INTERFACE SPECIFICATION

FOR THE

INTEGRATED OPERATIONAL NUDET DETECTION SYSTEM (IONDS)

GLOBAL SEGMENT (IGS) TERMINAL/HOST FACILITIES

SPACE DIVISION/AFSC/ YEG
P. O. Box 92960
Worldway Postal Center
Los Angeles, California 90009

Proposal No.: F04701-81-R-0025

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INTEGRATED OPERATIONAL NUDET

DETECTION SYSTEM (IONDS) GLOBAL SEGMENT (IGS)

TERMINAL/HOST FACILITIES

APPROVAL/CONCURRENCE

	Organization	Signature	Date
AF/PO	Space Division/ AFSC/ YEG		
Principal Contractor			
Participating Contractor(s)			
System Engineering & Integration Contractor	Ford Aerospace & Communications Corp. (FACC)	_John M Blake_	3/15/82

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1. INTRODUCTION

1.1 <u>Scope</u>. This interface specification (IFS) establishes the baseline for the design and control of the Ground/Airborne IGS Terminal (G/AIT) interfaces with the host facility. The host facility in this context is the airborne command post (with or without ADP), and Ground Command post (with or without CCPDS). This IFS describes the physical and functional interfaces between the G/AIT and the host facility.

1.2 <u>IFS approval and changes</u>. The G/AIT Systems Engineering and Integration Contractor (SEIC) is responsible for the initial IFS; the G/AIT contractor then assumes this responsibility. The following participants must approve this IFS:

    a. G/AIT SEIC – Ford Aerospace and Communications Corporation (FACC)

    b. G/AIT Contractor - (TBS)

    c. Principal Users - (TBS)

    d. Space Division/AFSC - YEG

Initial signature approval of this IFS can be contingent upon a letter of exception delineating those items by paragraph number that are not a part of the approval. This letter of exception can be prepared by any participant and must be furnished to FACC for inclusion in the final distribution of the initially approved IFS.

Changes to the approved version of this IFS can be initiated by any
participant and must be distributed to and approved by all participants.
FACC or the G/AIT contractor, as applicable, is responsible for the
preparation of the change pages, the coordination and the obtaining of
approval by required participants.

2. APPLICABLE DOCUMENTS

The following documents are applicable to this IFS.

2.1 Government documents

Specifications:

IGS-US-101 (SECRET) 11 Dec 1981	System Subsegment Specification for the Integrated Operational NUDET Detection System (IONDS) Global Segment (IGS) User Subsegment (U)
MIL-STD-188C	Common Long Haul and Tactical Communication System Technical Standard
FED-STD-1003	Synchronous Bit Oriented Data Line Control Procedures
NCMC	Data Processing and Link Processing for ADCCP
FAA	(TBD)

2.2 Non-government documents

Standards/Specifications:

ANSI X3.66 1979	American National Standard for Advanced Data Communication Control Procedures (ADCCP)
ROLM	1666 Processor & Communication Hardware/Software Specification
Interstate Electronic Corp. (IEC)	PD-3000 Display Terminal Specification

TRACOR INC.   TIN--2000 129-1 Specification

Data Metrics   DM-1500 Specification

EIA-RS-232C   Electronic Industry Association
MILCOPE   Graphic Inc.

3. INTERFACE REQUIREMENTS

The G/AIT shall be compatible physically and functionally with the host
facility and operational requirements. A diagram of the G/AIT which defines
its interfaces with the host facility and other interface capabilities is
shown in Figure 1. The numbers on the diagram key to the paragraph numbers
of Section 3.1 which describe the interfaces. All mechanical and electrical
interfaces between the G/AIT and the host shall comply with the FAA
specification.

3.1 Physical interfaces

3.1.1 G/AIT equipment rack to host facility. This is a mechanical interface
which provides for the attachment of the G/AIT equipment, exclusive of the
G/AIT antenna, to the host.

3.1.2 G/AIT antenna to host facility. This is a mechanical interface which
provides for mounting the antenna. The location shall support the L Band
signal reception requirements of IGS-US-101.

