SITE TECHNICAL BULLETIN

DATE: September 15, 1995 **NUMBER:** STB-RIT-002

SYSTEM/TYPE: Radar Intelligent Tool - Enroute (ERIT)

SUBJECT: ERIT System Rack/ Interface Cable Installation

1. PURPOSE. This site technical bulletin (STB) delivers the ERIT System Rack and ERIT Interface Cables, including all necessary hardware and instructions for installation. The ERIT System Rack's primary use is house the the FAA's new 24 hour, multi sensor radar recording system designated ERIT/R (ERIT Recorder). The ERIT Interface Cables (already delivered) interface the ERIT/R to the NAS modem rack.

2. DISTRIBUTION. The ERIT System Rack/Interface Cable distribution follows a selected site schedule (only ARTCC's, see attachment 3).

3. REFERENCES. Not applicable.

4. DESCRIPTION OF PROBLEM. Refer to Attachment 1.

5. SITE APPLICATION. As listed in attachment 3.

6. CONTENTS.

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7. RECOMMENDED SOLUTION. Refer to Attachment 4 & 5.

8. HARDWARE IMPACT. Refer to Attachment 4 & 5.

SOFTWARE IMPACT. Not applicable.

9. CLARIFICATION OR COMMENTS. The ERIT System Rack Installation Manual and the ERIT Interface Cable Installation Manual is delivered under this cover. As it becomes available, additional information will be delivered to the offices identified in the Attachment 2 distribution list.

For further information or comments, please contact the National Data Communications Systems Engineering Division, AOS-500, on FTS 485-HELP, commercial (609) 485-HELP.

Manager, National Data Communications
Engineering Division, AOS-500

5 Attachments

Attachment 1

ERIT System Rack Installation Plan

ERIT System Rack Assembly

The National Data Communications Systems Engineering Division, AOS-500, as part of the En Route Radar Intelligent Tool (ERIT) Project is delivering an equipment rack assembly to house the ERIT/Recorder (ERIT/R). AOS-500 is supplying the racks to provide selected site users (refer to attachment 3) with a convenient “home” for the ERIT/R that has a small footprint. The data sheet on the ERIT System Rack is included in attachment 4.

The ERIT System Rack is a standard 19” equipment rack with a footprint of approximately 74.5”Hx22.0”Wx25.5”D. The rack has a Plexiglas window in the front door panel allowing site users to view the recorder’s status without unlocking and opening the door. The floor panel of each rack has been removed to allow access to the ERIT System Interface Cables installed in the cable troughs under the floor. Site users will need access to the front and rear doors of the rack when installing and connecting the cables to the RDI (Radar Data Interface) Adapter Boxes.

The procurement and manufacture of the ERIT Rack Assembly is nearly complete. Delivery will by year end FY95 (September 28, 1995), shipping direct from the manufacturer to each designated site. The rack will be delivered pre-assembled to each site, requiring minimal site user assembly (4 leveling feet, sliding shelf handle). The ERIT System Rack installation manual is included in attachment 4.

ERIT Interface cables

The ERIT Interface Cables have been manufactured and delivered to each site early FY95 (refer to attachment 3, column #7). The custom length cables are designed to be installed under the floor connecting the modem splitter’s J6 connector to the ERIT RDI Adapter Box mounted in the rack. The ERIT Interface Cable installation manual is included in attachment 5.

Attachment 2

ERIT System Project Installation Plan

Introduction

The National Data Communications Systems Engineering Division, AOS-500, has initiated a standardization effort to commonize and standardize the FAA's radar analysis tasks and methods. This standardization effort has created the En Route Radar Intelligent Tool (ERIT) Project. The ERIT Project is a PC based, 24 hour, multi-sensor, radar data recording and analysis system designed to provide operational ARTCC's with off-the-HOST recording and analysis tools.

