepared for
PRODUCT MANAGER
SPECIAL ELECTRONIC MISSION AIRCRAFT
ST. LOUIS, MISSOURI
under Contract DAAB07-78-A-6606-2V14

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The objective of the IGRV RAM Tracking Plan is to provide continuous visibility of fielded equipment RAM performance to permit the PM SEMA to determine failure patterns, identify the necessity for in-depth engineering investigations, and assess the desirability of pursuing RAM improvement measures. The plan is designed to be consistent with the requirements contained in the Reliability, Availability, Maintainabity Program Plan for Improved GUARDRAIL V. This IGRV RAM Tracking Plan defines the responsibilities, procedures, resources, and schedules necessary to develop, implement, & maintain a RAM audit trail during the life of the system.

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by,

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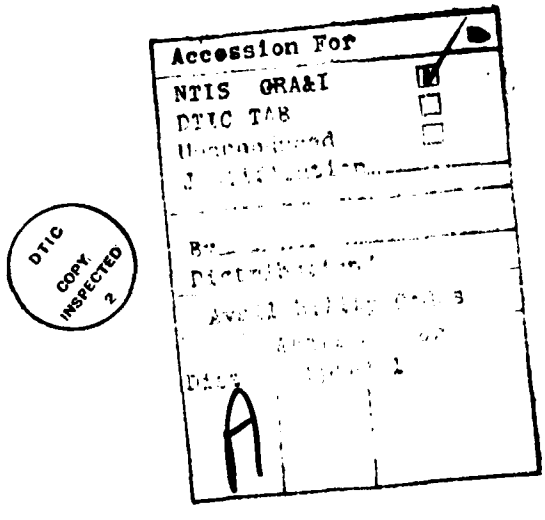

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

The Product Manager, Special Electronic Mission Aircraft (PM SEMA), today has cognizance over three GUARDRAIL V (GR-V) systems operating in the field. A review of the reliability, availability, and maintainability (RAM) information available to PM SEMA related to the existing GR-V systems showed deficiencies in the quantity and quality of data necessary to adequately describe and evaluate RAM performance. The primary data presented to PM SEMA relate to operational availability (full mission capable, partial mission capable, and not mission capable) for the RU-21H airborne platform only. These data are taken from DA Forms 1352, submitted monthly by each GR-V unit. Specifically lacking are RAM data relative to the other three major GR-V subsystems: the Remote Radio Receiving Set, AN/ARW-83, called the ARF; the Surveillance Information Processing Center, AN/TSQ-105, called the IPF; and the Flight Line Test Set, AN/ARM-163, called the AGE Van. This RAM Data Tracking Plan has been developed to rectify that situation for the Improved GUARDRAIL V System (IGRV).

1.2 OBJECTIVE

The objective of the IGRV RAM Tracking Plan is to provide continuous visibility of fielded equipment RAM performance to permit the PM SEMA to determine failure patterns, identify the necessity for in-depth engineering investigations, and assess the desirability of pursuing RAM improvement measures. The plan is designed to be consistent with the requirements contained in the Reliability, Availability, Maintainability Program Plan for Improved GUARDRAIL V (Appendix A to the "RAM Program Plan for SEMA Systems," dated February 1981) and is specifically designed for the collection and analysis of RAM data on fielded, operational IGRV systems.

1.3 PURPOSE

This IGRV RAM Tracking Plan defines the responsibilities, procedures, resources, and schedules necessary to develop, implement, and maintain a RAM audit trail throughout the operational life of the system.

1.4 SCOPE

This document describes the PM SEMA RAM tracking plan for fielded operational IGRV systems, which includes the Remote Radio Receiver Set, AN/ARW-83; the RC-12D aircraft; the Surveillance Information Processing Center, AN/TSQ-105; and the Flight Line Test Set, AN/ARM-163. Details specifying the IGRV system and subsystems to be tracked are contained in Chapter Two and Annex A of this document.

Certain IGRV subsystems and ancillary equipment fall under the responsibility and tracking of product managers other than PM SEMA. In order to avoid duplicate reporting procedures, those subsystems are excluded from this plan. The specific subsystems and associated equipment that will not be tracked include the aircraft survivability equipment (ASE), common power generator sets (100 kW, 60 Hz and 60 kW, 60 Hz), and common ground handling equipment associated with the aircraft and IPFs. However, mission-critical Government furnished equipment (GFE), such as wide-band data link, cryptographic equipment, and UHF transceivers, will be tracked (even though they fall under the cognizance of other product managers).

The RC-12D aircraft, including its core avionics, antennas, and inertial navigation system (INS), will be maintained by Beech Aircraft Service, Incorporated (BASI), under a separate service contract. While the mission-critical INS will be tracked under this plan, the RC-12D will be tracked only as an entire subsystem. RAM performance of RC-12D LRUs will fall under the responsibility of the BASI maintenance contract.

1.5 IMPLEMENTATION

This plan is designed for implementation in two phases. The initial phase will involve the collection and analysis of organizational, direct support, and general support levels of RAM data maintained by the IGRV units. The primary purpose of this phase will be to provide RAM performance information for LRUs and their parent systems. Analysis of RAM data at this level will determine the need for selective implementation of the second phase.

The second phase of this plan would be implemented to provide intensive analysis of particular problem line replaceable units (LRUs) identified under the phase-one tracking. It involves the collection and analysis of maintenance data (to the removed-component level) from off-site maintenance facilities. Depending on the particular LRU being investigated, the off-site facilities could include Army, Air Force, and commercial general support and depot facilities. Collection of the requisite data necessitates individual data gathering agreements with each maintenance facility and may involve contractual funding as dictated by various commercial vendors. In view of the complexities involved with implementing phase two, only phase one should be implemented initially, and phase two should be used on a selective basis at the discretion of the PM SEMA.

The schedule for implementation of this plan is provided in Annex D. The plan can be tested on existing GR-V systems to evaluate data accuracies and address problems before IGRV is fielded. The plan may be adopted for continuing use with fielded GR-V systems.

1.6 PLAN ORGANIZATION

This plan was prepared in accordance with AR 702-3 and Appendix A (dated February 1982) to the "RAM Program Plan for SEMA Systems," dated 16 February 1981. This plan consists of five chapters:

- Chapter One, Introduction
- Chapter Two, Improved GUARDRAIL V (IGRV) System Description
- Chapter Three, RAM Tracking Parameters
- Chapter Four, RAM Data Collection Process
- Chapter Five, RAM Data Analysis

Annex A of this plan contains a baseline of IGRV system equipments and a detailed breakout of the IGRV system LRUs by part/model number. Overall IGRV program and RAM management points of contact are identified in Annex B. Annex C contains a partial list of applicable RAM standards, directives, and other documents. Annex D provides an implementation schedule, and Annex E describes the maintenance data collection forms.

CHAPTER TWO

IMPROVED GUARDRAIL V SYSTEM DESCRIPTION

2.1 SYSTEM BACKGROUND

IGRV is the latest in a series of U.S. Army airborne intelligence-collection systems dating back to 1974. Originally conceived as a Quick Reaction Capability (QRC) effort by Electromagnetic System Laboratory (ESL), Inc., Sunnyvale, California, three different versions (GR-IIA, GR-IV, GR-V) have been fielded in Europe, the Far East, and in the continental United States (CONUS). There are currently three GR-V systems operating in the field, installed in RU-21H turboprop aircraft and using UHF encrypted command and data links. The other versions of the system have been dismantled. IGRV, a product improvement to GR-V, will be developed according to system specifications similar to those of GR-V and use some identical or modified GR-V equipment. Two or more new systems will be built.

2.2 OPERATIONAL SCOPE

Improved GUARDRAIL V is an Army tactical communications intercept and direction-finding system. The fielded system will consist of six RC-12D aircraft per IGRV unit, each including an AN/ARW-83 (ARF); a ground processor, AN/TSQ-105 (IPF); a vehicle-mounted preflight test set, AN/ARM-163 (AGE Van); and other associated test and maintenance equipment. GUARDRAIL is designated as a corps intelligence asset, and is designed to provide a surveillance capability over a corps front of approximately 150 kilometers. It is expected to perform its mission day or night and in any location and climate where any other corps aviation asset could normally operate.

Under the present operational concept, the Improved GUARDRAIL V System would normally operate with two airborne Beech RC-12D mission aircraft with interfaces with the ground processing facility through a Ku-band microwave data link subsystem. It would communicate with the tactical commander via encrypted UHF voice and teleprinter radio links; see Figure 2-1 for details of the total system concept.

The IGRV will provide the following operational modes:

(A) General Search - the system will map the desired electromagnetic environment to generate an electronic order of battle (EOB).