3.1.3 Host facility primary power and ground to G/AIT. This is an
electrical power interface which provides primary power of the required
voltage, amperage, and frequency to the G/AIT power supply unit via a power
cable. The G/AIT power requirements shall be in accordance with IGS-US-101.
The interface connection between the G/AIT ground and the facility ground is
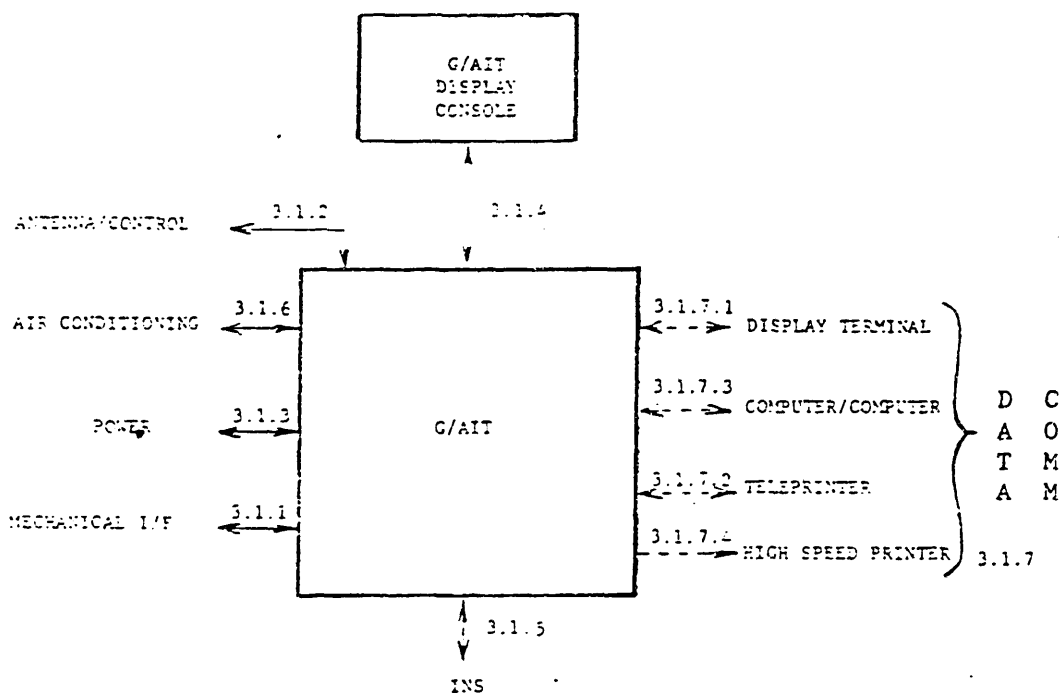made via a conductor or cable shield, as part of the power cable.

Figure 1. G/AIT to Host Facility Interface Capabilities

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--------- CAPABILITIES

3.1.4 <u>G/AIT display console interface</u>. This is a communication interface
that provides the means to add or delete the G/AIT's inherent display. The
G/AIT's inherent display is only required by a G/AIT operating in a stand
alone manner (i.e., airborne command post without ADP, or ground command post
without CCPDS, any installation that does not have a display device that can
acquire and display the G/AIT output).

The communication performance characteristic of this interface shall be as
specified in 3.1.7.1.

3.1.5 <u>G/AIT to INS interface</u>. This capability is provided for a G/AIT
operating onboard an Airborne host facility. This interface is used for
provision of aircraft orientation. The interface characteristics of this
interface shall be TBD. The functional requirements of this interface are
specified in 3.2.5.

3.1.6 <u>G/AIT air conditioning from the host facility</u>. This is a mechanical
interface which provides for conditioned air as specified in IGS-US-101.

3.1.7 <u>G/AIT/user and host communication interface</u>. The communication
interface between the G/AIT and the user/host equipment shall be in
accordance with the specifications of equipment currently operating in
certain host facilities (such as the airborne command post equipped with ADP
or ground command post equipped with CCPDS). The interconnection of this
specific equipment with G/AIT is discussed in the following paragraphs.
Equipment model numbers and manufacturers are identified. A summary of
interface characteristics for the equipment is provided.

3.1.7.1 <u>Display terminal interface</u>. The communication performance

characteristics of this interface shall be as follows:

    a. Communication interfacing in accordance with MIL-STD-188C,

        electrical interface shall be EIA-RS-232C compatible, serial,

        asynchronous.

    b. Communication speed of up to 9600 bps, half duplex.

The display device is a PD-3000 ruggedized alpha/graphic display terminal

manufactured by Interstate Electronic Corporation (IEC).

