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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

INTERFACE REQUIREMENTS DOCUMENT

GROUND NETWORK INTERFACE (GNI) TO VOICE SWITCHING AND CONTROL SYSTEM (VSCS) INTERFACE FOR THE NEXCOM ENGINEERING DESIGN MODEL

The NEXCOM Integrated Product Team, AND-360
and the Voice Switch Integrated Product Team, AND-320

RECORD OF CHANGES

Revision	Date	Action
0.0	4/16/2002	GNI/VSCS IRD 4/5/02 Draft Baselined as Revision 0.0

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

1.0 INTRODUCTION

1.1 Scope

This Interface Requirements Document (IRD) is prepared in accordance with FAA-STD-025d. This IRD provides the requirements for an interface between the Engineering Design Model (EDM) of NEXCOM's Ground Network Interface (GNI) Equipment and Voice Switching and Control System (VSCS) Equipment. The EDM will be demonstrated at WJHTC, and will interface with VSCS GRIM and BUEC interfaces for VHF service only. This IRD is therefore limited in scope to describing those two interface configurations[1]. The interfaces described herein contain the necessary set of signaling of those two configurations, including only signaling specified by the NEXCOM Minimum Threshold Document (MTD), FAA-P-2959, which will be demonstrated in the EDM. **This IRD is valid only for the EDM.**

*Note: The NEXCOM MTD also prescribes **new** signaling not available from the VSCS equipment (GRIM and BUEC.) The interface to support these new signaling requirements is not given in this document: refer to the MTD for this information.*

1.2 Subsystem Responsibility List

Table 1-1

Subsystem equipment responsibility

Subsystem/Equipment	Common Name	Responsible Organization
NEXCOM Ground Network Interface	GNI	Contractor
Voice Switching and Control Equipment	VSCS	ACT-330

1.3 Document Organization

This document is organized as follows:

Section 1, SCOPE, identifies the interfacing systems and provides a summary of the contents of this document.

Section 2, APPLICABLE DOCUMENTS, provides a list of referenced documents, including both Government and Non-government documents.

Section 3, INTERFACE REQUIREMENTS, provides the general, functional, and physical requirements for the interface.

Section 4, QUALITY ASSURANCE PROVISIONS
Section 5, PREPARATION FOR DELIVERY, N/A

[1] A full interface requirements document for Voice Switching and Control Equipment (VSCE) to GNI to support NEXCOM Full-Scale Development is provided separately.

Section 6, NOTES, provides a list of applicable definitions used in this document.

Appendix A provides the Verification Requirements Traceability Matrix for document requirements.

Appendix B provides a list of abbreviations and acronyms.

2.0 APPLICABLE DOCUMENTS

The following documents form a part of this IRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this IRD, the contents of this IRD **shall** provide the superseding design guidance.

2.1 Government Documents

2.1.1 FAA Standards

FAA-STD-025d	Preparation of Interface Documentation, October 1995

2.1.2 FAA Specifications

FAA-G-2100g	Electronic Equipment, General Requirements October 22, 2001
FAA-E-2958	NEXCOM System Requirements Document, April 16, 2002, V1.0.
FAA-P-2959	Minimum Threshold Document (MTD) for the Engineering Demonstration Model (EDM), April 6, 2002, V0.0
NAS-IC-41024000	VSCS to the Existing Radio Interface ICD for the Voice Switching and Control System, October 1997
NAS-IR- 64024201	Voice Switching and Control System to BUEC ICD, August 8, 1997

2.2 Document Sources

2.2.1 FAA Documents

Copies of FAA specifications, standards, and publications may be obtained from the Contracting Officer, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C., 20591. Requests should clearly identify the desired material by number and date, and state the intended use of the material.
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3.0 INTERFACE REQUIREMENTS

3.1 General Requirements

This IRD describes the interface requirements for voice and control signals between NEXCOM GNI and VSCS for the EDM. The GNI and VSCS **shall** exchange communications in order to support the following functions:

a) Communications between Area Control Facility (ACF) controllers or specialists and aircraft via air-ground (A/G) radio equipment.
b) Control by ACF controllers or specialists of A/G radio equipment.
c) Indication to ACF controllers or specialists of the status of A/G radio equipment.

In order to meet this requirement:

d) GNI and VSCS **shall** exchange analog voice signals.
e) GNI and VSCS **shall** exchange discrete control signals.

For demonstration purposes, new NEXCOM-specific voice switch functions will be implemented in a DST per FAA-P-2959.

