APPENDIX B

OPERATIONAL APPLICATION DATA

B.0 Operation, Deployment and Maintenance Introduction

This section provides some operational guidelines specific to System 2. System 2's operational capability is greater than other Guardrail systems, hence not all of this data applies to previous systems, but most of the site considerations, set-up guidelines and mission initialization processes described here are typical for any of the system's deployment and operational considerations. Most of the differences between the systems applications described in this appendix are: 1) different technical manuals numbers apply, 2) System 2 has a larger signal set and new "scan plans" that apply to its expanded operation in a modern signal environment, 3) System 2 has built-in payload preflight BIT, and 4) The instructions here include references to Universal Workstations that are unique to Guardrail Systems 1 and 2. (Older systems use the Main System Computer (MSC) to control the operator terminals).

The information in this section is not intended to be all inclusive, but is only to give the reader the flavor of how to apply System 2 with its enhancements and provide an indication of the added power of its programmable capabilities.

B.1 Re- deployment Considerations

The GR/CS System maintenance manual, TM 11-5865-273-12, provides site selection and preparation instructions. Also, a complete, detailed, explanation of how to accomplish the tear-down/set-up tasks is included in TM 11-5865-267-23. The following paragraphs are a supplement to the site selection, preparation, and movement procedures contained in the manuals.

B.1.1 Site Selection and Preparation

It is recommended that potential IPF sites be identified and that a global positioning system (GPS) survey by a topographical unit be included in GDP planning. The following points must be determined within one meter:

o The two communications antenna masts placed 100 feet apart, and a precisely known point midway between the masts. This survey data will be entered into the IPF computer so that the masts may be used to calibrate and monitor system accuracy throughout the mission.

o The geographical coordinates and the elevation of the points on the ground above which each IDL tracker will be placed must be known for proper calibration of the IDL links. True north with respect to each tracker antenna axis must be known.

o A landmark greater than 1500 feet from the tracker antennas, within sight of the tracker antennas, that will be used to optically boresight the antennas.

As part of the survey, an analysis should be performed to identify obstacles on the horizon, to determine the best locations for the tracker antennas. This analysis should be accomplished utilizing a theodolite to map the height of the horizon, and obstacles above 0 degrees vertical, at 5-degree intervals around that portion of the compass in which the IDL trackers will probably be oriented during the anticipated missions. Refer to the Track Range vs Aircraft Altitude figure in TM 11-5865-273-12. This graph shows the range limit of the IDL link versus aircraft altitude, for ideal conditions.

A pre-survey by an advance party should be performed on the proposed site to initiate a GPS survey or via support from an artillery unit's organic survey assets.

The site must have a vehicle access with a minimum of 13 feet overhead, and 9 feet side-to-side clearance. Refer to the figure at the end of appendix C for a typical IPF site layout.

Refer to the Transportability Engineering Analysis. Figure FO-8 in TM 11-5865-267-23 is a transportability diagram showing dimensions and weights for all IPF trailers. Shoring kits (for C-5A, C-130 and C-141 aircraft). Shoring is required to provide an additional truck ramp and reinforcement for the aircraft loading , or a K-Loader for C-130 and C-141's (see Figure 10-1).

B.1.2 Disassembly

B.1.2.1 IPF

The IPF is installed in a rear area. When a move is planned, the IPF maintenance manual recommends that the IPF crew be organized into work details, and describes the tasks each detail performs in tearing down and setting up the IPF.

The minimum area required is that which will allow the IPF vans and the power trailers to be parked parallel to each other. The IPF vans should be spaced such that the walkways can be easily installed. After the vans are parked, they need to be leveled within limits (see TM 11-5865-273-12, chapter 2, for IPF site preparation specifications).

Refer to TM 11-5865-273-12, chapter 2, for Subsystem Site Preparation. Refer to TM 11-5865-267-23, chapter 2, for IPF Site Assembly Instructions. Instead of the van layout shown in the manuals, the commander may prefer a more militarily defensive positioning of the IPF vans and trailers. Typically, the maintenance vans would be positioned to protect the IPF vans, and sandbag brumes would be placed appropriately to protect the IPF and power trailers. The maximum distances (100 feet) for cabling to and from the power trailers, and other maximum distances as shown on the layout diagrams, must be satisfied, however. The maximum distance between the two power trailers is 30 feet. This can be used if it is desired to park the fuel trailers between the power trailers. If it is desired to use the walkway bridge between the power trailers, the trailers must be spaced 6 feet apart (6 feet minimum, 6 feet 6 inches maximum).