3.1.7.2 <u>Teletypewriter interface</u>. The communication performance

characteristics of this interface shall be in accordance with MIL-STD-188C,

serial asynchronous and include the following:

    a. Receive and transmit the ASCII 128 character set, in accordance with

        MIL-STD-188C, and print the ASCII-64 character subset plus parity

        error.

    b. Input/output data rate from G/AIT to the communication interface in

        the range from 75 bps to 2400 bps.

The device is a UGC-129 teletypewriter set manufactured by Tracor, Inc.

3.1.7.3 <u>Computer to computer communication interface</u>. This is an interface

between the G/AIT processor and any external (host facility) processor. Two

systems with which the G/AIT must be capable of communicating are the ADP

(onboard the aircraft) and the CCPDS (used at the NMCC, ANMCC, SAC, and NORAD

ground command posts.) The interface characteristics of these interfaces

shall be:

a. G/AIT to ADF interface

   (1) Synchronous operation, minimum 9600 bps

   (2) MIL-STD-153 compatible electrical interface

   (3) Full duplex

   (4) Character protocol TBD

b. G/AIT to CCPDS interface

   (1) Synchronous operation, 9600 bps

   (2) EIA-RS-232 compatible electrical interface

   (3) Full duplex point to point operation

   (4) Character protocol ADCCP

Detailed information on G/AIT to CCPDS interface is provided in NCMC data processing and link control procedures for systems using ADCCP Link Protocol.

3.1.7.4 <u>G/AIT High speed printer interface</u>. This is a one way communication interface providing the user with a hardcopy printout. This interface provides the means of switchability of the high speed printer between the G/AIT and the host facility data processing equipment. The high speed printer used onboard the EC-135C is a high speed, non-impact, microprocessor-driven militarized page printer/plotter, DMC-1500, manufactured by Data Metrics Corporation. The high speed printer onboard the E-4B is manufactured by MILCOPE Graphics Inc.

The basic characteristics of the interface to handle this device are:

   a. Print rate of up to 1200/80 column lines per minute or 1600 characters per second.

   b. Asynchronous operation using the standard ASCII-64 character code.

c. Graphics mode plotting speed of 13,200 dot lines per minute, 480
    dots per line.

3.2 Functional interfaces. The following describes the functions to be
performed, the qualitative criteria to be met and any interface restraints
for each of the G/AIT to host facility and user interface identified in
Section 3.1.

3.2.1 G/AIT equipment rack to host facility. The interface criteria/
function for installation of the G/AIT equipment rack in the host facility
is:

a. The G/AIT equipment rack shall be located so that access space is
    available in front of the equipment.

b. The G/AIT installation shall enable connection of interfacing
    cabling, e.g., power and ground, antenna cables, and data cables.

c. The G/AIT installation shall be physically secured to prevent
    dislocation during movement of the host facility (mobile facility),
    or against seismic effects (fixed facility).

d. The G/AIT installation shall enable connection of interfacing ducts,
    e.g., conditioned air.

3.2.2 G/AIT antenna host facility. The antenna shall be located on the
aircraft to minimize drag while meeting IGS-US-101 signal reception
requirements.

3.2.3 Antenna/host facility interface to G/AIT receiver assembly. The
following interface specifications shall apply to all user facility types:

a. The RF signal cable connecting the antenna output at the antenna/host facility interface to the G/AIT receiver assembly RF input shall be of a type and length for minimum RF signal loss.

b. The RF signal and antenna directional pointing control cables shall be electrically and physically secured against disconnect from the antenna and the receiver/processor assembly.

3.2.4 <u>Host facility primary power and ground to the G/AIT</u>. The host facility shall provide primary power and grounding for the G/AIT in accordance with IGS-US-101.

3.2.5 <u>Host facility to G/AIT interface</u>. To enable the G/AIT to maintain antenna pointing to the RF signal, the host facility shall provide velocity reference data and position orientation data (i.e., heading, pitch, roll) to enable:

a. At a .900 availability during a 12 hour mission (INS available)

o Latitude and longitude to an accuracy of 100 Km

o True heading $\pm$1 degree

o Aircraft pitch $\pm$1 degree

o Aircraft roll $\pm$1 degree

o Aircraft velocity $\pm$20 km per hour

o Aircraft groundtrack $\pm$1 degree

o Update 1/sec.

b. At a .995 availability during a 12 hour mission (INS non support)

o Latitude and longitude to an accuracy of 100 Km

o True heading $\pm$5 degrees

o Aircraft pitch $\pm$5 degrees

o Aircraft roll +5 degrees

o True airspeed + 20 km per hour

o Update 1/sec.