The total GNI/VSCS EDM interface consists of one set of GNI/VSCS(GRIM) audio interfaces, one set of GNI/VSCS(BUEC) audio interfaces, one set of GNI/VSCS(GRIM) channel control interfaces, one set of GNI/VSCS(BUEC) channel control interfaces for each A/G channel (associated with a single talk group) to be controlled by the facility[2]. Figure 3-1 depicts the total interface. The audio interface, as shown in Figure 3-2, is comprised of one transmit audio and one receive audio interface.

The GNI/VSCS(GRIM) is defined at the GNI-VSCS(GRIM) Intermediate Distribution Frame (IDF) for primary radios. The GNI/VSCS(BUEC) is defined at the GNI-VSCS(BUEC) IDF for BUEC radios.

Note: For the sake of VDL Mode 3 we have chosen to use the term "channel" for what was formerly called "frequency ", to associate a channel to a talk group.

3.1.1 Computer-Human Interface Requirements

This topic not applicable to this document.

3.2 Functional Design Characteristics

Functional characteristics of the GNI/VSCS interface are presented in the following subsections.

[2] Paired VHF/UHF frequencies, which comprise two talk groups, will not be used for the EDM. The EDM is concerned with VHF only.

3.2.1 Application Process

This topic not applicable to this document.

3.2 2 OSI-type (Data) Interface

This topic not applicable to this document.

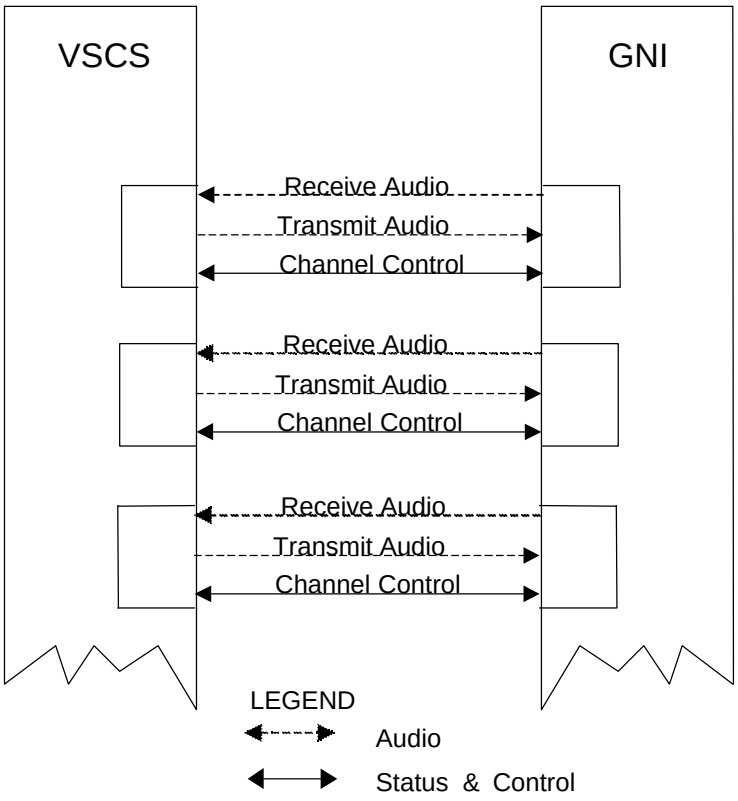

Figure 3-1

GNI Functional Connectivity

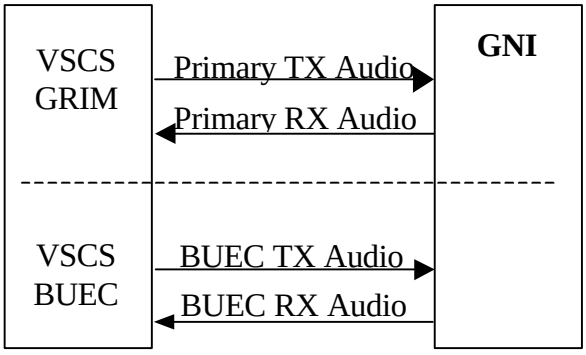

Figure 3-2

GNI-to-VSCS Audio Interfaces for a Single Talk Group

3.2.3 Analog-Type Interface

The GNI/VSCS analog interface supports the analog voice configuration depicted in Figure 3-2 and tabulated in Table 3-1. Specification details are given in the following subsections.