B.1.2.2 Power System

Position the power trailers so that all cables are able to reach their specified units (see IPF cabling diagram, TM 11-5865-267-23-3, figure FO-11, sheets 141 and 142). The critical cable distances are the main power input to van 1 (less than 100 feet of cable), the farthest air conditioners, and the van 2 computer air conditioners.

Grounding is very important to safety and operation. The grounding rods (supplied with the IPF) should be positioned as specified

B.1.3 Garrison Setup

Semi-permanent or "garrison" site improvements such as paving and permanent security fences, a guard shack and cleanliness procedures are recommended to increase the utility of the site and to minimize the need for extra maintenance of the system.

B.1.4 IPF Pad

In a field scenario, the IPF will require periodic checking of leveling of the vans and trailers. To minimize this requirement, a permanent pad of either concrete and asphalt is recommended.

B.1.5 Calibration Antennas

These antennas are not required for system operation but provide an important support function. A calibration antenna is mounted on each IPF antenna mast. The antennas are driven by the mid-band and high-band DF test transmitters in the IPF. They are used during calibration flights to gather DF calibration data, and are also used during missions to verify proper DF operation of the system. The masts must be spaced 50 to 100 feet apart, and the point mid-way between the masts must be accurately determined by GPS survey. Panel Bias emitters are selected from emitters with highly accurate, known locations. These will normally be "friendly" emitters with accurately surveyed locations.

B.1.6 Communications

After the IPF is set up, coordinate with the S-2 to install the secure phone and data interop (TRI-TAC) lines. The secure phone line connects to van 1, and the TRI-TAC line connects to van 3. A list of the various land lines with the type of data appropriate to each and data rates are listed in Table B.1.6-1. S-2 should manage all security and logistics matters regarding the ground interop lines.

Other communications are routed through the Three Channel CTT. These protocols include TIBS, TRIXS, TADIXS-B and TRAP nets as part of the CTT tactical reporting capability. The CTT also supports Quick Fire receive only collateral reporting.

Table B.1.6-1
Land Line Characteristics

Interface	Data	Protocol	Data Rate (kbps)
MSE SCI Data	Messages	AUTODIN Mode I	16
MSE Collateral Data	Messages	AUTODIN Mode I	16
AUTODIN SCI Data	Messages	AUTODIN Mode I	1.2 or 2.4
AUTODIN Collateral Data	Messages	AUTODIN Mode I	1.2 or 2.4
KY68 Secure Voice	Voice, facsimile		16
STUIII Secure Voice	Voice, facsimile		1.2 (fax) or 2.4 (voice)

B1.7 Data Link

The tracking antennas must have unobstructed line of sight to the aircraft for the full racetrack lengths. Refer to the Flight Tracks topic in the Aircraft Operation section for guidelines for determining flight tracks. If the racetracks are satisfactory for ELINT and CHAALS, they will be acceptable for to DOA. Refer to TM 11-5865-273-12, chapter 2, for a chart showing Track Range vs Aircraft Altitude.

If a greater height advantage is required to achieve required coverage, the trackers should be positioned on brumes at an elevation high enough to permit the IPF to link up with the aircraft over the entire mission area. If practical, the position of the tracker should also allow link-up on the ground prior to takeoff. The position of all three trackers should be such that the three link RF beams do not cross each other. If brumes are required to achieve height advantage for the trackers, they should be built with a gradual ramp, so that a truck tractor is able to back the tracker trailer into place.

Safety warning notices are included on the inside front cover and in the front-matter safety summary section of each GR/CS manual. In particular, safety notices regarding harmful microwave radiation from the IDL antennas and hazards caused by rotation of the IGDL dishes are provided.

B.2 Security

B.2.1 Security During Setup

The GR/CS System (the IPF subsystem in particular) must operate in a secure environment. Measures to ensure the security of the system include physical security, communications security, data security, and operational security. These measures must be taken to both protect the system and permit it to operate as a special Compartmented intelligence facility (SCIF).

B.2.2 Physical Security

The IPF must be located in a secure locality with a secure perimeter and controlled access to the compound. The airfield should also be a secure area. Approved safes need to be provided for classified documentation and magnetic media. Approved padlocks should be used to lock the IPF outside doors and passageway doors when the IPF is unmanned. COMSEC equipment onboard must be removed between missions.

B.2.3 Communications Security

All GR/CS system communications, including radio, data link, and land line, are secured through the use of appropriate COMSEC devices (see TM 11-5856-273-12, Security Safeguards in chapter 2). Care must be taken to ensure that the security of the devices themselves as well as any accompanying documentation is maintained. This is especially true for those devices located at the airfield with the ARF platforms, and the units deployed with the CTT's. Care also must be taken to operate the installed communications and COMSEC equipment properly, so that communications security is not compromised.

