AEEC

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To	Traffic and Weather Surveillance Subcommittee	**Date**	February 6, 2020
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Subject **Strawman for ARINC Project Paper 768A:** ***Second Generation Integrated Surveillance System (2G ISS)***

Summary

The AEEC Executive Committee activated the Traffic and Weather Surveillance Subcommittee to develop several ARINC Standards, among them **ARINC Project Paper 768A:** *Second Generation Integrated Surveillance System (2G ISS)*. The activity is authorized by APIM 19-007.

ARINC Project Paper 768A is expected to define standards for a second generation Integrated Surveillance System (2G ISS) that may be configured to suit a wide variety of aircraft installations. The 2G ISS may include components and modules to perform multiple surveillance functions. The starting point for this Project Paper will be **Supplement 2 to ARINC Characteristic 768:** *Integrated Surveillance System (ISS)*. The document will include new material as follows:

- Addition of Distance Measuring Equipment function
- Removal of Weather Radar references
- Inclusion of the latest RTCA MOPS requirements (per **Supplement 3 to ARINC Characteristic 768**)
- Other content as needed

Action This document will be reviewed via web conference and at the next in-person meeting to be held March 19-20, 2020 in Phoenix, Arizona. Comments on this strawman should be submitted in writing to Larry A. Hesterberg before March 14, 2020.

cc SAI

Strawman for

ARINC Project Paper 768A

Second Generation Integrated Surveillance System (2G ISS)

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ATTACHMENTS

1.0 INTRODUCTION

1.1 Purpose of this Document

This document provides standards for a **second generation** Integrated Surveillance System (**2G** ISS) that may be configured to suit a wide variety of aircraft installations. The **2G** ISS may include components and modules to perform multiple surveillance functions:

- Airborne Collision Avoidance System (ACAS) **including ACAS-X**
- Air Traffic Control Transponder (ATCRBS/Mode S)
- Terrain Awareness and Warning System (TAWS)
- Automatic Dependent Surveillance – Broadcast (ADS-B) OUT/IN
- **Distance Measuring Equipment (DME)**

This document uses a building block approach to define a **second generation** ISS with a combination of surveillance functions. This document establishes interoperability standards for these configurations. The ISS is intended for installation on commercial air transport aircraft with digital interfaces (ARINC 429 or ARINC 664) with primary applicability to future aircraft and derivatives of the current generation production aircraft. This document provides standards for equipment form factor, signal interfaces, aircraft interwiring and connector pin allocation.

The minimum operational and performance capabilities of the ISS are further described in the related RTCA and EUROCAE Minimum Operational Performance Standards (MOPS) and Minimum Aviation System Performance Standards (MASPS) documents for ACAS, Mode S transponder, TAWS, and ADS-B OUT/IN. Section 1.8 includes a list of reference documents.

The primary goal of the ISS is to simplify aircraft installations and reduce life cycle costs through integration, as well as providing meaningful operational benefits. Another goal is to establish an enabling platform for future surveillance capabilities.

COMMENTARY

Manufacturers should design the ISS for current production (with aircraft installation and configuration changes), future derivative, or new aircraft architectures. Analog interfaces should not be used.

The intent of this document is to maximize the functional integration of similar surveillance systems. To the extent practical, manufacturers should envisage growth provisions for integrated surveillance processing functions.

1.1.1 Relationship to Other Documents

This document conforms to ARINC Report 660A recommendations for the Integrated Surveillance System (ISS). Many functions included in the ISS are presently defined in existing standards, for example TCAS (ARINC 735A), Transponder (ARINC 718A), TAWS (ARINC 762), ADS-B OUT (ARINC 718A-3), and ADS-B IN (ARINC 735B). Where practical, this document will define functions by referencing pertinent ARINC documents.

1.1.2 Relationship to ARINC Characteristic 768

This document represents a generational step of technology for traffic and terrain surveillance compared to the original ISS defined by ARINC

1.0 INTRODUCTION

Characteristic 768. This document was written to retain significant structural alignment with the original ISS standard. Section headers are retained for familiarity and comparison of ISS and 2G ISS.