The ERIT System

An ERIT System consists of two COTS PCs with SVGA capability and SCSI peripherals. One PC is designed to be the ERIT/R(ecorder) and the second PC is designed to be the ERIT/A(nalyzer). The ERIT/R is the FAA's dedicated 24 hour radar data recording system, storing radar data files for later analysis on the ERIT/A.

The ERIT/Recorder

The ERIT/R(ecorder) is a COTS AST Premium 486DX2/66 Mhz tower PC with seven available EISA expansion slots, a single 3.5" floppy diskette drive, a 1.0 gigabyte SCSI harddrive, a dual magneto-optical SCSI drive tower, a mouse, a SVGA interface and 14" SVGA monitor and the FAA's Radar Data Interface (RDI) Recording System. The ERIT/R will provide site users the means of capturing all radar data products that flow into an operational ARTCC using a sufficient number of RDI Systems (the quantity dependent on the number of radar channel inputs) to capture the data. Radar data is then directed to PC based secondary storage devices (harddrive, magneto-optical drives, etc.). ERIT/R provides site users with a convienient, removable magneto-optical media to store the captured radar data. A suite of COTS software is included for system operation and maintenance (MS DOS v6.21, MS Window v3.1, and Norton Utilities v7.0 for harddrive maintenance).

The RDI System

The Radar Data Interface (RDI) System is the heart of the ERIT System. The RDI System is designed to capture all incoming radar data products for storage to PC based storage subsystems (i.e. harddrives, magneto-

optical drives) and realtime statistical analysis. The RDI System is comprised of three hardware components and one software component; the RDI Board, the RDI Cable, the RDI Adapter Box and the RDI Recording software.

The RDI Board is an intelligent eight port radar data capture card that installs into a COTS PC via the ISA expansion bus. The RDI Board hosts a Motorola MC68000 microprocessor, 768 Kbytes of onboard RAM, 4 Kbytes of dual ported RAM and an eight serial port VLSI chip. The RDI Board receives and transmits TTL level signals up to 19,200 baud per channel to its' single DB44 high density connector. Each channel can be configured to receive or transmit data independently of each other channel.

The RDI Cable is a 50 conductor, shielded, twisted pair cable with high density DB44 connectors on both ends. The cable is used to connect the RDI Board with the RDI Adapter Box.

The RDI Adapter Box hosts both, RS232 and RS530 transceivers to convert RS232/RS422 radar data signals to TTL levels compatible with the RDI Board for each of the eight radar channel interface ports. The Box also has system diagnostic options to assist in the indentifying and correction of faults.

The RDI Recording Software is a Microsoft Windows v3.1 compatible application. Site users use the RDI software tools to customize each RDI System's configuration to receive/transmit the incoming radar data.

The ERIT Interface Cables

The ERIT Interface Cables are six (6) connductor, plenum rated, shielded cable. The cables, installed under the floor, are designed to connect the modem splitter's J6 connector to the ERIT's RDI Adapter Box. Cable lengths vary from site to site and are customed manufactured for each site (refer to attachment 3, column 6).

The ERIT/Analyzer

The ERIT/A(nalyzer) is a COTS AST 486DX2/66 Mhz tower PC with seven (7) available EISA expansion slots, a single 3.5" diskette drive, a high capacity SCSI internal tape drive, a 1.0 gigabyte SCSI harddrive, an internal SCSI CD-ROM drive, a single external SCSI magneto-optical drive, a mouse, an internal 9600 baud Fax/modem, a wide carriage dot matrix color printer, a black and white bubble jet prineter, a SVGA interface

and 14” SVGA monitor and the FAA’s suite of radar analysis tools.

The site user can analyze pre-recorded radar data files utilizing FAA’s suite of radar analysis tools installed on the ERIT/A system. The pre-recorded radar data files can be located on: removable magneto-optical media cartridges, a harddrive, a floppy diskette or a network drive.

COTS software provided for the operation, maintenance and various reporting tasks are: MS DOS v6.21, MS Windows v3.1, MS Word v6.0, Back-it v4.0 for system backups, Norton Utilities v8.0 for harddrive maintenance, Pizzaz Plus v4.0 print screen utility for printing any screen image to the printer.