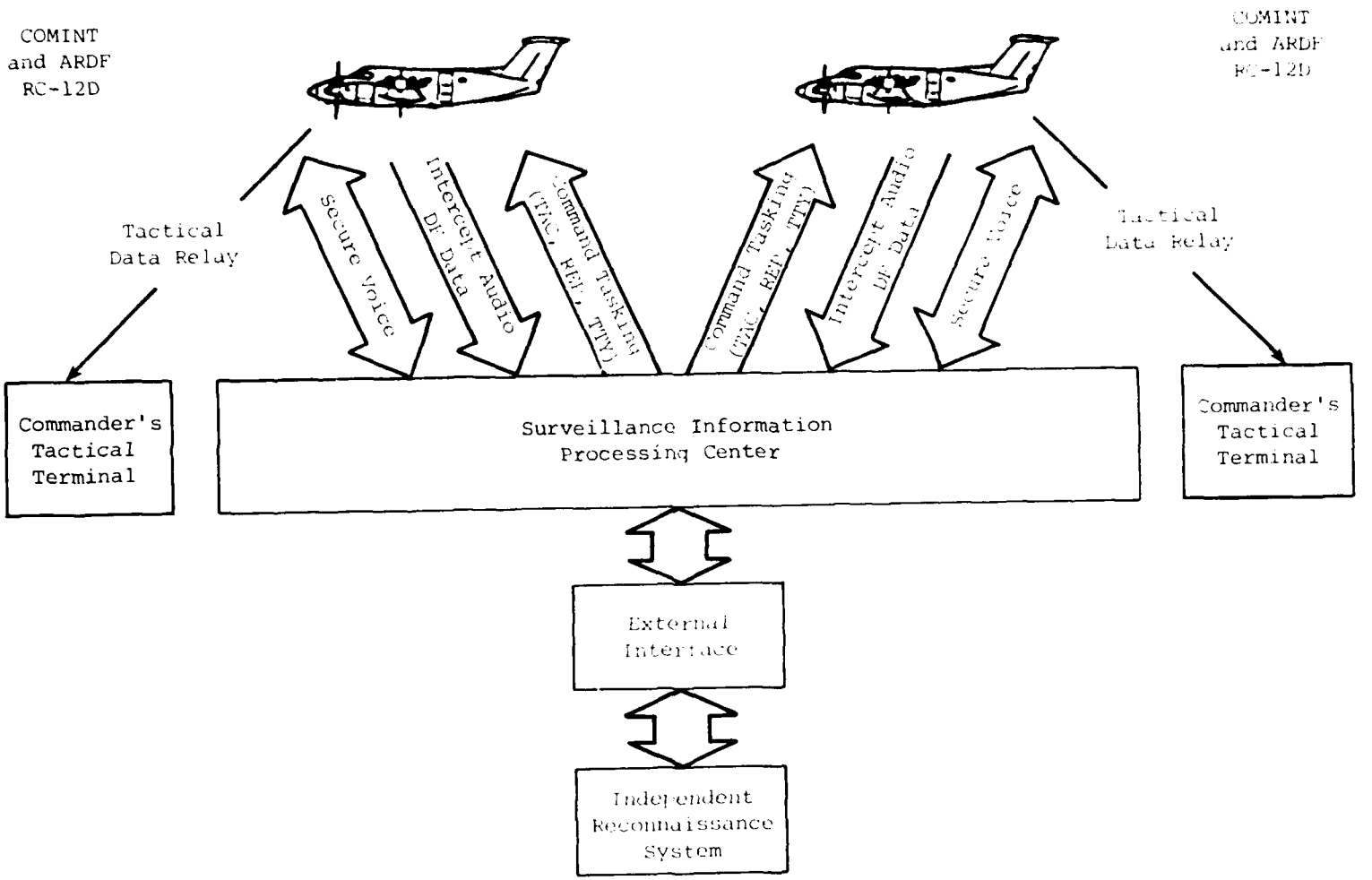

Figure 2-1. IMPROVED GUARDRAIL V SYSTEM CONCEPT

(B) Programmed Search - IGRV will search for known emitters on unknown frequencies.

(C) Directed Search - the system will search for known signals on predetermined frequencies.

After collection and processing in the associated ground facility, the data are then passed over encrypted UHF data links to the tactical commander for near real-time use. Although the time committed to each of the above operational modes may vary according to the tactical situation, the overall concept of system operation should not vary between peacetime and wartime; however, the number of missions would probably increase dramatically as indications of the imminence of hostilities increase.

2.3 BASIC SYSTEM EQUIPMENT DESCRIPTIONS

For RAM management and analysis purposes, the Improved GUARDRAIL V system has been segmented into a number of functional subsystems as shown in Figure 2-2.

- RC-12D Aircraft. This is a modified Beechcraft C-12 aircraft that carries the Remote Radio Receiver Set, AN/ARW-83.
- Remote Radio Receiver Set, AN/ARW-83. The ARF consists of the special electronic mission equipment.
- Surveillance Information Processing Center, AN/TSQ-105. The IPF provides ARF remote control, data processing capabilities, and intelligence information reporting means. It is housed in four trailer-mounted vans.
- Flight Line Test Set, AN/ARM-163. The AGE Van is the ground support equipment used to test the ARF prior to mission flights and to troubleshoot system faults.

Each of these major subsystems has a number of system functions embedded within it for system analysis purposes.

Note: The presently deployed GR-V system contains many commander's tactical terminals (CTT, AN/TSC-87), which will be interoperable with the IGRV system. For the purposes of this RAM Data Tracking Plan, they will not be considered as part of the IGRV system since they do not belong to the IGRV unit. They are to be operated and maintained by the units to which they are assigned.

2.3.1 RC-12D Aircraft

Contained within the RC-12D are the following subsystem equipments:

- The RC-12D aircraft platform, including the basic airframe, powerplants, power generators, instruments, and antennas

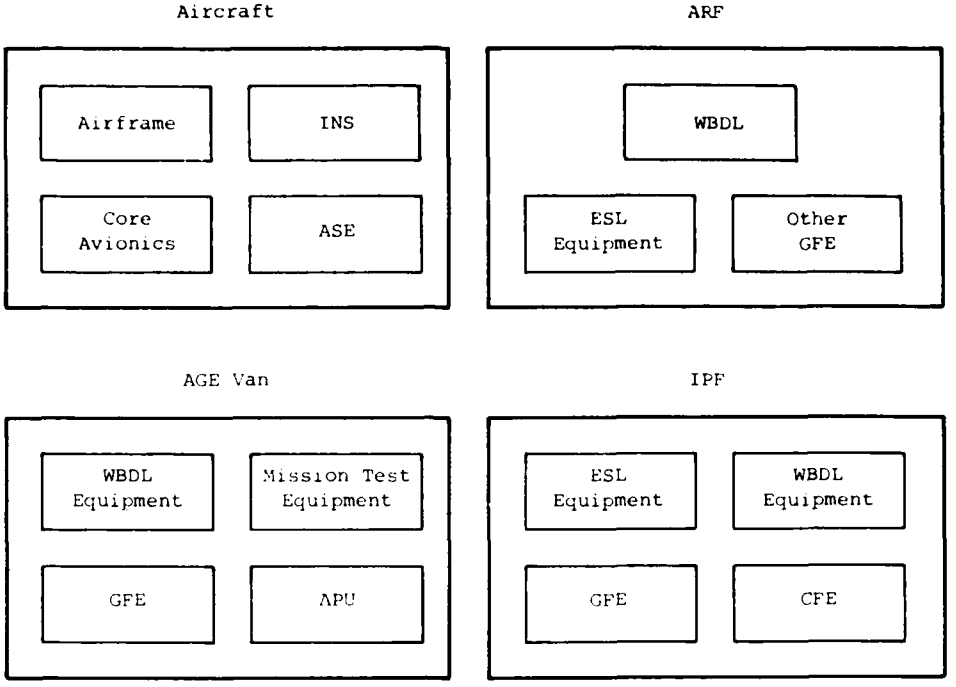

Figure 2-2. IMPROVED GUARDRAIL V SYSTEM

- The RC-12D aircraft's core avionics, including navigation equipment (DME, VOR, TACAN, etc.), aircraft radios, autopilot/flight director, and navigation radar
- Aircraft survivability equipment (ASE), including radar warning receivers (AN/APR-39, AN/APR-44); laser, optical, and missile warning receivers; M-130 chaff/flare dispenser; engine exhaust IR suppressors; low reflectance IR paint; and optional electronic countermeasures (ECM) equipment
- A new improved inertial navigation system (INS - Carousel IV), including the navigation computer, inertial measurement unit, and associated interface units

2.3.2 Remote Radio Receiver Set

Contained within the ARF are the following subsystem equipments:

- Wide-band data link (WBDL), including traveling wave tube amplifier (TWTA), mux/demux equipment, microwave receivers, antenna controllers, etc. This equipment is being developed by the U.S. Air Force and will be Government furnished equipment for the IGRV system.

- ESL special electronic mission equipment, including intercept receivers, direction-finding receivers, digital processor, DF controller, spectrum display converters, automatic signal search and recognition equipment, and status display equipment.
- Other GFE, including KY and KG series encryption equipment, receiver filters, UHF link transceivers, and regenerative repeaters.

2.3.3 Surveillance Information Processing Center

Contained within the IPF are the following subsystem equipments:

- ESL equipment, including command and control equipment, signal processing equipment, display and analysis equipment, intercommunication/signal data distribution equipment, built-in test and calibration test equipment.
- Wide-band data link equipment, including Ku-band tracker trailers and associated microwave processing equipment, receivers, and baseband processing equipment.
- GFE, including KY/KG series encryptors/decryptors, voice tape recorders, UHF/VHF and FM transceivers, master analog system time equipment, and multichannel demodulators.
- Other contractor furnished equipment (CFE), including computer and peripheral equipment, display units, environment control equipment, radio frequency filters, test antennas, and trailer-mounted vans.

2.3.4 Flight Line Test Set

Contained within the AGE Van (a heavy duty step-van vehicle to provide mobility) are the following subsystem equipments:

- Wide-band data link equipment
- Other GFE equipment such as UHF transceivers and KG/KY series encryptors/decryptors
- Microprocessor-controlled airborne mission test equipment
- Special display equipment for equipment preflight check-out
- A self-contained auxiliary power unit (APU)

2.3.5 Other Equipment

Several other items of equipment are supplied as part of the basic IGRV system, but will not be included in the RAM data tracking system. They fall under the cognizance of other PMs in various commands and data can be obtained from the PMs as required. These equipments are as follows:

- Three equipment storage/repair vans
- Five 100 kW, 60 Hz generator sets

- Two 60 kW, 60 Hz generator sets
- One log periodic antenna test/calibration antenna

2.4 DETAILED EQUIPMENT LIST

A detailed list of LRUs with part/model number for the ARF, IPF, and AGE Van is contained in Annex A. A list of LRUs for the RC-12D will be developed when the design is complete. Under present design criteria there are 39 LRUs in each ARF subsystem (six ARFs per IGRV unit), 110 LRUs in the IPF subsystem (one IPF per IGRV unit), and 28 LRUs in the AGE Van subsystem (one van per IGRV unit).