B.2.4 Data Security

Since the IPF operates at the SCIF level, provisions must be made by the unit for securing operational data, especially at vulnerable times, such as during movement. Approved safes are provided for storage of classified documentation and removable magnetic media. This includes the posted frequency assignments, any classified technical manuals, printed classified messages, IEWP Bernoulli cartridge, computer tape drive magnetic tapes, reel-to-reel magnetic tapes, and 30-day storage magnetic tape cartridges. Items such as the computer hard disk drive units and the digital temporary storage recorder (DTSR) units, however, cannot be removed for secure storage. Thus, access to the vans must be restricted at all times.

In the event of movement or other possible compromising situation, it is recommended that the data on these non-removable units be erased. Since the GR/CS system has not been approved/accredited as a multi-level security (MLS) system, all data leaving the system must be treated at the highest clearance level of the system unless it has been reviewed.

B.2.5 Operational Security

The GR/CS System has been physically designed to limit, to the greatest extent possible, any compromising emanations or susceptibility to external interference (TEMPEST). This includes electrical, electromagnetic, visual, and acoustical compromise. These security measures are enhanced by locating the IPF in a secure area set back from the FLOT, out of range of hostile sensors with the specified perimeter. Care must be taken not to alter the system or introduce any devices that might defeat the safeguards built into the system.

B.3 Maintenance Concept

The basic isolation of problems will be performed by Army maintenance personnel (33R type) using the built-in-test capabilities of the IPF and ARF. Once a failure has been identified, the replacement of certain items dictates a thorough working knowledge of the UNIX operating system in order to handle various contingencies and understand status messages during system initialization. This knowledge is beyond the scope of "cook book" recipes such that training in this is required separately.

Training for a computer system administrative function will need to be obtained for responsible unit personnel. Training should include system administrative functions for the CCC Micro 5 OS/32 operating system, CCC 7000 series chassis RTU operating system, SUN UNIX operating system for the workstations and file servers.

B.4 Mission Mode Operational Descriptions

The following sections provide a description of how the system works from the operations standpoint and the strengths of specific configurations and functions. The section starts with a description of the types of scan plans which can be selected and what they mean, a description of the various flight profiles, and a description, by mission scenario, of the functions available. The first scenario described, Guardrail Garrison Tethered Standard Operations Scenario, will be the normal operational configuration. Since in this configuration, over 85% of the functions are available, this section contains the primary functional descriptions. The scenarios which follow this section describe the deltas in functionality dependent on the specific configurations involved.

B.4.1 Guardrail Garrison Tethered Standard Operations Scenario

Normal peacetime operation, except for certain field manuvers, takes place in a garrison setting. Garrison is primary location of system and has the best facilities. This is a standard mission consisting of the launching of 3 system 2 ARFs in a standard tethered configuration.

B.4.2 Mission Planning

B.4.2.1 Tasking Definition

The definition of a mission starts with the analysis of various tasking inputs and research to define target specifics.

B.4.2.1.1 Tasking Inputs

B.4.2.1.1.1 Corps Tasking

Corps tasking is derived by the analysis of all corps related intelligence and the mission directives passed to the corps and is generated by the corps TCAE.
Corps tasking is passed to the unit by one of the IPF comms interfaces.

Corps tasking will normally include general tasking such as look for any type of tactical units, and some specific tasking which includes tips on specific exercises which may be taking place.

B.4.2.1.1.2 Battalion Tasking

The battalion S2 receives the corps TCAE tasking which is implemented by the Guardrail mission managers. Specific tasking has a direct consideration during system initialization and mission planning. Mission planning includes a simulated view of the mission area using digitized terrain maps with automatic field of view and shadowing of target areas. The flight tracks are planned and mission assets are allocated to optimize the mission results.

B.4.2.2 Tip reports

Tip reports are received through any of the various message interfaces. Tip reports are received from other collection systems. This information can be of varying accuracy and timliness dependent on the source.

B.4.2.3 Research and Analysis

B.4.2.3.1 Site Specific Information

Site specific information consists of that information which has been gathered either prior to the unit arriving or during past missions. This may include historical information from other systems. The information would include targets which have been identified, normal transmission characteristics, normal locations, etc.

B.4.2.3.2 EOB Data Usage

The EOB data provides generic definitions of target groups. This information can be used to provide basic target information relating to given tasking which is specified for expample, in the form of "find all armored cavalry units". This information is combined with the site specific information to define the target set for the mission.

B.4.2.4 Mission Definition

After the tasking has been analyzed, a mission definition is developed by taking the target lists developed and inputting specific search plans into the system. Search plans are generated for both communications and non-communications signal types.