3.2.3.1 Voice Path

The GNI/VSCS audio interface provides a full duplex, four-wire connection for transmission of voice from the VSCS to the GNI (transmit audio) and for the transmission of voice from the GNI to VSCS (receive audio.)

3.2.3.1.1 Voice Path Configuration

a) The GNI/VSCS interface **shall** provide an audio path for emulation of the VSCS(GRIM) interface.
b) The GNI/VSCS interface **shall** provide an audio path for emulation of the VSCS(BUEC) interface.

Table 3-1a

Analog Interface Summary Table for Primary Radios

Signal	Quantity	Direction
Transmit Audio	1	VSCS(GRIM) to GNI
Receive Audio	1	GNI to VSCS(GRIM)

Table 3-1b

Analog Interface Summary for BUEC Radios

Signal	Quantity	Direction
BUEC Transmit Audio	1	VSCS(BUEC) to GNI
BUEC Receive Audio	1	GNI to VSCS(BUEC)

3.2.3.2 Transmit Audio to GNI

a) The VSCS provides an audio connection to the GNI over the GNI/VSCS(GRIM) interface to convey voice communications to be sent over the primary A/G radio transmitter equipment.
b) The VSCS provides an audio connection to the GNI over the GNI/VSCS(BUEC) interface to convey voice communications to be sent over the backup A/G radio transmitter equipment.
c) The transmit audio connection electrical characteristics for the GNI/VSCS(GRIM) interface other than those specified here are specified in this IRD, paragraph 3.3.1.3.2.
d) The transmit audio connection electrical characteristics for the GNI/VSCS(BUEC) interface other than those specified here are specified in this IRD, paragraph 3.3.1.3.3.

3.2.3.3 Receive Audio to VSCS

a) The GNI **shall** provide an audio connection to the VSCS over the GNI/VSCS(GRIM) interface to convey voice communications from remote primary A/G radio receiver equipment.
b) The GNI **shall** provide an audio connection to the VSCS over the GNI/VSCS(BUEC) interface to convey voice communications from remote backup A/G radio receiver equipment
c) The receive audio level of the primary radios, as measured at the GNI/VSCS(GRIM) IDF **shall** be -8 dBm ±1.5 dB.
d) The receive audio level of the BUEC radios, as measured at the GNI/VSCS(BUEC) IDF **shall** be -8 dBm ±1.5 dB.
e) The receive audio connection electrical characteristics for the GNI/VSCS(GRIM) interface other than those specified here **shall** be as specified in this IRD, paragraph 3.3.1.3.2.
f) The receive audio connection electrical characteristics for the GNI/VSCS(BUEC) interface other than those specified here **shall** be as specified in this IRD, paragraph 3.3.1.3.3.

3.2.4 Discrete-Control Interface

Discrete control signals are employed on the GNI/VSCS(GRIM) and GNI/VSCS(BUEC) interfaces for the purpose of controlling and confirming the configuration of the A/G communications channel and reporting equipment status. Electrical characteristics of these discrete signals are defined in this IRD under Section 3.3.1.3.4. The electrical characteristics of “On State”, and “Off State” are given in Tables 3-5 and 3-7.

Figure 3-3 depicts the discrete control signal exchanges that are requirements of the GNI/VSCS interfaces for each NEXCOM A/G channel to be controlled by the VSCS. The VSCS will provide two subtypes:) and BUEC. The set of discrete controls in the VSCS(GRIM) Radio Card is different from the set in the VSCS(BUEC) Radio Card (discrete controls normally available in the VSCS interfaces, but not needed for the EDM, have been excluded from the Figure.)

Table 3-2 summarizes the discrete controls needed for EDM.

3.2.4.1 Discrete-Control Interface Configurations

The GNI interface circuitry to the VSCS **shall** be reconfigurable to support existing GRIM and BUEC VSCS interfaces.