CHAPTER THREE

RAM TRACKING PARAMETERS

3.1 BACKGROUND

The selection of parameters to adequately portray the RAM characteristics of the IGRV system must be tailored to accommodate the system/subsystem design and to minimize the impact on existing data collection procedures. The parameters selected for this collection system are consistent with the above criteria. Since several types of RAM parameters are in common use today and the requirements and techniques for their computation vary, the following paragraphs define the specific parameters, data elements, and equations of interest.

3.2 RELIABILITY

The normal quantitative measure of reliability is mean time between failures (MTBF). MTBF is defined for a particular interval of time. It is the result of dividing the total functioning life of a population of an item by the total number of failures within the population during the measurement interval. This definition holds for time, cycles, miles, events, or any other measure of life units. Of primary interest to the IGRV system managers is mean time between operational mission failures (MTBOMF). This parameter will be computed for the entire system and for each of the four subsystems: RC-12D, ARF, IPF, and AGE Van.

$$\text{MTBOMF} = \frac{\text{Total Operating Time All Systems/Subsystems}}{\text{Number of Operational Mission Failures}} = \frac{\text{TOT}_s}{\text{NU}}$$

Of secondary interest to the overall IGRV system but required for individual LRUs is mean time between unscheduled maintenance actions (MTBUMA). At the LRU level, it is assumed that an unscheduled maintenance action reflects a failure of the LRU that renders it not-mission-capable (NMC). The MTBUMA is calculated for each type of LRU:

$$\text{MTBUMA} = \frac{\text{Total Operating Time All LRUs}}{\text{Number of Unscheduled Maintenance Actions}} = \frac{\text{TOT}_l}{\text{NU}}$$

3.3 AVAILABILITY

Availability is defined in MIL-STD-721B as "a measure of the degree to which an item is in an operable and committable state at the start of the mission, when the mission is called for at an unknown (random) point in time." Operational availability (A_o) will provide a measure of the degree to which the IGRV system (and its subsystems) is either operating or is capable of operating at any random point in time within its maintenance and supply environment. A_o will be computed for the entire system and for each of the four major subsystems: RC-12D, ARF, IPF, and AGE Van.

$$A_o = \frac{\text{Total Calendar Time - Total System/Subsystem Downtime}}{\text{Total Calendar Time}} = \frac{TCT - TDT}{TCT}$$

where,

TDT = TCM + TPM + TALDT

TCM = Total system/subsystem downtime for corrective maintenance (unscheduled) in clock hours during the period

TPM = Total system/subsystem downtime for preventive maintenance (scheduled) in clock hours during the period

TALDT = Total administrative and logistics system/subsystem delay time spent waiting for parts, maintenance personnel, or transportation per given calendar time period. Under the IGRV maintenance concept, only repair at the unit level will cause the system to be unavailable. Delays due to intermediate level repair will be reflected in TALDT.

Note: It is assumed that an unscheduled maintenance action that does not constitute an operational mission failure will not contribute to TDT for the purpose of calculating A_o.

Since the PM SEMA is interested in more than mission operational availability, specifically, the response of the logistics support system to the IGRV units' requirements, another availability measure is required. Average administrative logistics delay time (ALDT) is a parameter that relates the total administrative logistics delay time (for both mission-critical and all other non-mission-critical repair actions) to the number of maintenance actions.

$$ALDT = \frac{\text{Total ALDT (Unscheduled Maintenance Actions)}}{\text{Number of Unscheduled Maintenance Actions}} = \frac{TALDT(U)}{NU}$$

3.4 MAINTAINABILITY

The maintainability parameter is a quantifiable statement about the allowable resources or manpower (time) required to perform a given type of support task to a given standard. The normal quantitative measure for maintainability is mean time to repair (MTTR).

3.4.1 Unit Level Maintainability

MTTR--Unit level (MTTR-U) is defined as the average corrective maintenance time to perform a corrective action at the unit level. MTTR-U is used as a unit maintainability index and is not used to track the repairs of subassemblies/components replaced by organizations or activities other than the IGRV units.

$$\text{MTTR-U} = \frac{\text{Sum of Total Corrective Maintenance Time (Clock Hours) at Unit Level}}{\text{Number of Unscheduled Maintenance Actions}} = \frac{\text{TCM-U}}{\text{NU}}$$

Another useful statistic is the maintenance ratio--unit level (MR-U), defined as the total number of man-hours of maintenance during a given period of time divided by the total number of operating hours during that same period of time. The maintenance ratio is expressed for specific levels of maintenance, in this case, unit level. Man-hours for off-system repair of replaced components are not included. Man-hours for preflight operational checks will be included for the aircraft portion of this system. The MR-U for the IGRV system will be calculated as follows:

For the ARF and AGE: $\text{MR-U} = \frac{\text{TCM-U + TPM-U}}{\text{Total Flying Hours}}$

For the IPF: $\text{MR-U} = \frac{\text{TCM-U + TPM-U}}{\text{TOT}}$

MR-U will provide a ratio of maintenance man-hours per flying hour (or operating hour) that will be useful in determining trends in maintenance improvement or degradation in relation to IGRV system use.

3.4.2 Depot Level Maintainability

For those repair actions accomplished by organizations or activities other than the IGRV unit, an MTTR and MR will be calculated when phase two of this tracking plan is implemented.

CHAPTER FOUR

RAM DATA COLLECTION PROCESS

4.1 OVERVIEW

The goal of the RAM data collection process is to generate a complete, accurate, and timely data base within the organizational and budgetary limitations of the PM SEMA. Most of the specific data elements identified in Chapter Three of this plan can be obtained from standard DA Forms 1352, 2406, and 2407, when they are properly completed. Recording, collecting, verifying, and accumulating the requisite data elements are the subjects of this chapter.

4.2 DATA SOURCES

The data elements identified in Chapter Three are generally available from DA Forms 1352, 2406, and 2407. (The notable exceptions are total operating time and total corrective maintenance clock time. Those data are discussed further below.) These are standard U.S. Army forms; descriptions of the forms are given in Annex E. Specific sources of the data elements are as follows:

- Total corrective maintenance time - system/subsystem downtime, TCM: DA Form 1352, Blocks 10i and 10j (NMCM for AVIM and AVUM) for the RC-12D and DA Form 2406, column M of Blocks 9i and 9j (non-available days) for the ARF, IPF, and AGE Van.
- Total preventive maintenance time - system/subsystem downtime, TPM: Not separately recorded. It is assumed that TPM is included in DA Form 1352, Block 10j, for the RC-12D. TPM for the ARF, IPF, and AGE Van are assumed to be insignificant since the preventive maintenance checks and services (PMCS) for the equipments in those subsystems generally can be accomplished while the equipment is operating and result in no downtime.
- Total administrative logistics delay time - system/subsystem delay time, TALDT: DA Form 1352, Block 10g (non-mission capable supply) for the RC-12D and DA Form 2406, Column S of Blocks 9i and 9j (non-available days) for the ARF, IPF, and AGE Van.
- Total corrective maintenance time - All unscheduled maintenance actions, TCM: DA Form 2407, Block 20g (man-hours). The parameter of

interest here is elapsed maintenance clock time. For purposes of this plan, the data entered in block 20g are assumed to be the single repairman clock time for the maintenance actions recorded.

- Total administrative and logistics delay time - All unscheduled maintenance actions, TALDT: DA Form 2407, Blocks 23, 27 (Julian dates), and 20g (elapsed time, see TCM above).

  TALDT = ((Block 27 - Block 23) x 24) - Block 20g

  Since Blocks 23 and 27 record Julian dates, the result of the subtraction of Block 23 from Block 27 must be multiplied by 24 to convert the number of days to hours.

- Maintenance man-hours: DA Form 2407, summation of entries in Block 20g

- Total flying hours: DA Form 1352, Block 10k

- Total calendar time: Total number of hours in the reporting period.

- Total operating time, TOT: Since there are no time meters on IGRV hardware, TOT must be estimated on the basis of a known parameter -- flying hours. The following ratios are recommended for conversion from flying hours to operating hours:

  -- Airborne equipment: Assume 1 hour ground operating time for pre-flight and post-flight checks. Assume 5 flight hours per aircraft per mission. The ratio of operating hours to flying hours is 6:5 = 1.2

  -- AGE Van: Assume the van is used for 2.5 hours to check out 2 mission aircraft, or about 1.25 hours for each aircraft. Assume a 5 hour flying mission. The ratio of operating hours to flying hours is 1.25:5 = 0.25

  -- IPF: Assume the IPF operates approximately 7.5 hours for every 5 hour mission. Assume all missions use 2 aircraft or 10 flying hours. The ratio of operating hours to flying hours is 7.5:10 = 0.75

- Number of unscheduled maintenance actions, NU: The number of actions reported equals the number of DA Form 2407s.

- Number of operational mission failures, NO: For the RC-12D, this figure can be determined from submissions of DA Form 1352. For the other subsystems, submissions of DA Form 2407 must be screened to determine which maintenance actions result in an operational mission failure. In Annex A, the column labeled "Mission-Essential" shows whether a particular LRU must be operational to make the subsystems mission-capable. (Where there is LRU redundancy, the column indicates the minimum quantity required for mission capability.)