B.4.2.4.1 Communications Signals Search Definition

The generation of a mission plan for the search and exploitation of communications signals consists of utilizing the mission definition and setting scan plans, operator assignments, directed search tasking, and general search tasking.

B.4.2.4.2 Scan Plan Definition

The selection of a scan plan is dependent on the expected density of the signal environment which the mission manager expects to encounter and the types of comms signals expected. There are five scan plans which the mission manager can choose from to optimize comms mission performance. Selection of scan plans may be performed on a payload-by-payload basis but must be done with an understanding of the operational constraints imposed by the selections.

B.4.2.4.2.1 Scan Plan 1: Combined

Scan plan 1 is the default scan plan for system operations. This scan plan provides a balanced search plan for the automatic search assets, allowing for optimum performance in a combined conventional and LPI comms environment. This scan plan allows for operations in a combined environment consisting of X conventional nets and Y LPI nets with the LPI emitters ranging from A to N.

This scan plan provides for the generation of conventional comms search and DF results for bands 2-4 with a paricular revisit rate. The scan plan provides for the generation of LPI comms results over a 60 MHz band, located anywhere in the band 2 or 3 range with a revisit rate of B. When this scan plan is used, there is also the ability to obtain search results in the band 5 range on comms signals without DF. This scan plan also provides for visual search inputs for the narrow band conventional receiver assets.

B.4.2.4.2.2 Scan Plan 2: LPI

Scan plan 2 provides for optimized performance in an LPI environment. In this mode, the payload resources are dedicated to the task of search and DF on LPI signals. This scan plan allows for operation in a rich LPI environment.
When this scan plan is selected, while the narrow band conventional receivers are available for manual intercept operations, there are no resources available for performing "conventional comms non-DF search" nor are there resources available to provide PAN/SD data generation.

B.4.2.4.2.3 Scan Plan 3: Conventional

This scan plan is selected to optimize operations against conventional signals. This scan plan would be utilized if the tasking definition showed either the absence of LPI emitters or if the LPI environment is light and not of primary mission interest. Using this scan plan allows for the generation of results in a typical tactical environment. The use of this scan plan also configures the system for non-DF search in band 5 and PAN/SD support for the narrow band conventional receivers.

B.4.2.4.2.4 Scan Plan 4: Full-band LPI Copy

Scan plan 4 is selected to provide for the capability to track and copy LPI type signals. This scan plan provides for up to four copy channels in a moderate LPI environment. Fewer copy channels are available in denser environments since some resources must be utilized to provide additional tracking information. This scan plan would be selected for one aircraft only. The other two aircraft are required to be configured for scan plan 1 or 3 since they provide additional tracking information to the "copy" comfigured platform.

B.4.2.4.2.5 Scan Plan 5: Sub-band LPI copy

Scan plan 5 is similar to 4 except it is targeted at environments in which only limited band LPI transmissions of interest are present.

B.4.2.4.3 Manual Search Definition

Manual search definition is the generation of operator tasking. Mission managers will designate who the mission supervisor will be for the mission and define manual search operations ranges. Operator supervisors assign the frequencies of interest to each collection operator to collect on. It is the supervisor's responsibility to monitor the status of collection operator performance and help in resolving any mission difficulties. The manual search definitions are then entered into the system using the list function to provide frequency range and tasking lists for individual operators.

B.4.2.4.4 Directed Search Definition

Directed search operation is defined as the tasking for automatic search for conventional comms signals of known parameters. Known parameters must include frequency and may include potential locations, and signal types. Directed search operations are under control of individual operators. Mission managers and supervisors can either pass directed search entries to the operators via the Directed Search list definition facility or they can enter these signal parameters themselves.

B.4.2.4.5 General Search Definition

General search is the ability of the system to automatically search for signals within bands of interest. The general search capability is used to provide the mission manager with general environmental information when little or no apriori information on the signal environment is known; however, it is highly advantageous to desginate General Search bands that are consistent with partcular signal types.

The definition of the general search bands of interest and geographic areas of interest to limit the search are defined as part of the tasking definition.

Once the general search parameters are defined, the mission manager can enter this information into the system prior to mission.

B.4.2.4.6 Non-communications Signals Search Definition

The signal environment encountered by the GR ELINT system may be intense, with many unwanted emissions mixed with target information from the mission area. One method of reducing the processing and confusion generated by the intercept of all emissions, is to carefully develop the scan tables to search in a "smart" manner. A thorough study of the spectrum and environment will reveal which emissions are of no interest to the Tactical Commanders that are being supported by the ELINT system. However, some of the emissions may be in close RF proximity to signals of interest, and cannot be completely filtered via the scanning routines.