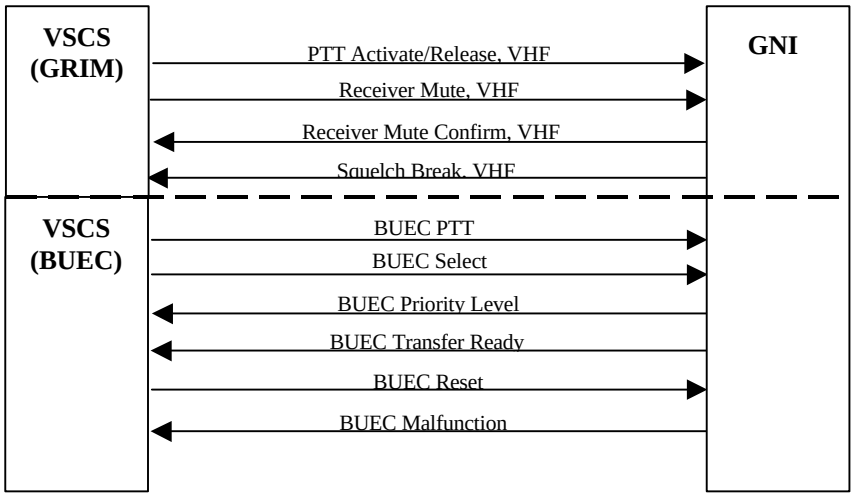

Figure 3-3

GNI/VSCS Discrete Control Interface

Table 3-2

Discrete Interface Summary Table

Signaling between VSCS(GRIM) and GNI	Paragraph	Direction
Push-To-Talk Activate/Release VHF	3.2.4.2.1	VSCS(GRIM) to GNI
Receiver Mute VHF	3.2.4.2.2	VSCS(GRIM) to GNI
Receiver Mute Confirm VHF	3.2.4.2.3	GNI to VSCS(GRIM)
Squelch Break VHF	3.2.4.2.4	GNI to VSCS(GRIM)
Signaling between VSCS(BUEC) and GNI		
BUEC PTT	3.2.4.3.1	VSCS(BUEC) to GNI
BUEC Select	3.2.4.3.2	VSCS(BUEC) to GNI
BUEC Priority Level	3.2.4.3.3	VSCS(BUEC) to GNI
BUEC Transfer Ready	3.2.4.3.4	GNI to VSCS(BUEC)
BUEC Reset	3.2.4.3.5	VSCS(BUEC) to GNI
BUEC Malfunction	3.2.4.3.6	GNI to VSCS(BUEC)

3.2.4.2 GNI Interface to VSCS(GRIM) Radio Card

The following discrete signals exist across the GNI to VSCS(GRIM) Radio Card interface.

3.2.4.2.1 Push-To-Talk (PTT) Activate/Release, VHF

a) The VSCS indicates the engagement of push-to-talk control of the VHF radio by placing the PTT-VHF Activate/Release interface in an ON state.
b) The PTT-VHF Activate/Release interface is maintained in an OFF state at all other times.

3.2.4.2.2 Receiver Mute, VHF

a) The VSCS requests the muting of a remote VHF receiver by placing the Receiver Mute, VHF interface in an ON state.
b) The Receiver Mute, VHF interface is maintained in an OFF state at all other times.

3.2.4.2.3 Receiver Mute Confirm, VHF

a) The GNI **shall** acknowledge the muting of a remote VHF receiver by placing the Receiver Mute Confirm, VHF interface in an ON state.
b) The Receiver Mute Confirm, VHF interface **shall** be maintained in an OFF state at all other times.

3.2.4.2.4 Squelch Break, VHF

a) The GNI **shall** inform the VSCS that squelch break has occurred on a VHF receiver (i.e., that an RF signal above the preset threshold has been detected at the receiver) by placing a Squelch-Break VHF interface in an ON state.
b) The Squelch-Break VHF interface **shall** be maintained in an OFF state at all other times.

3.2.4.3 GNI Discrete Interface to VSCS(BUEC) Radio Card

The following discrete signals are required across the GNI to VSCS(BUEC) Radio Card interface.

3.2.4.3.1 BUEC PTT

a) The VSCS(BUEC) indicates the engagement of push-to-talk control of the BUEC radio by putting the BUEC PTT interface in an ON state.
b) The BUEC PTT interface is maintained in an OFF state at all other times.

3.2.4.3.2 BUEC Select

a) The VSCS(BUEC) requests selection of the BUEC radios by putting the BUEC Select interface in an ON state for a period of 100 ms ±10%.
b) The BUEC Select interface is maintained in an OFF state at all other times.

3.2.4.3.3 BUEC Priority Level

a) The GNI **shall** maintain the BUEC Priority Level interface at zero Volts DC at all times.

3.2.4.3.4 BUEC Transfer Ready

a) Upon completion of transmission of a BUEC Priority Level interface, the GNI **shall** place the BUEC Transfer Ready signal in an ON state, defined as contact closure.
b) The BUEC Transfer ready **shall** be maintained in the ON state until receipt of a BUEC Reset interface from VSCS.