3.2.6 G/AIT to host facility interface. During a benign communications
environment, the G/AIT shall provide to the host facility:

a. Three dimensional position with:

o Accuracy of 50 meter SEP.

o Frequency of update no less than or equal to once/minute.

b. Velocity:

o accuracy within 1 meter/sec.

o frequency of once/minute.

3.2.7 G/AIT/user communication interface processing. The communication
interface processing function between G/AIT and user consists of these
categories:

a. Computer to computer interface processing

b. Display processing

c. Hardcopy processing

d. High speed output processing

3.2.8 Computer to computer interface processing

3.2.8.1 G/AIT to ADP interface. This function is performed by direct
interaction of the G/AIT processor with the user/host processor. The user/
host system has been defined as the Automatic Data Processing (ADP) system
that operates onboard some airborne command posts (i.e., E-4B and EC-135C).

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The ADP system depicted in Figure 2 uses a ROLM-1666 processor. The ADP
offers no high speed computer to computer communication capability. However,
it provides adaptibility to a variety of ROLM-provided off-the-shelf
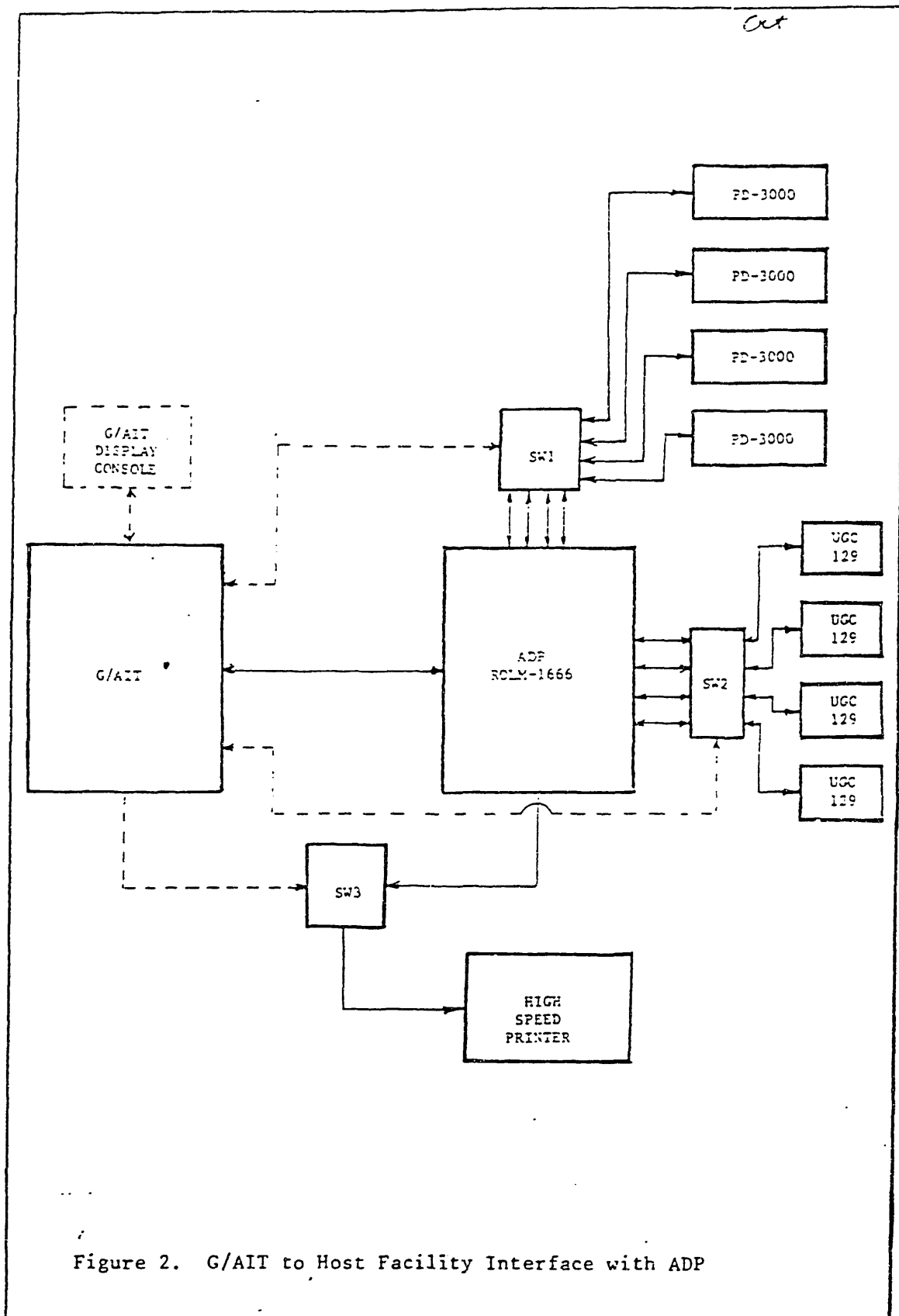communication interface devices combined with related ROLM software.