Initial missions will be flown with the scanning routines set to search the full spectrum. Attempts to pre-program the scanning routines before flights in an unfamiliar area could result in failure to intercept critical information. After the initial "hear ability" flights, the analysts should begin to program the routines to eliminate the unwanted clutter. The process of programming the scanning routines must be gradual and cautious to avoid inadvertent elimination of emitters of interest.

B.4.2.5 Blue/Gray/Red Deployment

The flight tracks for the GRCS will allow the GR system to intercept friendly emitters as well as enemy emitters, or they may be filtered. Because of the proximity of emitters to each other on the battlefield filtering may not be possible by AOI screening alone. Also, with the modern deep-battle concept and the high mobility of assault forces, there may be rapid, deep penetration of lines with enemy or friendly emitter activity that crosses the line and with unforeseen movements. In addition to the fluid environment, there are often emitters and weapon systems common to both sides in the battle. All these factors lead to difficulty in identification of specific emitters with specific forces. In some cases, the scan tables can also be adjusted to make this problem less difficult for the analysts to solve.

The primary method used to deal with this situation is through identification of special areas of high interest, but may require operator intervention and careful analysis of nets and origin of signals to adequately screen the data.

B.4.2.5.1 Operator Functions/Assignments

The functions and operator assignments within the specific GR IPF subsystem are fairly well defined. Generally three non-communications positions provide for an ELINT supervisor and two operator/analysts. Any of the three positions can be selected at the beginning of the mission to perform the supervisor functions. One of the operator positions is also designated by the ELINT supervisor as the TDOA position. Most of the location correlation as well as TDOA functions will probably be performed at this position.

The functions of the ELINT supervisor and the TDOA position must be identified and selected by specific position. Tactical reports can be generated at any of the positions, but must pass through the ELINT supervisor for final approval and release.

B.4.2.5.2 ELINT Clutter

There are several types of emitters that can clutter some segments of the spectrum, causing excessive processing time and storage demands. Examples of such emitters are TACAN and navigation systems, microwave data and communications systems, and commercial systems. In addition, some radar systems may be so concentrated in some areas that they cause processing problems. One type that could be encountered in certain theaters is navigation radar used on commercial and private ocean vessels. Some nations have allocated frequency bands for these, and other, specialized systems. Interference with signals that are of interest to the operator may result from these unwanted signals. It is at this point that the analysts must determine how much of the band can be eliminated from the scanning routines. The scan tables can be modified to either exclude these emitter ranges, if no critical data is lost, or add them to an "airborne emitter" file if appropriate.

B.4.2.5.3 Airborne Emitters

Location processing can be disabled on specific emitters that are moving or for which no location information is desired. These emitters are identified in the planning as "airborne emitters". They may or may not actually be airborne platforms, but are treated by the location processors as a moving emitters not requiring location processing.

B.4.2.5.4 Priority Emitters

Priority emitters can be identified by ELINT notation (ELNOT) or TSF emitter. When selected, the scan routines will apply special consideration in scanning for these emitters. Another method of prioritization is designation of areas of high interest. The emitters intercepted and falling within these areas will be prioritized by the DAOS and passed to the scanning routines in the APOS to provide special scanning while the emitters remain active.

B.4.2.5.5 TDOA Emitters

Automated TDOA processing will occur for designated emitters that are included in the priority emitters list; that is, identified by ELNOT or TSF, and included in the appropriate TDOA file and can be intercepted by at least one other platform simultaneously. When initial parameters for automated TDOA are met, the TDOA will be performed without operator direction. Manual TDOA can also be performed on any emitter that has been observed by at least two aircraft. After a TDOA location has been determined, the operator/analyst can report the location by normal reporting functions.

B.4.2.5.6 COMINT TDOA Designations

TDOA does not affect the operation of DOA. The only affect to DOA is that TDOA is a queuing type of operation, such that when TDOA is preoccupied by a task, no other queued TDOA is able to interrupt and no TDOA fix will be performed. This will sometimes slow a collection operator when he is trying to get a TDOA at a particular frequency and he is unable to get into the queue. Thus, he will be unable to move on to the next frequency. TDOA is much slower than DOA, and the TDOA response time is inversely related to the frequency of interest. A HF TDOA takes about 4 seconds, but the response time is less for UHF and VHF.

B.5 System Internal Communications Configuration

B.5.1 Intercom Nets

The IPF has a default intercom net configuration. However, when programming a net for intercom, is recommended that one net be configured for all operators, for general announcements or as a type of controller channel. The other nets can then be set up so that operators with similar or related tasks can communicate with one another.

The ELINT personnel in the IPF should be placed on one intercom net for mission activities. This will preclude interference and excessive mission associated communications on all the nets. The ELINT supervisor should be available on other nets as required.