3.2.4.3.5 BUEC Reset

a) The VSCS(BUEC) requests termination of BUEC radios selection by putting the BUEC Reset interface in an ON state.
b) The BUEC Reset interface is maintained in an OFF state at all other times.

3.2.4.3.6 BUEC Malfunction

a) Upon receipt of a BUEC Select command, the GNI **shall** indicate the absence of a BUEC Radio malfunction by placing the BUEC Malfunction interface in an ON state, defined as contact closure.
b) The BUEC Malfunction interface **shall** be maintained in an OFF state at all other times.

3.2.5 Interface Design Characteristics

Table 3-3

Interface Design Characteristics Table

Signal	Format	Size	Rate/BW	Signal Flow
Primary Radio Analog Voice TX	Analog	N/A	3.000 KHz	VSCS(GRIM) to GNI
Primary Radio Analog Voice RX	Analog	N/A	3.000 KHz	GNI to VSCS(GRIM)
BUEC Radio Analog Voice TX	Analog	N/A	3.000 KHz	VSCS to GNI
BUEC Radio Analog Voice RX	Analog	N/A	3.000 KHz	GNI to VSCS
PTT Activate/Release	Discrete	N/A	N/A	VSCS(GRIM) to GNI
RX Mute	Discrete	N/A	N/A	VSCS(GRIM) to GNI
RX Mute Confirm	Discrete	N/A	N/A	GNI to VSCS(GRIM)
Squelch Break	Discrete	N/A	N/A	GNI to VSCS(GRIM)
BUEC PTT	Discrete	N/A	N/A	VSCS(BUEC) to GNI
BUEC Select	Discrete/pulse	N/A	N/A	VSCS(BUEC) to GNI
BUEC Priority Level	Discrete	N/A	N/A	GNI to VSCS(BUEC)
BUEC Transfer Ready	Discrete/pulse	N/A	N/A	GNI to VSCS(BUEC)
BUEC Reset	Discrete	N/A	N/A	VSCS(BUEC) to GNI
BUEC Malfunction	Discrete/pulse	N/A	N/A	GNI to VSCS(BUEC)
+12 VDC	Power	N/A	N/A	GNI to VSCS(GRIM)
Ground	Power	N/A	N/A	VSCS(GRIM) to GNI

3.3 Physical Requirements

3.3.1 Electrical Power/Electronic Characteristics

The requirements specified in this section are described in accordance with FAA-G-2100g: *Electronic Equipment General Requirements.*

3.3.1.1 Connectors

TBD by vendor

3.3.1.2 Wire/Cable

Wire **shall** be PVC-insulated solid copper that will properly interface with a 66/110 block.

3.3.1.3 Electrical Power/Electronic Referencing Characteristics

Note: VSCS, as legacy equipment, constrains the electrical characteristics of the GNI/VSCS interface. Discrete control and analog audio will continue to be used until new voice switching equipment is procured to provide for message-oriented signaling within VSCS, between VSCS and NEXCOM equipment. Accordingly, the electrical characteristics of the GNI/VSCS are those of the existing equipment. Specific requirements are described in the following subsections.

3.3.1.3.1 Interface Electrical Power Characteristics

a) The GNI **shall** supply DC Power to the GNI/VSCS(GRIM) interface, as specified in Table 3-4.
b) The GNI **shall** supply a DC Ground return to the GNI/VSCS(GRIM) interface.

Table 3-4

GNI to VSCS(GRIM) DC Power Source Characteristics

Parameter	Value
Voltage	+12 VDC ±5% (adjustable)
Current	3.6 A @ 40° C
Regulation	0.1% no load-full load
Ripple	1.5 mV RMS, 5 mV peak-peak one terminal grounded

Note: The GNI/VSCS(BUEC) interface has no DC power requirements for the EDM.

3.3.1.3.2 GNI/VSCS(GRIM) Analog Audio Interface Electrical Characteristics

The GNI/VSCS(GRIM) audio interface has the following characteristics.
a) Impedance: The VSCS(GRIM)-to-GNI audio connection **shall** be a balanced, transformer-coupled, 600-Ohm ± 10%, two-wire pair, isolated from ground, per FAA-E-2731.
b) Bandwidth: The VSCS(GRIM) transmit audio and GNI receive audio each **shall** have a frequency response of 300 to 3,000 Hz +0.5 dB to –0.6 dB relative to 1 kHz.
c) The interface circuitry **shall** maintain an audio response distortion of 0.1% or less.