In this configuration, the G/AIT is directly connected to ADP. All queries
originated from any one of the PD-3000 Display terminals will be directed to
the ADP and will be sent to the G/AIT from ADP. Responses to the query
and/or data are sent back from the G/AIT to ADP through the same direct
interface. It is the ADP task to direct these responses/data to PD-3000s or
the high speed printer as appropriate.

As shown in Figure 2, solid lines represent operational data paths and the
broken lines show the nonoperational data paths.

Three switches are shown for ease of understanding and not to levy a
requirement for three independent switches.

3.2.8.2 G/AIT to CCPDS interface. This function is performed by direct
interaction of G/AIT processor with the user/host processor. This is the
Command Control Processing and Display System (CCPDS), a ground based system
used at four major command posts (NMCC, ANMCC, SAC and NORAD).

As shown in Figure 3, CCPDS receives data simultaneously from two G/AITs.
Data from one G/AIT is used, and the other data is rejected. The decision on
what data to use is made within CCPDS. ..

Figure 2. G/AIT to Host Facility Interface with ADP

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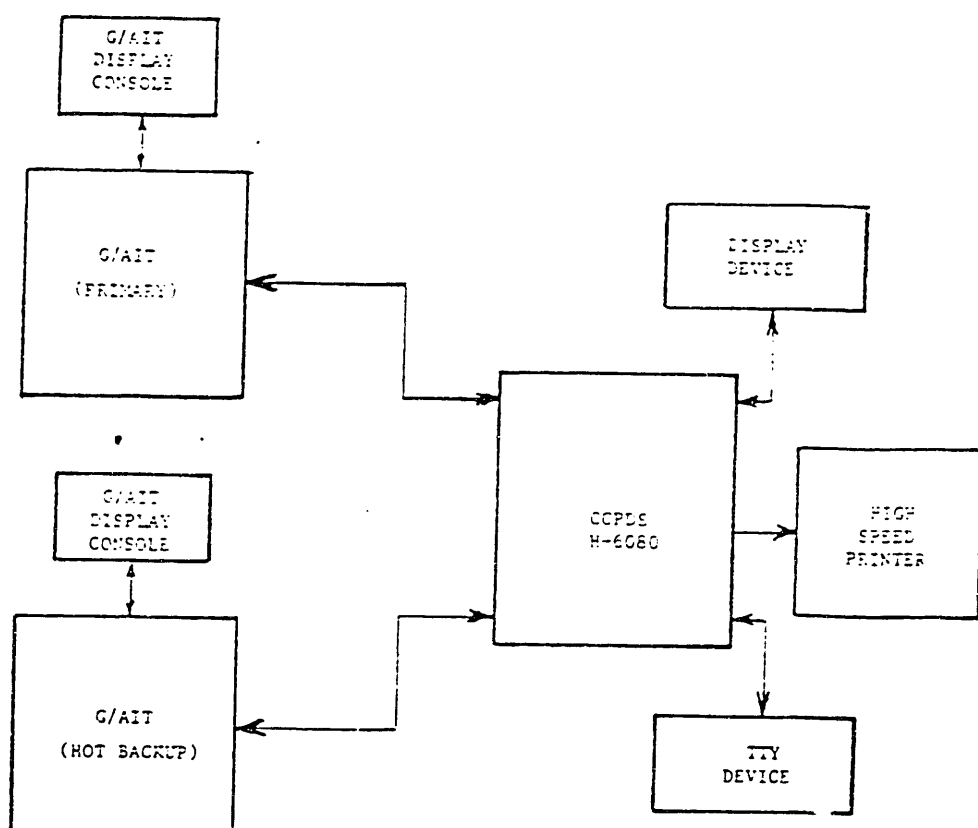_____ OPERATIONAL

----------- NON-OPERATIONAL

Figure 3.   G/AIT to Host Facility Interface with CCPDS

Devices served through CCPDS (i.e., Display, TTY and high-speed printer) have no direct interface path to the G/AIT, all data transmitted or received by these devices destined to -- or initiated at G/AIT, pass through CCPDS.