The term "2G ISS" refers to functions and capabilities unique to ARINC 768A.

The term "ISS" refers to function and capabilities expected to be found in all ISS-equipped aircraft.

1.2 System Description

The **2G** ISS may be implemented in **TBD** configurations. Each configuration contains various combinations of surveillance functions. The primary objective is to maintain maximum commonality between different configurations.

Table 1-1 – Functional Configuration

Config	ACAS	XPDR	TAWS/RWS	ADS-B OUT	ADS-B/TIS-B/ADS-R IN
A	X	X	X	X	X
B	X	X		X	X
C	X		X		X

1.2.1 Configuration A

This configuration contains the following ISS functions:

- ACAS
- ATCRBS/Mode-S
- TAWS/RWS
- ADS-B OUT
- ADS-B/TIS-B/ADS-R IN

1.2.2 Configuration B

This configuration contains the following ISS functions:

- ACAS
- ATCRBS/Mode-S
- ADS-B OUT
- ADS-B/TIS-B/ADS-R IN

1.2.3 Configuration C

This configuration contains the following ISS functions:

- ACAS
- TAWS/RWS
- ADS-B/TIS-B/ADS-R IN

1.2.4 Configuration D (not applicable)

1.3 Functional Descriptions

1.3.1 ACAS

The function of ACAS is to determine the range, altitude and bearing of other aircraft equipped with Mode S/ATCRBS transponders with respect to the location of own aircraft. The system monitors the trajectory of these aircraft for the purpose of determining if any of them constitute a potential collision hazard. The system is responsible for estimating the separation at closest approach and determining if a potential conflict exists. If so, the system should display an advisory to the pilot. In cases defined in this document, the system should also provide guidance for the optimum vertical avoidance maneuver. The correctness of the avoidance maneuver is ensured by coordination of mutual intentions with the other ACAS equipped aircraft through the Mode S transponder. Refer to ARINC Characteristic 735A for a detailed systems description.

ACAS-X is an extension of traffic surveillance capabilities. These additional functions include [TBD].

1.3.2 ATCRBS/Mode S Functions

The ATCRBS/Mode S transponder supports surveillance functions. These include classic Secondary Surveillance Radar (SSR) Mode A/C, Mode S, Elementary Surveillance, and Enhanced Surveillance functions. Refer to ARINC Characteristic 718A (latest revision) for a detailed system description.

1.3.3 Weather Radar Functions (not applicable)

There are no weather radar functions defined for inclusion in the 2G ISS.

COMMENTARY

ARINC weather radar standards are provided in ARINC Characteristic 708A and ARINC Project Paper 7xx.

Section headers are provided in this document to retain organizational alignment with the original ISS definition, ARINC Characteristic 768.

1.3.4 TAWS Functions

The TAWS function contains both the basic Ground Proximity Warning System (GPWS) functions as well as the terrain data base derived forward-looking terrain alerting capability. As an optional capability, the ISS may include reactive windshear detection capability. Refer to ARINC Characteristic 762 (latest revision) for a detailed system description.

1.3.4.1 Alert Prioritization

All ISS configurations with TAWS capability should also include alert prioritization for the surveillance functions, per FAA TSO-C151b.

1.3.4.2 TAWS Growth Functions

All ISS configurations with TAWS functionality should also consider growth capability for emerging functions.

1.3.5 ADS-B OUT Function

The ADS-B OUT function supports RTCA DO-260**C**/EUROCAE ED-102**B**. Refer to ARINC 718A (latest revision) for a detailed system description.

1.3.6 ADS-B IN Function

The ISS may also include the capability to receive and process:

- 1090 MHz ADS-B messages from other aircraft
- 1090 MHz TIS-B messages from ADS-B ground stations
- 1090 MHz ADS-Rebroadcast (ADS-R) messages from ADS-B ground stations

The data from these messages can be used to support a number of ADS-B IN applications. Refer to Section 3.2.2 for a list of ADS-B IN applications.