4.3 DATA COLLECTION

Two methods of data collection are available to PM SEMA for the purpose of RAM tracking. They are commonly referred to as free-flow and semicontrolled data collection.

4.3.1 Free-Flow Data Collection

In the free-flow data collection process, PM SEMA currently has access to DA Form 1352 data. To enhance the RAM data base, operational IGRV units must ensure that data files are maintained in accordance with The Army Maintenance Management System (TAMMS - TM 38-750) and the provisions of this tracking plan. Additionally, the IGRV units must be directed to forward copy 4 of all DA Form 2407s to PM SEMA at the end of the 90-day retention period required by TM 38-750. It is anticipated that following the initial 90-day period, IGRV units will submit data records monthly, as consecutive 90-day periods expire.

In addition, PM SEMA will initiate steps to have IGRV subsystems (ARF, IPF, and AGE Van) included in TAMMS, TM 38-750, paragraph 4-6, List of Items for Material Condition Status Report (DA Form 2406). DA Form 2406 then will provide availability information at the subsystem level. Specifically, it will quantify administrative and logistics delay time as well as maintenance downtime for reportable equipment. The parameters of interest from DA Form 2406 are not mission capable maintenance (NMCM) and not mission capable supply (NMCS). While NMCM and NMCS data are available on DA Form 1352 for the aircraft, they are not reported at the present time for the AGE Van, IPF, or ARF.

4.3.1.1 Detailed Data Flow

Under this free flow data collection process, PM SEMA must provide for the collection and processing of RAM data within TSARCOM. DA Forms 1352, 2406, and 2407 completed by IGRV units will be forwarded to a central collection point located within the SEMA Program Management Office (PMO). This collection point will be the central repository for all data inputs from the field sites. Figure 4-1 and the following paragraphs describe the process:

- DA Form 1352 is generated at the user unit and forwarded to the PM SEMA collection point by mail. This form will track aircraft flying hours, plus full mission capable (FMC), partial mission capable (PMC), and not mission capable (NMC) hours for the RC-12D.
- DA Form 2406 also is generated at the user unit level and forwarded. It will track NMCS and NMCM data elements for the ARF, IPF, and AGE Vans.
- DA Form 2407 will be completed at the IGRV unit and forwarded by mail to the collection point. It will track LRU description, serial number, failure description, maintenance man-hours expended, and total LRU/system downtime.
- From the collection point, the data will enter the collation/analysis process. The process can be accomplished either manually or by using automatic data processing (ADP). Given the volume of data expected, ADP appears to be the logical approach.
- The RAM reports generated as a result of the analysis process will be used for system management and engineering decisions by PM SEMA. Appropriate decisions and recommendations will then be forwarded to the appropriate activity/agency.

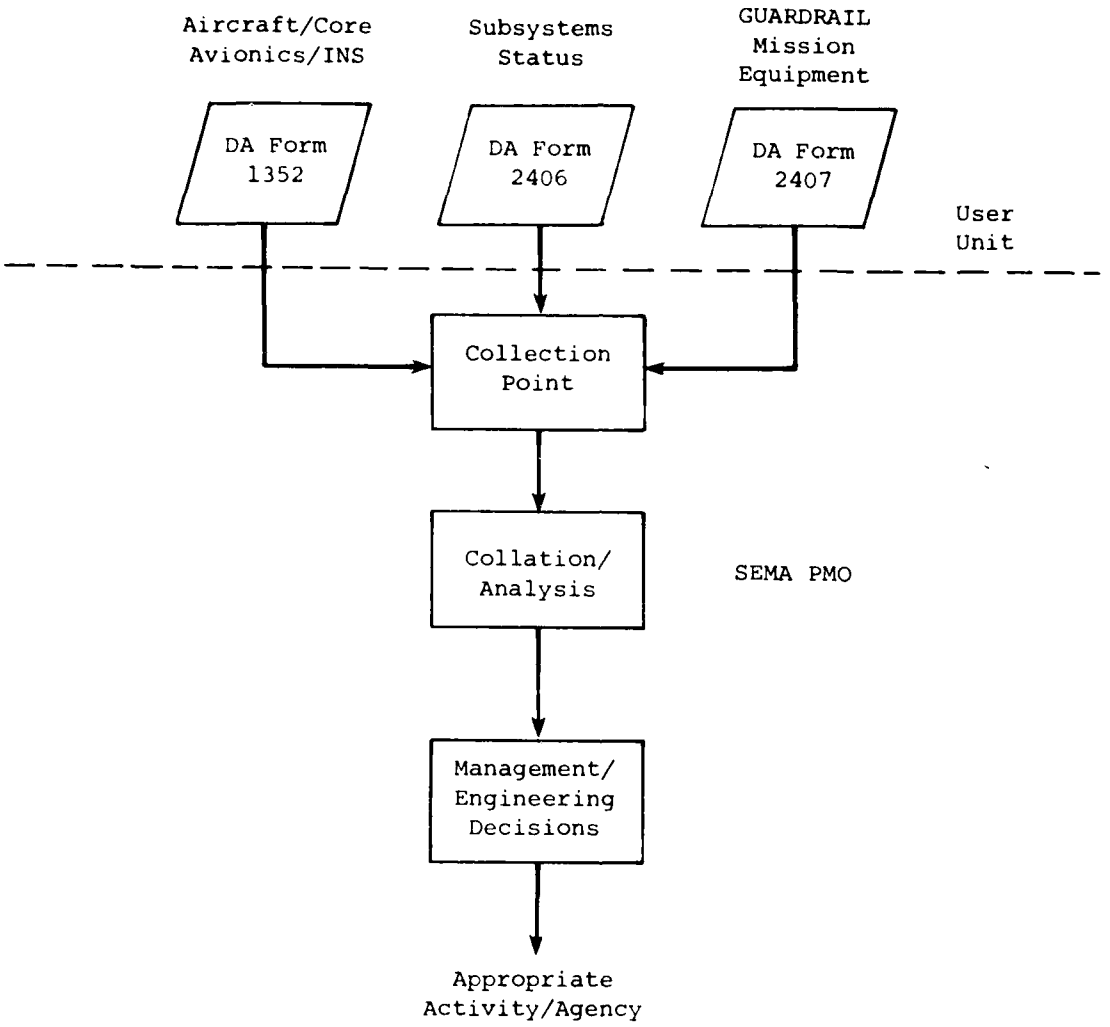

Figure 4-1. RAM COLLECTION SYSTEM DATA/ACTIVITY FLOW

Specific implementation instructions for this in-house system will be developed upon selection of the free-flow data collection process as the method of data collection.

4.3.1.2 In-House System Advantages

This proposed data collection system offers a number of advantages for PM SEMA:

- All organizational structures are already in place and functioning in the field.
- All necessary forms are in world-wide use as required by TM 38-750.
- No specialized training will be required for personnel at the IGRV unit and support maintenance levels. Some training reinforcement might be required to ensure accuracy and completeness in entering data in DA forms.
- No specialized data transmission facilities will be required.
- All data analysis could be performed within SEMA PMO, reducing security-related problems.
- The data reduction and analysis can be performed on organic U.S. Army ADP machines without additional capital investment for computer equipment. However, some software may have to be developed for formatting the IGRV-peculiar reports.

4.3.2 Semicontrolled Data Collection

Reliance on free flow data collection places the entire burden of data accuracy and completeness on the on-site Army personnel. By means of semicontrolled data collection processes, various Army agencies (including the TSARCOM UH-1H Helicopter Program) have increased data collection accuracy and reduced administrative burdens. Under a semicontrolled data collection process, PM SEMA would contract for on-site assistance in collecting and verifying maintenance data records (DA Forms 2406 and 2407). The most widely used form of semicontrolled data collection is under the Sample Data Collection (SDC) Program in accordance with AR 750-37. There are several advantages to the SDC Program:

- All necessary reliability and maintainability data are completely and accurately collected at the designated site. This would include the special data provisions of this plan.
- No additional workload is imposed on on-site Army personnel.
- Sampling techniques conform to AR 750-37.
- A full range of machine-generated reports would fulfill PM SEMA reliability and maintainability data requirements. (Availability data would be available in DA Forms 1352 and 2406 as previously stated.)
- Minimum data collection, accumulation, and processing would be required at SEMA PMO.

4.4 DATA STORAGE

Following the collection of requisite data at the central repository, SEMA PMO, or SDC contractor, all data will be logged, reviewed for completeness, and prepared for automatic data processing in accordance with TM 38-750-1, TAMMS Field Command Procedures. Reducing and storing these data within TSARCOM facilities would require dedicated personnel and possibly the generation of a software program tailored to meet the IGRV data report requirements. A more practical and immediately available method would be to use the sample data collection and data storage techniques currently developed and provided to TSARCOM for the UH-1H Helicopter Program, augmented by an in-house process to track availability.

The data storage technique will maintain a file of all collected raw data. Additionally, the RAM parameters specified in Chapter Three will be available through the exercise of the developed software program. As the data base grows, the historical record of the calculated RAM parameters will provide the input for the data analysis discussed in Chapter Five.

CHAPTER FIVE

RAM DATA ANALYSIS

5.1 OVERVIEW

The reduction and analysis of the collected RAM data is a critical step in meeting the goals of this plan. It is at this point in the system that usable data become available to the PM SEMA in the form of RAM data reports.