B.6 System Power Up

In the garrison configuration, the IPF normally remains powered 24 hours per day. However, in the event that the IPF has been previously powered down, the process for restoring power is listed. The process generally assumes that the airconditioning system has remained active during the time the vans have been without power. The sequence of powering the vans is not relevant.

B.6.1 Computer Initialization

Computer Initialization refers to the booting and loading of mission programs and data into the Main System Computer (MSC) and the Elint system Computer (ESC). The Initialization is performed via console windows on workstations with direct RS232 connections to the computer to be initialized.

The initialization is performed in two steps: 1) Console Login which is attaining access to a RS232 connection to the computer to be initialized, and 2) computer booting which is the loading and initialization of the system and the mission software.

B.6.2 Console Login

The operator must first login to the Workstation with an RS232 connection to the Computer to be booted. (See Workstation initialization Below) After, the operator completes login on the workstation, the RS232 ICON is selected from the ICON Window. A terminal window is displayed and the operator has a direct RS232 connection to the computer to be booted.

B.6.3 Computer Booting

The MSC processor utilizes the Concurrent Control Diagnostic System (CDS) to accomplish bootstrap functions. The CDS is a microprocessor controlled bootstrap function which requires operator input at the System Console. Workstations with direct RS232 links to the computer are utilized as the System Console by bringing up and RS232 Window. The Concurrent CDS will normally be used to bootstrap the system from disc.

As a backup, the system may also be bootstrapped from magnetic tape, utilizing the CDS. On successful boot, the operating system will prompt at the System Console for time initialization of the system clock to be maintained by the system.

The second phase of system initialization is to load the MSC software into memory. This function requires operator input at the System Console.

The MSC software consists of operational, calibration data gathering, and offline support software. The operational software is defined as the software required to support normal operations.

The third phase of system initialization is to initialize system parameters. This function allows the Test Operator to initialize mission specific parameters. System parameter initialization occurs only at the beginning of a processing session. A processing session is defined as beginning when the operational software is loaded into memory and ending when the operational software is removed from memory.

The first step in parameter initialization is to specify the mode of operation and the file ID to be used during this processing session. Three modes of operation are supported by the GR/CS System. These are: 1) processing of a new mission, 2) processing of a previous mission, and 3) analysis of an historical mission. The file ID input specifies which Mission File and Situation Data Base are to be used. Since the Mission File and the Situation Data Base contain associated data, they are considered a set. The operator should be aware that specification of processing of a new mission causes previous mission data contained in the Mission File and Situation Data Base associated with the ID specified to no longer be accessible. In addition, the Message File may be purged by the operator during system initialization for each processing session.

The second step in system parameter initialization is to optionally modify the system parameter list which was used during the last processing session. The system parameter list includes the following: IPF and LB calibration antenna locations, spheroid of mission area covered, DOA frequency range for MB/HB and LB operations, aircraft roll limit thresholds, TDOA initialization parameters (TDOA frequency range, base refractivity and height, CEP and dwell defaults, equatorial gravity, tracker location and height information, and default FOI coordinates), ELINT initialization parameters (ELINT frequency range), coordinates for the LB Default FOI, receiver type information (including MB/HB or LB usage), and TRI-TAC routing indicators.

B.6.4 Workstation Initialization

At initialization, the workstation boots and performs a set of diagnostic tests on its associated hardware. If the tests pass, the workstation software presents a login screen to the operator and operator input is enabled.

The operator enters personal login identification information. The login information is checked against a local copy of an encrypted password file. If the login information is legal, the workstation attempts to connect with the MSC and pass it the login information. The MSC uses the information to look up and pass back the command class information to the workstation. The workstation uses the command class information to decide what system functions to make available to the operator. The default MMI screen is then presented to the operator, consisting of the main menu bar with options corresponding to major system functions.

If the MSC communication link cannot be established, the workstation will present the operator with an MMI that contains a minimum set of options enabled, including RCU, Ramtek emulator, and minimal audio capability. If the initial diagnostics test fail, a failure explanation will be displayed to the operator.

B.6.5 PAM

PAM's initialize the normal default operational mode during the power-up procedure.

B.7 BIT

B.7.1 IPF Premission BIT

Premission test of the COMINT equipment in the IPF is performed as part of the overall IPF initialization process. After initialization, each unit automatically reports its operational readiness as part of the on-line process. The display equipment page shows each IPF unit and designates its status by label and a color code. By using the expanded BIT display, the test operator can also check the status of each circuit card assembly (CCA)/module to the extent that that level of reporting is supported in the IPF. During the normal initialization process, the major system interfaces are simultaneously tested automatically with the individual units. If the units report in, this validates that the MCL is working since communications with each unit if via the MCL. As part of the AMS self test, a canned data stream representing audio data is passed across the RTL to verify that the RTL connection is working. In a similar manner, each workstation performs an RTL loop test to validate its connection to the network.