1.3.7 Distance Measuring Equipment (DME) Function

The 2G ISS is expected to provide the DME functions further defined in ARINC Characteristic 709A: *Precision Distance Measuring Equipment (P/DME).*

1.4 Unit Description

The **2G** ISS consists of **multiple** units depending on the configuration:

- ISS Processor Unit (ISSPU) applicable to all configurations.
- ISS Control Panel (ISS CP) applicable to all configurations. Control panels are implemented in accordance with the requirements of the airframe manufacturer.
- ACAS/ATC antenna, applicable to all configurations.
- These units are described in Sections 1.4.1 through 1.4.4 below.

1.4.1 ISS Processor Unit (ISSPU)

The ISS processor unit houses all elements which provide the signal processing, power supply, ACAS/ATC RF processing and the communication processing for the system.

1.4.2 Weather Radar Antenna Unit (WRAU) (not applicable)

There are no weather radar functions defined for inclusion in the 2G ISS.

COMMENTARY

ARINC weather radar standards are provided in ARINC Characteristic 708A and ARINC Project Paper 7xx.

Section headers are provided in this document to retain organizational alignment with the original ISS definition, ARINC Characteristic 768.

1.4.3 ISS Control Panel Description

Control of the surveillance functions may be implemented in one of several ways. The control functions may be integrated with the Cockpit Display System (CDS) and/or through one or more dedicated control panel(s). Where dedicated control panels are used with ISS, this document provides guidance on form factor and interwiring. Airline user preferences are expected to play a large role in control panel design.

1.4.4 ACAS/ATC/ADS-B Antenna

Each ISS should provide two ACAS/ATC/ADS-B transmit/receive directional antennas to be shared by the ACAS/ATC/ADS-B functions of each ISS processor unit, one located on the underside of the fuselage and the other on top. These antennas provide the ISS processor unit with signals for an estimation of the signal angle-of-arrival, and also have the capability to meet the omni-directional radiation pattern requirements of the ATCRBS/Mode S transponder, the ADS-B OUT (transmit) function, and the ADS-B IN (receive) function.

1.5 Interchangeability

1.5.1 General Requirements for Interchangeability

One of the primary functions of an ARINC Characteristic is to designate, in addition to certain performance parameters, the interchangeability in an aircraft of equipment produced by various manufacturers. The manufacturer is referred to ARINC Report 607 for definitions of terms and general requirements for interchangeability. As explained in that document, the degree of interchangeability considered necessary and attainable for each particular system is specified in the pertinent ARINC Characteristic for that system.

1.5.2 Interchangeability Desired for the ISS

Although it is desirable to have complete interchangeability for all ISS components supplied by different manufacturers, such level of interchangeability might not be achievable due to large variations between the ISS configurations. However, it is necessary to maintain total system interchangeability for a given configuration supplied by different manufacturers.

Due to the complicated, and sometimes proprietary, interfaces that exist between the antenna units (e.g., ACAS/ATC/ADS-B antennas) and the ISS processor unit, it is not practical to achieve full unit level interchangeability between the units supplied by different manufacturers for a given ISS configuration. However, by maintaining form factor and interwiring standardization, system level interchangeability in installations designed in accordance with this document is a requirement for each of the ISS configurations.

Interchangeability of the equipment between different aircraft types might be achievable only by using onboard software loading capability and loading unique software intended to be used on the aircraft that the unit is being installed.

1.5.3 Generation Interchangeability Considerations

Unchanged is the industry’s traditional desire that future evolutionary equipment improvements and the inclusion of additional functions in new equipment. These improvements should not violate the interwiring and form factor standards set forth in this document. Provisions to ensure forward looking “generation interchangeability” (as best can be predicted) are included in this document to guide manufacturers in future developments.

Forward-looking interchangeability may also be achieved by implementation of table-loaded information to provide this (static configuration) information, for example by an Airplane Personality Module (APM) or via digital buses.