Attachment 3

List of ERIT System Candidates

ERIT System Candidates							
1 Seq #	*2 Site Id*	*3 Site Name, State*	*4 RDI Sys Qty*	*5 ERIT Cable Qty*	*6 ERIT Cable Lengths*	*7 ERIT Cable delivery date*	*8 ERIT Rack Assembly delivery date*
1	ZMP	MINNEAPOLIS ARTCC, MN	8	57	25 ft	01/06/95	09/28/95
2	ZDV	DENVER ARTCC, CO	8	54	250 ft	01/24/95	09/28/95
3	ZOA	OAKLAND ARTCC, CA	6	36	50 ft	01/25/95	09/28/95
4	ZBW	BOSTON ARTCC, NH	5	33	50 ft	01/27/95	09/28/95
5	ZLA	LOS ANGELES ARTCC, CA	6	41	50 ft	01/31/95	09/28/95
6	ZID	INDIANAPOLIS ARTCC, IN	6	36	50 ft	01/31/95	09/28/95
7	ZTL	ATLANTA ARTCC, GA	6	36	50 ft	02/02/95	09/28/95
8	ZDC	WASHINGTON ARTCC, DC	6	36	50 ft	01/12/95	09/28/95
9	ZFW	FORT WORTH ARTCC, TX	7	45	50 ft	01/31/95	09/28/95
10	ZAB	ALBUQUERQUE ARTCC, NM	8	56	50 ft	12/27/95	09/28/95
11	ZAU	CHICAGO ARTCC, IL	6	36	50 ft	02/02/95	09/28/95
12	ZME	MEMPHIS ARTCC, TN	5	33	50 ft	02/07/95	09/28/95
13	ZOB	CLEVELAND ARTCC, OH	6	36	50 ft	01/30/95	09/28/95
14	ZNY	NEW YORK ARTCC, NY	5	27	50 ft	01/17/95	09/28/95
15	ZKC	KANSAS CITY ARTCC, MO	8	56	175 ft	01/12/95	09/28/95
16	ZSE	SEATTLE ARTCC, WA	6	42	100 ft	01/11/95	09/28/95
17	ZHU	HOUSTON ARTCC, TX	8	51	100 ft	01/09/95	09/28/95
18	ZJX	JACKSONVILLE ARTCC, FL	6	42	100 ft	01/11/95	09/28/95
19	ZMA	MIAMI ARTCC, FL	5	33	100 ft	01/03/95	09/28/95
20	ZLC	SALT LAKE CITY ARTCC, UT	8	58	100 ft	01/11/95	09/28/95

Attachment 4

ERIT System Rack Installation Manual

ERIT/R = AST Premium 486DX2/66 Mhz Tower PC dedicated as a 24hr data recorder hosting multiple RDI Systems and a dual magneto-optical drive tower.

ERIT/A = AST Premium 486DX2/66 Mhz Tower PC (interchangeable with ERIT/R for redundancy) dedicated as a radar data analysis station hosting the FAA's suite of PC based radar analysis tools and a external magneto-optical drive.

CHAPTER 1

ERIT System Rack Installation for the ERIT/R

INTRODUCTION: This chapter will provide you with the information you need to install the ERIT System Rack Assembly quickly. The rack installation is simple and straightforward, with minimal assembly required.