3.3.1.3.3 GNI/VSCS(BUEC) Analog Audio Interface Electrical Characteristics

The GNI/VSCS(BUEC) audio interface has the following characteristics.
a) Impedance: The VSCS(BUEC)-to-GNI audio connection **shall** be a balanced, transformer-coupled, 600-Ohm ± 10%, two-wire pair, isolated from ground, per FAA-E-2731.
b) Bandwidth: The VSCS(BUEC) transmit audio and GNI receive audio each **shall** have a frequency response of 300 to 3,000 Hz +0.5 dB to –0.6 dB relative to 1 kHz.
c) The interface circuitry **shall** maintain an audio response distortion of 0.1% or less.

3.3.1.3.4 GNI/VSCS Discrete Control Interface Electrical Characteristics

3.3.1.3.4.1 VSCS Characteristics

The VSCS(GRIM) and VSCS(BUEC) radio cards provide several electrical interface standards for discrete control.

a) Signals sourced from VSCS have the electrical characteristics listed in Table 3-5.
b) The VSCS radio cards present the impedances to signals received from GNI, as shown in Table 3-6.

Table 3-5

VSCS Signal Sourcing Electrical Characteristics

VSCS Part No	Common Name	On State	Off State
212693-G0X	GRIM	+12 VDC ±25% @0.5mA max	Open circuit
181893-007	BUEC	0 VDC @3.0mA max	+5 VDC @ 2.4mA max

Table 3-6

VSCS Signal Sinking Characteristics

VSCS Part No	Common Name	Maximum Sink Current
212693-G0X	GRIM	20 mA
181893-007	BUEC	Ref. NAS-IC-64024201 Table 3-1

3.3.1.3.4.2 GNI Characteristics

The GNI provides several electrical interface standards for discrete control.

a) Signals sourced from GNI **shall** have the electrical characteristics as listed in Table 3-7.
b) The GNI **shall** present the impedances to signals received from VSCS shown in Table 3-8.

Table 3-7

GNI Signal Sourcing Electrical Characteristics

VSCS Part No	Common Name	On State	Off State
212693-G0X*	GRIM	+12 VDC ±10% @0.5 mA	Open circuit
181893-007	BUEC	Open Contact	Contact Closure

*X=1, 2, or 3.

Table 3-8

GNI Signal Sinking Characteristics

VSCS Part Number	Common Name	Maximum Sink Current
212693-G0X*	GRIM	20 mA
181893-007	BUEC	Ref. NAS-IC-64024201 Table 3-1

3.3.1.4 Fasteners

Fasteners **shall** be as specified in FAA-G-2100G.

3.3.1.5 Electromagnetic Compatibility

Electromagnetic compatibility **shall** be as specified in FAA-G-2100G.

4.0 QUALITY ASSURANCE PROVISIONS

Compliance with the requirements stated in this IRD are deemed met when all the requirements specified in a paragraph are verified by one or more of the methods outlined in the subsequent subparagraphs. The results of the verification activities **shall** be expressed as either pass or fail.

4.1 Responsibility For Verification

4.2 Special Verification Requirements

4.3 Verification Requirements Traceability Matrix

Verification Requirements Traceability Matrix may be found in Appendix A.

4.4 Verification Levels And Methods

The levels and methods of verification appropriate for use in the VRTM, presented in Section 4 of the IRD, are defined in the following paragraphs.

4.4.1 Verification Levels

a) SUBSYSTEM LEVEL. This level of verification is usually accomplished at the contractor's facility and culminates in the formal acceptance of a contractual end-item.
b) INTEGRATION-LEVEL. This level of verification is conducted at the WJHTC, or at a key site. The verification conducted will determine if the hardware, software, or subsystem to be deployed for site installation will perform in a NAS environment and in accordance with NAS system-level operational and functional requirements.
c) SITE-LEVEL. This level of verification is usually performed at the designated site. The verification portion of the subsystem installation and checkout will emphasize demonstration of the overall system performance requirements. It includes the demonstration of an end-item, subsystem and/or system, the final acceptance demonstrations, and commissioning activities.