1.6 Regulatory Approval

The ISS should meet all applicable ICAO, ITU, EASA and FAA regulatory requirements. This document does not and cannot set forth the specific requirements that the equipment must meet to be assured approval. This information must be obtained from the appropriate regulatory authority.

1.7 Reliability

The airlines insist upon the utmost attention to the need for reliability in all phases in the design, production, installation and operation of the ISS. It is most critical to achieve high levels of reliability to benefit from integration and to realize low life-cycle costs.

1.8 Reference Documents

The **latest versions of the** following documents pertain to ISS development and installation:

ARINC Specification 404A: *Air Transport Equipment Cases and Racking*

ARINC Report 413A: *Guidance for Aircraft Electrical Power Utilization and Transient Protection*

ARINC Specification 429: *Digital Information Transfer System (DITS)*

ARINC Specification 600: *Air Transport Avionics Equipment Interfaces*

ARINC Report 604: *Guidance for Design and Use of Built-In Test Equipment (BITE)*

ARINC Report 607: *Design Guidance for Avionic Equipment*

ARINC Report 609: *Design Guidance for Aircraft Electrical Power Systems*

ARINC Report 615A: *Software Data Loader Using Ethernet Interface*

ARINC Report 624: *Design Guidance for On-Board Maintenance System*

ARINC Report 660A: *CNS/ATM Avionics Functional Alloction and Recommended Architectures*

ARINC Specification 661: *Cockpit Display System Interfaces to User Systems*

ARINC Specification 664: *Aircraft Data Network*

ARINC Report 665: *Loadable Software Standards*

ARINC Characteristic 709A: Precision Distance Measuring Equipment (P/DME)

ARINC Characteristic 718A: *Mark 4 Air Traffic Control Transponder (ATCRBS/Mode S)*

ARINC Characteristic 735A: *Mark 2 Traffic Alert and Collision Avoidance System (TCAS)*

ARINC Characteristic 735B: *Traffic Computer TCAS and ADS-B Functionality*

ARINC Characteristic 762: *Terrain Awareness and Warning System (TAWS)*

ARINC Specification 801: *Fiber Optic Connectors*

FAA document: *"Application Integrated Work Plan (AIWP)", Version 2.0, June 2010*

FAA TSO-C92c: *Airborne Ground Proximity Warning Equipment*

FAA TSO-C112c: *Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment*

FAA TSO-C119c: *Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS II*

FAA TSO-C151b: *Terrain Awareness and Warning System*

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FAA TSO-C166b: *Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Service – Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)*

FAA TSO-C195: *Avionics Supporting Automatic Dependent Surveillance – Broadcast (ADS-B) Aircraft Surveillance Applications (ASA)*

ICAO Annex 10 Volume III: *Chapter 5 Appendix (Amendment 81)*

ICAO Annex 10 Volume IV: *Surveillance Radar and Collision Avoidance Systems and Chapter 5 of Volume III Part 1 SSR Mode S Air-Ground Data Link.*

RTCA DO-160G/EUROCAE ED-14G: *Environmental Conditions and Test Procedures for Airborne Equipment*

RTCA DO-161A: *Minimum Performance Standards – Airborne Ground Proximity Warning Equipment*

RTCA DO-178C/EUROCAE ED-12C: *Software Considerations in Airborne Systems and Equipment Certification*

RTCA DO-181F/EUROCAE ED-73E: *Minimum Operational Performance Standards for Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment*

RTCA DO-185B/EUROCAE ED-143: *Minimum Operational Performance Standards for Traffic Alert and Collision Avoidance System (TCAS II) Airborne Equipment*

RTCA DO-214: *Audio Systems Characteristics and Minimum Operational Performance Standards for Aircraft Audio Systems and Equipment*

RTCA DO-242A: *Minimum Aviation System Performance Standards for Automatic Dependent Surveillance - Broadcast (ADS-B)*

RTCA DO-254/EUROCAE ED-80: *Design Assurance Guidance for Airborne Electronic Hardware*