KIT HARDWARE INVENTORY:

1 - ERIT SYSTEM EQUIPMENT RACK ASSEMBLY
4 - ADJUSTABLE LEVELING FEET
2 - SELF ADHESIVE CUSHION STOPS
2 - SECURITY KEY SETS (1 SET FRONT DOOR, 1 SET REAR DOOR)

TOOLS REQUIRED (SITE SUPPLIED):

1 - SCREW DRIVER [SLOTTED]
1 - WRENCH [CRESCENT]

HARDWARE INSTALLATION:

1. Remove packing/shipping material.
   a. Remove tape securing keyboard shelf from rear door (wrapped around both rails).
2. Install leveling feet (4).
   a. Located in the cloth component bags secured to the interior of frame.
   b. Screw one nut on threaded stud, turning all the way to stop.
   c. Insert threaded stud through hole in frame bottom, screw second nut on threaded stud until tight (tighten with crescent wrench until snug).
   d. Repeat for all four feet.
3. Install keyboard shelf handle.
   a. Located on face of keyboard shelf (installed backwards).
   b. Unscrew both screws and remove handle.
   c. Orient handle on the front face of keyboard shelf, screw both screws until snug.
4. Install (2) keyboard shelf cushion stops.
   a. Located in the cloth component bags secured to the interior of frame.
   b. Separate and install each self-adhesive cushion to the keyboard shelf lip on both sides of the shelf to protect the frame from impact.
5. Set rack in place, level.
   a. Locate the rack over a hole in the floor.
   b. Level rack using the four leveling feet.
   c. Access to rack will be required from both doors (the front door being with the plexiglass window).
6. Security keys.
   a. Located in the cloth component bags secured to the interior of frame.
   b. Two sets (4 keys), one set for front door, one set for rear door.