CCPDS uses Honeywell 6080 processors and offers high-speed, full duplex computer to computer interface using ADCCP protocol and RS-232 compatible electrical interface.

The G/AIT shall provide the compatible hardware and the software to enable communication with the CCPDS. The G/AIT display console can be used as a backup device.

3.2.9 Display processing. The display processing function is performed in the G/AIT for provision of IGS NUDET data, IGS Orbital Subsystem status and G/AIT configuration and operation status data to the user. The display processing can be initiated internally by the G/AIT for displaying alarms and error conditions, or by the action officer in query form. A query can be sent to the G/AIT from either a display console directly connected to G/AIT (stand alone G/AIT), or from any one of the display devices connected to an intermediary medium such as ADP or CCPDS.

In an airborne environment with ADP, as depicted in Figure 4, if ADP becomes non-operational (due to a malfunction or service/maintenance), the action officer is able to switch any one of the ADP's PD-3000 Display terminals to the G/AIT. This is done through the use of switch no. 1 (SW1). The G/AIT will have the capability to identify the type of interconnection established. It will format the data before output to the display device to which it is

G/AIT
DISPLAY
CONSOLE

PD-3000

PD-3000

PD-3000

PD-3000

SW1

G/AIT

ADP
ROLM-1666

SW2

UGC
129

UGC
129

UGC
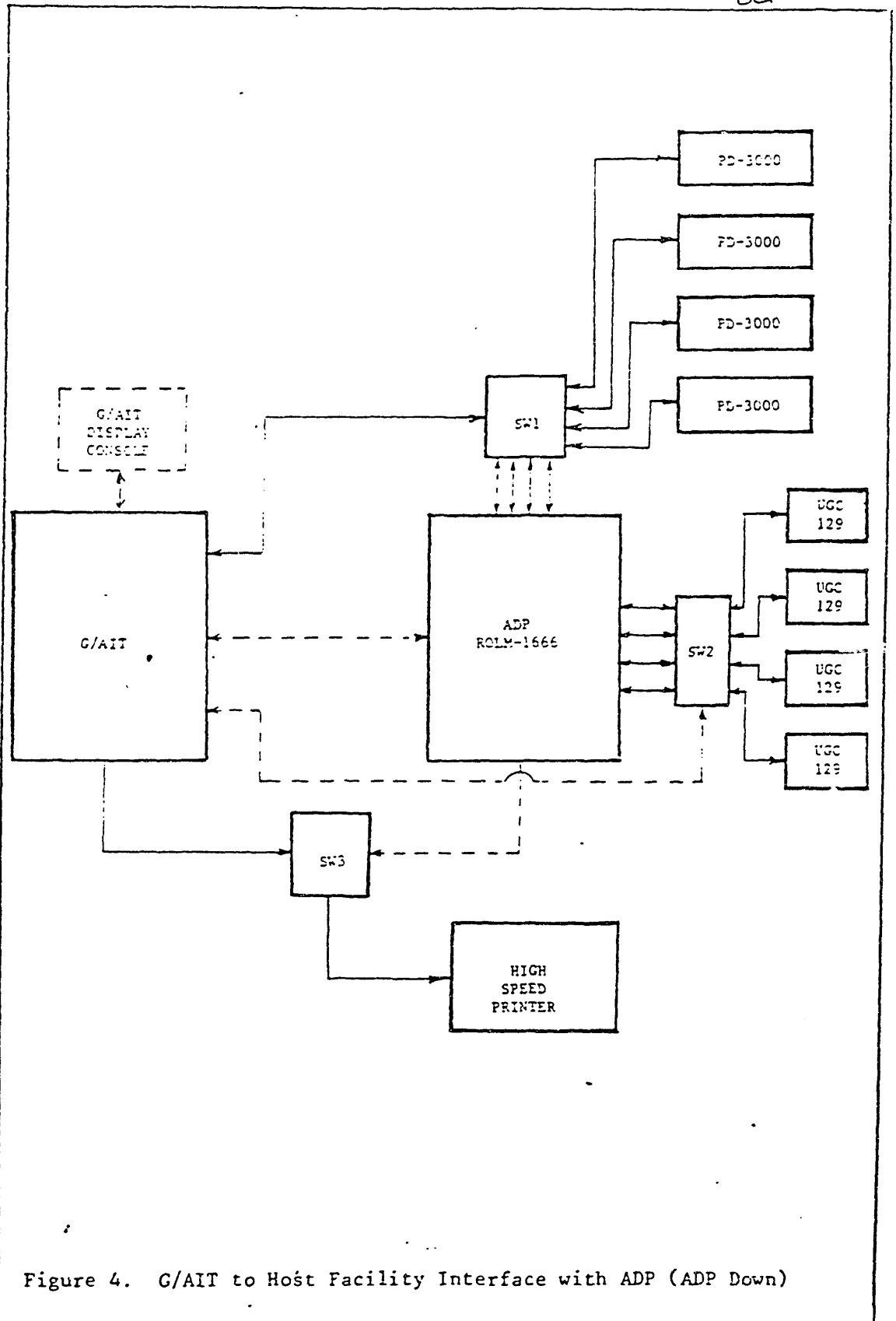129

UGC
129

SW3

HIGH
SPEED
PRINTER

Figure 4.   G/AIT to Host Facility Interface with ADP (ADP Down)

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directly connected. For display devices not directly connected to the G/AIT, (ADP operational) G/AIT will output unformatted data with the assumption that the formatting will be performed outside of the G/AIT (i.e., ADP) before display.

In the CCPDS ground environment it is assumed that the system is operational at all times and there is no direct connection of CCPDS's Display terminal(s) with G/AIT.

3.2.10 Hard copy processing. The hard copy processing function is performed in the G/AIT for provision of data specified in 3.2.9 in hardcopy/printed form. The hardcopy device, due to its mechanical design, does not offer many of the formatting flexibilities offered by the display/graphical terminals; hence, data routed to this device for printing is limited to data in textual format and not in graphical format.

As depicted in Figure 5, hardcopy processing is activated only when ADP and display terminals or the corresponding ports on the G/AIT become non-operational. In this mode, only one of the UGC-129 teleprinters can be switched to the G/AIT and initiate queries. This is done through the use of switch no. 2 (SW2).