These data reports will provide the PM SEMA with information necessary for the following purposes:

- Assessing the RAM performance of IGRV equipments
- Evaluating the effectiveness of maintenance operations
- Monitoring RAM growth progress
- Determining the readiness posture of the IGRV system
- Assessing system logistics supportability
- Identifying logistics problems requiring further analysis

Individual RAM parameters can provide useful information when compared to a standard, if that standard is known. For instance, an instantaneous MTBF can be compared to a contractually specified MTBF. However, the data analysis routines of this chapter provide a more powerful tool by showing historical trends in the change of specific RAM parameters. In addition, observing the trends over a period of time provides the analyst with greater insight into current and potential problems.

5.2 TECHNICAL REPORT REQUIREMENTS

A series of technical reports will be generated and updated quarterly to provide PM SEMA with concise information and a trend analysis. The reports will be structured to provide analytical tables, as well as graphic presentations of the data.

The reports described below constitute a minimum of data requirements to assess RAM performance. Since raw data are maintained, the breadth of parameters may be expanded to meet unusual information needs as they arise.

5.2.1 Reliability Report

This report will track the mean time between operational mission failure (MTBOMF) for each IGRV system and for its major subsystems: RC-12D aircraft, ARF mission avionics, IPF, and AGE Van. Additionally, mean time between unscheduled maintenance actions (MTBUMA) will be tracked for individual LRUs. The ten LRUs that generate the greatest number of maintenance actions will be highlighted.

5.2.2 Availability Report

This report will track the operational availability (A_o) for each IGRV system (site) and for its major subsystems: aircraft, ARF, IPF, and AGE. Additionally, this report will show average administrative logistic delay time (ALDT) for each site by system, subsystem, and LRU.

5.2.3 Maintainability Report

This report will track for each IGRV system the mean time to repair--unit level and the maintenance ratio--unit level (MTTR-U, MR-U). These statistics will be provided for each major subsystem. The report will highlight the ten LRUs that required the greatest expenditure of maintenance man-hours per quarter.

5.3 TECHNICAL REPORT GENERATION

Automatic data processing routines are currently available within the Sample Data Collection Program to generate the reliability and maintainability reports required by Section 5.2. Minor software development may be required for formatting and labeling IGRV tables and graphs.

Availability reports can be generated within TSARCOM. If automated procedures are desired for the availability report, some software development will probably be required.

5.4 REPORT GRAPHICS

Graphic presentation of data is an excellent method for displaying statistics so they can be easily read and understood. The following RAM data can be effectively displayed with graphics.

- A_o versus total flight hours
- A_o versus calendar time
- System/subsystem reliability versus calendar time
- ALDT versus calendar time
- MR-U versus calendar time
- Number of unscheduled maintenance actions versus calendar time
- MTTR-U versus calendar time

5.5 REPORT USE

The various reports supplied by the program software will be used by SEMA PMO managers to monitor system RAM characteristics and evaluate the effectiveness of earlier management decisions. These reports will provide SEMA PMO with a historical RAM data base displaying the IGRV RAM growth.

Within SEMA PMO these reports will be distributed as shown in Table 5-1. The proposed implementation schedule for this plan is contained in Annex D.

Table 5-1. REPORT DISTRIBUTION AND USE

Group	Distribution: Reliability Report	Distribution: Availability Report	Distribution: Maintainability Report	Use
PM SEMA	X	X	X	Program management Future planning
Integrated Logistics Support Management Team (ILSMT)		X	X	Program supportability Training requirements Manuals effectiveness
RAM Working Group	X	X	X	RAM tracking RAM growth ECP monitoring Technical liaison
Test Integration Working Group (TIWG)	X		X	Test plans RAM data review Technical support
Interface Control Working Group (ICWG)	X		X	Resolving interface problems ECP monitoring Technical support
Configuration Control Board (CCB)	X	X	X	ECP monitoring Upgrading acceptance test plans Change control Resolving interface problems Redesign
SEMA PMO (Reliability)	X	X	X	RAM program monitoring
SEMA PMO (Engineering)	X	X	X	Program engineering
SEMA PMO (Logistics Management Division)		X	X	Logistics support
SEMA PMO (Business Management Division)	X	X	X	Budgeting Future programs

ANNEX A

LRU LISTS FOR MAJOR SUBSYSTEMS OF IMPROVED GUARDRAIL V

Major Subsystem: AGE Van, AN/ARM-163 (Page 1 of 1)

LRU EQUIPMENT LIST-IGRV

No.	Unit	Nomenclature	Part Number	ESL	GFE	CFE	Quantity per Subsystem	Mission Essential	Commonality			Failure Rate	Source of Reliability Data	Equipment Source			
									ARF	IPF	AGE			New	GRV Modified	GRV	Commercial
1	Audio Generator		HP 3325A			X	1	N			X						X
2	RF Signal Generator		HP 8662A			X	1	N			X						X
3	Frequency Counter		EIP 545A			X	1	N	X		X						X
4	Digital Voltmeter		HP 3455A			X	1	N	X		X						X
5	SDU Display	IP-1337A-011	10-131159-1	X			1	N		X	X	0.000138	ARINC Research			X	
6	UHF Transceiver, ARC-164	RT-1167	5821-00-148-7990		X		2	N	X	X	X	0.000160	ESL Jan 80			X	
7	Encryptor	TSEC/KG45			X		1	N	X	X	X	0.000435	ESL Jan 80	X			
8	UHF Distribution		10-TBD	X			1	N		X	X	0.000103			X		
9	RF Power Meter		HP 436A			X	1	N		X	X						X
10	Spectrum Analyzer		HP 141T/8554B			X	1	N		X	X						X
11	Interface Unit		ESL (TBD)	X			1	N			X			X			
12	Multiprogrammer		HP 9845			X	1	N			X						X
13	Encryptor		TSEC/KY-58		X		2	N	X	X	X	0.000592	ESL Jan 80	X			
14	Oscilloscope		TEK R7603			X	1	N		X	X						X
15	Viterbi Decoder		Sperry 7616018-00		X		1	N		X	X	0.000489	Sperry Univac Dec 79	X			
16	Command Multiplexer		ESL (TBD)	X			1	N		X	X			X			
17	Data Demultiplexer		ESL (TBD)	X			1	N		X	X	0.000076	Sperry Univac Dec 79	X			
18	RF Switch		Sperry 7616024-00		X		1	N		X	X			X			
19	Down-Link Receiver		Sperry 7616020-00		X		1	N	X	X	X	0.000169	Sperry Univac Dec 79	X			
20	Up-Link Transmitter		Sperry 761622-00		X		1	N		X	X	0.000300	Sperry Univac Dec 79	X			
21	SDU Processor	MX-10014	10-131148-2	X			1	N		X	X	0.000103	ARINC Research			X	
22	Communications Panel	C-10512	10-131150-1	X			1	N			X	0.000086	ESL Mar 80			X	
23	Command Demultiplexer		ESL (TBD)	X			1	N		X	X			X			
24	Data Multiplexer		ESL (TBD)	X			1	N		X	X			X			
25	Digital Processor		Sperry 7616017-00		X		1	N		X	X			X			
26	Power Distribution		Sperry (TBD)		X		1	N			X			X			
27	External Interface Panel		Sperry (TBD)		X		1	N			X			X			
28	AGE Interface Panel		ESL (TBD)	X			1	N			X			X			

Major Subsystem: ARF, AN/ARW-83 (Page 1 of 2)

LRU EQUIPMENT LIST-IGRV

No.	Unit	Nomenclature	Part Number	ESL	GFE	CFE	Quantity per Subsystem	Mission Essential	Commonality			Failure Rate	Source of Reliability Data	Equipment Source			
									ARF	IPF	AGE			New	GRV Modified	GRV	Commercial
1	Digital Processor		Sperry 7616017-00		X		1	Y	X			0.000437	ARINC Research	X			
2	Command Demultiplexer	TD-1265/U	10-131098-1	X			1	Y	X	X				X			
3	Transceiver	AN/ARC-164	5821-00-148-7990		X		2	Y	X	X	X	0.000300	ESL 1980		X		
4	Data Multiplexer		AEL-TBD		X		1	Y	X	X	X	0.000241	CEFLY LANCER Program	X			
5	Diplexer		Sperry 7616015		X		1	Y	X			0.000020	ARINC Research	X			
6	Power Control Unit		10-TBD	X			1	Y	X					X			
7	Notch Filter		K&L - F1474			X	2	N	X			0.000449	ARINC Research 1978				X
8	Directed SCARS Receiver	R-924	10-TBD	X			1	Y	X					X			
9	RF Distribution	CV-2234/ ARW-83	10-TBD	X			1	Y	X			0.000539	ARINC Research 1978		X		
10	Encryptor	TSEC/KG-45			X		1	Y	X	X	X			X			
11	SCARS Down Converter		10-TBD	X			1	N	X					X			
12	Airborne Executive Processor	AN/UYK-19	Sperry 7616006		X		1	Y	X			0.002800	CEFLY LANCER	X			
13	TWTA		Sperry 7616010		X		1	Y	X			0.000765	ARINC Research	X			
14	Multiplexer/Modulator Unit		Sperry 7616007		X		1	Y	X			0.000823	ARINC Research	X			
15	Waveguide Switch		Sperry 7616024-00		X		1	Y	X			0.000020	ARINC Research	X			
16	Link Command Receiver		Sperry 7616020-00		X		1	Y	X			0.000694	ARINC Research	X			
17	Data Link Interface Panel		Sperry TBD		X		1	Y	X					X			
18	Airborne Decoder		Sperry 7616018-00		X		1	Y	X					X			
19	Regenerative Repeater	MX-9331C	5895-01-074-6294		X		1	N	X			0.000374	ESL 1980			X	
20	Interface Connector Panel		Rolm TBD		X		1	Y	X			0.000200	CEFLY LANCER	X			
21	SCARS R924 Receiver	R924	10-TBD	X			1	N	X					X		X	
22	SDU Converter #1	CV-3537/ ARW-83(V)	10-131147-1	X			1	Y	X	X	X	0.000449	ESL 1980			X	
23	UHF Intercept Receiver	R2134/ ARW-83(V)	10-131140-1	X			1	Y	X			0.001348	ESL 1980			X	
24	DF Receiver		Fast DF	X			1	Y	X			TBD					TFD
25	VHF Intercept Receiver	R-2017/U	10-123847-1	X			5	60%	X			0.000449	ESL 1980			X	