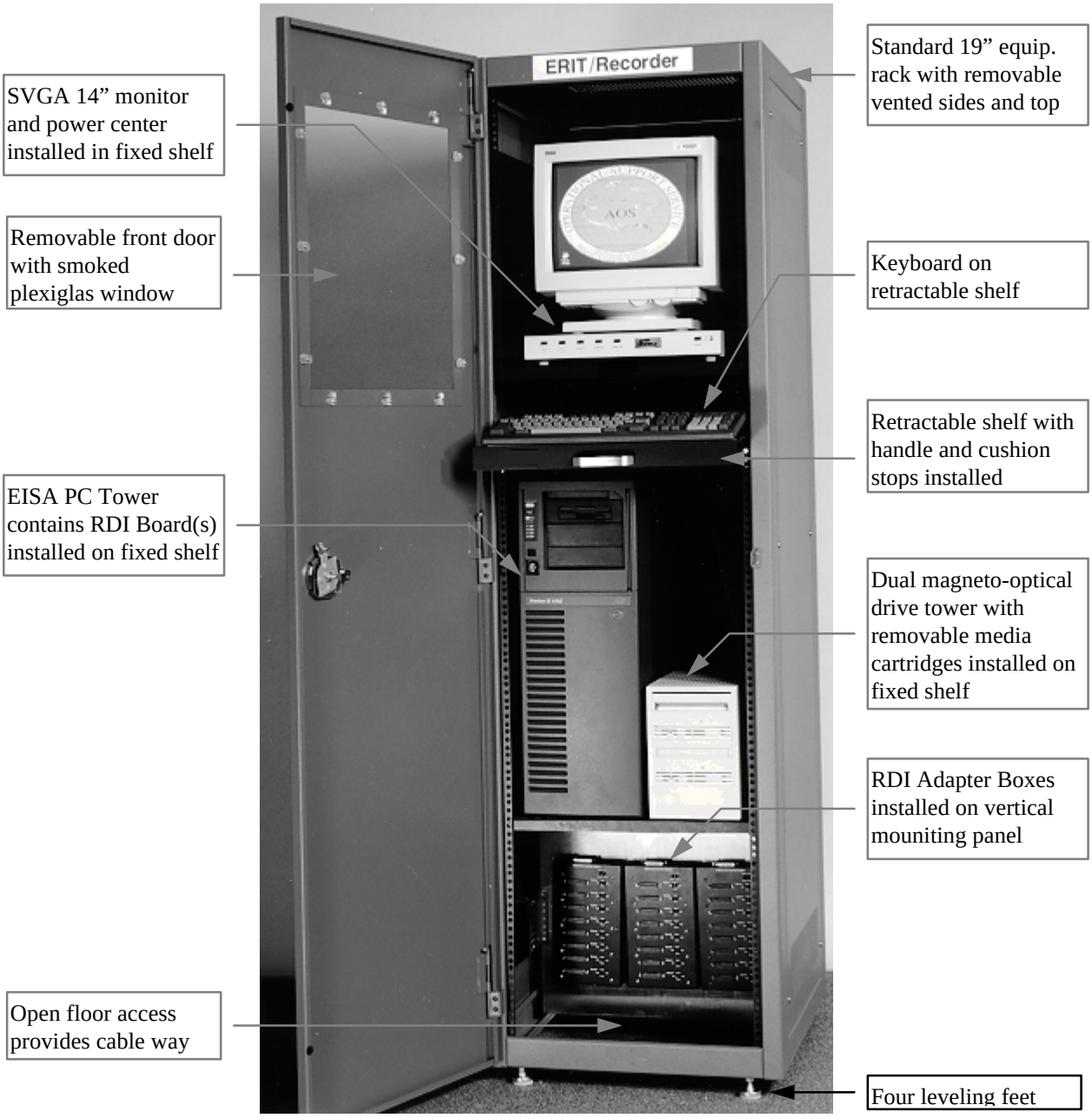

FIGURE 4-1
ERIT/R SYSTEM SHOWN IN RACK ASSEMBLY

CHAPTER 2

ERIT System Rack Assembly Data Sheet

Manufacturer:	MarkHon, Inc. Wabash, Indiana (219) 563-2161
Hardware description:	
ERIT Rack Assembly	MarkHon p/n: 7957 [modu-mount brand components]
	Rack Assembly shipped fully assembled ready to populate
	(4) leveling feet
Frame:	MarkHon p/n: 41f701919x
overall dimensions	74.5″h x 22.0″w x 25.5″d
opening dimesions	70.12″h x 19.06″w x 19.06″d
material	14 gauge cold rolled steel
frame static load	3000 lbs.
finish	heat-cured waterborne textured enamel paint
	color: carribbean blue
construction	arc welded, markhon patented corner construction
	vertical panel for rdi Adapter box mounting
	bottom open to floor to facilitate erit signal and power cable routing
Side panels (2)	MarkHon p/n: p7019ltb
material	16 gauge cold rolled steel
finish	heat-cured waterborne textured enamel paint
	color: caribbean blue
construction	vented at top and bottom with (24) 3″ slots [total 20 square inches of open area per panel]
	secured to frame by (6) screws
Top panel	MarkHon p/n: pt1919v
material	16 gauge cold rolled steel
finish	heat-cured waterborne textured enamel paint
	color: caribbean blue
construction	vented with (40) 0.125″ x 4.0″ slots [total 20 square inches of open area]
	secured to frame by (4) screws

RACK DATA SHEET (CONT.)