4.4.2 Verification Methods

There are four verification methods that can be used at any of the three verification levels. Verification methods are:

a) INSPECTION. Inspection is a method of verification to determine compliance without the use of special test equipment, procedures, or services, and consist of a non-destructive static-state examination of the hardware, software, and/or the technical data and documentation.
b) TEST. Test is a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance to the success criteria stipulated in the IRD or project specification. The process uses standardized laboratory equipment, procedures, hardware, and/or services.

c) DEMONSTRATION. Demonstration is a method of verification where qualitative determination of properties is made for configuration items, including software, and/or technical data and documentation measured, in a dynamic state.
d) ANALYSIS. This method of verification consists of comparing hardware or software design with known scientific and technical principles, procedures, and practices to estimate the capability of the proposed design to meet the mission and system requirements. When certain elements of design are comprised of previously qualified elements such as commercial off the shelf (COTS) equipment, then analysis of previous qualification testing in meeting specification requirements may be used to reduce the amount of qualification testing.

5.0 PREPARATION FOR DELIVERY

This topic not applicable to this document.

6.0 NOTES

6.1 Definitions

6.2 Abbreviations And Acronyms

The list of abbreviations and acronyms may be found in appendix B.

APPENDIX A

Verification Requirements Traceability Matrix

Table A-1

Verification Requirements Traceability Matrix

(Verification Methods: D - Demonstration, I - Inspection, A - Analysis, T - Test, X - Not Applicable)

Section	Requirements	Verification Phase and Method			
		Sub-system Level	Integration Level	Site Level	Remarks
3.1.a	Support A/G communications	D	D	D	
3.1.b	Control A/G equipment	D	D	D	
3.1.c	Indicate A/G equipment status	D	D	D	
3.1.d	Exchange analog audio signals	D	D	D	
3.1.e	Exchange discrete control signals	D	D	D	
3.2.3.1.1.a	Provide Audio Path for GRIM emulation	D	D	D	
3.2.3.1.1.b	Provide Audio Path for BUEC emulation	D	D	D	
3.2.3.3.a	GNI provides receive audio to VSCS GRIM Radio interface	D	D	D	
3.2.3.3.b	GNI provides receive audio to VSCS BUEC Radio interface	D	D	D	
3.2.3.3.c	Primary radio receive audio level	T	T	T	
3.2.3.3.d	Backup radio receive audio level	T	T	T	
3.2.3.3.e	Other primary radio audio characteristics	T	T	T	Ref sec 3.3.1.3.2
3.2.3.3.f	Other backup radio audio characteristics	T	T	T	Ref sec 3.3.1.3.3
3.2.4.1	Configurable GNI interface circuitry	D	D	D	
3.2.4.2.3.a	Receiver Mute Confirm, VHF ON	D	D	D	
3.2.4.2.3.b	Receiver Mute Confirm, VHF OFF	D	D	D	
3.2.4.2.4.a	Indicate Squelch Break VHF ON	D	D	D	
3.2.4.2.4.b	Indicate Squelch Break VHF OFF	D	D	D	
3.2.4.3.3.a	Indicate BUEC Priority Level	D	D	D	
3.2.4.3.4.a	Place BUEC Transfer Ready ON	D	D	D	
3.2.4.3.4.b	Maintain BUEC Transfer Ready ON	D	D	D	
3.2.4.3.6.a	Indicate BUEC Malfunction	D	D	D	
3.2.4.3.6.b	Turn Off BUEC Malfunction	D	D	D	
3.3.1.2	Wire and Cable	I	T	T	
3.3.1.3.1.a	GNI Supplies electrical power for	T	T	T	