On receipt of a query, the G/AIT will respond by sending data directly to the teleprinter it is connected to, or the high speed printer, depending on the routing parameter used.
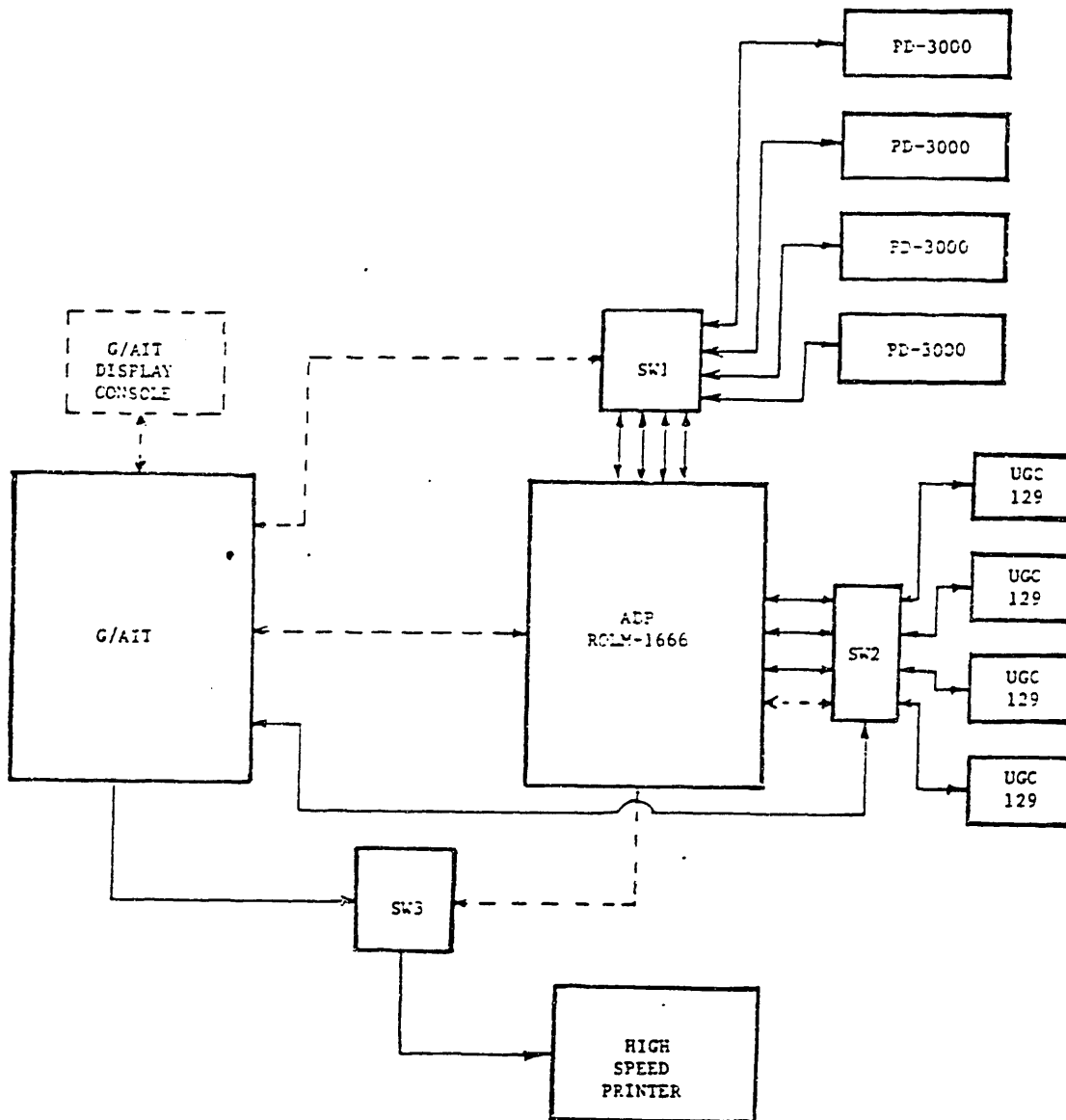
Figure 5.   G/AIT to Host Facility Interface with ADP
            (ADP + PD-3000s, Down)

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3.2.11 <u>High speed output processing</u>. Output processing is a function performed in G/AIT for provision of data originating from the G/AIT through a one-way interface. Because of the high speed nature of this interface, massive amounts of data can be output in hardcopy format to the user/action officers in control of the G/AIT in a relatively short time. The user/action officer can use this function by sending a query to the G/AIT via the G/AIT-external terminal device. The request will cause this function to be activated and, in turn, data to be routed and transmitted through the high speed interface to the device where it can be available to the requestor in hardcopy form.

In an airborne environment with ADP, this function is always performed in ADP. (The switch for high speed printer is set to ADP.) In the event the ADP is not operational (Figure 4), the high speed printer is switched back