REAR DOOR	MARKHON P/N: DL7019H2L
MATERIAL	18 GAUGE COLD ROLLED STEEL
FINISH	HEAT-CURED WATERBORNE TEXTURED ENAMEL PAINT
	COLOR: CARIBBEAN BLUE
CONSTRUCTION	HINGED LEFT HAND [REVERSIBLE]
	FEATURES RECESSED COMBINATION HANDLE/LATCH AND LOCK [(2) KEYS]
FRONT DOOR	MARKHON P/N: DBL7019-PLEXI
MATERIAL	18 GAUGE COLD ROLLED STEEL
FINISH	HEAT-CURED WATERBORNE TEXTURED ENAMEL PAINT
	COLOR: CARIBBEAN BLUE
CONSTRUCTION	SMOKED GRAY PLEXIGLASS HALF-PANEL
	1″ DEEP, BUSTLE TYPE [MOUNT EXTERNALLY ON FRAME, COVERS OVER PANEL OPENINGS]
	HINGED LEFT HAND [NON-REVERSIBLE]
	FEATURES RECESSED COMBINATION HANDLE/LATCH AND LOCK [(2) KEYS]
EQUIPMENT SHELVES	MARKHON P/N: SH1919VX
MATERIAL	14 GAUGE COLD ROLLED STEEL
SHELF STATIC LOAD	100 LBS.
FINISH	HEAT-CURED WATERBORNE TEXTURED ENAMEL PAINT
	COLOR: BLACK
CONSTRUCTION	ADJUSTABLE IN ANY VERTICAL POSITION ON 1.75″ SPACING
	SHORTENED DESIGN: DEPTH OF FRAME LESS 4.0″
	PERFORATED FOR CONVECTION COOLING
RETRACTABLE KEYBOARD SHELF	MARKHON P/N: RS1919
MATERIAL	16 GAUGE COLD ROLLED STEEL
SHELF STATIC LOAD	20 LBS.
FINISH	HEAT-CURED WATERBORNE TEXTURED ENAMEL PAINT
	COLOR: BLACK FRONT PANEL, ANTIQUE WHITE TOP SURFACE
CONSTRUCTION	ATTACHED TO VERTICAL MOUNTING ANGLES
	FEATURES PULL HANDLE ON FRONT PANEL
	INCLUDES NECESSARY MOUNTING HARDWARE

Attachment 5

ERIT System Interface Cable Installation Manual

CHAPTER 1

ERIT System Interface Cables

INTRODUCTION: This chapter will provide you with the information of the ERIT System Interface Cables. The modification is simple and straightforward.

KIT HARDWARE INVENTORY:

1 - ERIT SYSTEM INTERFACE CABLE DIAGRAM [REV. A]
1 - ERIT CABLE SET [RE: ATTACHMENT 3 LIST OF ERIT SYSTEM CANDIDATES]

TOOLS REQUIRED (SITE SUPLIED):

1 - SCREW DRIVER (SLOTTED)

HARDWARE INSTALLATION:

1. The ERIT System Interface Cables (refer to attachment 3 List of ERIT System Candidates) are designed to connect the NAS Modem Rack (the data source) with the ERIT RDI System Interface Boxes. The ERIT Cables are shielded plenum rated cables designed to be installed under the floor at each site.
2. Each site, as designated in attachment 3 of this STB, has received ERIT Cables custom fabricated (varying lengths) for each site in accordance with the site survey conducted by AOS-500. Each cable carries one channel of data from the modem splitter to the ERIT/Recorder.
3. The ERIT Interface Cables are designed to plug into the NAS Modem Splitter Rack, J6 connector. ERIT/R is designed to be a passive, non-intrusive data recording system. Cables should be marked at each end with identifing labels designating radar channel.