The test operator can not only review the initialization status of units, he can request BIT to be performed on individual units or perform various interface tests via the BIT page. For IPF premission testing, the tests which can be run are broken into two groups, LRU and INTERFACE BIT. The indiviudual tests are listed below.

B.7.2 Flight Line ARF Power Up

On hot days, prior to powering up the aircraft and its equipment, an air-conditioning cart is positioned to supply cooling. The cart is positioned so that the air duct can be routed through the aircraft entry door, but so that the unit itself does not interfere with the area between the tail boom antenna and the port wing pod (VHF baseline 5).

The next step is to position an auxiliary power unit (APU) next to the aircraft to supply power followed by Avionics Initialization

Once aircraft power has been activated, the PME is ready for power up. Prior to power up, all chassis boot cartridges must be in place attached to the SCSI ports of the VME #1 and #2 chassis. Power is then applied to the PME by putting the breakers on the port and starboard power panels into the "ON" position. This enables power to the individual units of the payload.

The airborne segment architecture includes all on-board BIT required to support normal operational readiness (GO/NO-GO) end to end tests. Testing includes power-on BIT, extended BIT, and thread BIT. Execution of BIT and display of BIT status are obtained by the use of the ARF Touch Panel Display (TPD). A secondary method allows for high level payload status to be viewed by using the avionics control system/multifunction display (ACS/MFD) in the cockpit.

The on-board premission BIT provides a thorough test of all PME equipment and data paths without the use of any external stimulus.

As the aircraft PME powers up, all units boot and run power-up diagnostics. The individual units hold the power on results until the maintenance software initializes and requests the results. After equipment power has been applied, the test operator will view the power-on BIT results on the TPD. Power-on BIT performs elemental testing of modules and circuit cards to validate that they have power and can communicate with the ARF maintenance manager. When power is applied to the GDDL, CHALS-X processor, and ARF server, these units self boot and automatically run self test on all components. When the common module carrier (CMC) chassis power is on, each line replaceable module (LRM) runs its own self test and reports the results to the ARF server. At this point, the server provides basic status to the test operator via a display on the ARF touch panel display. The results will be displayed at the chassis level showing pass/fail for the chassis. If any chassis has a failure, the display can be expanded to allow for viewing of individual CCA/module results in order to find a failed module location.

B.7.3. Software Load

After the power-on tests are complete, the test operator will attach the data disc drive to the drive port (SCSI port) on the ARF server which supplies power and a data transfer interface for the drive. This drive contains all of the mission and BIT software for the payload which is classified secret. The operator then uses the menu selections on the TPD to download the software from the mission disc to the ARF server RAM disc.

B.7.4 Extended BIT

Once the test code is downloaded, the test operator commands the initiation of the preflight BIT routines. The touch panel provides the test operator a method for starting a fully contained test routine or for running only specific test sections. The results of the extended BIT are displayed for each major equipment group, showing status to the circuit card assembly (CCA)/module level.

B.7.5 Thread BIT

The CHALS-X system performs self tests of the processor chassis and injects a signal into the front of the receiver to test the receiver paths. As part of the CHALS-X test sequence, a test signal is generated and broadcast from the BIT antenna (band 2 intercept antenna). Commands are sent to the CHALS-X subsystem to report the presence of the test signal to verify all RF paths to the receiver. All results are relayed to the ARF server via the ARF FDDI LAN.

The ELINT portion of the SIGINT system first performs module-level tests of all of the digitization and processor modules in CMC 4. The line replaceable unit diagnostics (LRUD) routines are then downloaded from the server to provide testing of the front end of the ELINT subsystem. All results are relayed to the ARF server via the ARF FDDI LAN.

The COMINT portion of the SIGINT system performs various thread tests in order to assure data paths are operational. After power-up, each LRM provides its self test results to the server. As part of the power-up testing, each module verifies its processor, memory, and fiber optic interfaces. The server then downloads test code to the various modules in order to support COMINT thread testing. COMINT testing provides for the testing of various data paths in the system. Tests include radiated BIT tests that check all COMINT RF paths; injected tests that test all paths from the RFD; and digital path tests verify wire, data flow, and FDDI interfaces.

To perform the data link testing, the maintenance operator first puts the GDDL into an aircraft RF loop mode by steering first the forward and then the reverse antenna to a point off the side of the aircraft (specific coordinates for good RF loops will be determined during I&T). Steering of the antennas and status access of the RF loop link is provided via the ACS/MFD. This loop should be established prior to initiating the preflight BIT or the ARF interface tests will need to be run separately. During data link testing, the ARF server sends a canned data message to the link equipment. This message is looped through the RF loop and sent back to the ARF server. The server then checks the received message to validate correct performance of all interfaces.