Major Subsystem: ARF, AN/ARW-83 (Page 2 of 2)

LRU EQUIPMENT LIST-IGRV

No.	Unit	Nomenclature	Part Number	ESL	GFE	CFE	Quantity per Subsystem	Mission Essential	Commonality			Failure Rate	Source of Reliability Data	Equipment Source			
									ARF	IPF	AGE			New	GRV Modified	GRV	Commercial
26	SCARS Level 0 Unit		10-TBD	X			1	N	X			0.000449		X			
27	Power Supply #1		Modular Power System TBD			X	1	Y	X								X
28	Wideband Intercept Receiver	R-924	10-TBD	X			8	50%	X							X	
29	SDU Converter #2	CV-3537/ ARW-83	10-131147-1	X			1	N	X	X	X	0.000449	ESL 1980			X	
30	Power Supply #2	PP-7492	10-131138-1	X			1	Y	X			0.001348	ESL 1980			X	
31	Status Panel/Annunciator		10-TBD	X			1	Y	X					X			
32	RF Processor	MX-( )/ ARW-83(V)	10-TBD	X			1	Y	X					X			
33	Encryptor	TSEC/KG-58	5810-00-919-4554		X		1	Y-1TC	X	X	X	0.000592	SEMO PMO	X			
34	2-Axis Antenna		Sperry 7609785-00		X		2	Y	X					X			
35	Annunciator Panel		10-TBD	X			1	Y	X					X			
36	VOW Switch		10-138478-1	X			1	N	X			0.000268	ARINC Research 1978			X	
37	Antenna Controller		Univac 2277914		X		1	N	X			0.001029	CEPLY LANCER	X			
38	ARF Direct Test Panel	J-3589	10-133623-1	X			1	N	X			0.000355	ARINC Research 1978			X	
39	VHF/FM Transceiver	AN/ARC-114			X		1	Y	X			0.001048	ARINC Research 1978			X	

Major Subsystem: IPF, AN/TSQ-105 (Page 1 of 5)

LRU EQUIPMENT LIST-IGRV

No.	Unit	Nomenclature	Part Number	ESL	GFE	CFE	Quantity per Subsystem	Mission Essential	Commonality			Failure Rate	Source of Reliability Data	Equipment Source			
									ARF	IPF	AGE			New	GRV Modified	GRV	Commercial
1	400 Hz Frequency Changer		1966-01-4750-1		X		1	Y		X		0.000276	ARINC Research 1978			X	
2	UHF Blade Antenna	AS-3326/U	12-138494-1		X	2	1	Y	X	X	X	0.000292	ARINC Research 1979			X	
3	VHF Whip Antenna	AS-3308/TSQ	10-131001-1	X			1	N	X	X	X	0.000214	TSARCOM Briefing			X	
4	LPA Low Band Antenna		ON-208995			X	1	N		X		0.000207	ARINC Research 1979			X	
5	LPA High Band Antenna		10-138197-1	X			1	N		X		0.000096	ARINC Research 1979	X			
6	Line Printer		Data Printer Corp. V-132-C			X	1	Y		X		0.000107	ESL Jan 80				X
7	Thermofax Unit		3M45EGA			X	1	N		X		0.000641	ESL Jan 80				X
8	Graphics Terminal	IP-1338/TSQ	HP2648A			A	22	50%		X		0.000107	ESL Jan 80				X
9	HP2648A Interface Unit	CV-3548/TSQ	10-136598-1	X			22	50%		X		0.000079	ESL Jan 80	X			
10	Hard Copy Unit		TEK-4631			X	3	N		X		0.000534	ESL Jan 80				X
11	IC/SD Amplifier	AM-6995/TSQ	10-117955-1	X			19	N		X		0.000031	ESL Jan 80			X	
12	Call Director	C-10483/TSQ	10-131195-1	X			5	N		X		0.000091	ARINC Research 1978			X	
13	Tactical Color Display		RAMTRK 9400			X	2	N		X							X
14	Secure Telephone				X		1	N		X				X			
15	Trackball		RAMTEK TBD			X	1	N		X							X
16	Teleprinter	TT-743/G	EXTEL-11R		X		2	N		X		0.000160	ESL Jan 80			X	
17	T. C. Distribution	C-10480/TSQ	10-131118-1	X			1	Y		X		0.000110	ARINC Research 1978		X		
18	Paper Tape Punch				X		1	N		X						X	
19	Magnetic Tape Recorder	AN/TMH-20A			X		14	50%		X		0.000321	ESL Jan 80			X	
20	Digital Display Indicator	ID-1707/U			X		13	N		X		0.000138	ARINC Research 1978			X	
21	Rack Power Supply		10-TBD	X			3	50%		X				X			
22	80 MB Disc Drive		Wanco ST-2222			X	5	Y		X		0.000427	ESL Jan 80				X
23	Magnetic Tape Transport		PERTEC T8840A9-45			X	2	Y		X		0.000321	ESL Jan 80				X
24	Magnetic Tape Contruller					X	2	Y		X							X
25	Central Processing Unit		Perkin-Elmer 3252			X	1	Y		X			ESL 1980				X

Major Subsystem: IPF, AN/TSQ-105 (Page 2 of 5)

LRU EQUIPMENT LIST-IGRV

No.	Unit	Nomenclature	Part Number	ESL	GFE	CFE	Quantity per Subsystem	Mission Essential	Commonality			Failure Rate	Source of Reliability Data	Equipment Source			
									ARF	IPF	AGE			New	GRV Modified	GRV	Commercial
26	I/O Chassis	MX-10021/TSQ				X	6	Y		X		0.000031	ARINC Research 1979				X
27	Graphics Tablet		TEK 4954			X	1	N		X		0.000189					X
28	Controller, Digital		TLC-100			X	1	Y		X							X
29	Digital Processor	AN/UYK-22			X		1	Y		X				X			
30	Encryptor	TSEC/KG-30			X		1	Y		X				X			
31	Encryptor	TSEC/KG-65			X		1	Y		X				X			
32	Interface Modem		10-TBD	X			1	Y		X				X			
33	Bit-Slice Processor		10-TBD	X			1	Y		X				X			
34	Up-Link Multiplexer		10-TBD	X			1	Y		X				X			
35	TTY Interface Unit		10-TBD	X			1	Y		X				X			
36	Operator Keyboard	MX-10012/TSQ	10-131108-1			X	14	50%		X		0.000069				X	
37	Data Multiplexer		10-TBD	X			1	Y		X				X			
38	SCARS Unit #1		10-TBD	X			1	Y		X				X			
39	SCARS Unit #2		10-TBD	X			1	Y		X				X			
40	Command Display		10-TBD	X			1	N		X				X			
41	DF Data Demultiplexer 1	MD-1051/U	10-132200-1	X			1	Y		X		0.000110	ARINC Research 1979			X	
42	DF Data Demultiplexer 2	MD-1052/TSQ	10-132200-2	X			1	N		X		0.000117	ARINC Research 1979			X	
43	System Status Panel		10-TBD	X			1	Y		X				X			
44	UHF Communications Panel		10-131129-1	X			1	N		X		0.000321	ARINC Research 1979		X		
45	+15, +5 V Power Supply		10-TBD	X			1	Y		X				X			
46	Encryptor	TSEC/KY-58	5810-00-449-0154		X		9	60%	X	X	X	0.000592	SEMA PM	X			
47	UHF Notch Filters					X	3	N	X	X	X						X
48	Transceiver	AN/ARC-164			X		3	1 Set	X	X	X	0.000160	ESL 1980			X	
49	Up-Link Multiplexer		10-TBD	X			1	Y		X	X			X			
50	28 V Power Supply	PP-7494/U	10-132542-1	X			6	Y		X	X	0.000151	TSARCOM Briefing			X	

Major Subsystem: IPF, AN/TSQ-105 (Page 3 of 5)