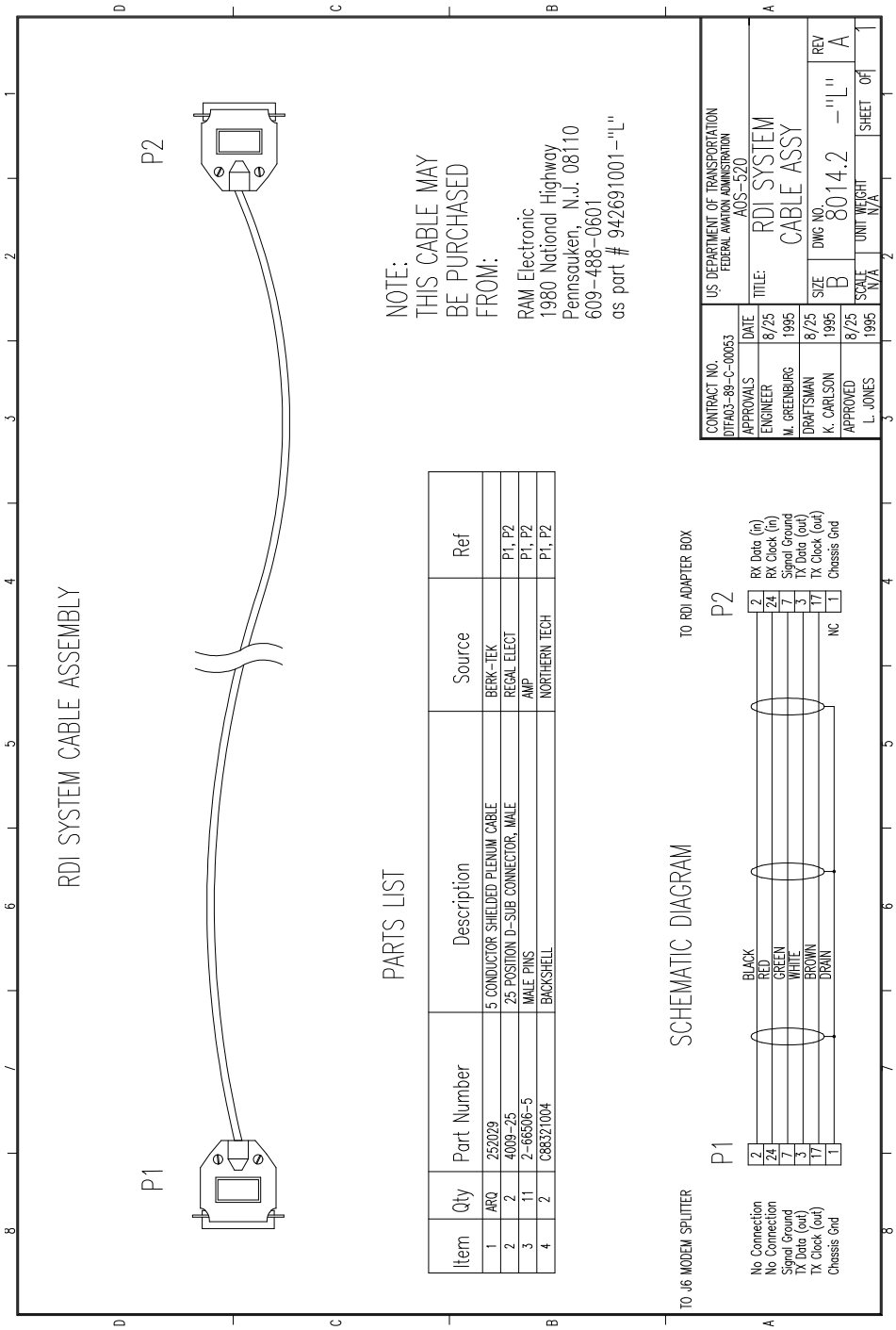

FIGURE 5-1

ERIT SYSTEM INTERFACE CABLE ENGINEERING DRAWING (REV A).

Understanding capacitance, inductance, resistance, and impedance.... lumped, distributed, and characteristic.

Capacitance in the electrical energy system is that component which opposes any change in the applied voltage. Capacitance in the mechanical energy system is called compliance. In the acoustic energy system it is called acoustic capacitance. In the mechanical energy system compliance is defined as that component which opposes a change in the applied force. In the acoustic energy system it is that element which opposes a change to the applied pressure. In any energy system capacitance, compliance, and acoustic capacitance all store potential energy. Compliance must exist in any energy system. Without it, elements would be infinitely “brittle”; and the slightest pressure or force would destroy the system.

Inductance in the electrical energy system is that component which opposes any change in current. Inductance in the mechanical energy system is called inertia. In the acoustic energy system it is called inertance. In the mechanical energy system inertia is defined as that element which opposes a change in velocity. In the acoustic energy system inertance is defined as that element which opposes a change in volume velocity. In any energy system inductance, inertia, and inertance all store kinetic energy. Inertia must exist in any energy system at all times. Without it elements would “accelerate” instantaneously and the slightest force would destroy the system.