Section	Requirements	Verification Phase and Method			
		Sub-system Level	Integration Level	Site Level	Remarks
3.1.a	Support A/G communications	D	D	D	
3.1.b	Control A/G equipment	D	D	D	
3.1.c	Indicate A/G equipment status	D	D	D	
3.1.d	Exchange analog audio signals	D	D	D	
3.1.e	Exchange discrete control signals	D	D	D	
3.2.3.1.1.a	Provide Audio Path for GRIM emulation	D	D	D	
3.2.3.1.1.b	Provide Audio Path for BUEC emulation	D	D	D	
3.2.3.3.a	GNI provides receive audio to VSCS GRIM Radio interface	D	D	D	
3.2.3.3.b	GNI provides receive audio to VSCS BUEC Radio interface	D	D	D	
3.2.3.3.c	Primary radio receive audio level	T	T	T	
3.2.3.3.d	Backup radio receive audio level	T	T	T	
3.2.3.3.e	Other primary radio audio characteristics	T	T	T	Ref sec 3.3.1.3.2
3.2.3.3.f	Other backup radio audio characteristics	T	T	T	Ref sec 3.3.1.3.3
3.2.4.1	Configurable GNI interface circuitry	D	D	D	
3.2.4.2.3.a	Receiver Mute Confirm, VHF ON	D	D	D	
3.2.4.2.3.b	Receiver Mute Confirm, VHF OFF	D	D	D	
3.2.4.2.4.a	Indicate Squelch Break VHF ON	D	D	D	
3.2.4.2.4.b	Indicate Squelch Break VHF OFF	D	D	D	
	VSCS GRIM Radio interface card				
3.3.1.3.1.b	GNI Supplies electrical ground for VSCS GRIM Radio interface card	T	T	T	
3.3.1.3.2.a	GNI to VSCS(GRIM) Audio Circuit impedance	D	D	D	
3.3.1.3.2.b	GNI to VSCS(GRIM) Audio Circuit bandwidth	T	T	T	
3.3.1.3.2.c	GNI to VSCS(GRIM) Audio Circuit Response Distortion	T	T	T	
3.3.1.3.3.a	GNI to VSCS(BUEC) Audio Circuit impedance	D	D	D	
3.3.1.3.3.b	GNI to VSCS(BUEC) Audio Circuit bandwidth	T	T	T	
3.3.1.3.3.c	GNI to VSCS(BUEC) Audio Circuit Response Distortion	T	T	T	
3.3.1.3.4.2.a	GNI Signal Source Electrical Characteristics	T	T	T	
3.3.1.3.4.2.b	GNI Signal Sink Electrical	T	T	T	

Section	Requirements	Verification Phase and Method			
		Sub-system Level	Integration Level	Site Level	Remarks
3.1.a	Support A/G communications	D	D	D	
3.1.b	Control A/G equipment	D	D	D	
3.1.c	Indicate A/G equipment status	D	D	D	
3.1.d	Exchange analog audio signals	D	D	D	
3.1.e	Exchange discrete control signals	D	D	D	
3.2.3.1.1.a	Provide Audio Path for GRIM emulation	D	D	D	
3.2.3.1.1.b	Provide Audio Path for BUEC emulation	D	D	D	
3.2.3.3.a	GNI provides receive audio to VSCS GRIM Radio interface	D	D	D	
3.2.3.3.b	GNI provides receive audio to VSCS BUEC Radio interface	D	D	D	
3.2.3.3.c	Primary radio receive audio level	T	T	T	
3.2.3.3.d	Backup radio receive audio level	T	T	T	
3.2.3.3.e	Other primary radio audio characteristics	T	T	T	Ref sec 3.3.1.3.2
3.2.3.3.f	Other backup radio audio characteristics	T	T	T	Ref sec 3.3.1.3.3
3.2.4.1	Configurable GNI interface circuitry	D	D	D	
3.2.4.2.3.a	Receiver Mute Confirm, VHF ON	D	D	D	
3.2.4.2.3.b	Receiver Mute Confirm, VHF OFF	D	D	D	
3.2.4.2.4.a	Indicate Squelch Break VHF ON	D	D	D	
3.2.4.2.4.b	Indicate Squelch Break VHF OFF	D	D	D	
	Characteristics				
3.3.1.4	Fasteners	I	I	I	
3.3.1.5	Electromagnetic Compatibility	T	T	X	

APPENDIX B

Abbreviations And Acronyms

B.1 Abbreviations And Acronyms

ACF	Area Control Facility
A/G	Air-to-Ground
ANSI	American National Standards Institute
BUEC	BackUp Emergency Communications
EDM	Engineering Design Model
FAA	Federal Aviation Administration
GNI	Ground Network Interface (NEXCOM)
GRIM	Ground Radio Interface Module
ICD	Interface Control Document
IRD	Interface Requirements Document
ISO	International Organization for Standardization
M/S	Main/Standby
MTD	Minimum Threshold Document (NEXCOM)
NAS	National Airspace System
PTT	Push To Talk
P/S	Primary/Secondary site
PVC	Polyvinyl Chloride
RX	Receiver
SRD	System Requirements Document (NEXCOM)
TX	Transmitter
UHF	Ultra-High Frequency
VDL	VHF Data Link
VHF	Very-High Frequency
VRTM	Verification Requirements Traceability Matrix
VSCS	Voice Switching and Control System (Harris Government Systems)
WJHTC	William J. Hughes Technical Center (Atlantic City, NJ)