LRU EQUIPMENT LIST-IGRV

No.	Unit	Nomenclature	Part Number	ESL	GFE	CFE	Quantity per Subsystem	Mission Essential	Commonality			Failure Rate	Source of Reliability Data	Equipment Source			
									ARF	IPF	AGE			New	GRV Modified	GRV	Commercial
51	Receiver Control Unit		10-TBD	X			12	50%		X	X			X			
52	FM Transceiver	RT-524/VRC			X		1	N		X		0.000100	CERCOM Jun 75			X	
53	Transceiver Power Supply	PS-524/VRC			X		1	N		X						X	
54	Attenuator Panel		10-TBD	X			1	N		X				X			
55	Multiplexer/Demultiplexer		10-TBD	X			1	Y		X				X			
56	Spectrum Display Unit	IP-1337/U	10-13N59-1	X			12	N		X	X	0.000138	ARINC Research 1979			X	
57	IC/SD Amplifier Power Supply		10-TBD	X			1	SD Only		X				X			
58	MCU Power Supply		10-TBD	X			3	Y		X				X			
59	Audio Demultiplexer		10-TBD	X			1	Y		X				X			
60	IC/SD Controller	C-10477 ITSQ	10-131165-1	X			3	SD Only		X		0.000151	ARINC Research 1980			X	
61	SD Distribution	C-10479/TSQ	10-131117-1	X			1	Y		X		0.000131	ARINC Research 1980			X	
62	I/C Distribution	C-10478/TSQ	10-131116-1	X			1	N		X		0.000131	ARINC Research 1980			X	
63	IC/SD Distribution Power Supply	PP-7489/TSQ	10-132385-1	X			1	Y		X		0.000328	ARINC Research 1980			X	
64	RCU Power Supply	PP-7495/U	10-131160-1	X			4	50%		X		0.000103	TSARCOM Briefing			X	
65	Test Transmitter 1		Ailtech 1020A			X	1	N		X		0.000321	ESL Jan 80				X
66	Test Transmitter 2		Ailtech 1021A			X	1	N		X		0.000321	ESL Jan 80				X
67	Test Controller	C-10504/TSQ	10-131120-1	X			1	N		X		0.000138	ARINC Research 1980			X	
68	Test Source		Wavetek 3001			X	1	N		X		0.000167	ARINC Research 1980			X	
69	Test Counter		HP 5383A			X	1	N		X	X	0.000110	ARINC Research 1980				X
70	SDU Processor	MX-10015/TSQ	10-131148-1	X			2	N		X	X	0.000321	ESL Jan 80			X	
71	Test/Age Power Supply		10-TBD	X			1	N		X				X			
72	Power Control Panel		Sperry 7616148		X		3	Y		X		0.000020	Sperry Dec 79	X			
73	Link Interface		Sperry 7616032		X		2	Y		X				X			
74	Up-Link/Down-Link Processor		Sperry-7616033		X		2	Y		X		0.000718	Sperry Dec 79	X			
75	COMSEC Assembly		Sperry 7611130		X		2	Y		X				X			

Major Subsystem: IPF, AM/TSQ-105 (Page 4 of 5)

LRU EQUIPMENT LIST-IGRV

No.	Unit	Nomenclature	Part Number	ESL	GFE	CFE	Quantity per Subsystem	Mission Essential	Commonality			Failure Rate	Source of Reliability Data	Equipment Source			
									ARF	IPF	AGE			New	GRV Modified	GRV	Commercial
76	QPSK Demodulator		Sperry 7616035		X		2	Y		X		0.000498	Sperry Dec 79	X			
77	P/N Modulator		Sperry 7616034		X		2	Y		X		0.000106	Sperry Dec 79	X			
78	Decoder/Deinterleaver		Sperry 7616018		X		2	Y		X		0.000498	Sperry Dec 79	X			
79	Antenna Interface I/O		Sperry 7616036		X		2	Y		X		0.000288	Sperry Dec 79	X			
80	Power Distribution Panel		TBD		X		1	Y		X		0.000020	Sperry Dec 79	X			
81	Manual Control Panel		Sperry 7616144		X		1	N		X		0.000215	Sperry Dec 79	X			
82	Intercom Panel		TBD		X		1	N		X				X			
83	Spectrum Analyzer		HP 8565/909			X	1	N		X							X
84	Analyzer Interface		Sperry TBD		X		1	N		X				X			
85	Winchester Disk		Sperry TBD		X		2	Y		X				X			
86	Up-Link Simulator		Sperry 7616038		X		1	N		X		0.000212	Sperry Dec 79	X			
87	Down-Link Simulator		Sperry 7616039		X		1	N		X		*0.000380*	Sperry Dec 79	X			
88	IF Down Converter		Sperry 7616056		X		2	Y		X				X			
89	Antenna Enclosure Interface		Sperry 7616060		X		2	Y		X		0.000020	Sperry Dec 79	X			
90	Enclosure Power Distribution		Sperry TBD		X		2	Y		X		*0.000002*	Sperry Dec 79	X			
91	Up Converter/TWTA		Sperry 7616055		X		2	Y		X		0.000040	Sperry Dec 79	X			
92	RF/IF Test Interface		Sperry 7616057		X		2	N		X				X			
93	Servo Power Supply		Sperry 761616		X		2	Y		X				X			
94	Tracker/Controller		Sperry 7616058		X		2	Y		X		0.000345	Sperry Dec 79	X			
95	Dual-Band Down Converter		Sperry 7616055		X		2	Y		X		0.000239	Sperry Dec 79	X			
96	RF Test Assembly		TBD		X		2	N		X				X			
97	Joystick Control		Sperry 7611368		X		1	N		X		0.000020	Sperry Dec 79	X			
98	Remote Control Unit		Sperry 7652014		X		2	N		X		0.000215	Sperry Dec 79	X			
99	Intercom Set Control	C6624/ A1C25(V)			X		2	N		X		0.000202	Sperry Dec 79	X			
100	28 V Power Supply		TBD		X		1	Y		X				X			

Major Subsystem: IPF, AN/TSQ-105 (Page 5 of 5)

LRU EQUIPMENT LIST-IGRV

No.	Unit	Nomenclature	Part Number	ESL	GFE	CFE	Quantity per Subsystem	Mission Essential	Commonality			Failure Rate	Source of Reliability Data	Equipment Source			
									ARF	IPP	AGE			New	GRV Modified	GRV	Commercial
101	Mapping Display	IP-1335/TSQ	TEK4010-1			X	1	N		X		0.000178				X	
102	Headset		Roanwell 123460-690			X	15	50%		X	X	0.000477	SEMA-PM Brief			X	
103	Antenna Pedestal		Sperry 7616113		X		2	Y		X		0.000777	Sperry 1979	X			
104	Harness		Sperry TBD		X		2	Y		X		0.000667	Sperry 1979	X			
105	Air Inlet Assembly		Sperry 7609831		X		2	Y		X		0.000000	Sperry 1979	X			
106	Power Filter		Sperry 7609832		X		2	Y		X		0.000020	Sperry 1979	X			
107	Trouble Light		Sperry 7609833		X		2	Y		X		0.008333	Sperry 1979	X			
108	Portable KU-Band Source		Sperry TBD		X		1	N		X		0.000102	Sperry 1979	X			
109	Test Antenna		Sperry TBD		X		1	N		X		0.000001	Sperry 1979	X			
110	Time Code Generator	TD-1064/U			X		1	Y		X		0.000189	ARINC Research 1980			X	

ANNEX B

IGRV POINTS OF CONTACT

Department of the Army

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	Ron Dlugosz (Project Leader, IGRV)	(201) 544-3180
	Tom Panos (Product Assurance, RAM)	(201) 544-4709

TSARCOM

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DRCPM-AEL	Bill Harper (Business Management Division)	(314) 263-3197
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SEMA (continued)

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	Cpt Hutstetter (Operations)	(202) 692-5678

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	Lloyd Brazil (ILS Manager)	Ex. 6120
	Don Rutter (CMP Manager)	Ex. 5365
	Jim Narveson (RAM Manager)	Ex. 5710
	Gil Barber (REL)	
	Vince Sivilli/Ed Dumbrowski (QA Director)	

ASD CCS

	Ltc Lloyd Burge (Army)	(513) 255-2511

Miscellaneous

MIL-STD-785	John Gerber (AF-ASD/ENESS)	(513) 255-6914/7151
MIL-STD-470	Jerry Klion (AF-RADC)	(513) 255-4726
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ANNEX C

PARTIAL LIST OF STANDARDS, DIRECTIVES, AND OTHER DOCUMENTS PERTAINING TO RELIABILITY, AVAILABILITY, AND MAINTAINABILITY

Military Standards

MIL-STD-105D	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-202E	Test Methods for Electronic and Electrical Component Parts
MIL-STD-414	Sampling Procedures and Tables for Inspection by Variables for Percent Defective
MIL-STD-415D	Test Provisions for Electronic Systems and Associated Equipment, Design Criteria for
MIL-STD-470	Maintainability Program Requirements (for Systems and Equipments)
MIL-STD-471A	Maintainability Verification/Demonstration Evaluation
MIL-STD-480	Configuration Control - Engineering Changes, Deviations, and Waivers
MIL-STD-481A	Configuration Control - Engineering Changes, Deviations, and Waivers (Short Form)
MIL-STD-482A	Configuration Status Accounting - Data Elements and Related Features
MIL-STD-490	Specification Practices
MIL-STD-499A	Engineering Management
MIL-STD-721B	Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors, and Safety
MIL-STD-756A	Reliability Prediction
MIL-STD-757	Reliability Evaluation From Demonstration Data

MIL-STD-780E(AS)	Work Unit Codes for Aeronautical Equipment; Uniform Numbering System
MIL-STD-781B with Notice 1	Reliability Design Qualification and Production Acceptance Tests: Exponential Distribution
MIL-STD-781C	Reliability Tests: Exponential Distribution
MIL-STD-785B	Reliability Program for Systems and Equipment Development and Production
MIL-STD-790C	Reliability Assurance Program for Electronic Parts Specifications
MIL-STD-881A	Work Breakdown Structures for Defense Material Items
MIL-STD-882A	System Safety Program Requirements
MIL-STD-965	Parts Control Program
MIL-STD-1304A	Reliability Report
MIL-STD-1388-1	Logistics Support Analysis
MIL-STD-1472B	Human Engineering Design Criteria for Military Systems, Equipment, and Facilities
MIL-STD-1521	Technical Reviews and Audits for Systems, Equipment, and Computer Programs
MIL-STD-2068(AS)	Reliability Development Tests
MIL-STD-2070(AS)	Procedures for Performing a Failure Modes, Effects, and Criticality Analysis for Aeronautical Equipment
MIL-STD-2072(AS)	Survivability, Aircraft; Establishment and Conduct of Programs

Military Specifications

MIL-H-46855B	Human Engineering Requirements for Military Systems, Equipment, and Facilities
MIL-Q-9858A	Quality Program Requirements
MIL-M-24365A	Maintenance Engineering Analysis, Establishment of, and Procedures and Formats for Associated Documentation, General Specification for
MIL-S-52779	Software Quality Assurance Program Requirements