Resistance in the electrical energy system is that component which causes a loss of energy to the system. In the mechanical and acoustic energy systems resistance is also called resistance and it is defined the same way. In many instances the resistance loss results in dissipated heat (usually wasted energy). However this is not always true. Energy can leave the system as “work” and in this case it can still be treated as resistance because energy left the system and did not come back.

Impedance in the electrical energy system occurs as a result of the combination of resistance, capacitive reactance, and inductive reactance. Any impedance always includes a portion of these three i.e. there can never be a pure resistance or reactance either capacitive or inductive.

Distributed resistance, capacitance, and inductance can occur in electrical systems. One example is a communications cable. These elements are not lumped together as in a circuit but rather distributed along two or more conductors. (One conductor would

have these elements with reference to free space but would almost certainly be an antenna).

When we read specifications on cable, they are normally given as:
1) Resistance per foot.
2) Capacitance per foot
3) Characteristic impedance also referred to as nominal impedance

Resistance per foot is dependent on cable gauge and conductor material. It is the lossy element in a cable and will always result in energy loss to the system (as heat). This is commonly referred to as attenuation losses.

Capacitance per foot is dependent on gauge, distance between the conductors, distance between conductors and the shield, type of shield and type of insulation between the conductors. Of these elements distance between conductors and conductors / shield is the most important factor.

For RS-232 applications, capacitance per foot is the most important specification. This capacitance is always totaled up based on the total length of the cable. The result of too much capacitance would be a rise time of the signal so poor that the amplitude becomes insufficient at the receiving end. This condition has two important factors. 1) the total distributed capacitance (cap/ft X total ft.) and 2) the baud rate.

The lower the baud rate, the longer the signal has to “ramp up” to the max voltage and therefore the less effect distributed capacitance has. Distributed capacitance is always minimized for long length RS232 cables.

Characteristic impedance is not to be confused with the normal definition of impedance, i.e. the combination of resistance, capacitance, and inductance. Characteristic impedance only occurs in systems where the frequency is high enough that signals along the conductor are of different amplitude even though they are all moving along at near the speed of light. (approx 1 foot / ns). This never occurs in RS232 systems. (or at least it shouldn’t). RS422 has risetimes approaching 10 ns and therefore cables which are only 50 feet long would take on a “transmission line character” since the waveform could be near ground at one end and at Vmax on the other end. A transmission line always has a characteristic impedance associated with it. A characteristic impedance defines the ratio of a wave or wavefront of voltage and current detached from its source and moving along at near the speed of light to its destination. Characteristic impedance is defined as the distributed inductance divided by the distributed capacitance. Its unit of measure is ohms. It defines the ratio

of the voltage wave to the current wave of the signal moving along the cable. It in no way includes resistance which is a separate spec and represents the attenuation of the signal. The characteristic impedance typically ranges from 75 to 150 ohms for communication cables and varies more widely for coax cables. There is no inherent advantage of a high vrs low characteristic impedance as far as the signal integrity is concerned. However, drivers normally feed into a higher characteristic impedance easier. Cables with characteristic impedance must be terminated with a resistance equal to the characteristic impedance.

Drivers driving into a characteristic impedance see what looks like a pure resistance since energy leaves the system and does not come back. This energy travels down the transmission line cable and (in a correctly terminated system) is totally absorbed in the terminating resistor.
Of interest here is the fact that waveguides also have a characteristic impedance. This impedance describes the ratio of the electric fields vrs the magnetic fields of the electromagnetic wave moving down the waveguide. Free space has what is known as intrinsic impedance. This impedance defines the ratio of the electric vrs the magnetic fields of an electromagnetic wave in free space. All free space has the same intrinsic impedance. Free air has its own acoustic intrinsic impedance which defines the ratio of pressure to volume velocity waves. Both of these make sound waves. As one can intuit, both the potential energy storage element and the kinetic energy storage element must be present to have a travelling wave and a travelling wave always travels with both kinetic and potential energy. (They are also in phase). The ratio of the potential energy to the kinetic energy is characteristic impedance.

For RS422 cables, characteristic impedance is always the most important specification.