to G/AIT switch no. 3 (SW3) allowing a PD-3000 Display terminal to direct data to the high speed printer through the G/AIT. The data can be in plain text, formatted text, or plotted form. The high speed printer onboard the E-4B is model number HSP 3609-212A, manufactured by MILTOPE Graphic, Inc.

3.3 <u>Environmental</u> (N/A)

3.4 <u>Safety</u> (N/A)

4.0 QUALITY ASSURANCE PROVISIONS (N/A)

5.0 NOTES (N/A)

6.0 LIST OF ACRONYMS

ADP   Automatic Data Processing

ADCCP   Advance Data Communication Control Procedures

AFSC   Air Force Systems Command

ANMCC   Alternate National Military Command Center

ASCII   American Standard

EIA   Electronic Industry Association

FAA   Federal Aviation Association

FACC   Ford Aerospace & Communications Corporation

G/AIT   Ground/Airborne IGS Terminal

IFS   Interface Specification

IGS   IONDS Global Segment

INS   Inertial Navigational System

IONDS   Integrated Operational NUDET Detection System

KM   Kilometer

NCMC   NORAD Cheyenne Mountain Complex

NMCC   National Military Command Center

NORAD   North American Air Defense Command

NUDET   Nuclear Detonation

RF   Radio Frequency

SAC   Strategic Air Command

SEIC   System Engineering & Integration Contractor

SEP   Spherical Error Probable

TBD   To Be Determined