As an alternate to the touch panel, the avionics control system (ACS) MMI will allow selection of ARF subsystem BIT. While not as detailed in display of results (GO/NO GO for subsystems, versus identification of failed units within subsystems), the ACS does permit another method for test operation. On selection of this option, a 1553B command is sent to the ARF server to execute the request. If the subsystems have not been loaded with operational software, the ARF server commands the subsystems to perform BIT, collects responses, and provides a message with GO/NO-GO response for the subsystems and ARF support group to the ACS, via the 1553B bus, for display. If the subsystems have already been loaded with the operational software, the ARF server will provide a BIT response based on the previously executed tests. The ACS MMI and control is a customer provided interface.

B.7.6 Recovery from BIT Failure

If a module or CCA is reported as defective, the test operator performs the necessary steps to replace the module, and runs the diagnostic tests again to assure system operation. Each CMC line replaceable module (LRM) has a mechanical flag that indicates failure of the module. During BIT execution, if a module failure is detected, the module is re-tested two more times. If the module fails two out of three tests, results in setting the mechanical flag. After successful completion of BIT, the operator can download the operational code and ARF calibration tables and initializes the platform for mission operations.

B.7.7 Pre-Launch Checks

Prior to takeoff, the power to the PME equipment is turned off, the power cart disconnected, and the engines started. Once the engines are restarted, the power is reapplied to the PME as part of the preflight procedure. The power-on BIT is rerun and results sent to the ACS/MFD where the pilots validate that the equipment is "GO" for the mission. The pilot then deactivates power to the mission except for the standby functions, and the mission is ready for take-off.

B.7.8 Overall Mission Initialization

B.7.8.1 Establish ARF Comms

Prior to launch of the aircraft, the mission manager in the IPF establishes communications with the pilots in the aircraft via the BUVOW UHF radio. This communications is used to verify that the PME was powered up successfully after engine startup, establish the exact time for takeoff, and aid in the establishment of a link between the IPF and the ARF if the positioning allows. After takeoff, the link operator in the IPF coordinates with the pilot via the BUVOW to establish data link communications.

B.7.8.2 System Level Mission BIT

After the aircraft is airborne and a stable data link is established, a series of tests of the system can be performed to validate the payload performance and system level performance. Testing consists of individual ARF PME tests or system level tests initiated by command from the IPF. Results of the ARF equipment testing is displayed on the ARF Equipment Status panel.

B.7.9 Resource Allocations

After the system test process has been completed, the system must be initialized for mission operations. This is done by the mission manager, who verifies or sets mission parameters and selects the capability threads for execution.

System parameters and thread selections are made such to meet the mission goals as defined by the system managers. Factors that determine what asset allocations are used include mission type (normal System 2, inter service interop, Guardrail interop, or mixed platform), mission profile (one, two, or three aircraft), environmental threat assessment (conventional, LPI, or combined COMINT), and platform mode selections (scanning or staring).
Selection of mission profile parameters includes setting the number of active aircraft, primary selection of required ARF functions, defining mission area, assigning receivers, etc, and is performed by accessing several equipment control pages.

Once the basic mission parameters are set, the manager selects the COMINT sensor capabilities that will be used at that point in the mission. These capabilities, which are called threads, define the hardware, software, and data paths that are configured to perform a specific function on the payload. The mission manager sets these threads by selecting the capabilities required for each platform. The thread selection is accomplished via the ARF resource manager window, a conceptual example of which is shown in figure B.7.9-1.

As capabilities are selected, the system "resource manager software" understands the hardware, software, and data path requirements for creating the thread to execute the desired capability.

Resources are then allocated automatically. As resources on each platform are used, some capabilities may no longer be available due to hardware utilization. As capabilities become unavailable, their selection is grayed out. By viewing the ARF resource manager window, the operator can see the modules required to construct a thread.

The resource allocations can be changed by the mission manager during a mission to meet changing mission profiles or to handle equipment failures. In order to change equipment allocations, the mission manager first deselects all capabilities for one or more platforms. He then selects the new capability mix desired. The system resource management software executes the desired setup and reallocates the resources.

Mission must be aborted when:

- Scheduled mission aircraft unable to establish data link
- DF inoperative on scheduled aircraft
- Navigation equipment inoperative
- Failure of avionics equipment crucial to safety of flight
- No spare LRUs to replace identified malfunctioned units, or if no reserve aircraft are available
- ARF server software function is not operating.

Example Directed Search/Geoscreening Thread

Figure B.7.9-1