MIL-T-21200	General Specification for Test Equipment for Use with Electronic and Electrical Equipment

Military Handbooks

MIL-HDBK-53	Guide for Sampling Inspection
MIL-HDBK-106	Multi-Level Sampling Procedures and Table for Inspection by Attributes
MIL-HDBK-107	Inspection and Quality Control - Single Level Continuous Sampling Procedures and Tables for Inspection by Attributes
MIL-HDBK-108	Quality Control and Reliability - Sampling Procedures and Tables for Life and Reliability Testing (Based on Exponential Distribution)
MIL-HDBK-109	Quality Control and Reliability - Statistical Procedures for Determining Validity of Supplier's Attributes, Inspection of
MIL-HDBK-175	Microelectronic Device Data Handbook
MIL-HDBK-189	Reliability Growth Management
MIL-HDBK-217C	Reliability Prediction of Electronic Equipment
MIL-HDBK-472	Maintainability Prediction
MIL-HDBK-251	Reliability/Design Thermal Applications

Army Documents

AMCP 11-3	Value Engineering Program Management Guidelines
DA PAM 11-25	Life Cycle System Management Model for Army Systems

Army Regulations

702-3	15 Nov 76 - Army Materiel Reliability, Availability, and Maintainability (RAM)
50-1	Army Materiel Maintenance Concepts and Policies
70-1	Army Research, Development and Acquisition - Change 1
70-10	Test and Evaluation During Development and Acquisition of Materiel

70-15	Product Improvement of Materiel
70-27	Outline Development Plan/Development Plan/Army Program Memorandum/Defense Program Memorandum/Decision Coordination Paper
70-37	Configuration Management
70-61	Type Classification of Army Materiel
71-3	User Testing
71-9	Materiel Objectives and Requirements
95-33	Army Aircraft Inventory, Status, and Flying Time Reporting
350-XX	New Equipment Training and Introduction
700-127	Integrated Logistic Support
702-3	Army Materiel Reliability, Availability, and Maintainability (RAM)
702-9	Production Testing of Army Materiel
702-10	Post-Production Testing of Army Materiel
750-37	Sample Data Collection: The Army Maintenance Management Systems (TAMMS)
750-43	Test, Measurement and Diagnostic Equipment Change 1
1000-1	Basic Policies for Systems Acquisition
750-1	1 Apr 78 - Army Materiel Maintenance Concepts and Policies

DA Pamphlets

11-25	Life Cycle System Management Model for Army Systems
70-21	The Coordinated Test Program (CTP)
71-X	Operational Testing and Evaluation Methodologies and Procedures Guide

DARCOM Pamphlet

750-16	DARCOM Guide to Logistic Support Analysis

TECOM Pamphlet

70-3	Project Engineers Handbook

TRADOC Regulation

71-9	User Testing and Evaluation

TRADOC Circular

70-1	Training Device Development

HQ DA LTR (The Adjutant General)

DALO-SML	Army Reliability Centered Maintenance (19 Apr 79) (RCM) Program

USA Logistics Center Handbook

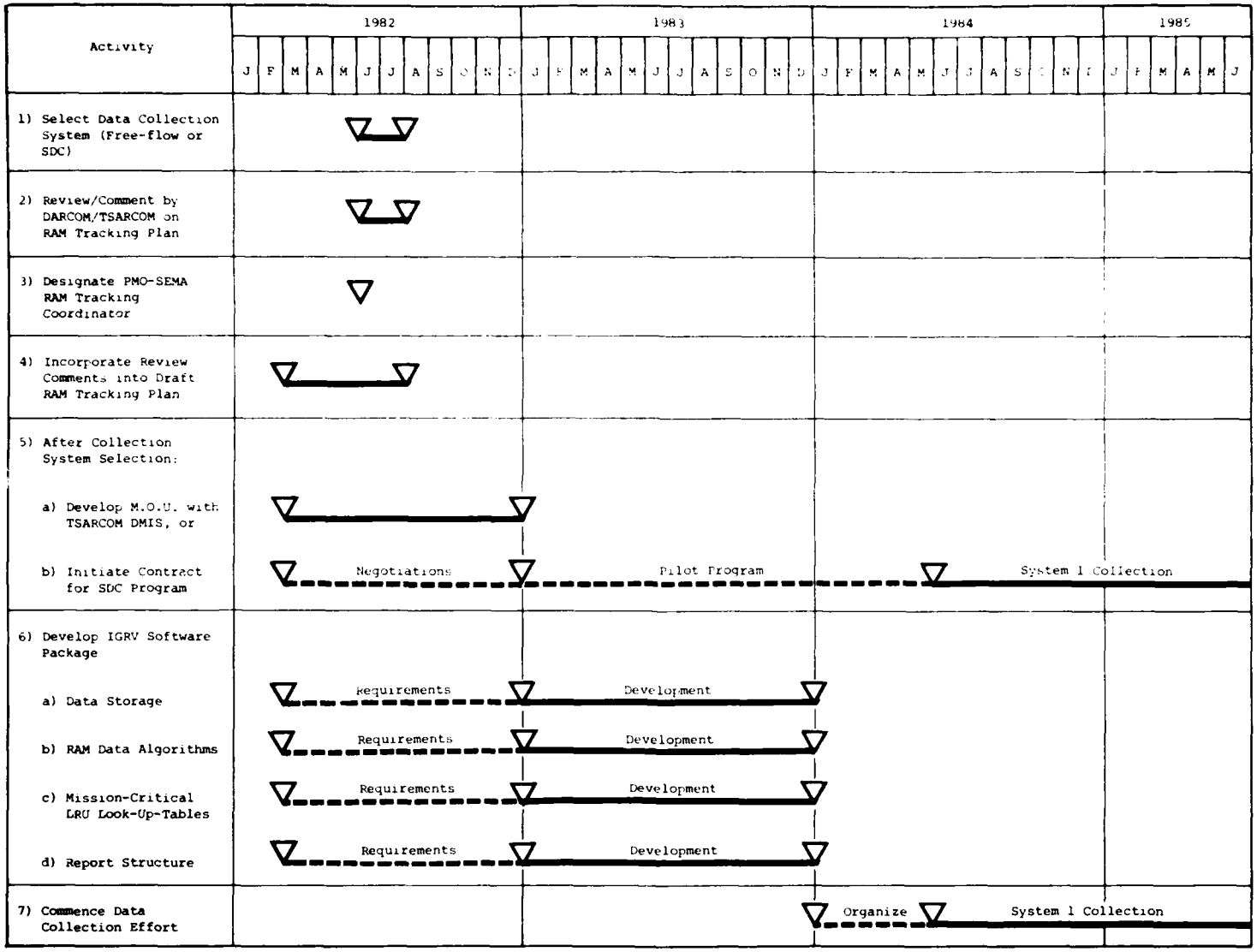
	RAM Rationale Annex

Miscellaneous

AD-A009-045	Maintainability Engineering Design Notebook
AD-A024-601	Reliability Design Handbook
RADC-TR-75-22	Non-Electronic Reliability Notebook
LD 35204A	RAM Handbook for the Combat Developer
LD 32447A	Reliability and Maintainability Planning Guide for Army Aviation Systems and Components
RADC-TR-77-287 (AD-A050837)	A Redundancy Notebook
RADC-TR-78-224 (AD-A069384)	A Guide to Built-In Test
DARCOM SUP. to AR 702-3	4 May 78 - Army Materiel Reliability, Availability, and Maintainability (RAM)
Army-Fort Lee, VA 13349-80-500-C	RAM Rationale Annex Handbook, U.S. Army Logistics Center, Fort Lee, Virginia, March 1980

ANNEX D

RAM TRACKING PLAN
IMPLEMENTATION SCHEDULE



ANNEX D. RAM TRACKING PLAN IMPLEMENTATION SCHEDULE

ANNEX E

DESCRIPTION OF DA FORMS

DA Form 2406, Material Condition Status Report (Figure E-1) provides:

- The DA Staff with a collection of information on those items of equipment which are considered essential and required a significant amount of maintenance to ensure operational reliability.
- Commanders at all levels with a means of forecasting equipment availability based upon current and historical data. The forecasting should be viewed as estimates since previous equipment downtime may have resulted from unusual or nonrecurring usage, climate conditions, or abuse.
- Unit commanders who are required to report unit status in accordance with AR 220-1, with a worksheet for computing equipment status (ES) and equipment readiness (ER).
- Commanders of logistics supporting activities with the status of equipment of the supported units.

This form allows the user to track equipment by quantity, availability, and supply and maintenance downtime. DA Form 2406 is completed monthly by all Army units for equipment listed in paragraph 4.6 of TM 38-750.

DA Form 2407, Maintenance Request (Figure E-2) is used to:

- Request maintenance from direct support or a higher level maintenance shop
- Request/report the accomplishment of modification work orders (MWO) on all Army aircraft and components
- Submit warranty claim actions
- Serve as a source document for the Sample Data Collection (SDC) Program
- Track work completed by maintenance man-hours

This form allows the user to track equipment repairs by LRU and serial number, parts replaced, and repair man-hours.

DA Form 1352, Army Aircraft Inventory, Status, and Flying Time Reporting (Figure E-3) is used to:

- Account for aircraft flying hours by task number
- Provide tracking for aircraft mechanical problems affecting safety of flight
- Provide data on aircraft not mission capable maintenance (NMCM) and not mission capable supply (NMC) characteristics

This form will allow the user to track flying hours for each aircraft assigned to a GUARDRAIL unit. This form will provide the main data input for determining total operating time (TOT) of the system.