RTCA DO- 260C/EUROCAE ED-102B: *Minimum Operational Performance Standards for 1090 MHz Automatic Dependent Surveillance - Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B)*

RTCA DO-263: *Application of Airborne Conflict Management: Detection, Prevention and Resolution*

RTCA DO-272B/EUROCAE ED-99B: *User Requirements for Aerodrome Mapping Information*

RTCA DO-276A/EUROCAE ED-98A: *User Requirements for Terrain and Obstacle Data*

RTCA DO-286B: *Minimum Aviation System Performance Standards (MASPS) for Traffic Information Services – Broadcast (TIS-B)*

RTCA DO-289: *Minimum Aviation System Performance Standards (MASPS) for Aircraft Surveillance Applications (ASA)*

RTCA DO-300: *Minimum Operational Performance Standards (MOPS) for Traffic Alert and Collision Avoidance System II (TCAS II) Hybrid Surveillance*

RTCA DO-303/EUROCAE ED-126: *Safety, Performance and Interoperability Requirements Document for the ADS-B Non-Radar-Airspace (NRA) Application*

RTCA DO-312/EUROCAE ED-159: *Safety, Performance and Interoperability Requirements Document for the In-Trail Procedure in Oceanic Airspace (ATSA-ITP) Application*

RTCA DO-314/EUROCAE ED-160*: Safety, Performance and Interoperability Requirements Document for Enhanced Visual Separation on Approach (ATSA-VSA)*

RTCA DO-317: *Minimum Operational Performance Standards (MOPS) for Aircraft Surveillance Applications System (ASAS)*

RTCA DO-318/EUROCAE ED-161: *Safety, Performance and Interoperability Requirements Document for Enhanced Air Traffic Services in Radar-Controlled Areas Using ADS-B Surveillance (ADS-B-RAD)*

RTCA DO-319/*EUROCAE ED-164*: *Safety, Performance and Interoperability Requirements Document for Enhanced Traffic Situational Awareness During Flight Operations (ATSA-AIRB)*

RTCA DO-322: *Safety, Performance and Interoperability Requirements Document for ATSA-SURF Application*

RTCA DO-338: *Minimum Aviation System Performance Standards (MASPS) for ADS-B Traffic Surveillance Systems and Applications (ATSSA)*

RTCA DO-361A: *Minimum Operational Performance Standards (MOPS) for Flight-deck Interval Management (FIM)*

RTCA DO-367: *TAWS MOPS Supplement*

RTCA DO-385: *Minimum Operational Performance Standards for Airborne Collision Avoidance System X (ACAS X) ACAS Xa and ACAS Xo)*

2.0 INTERCHANGEBILITY STANDARDS

2.1 Introduction

This section specifies **the 2G** ISS form factor, mounting provisions, interwiring, signal interfaces and power supply characteristics. These standards are necessary to ensure independent design and development of both ISS equipment and the airframe installation.

Manufacturers should note that although this Characteristic does not preclude the use of different form factors and interwiring features, the practical problem of redesigning what should then be a standard aircraft installation to accommodate a customized solution could very well make the use of that custom design prohibitively expensive for the customer. Manufacturers should recognize the practical advantages of developing equipment in accordance with the form factor, interwiring and signal standards of this document.

2.2 Form Factor, Connector, and Index Pin Coding

The ISS equipment should conform to the guidelines of ARINC 600 and ARINC 801.

2.2.1 ISS Processor Unit

The ISS Processor Unit (ISSPU) should comply with the dimensional standards in ARINC 600. The unit size is specified in the table below. The ISS should also comply with ARINC 600 standards in respect of weight, racking attachments, front and rear projections and cooling.

2G ISS Processor Unit Configuration	ARINC 600 Size
A	8 MCU
B	4 MCU
C	8 MCU (max)

The ISSPU should use a low insertion force ARINC 600 Size 3 service connector located on the center grid of the rear panel. The index code is specified as #158. The index pins on the ISSPU rear connector should be set as follows per ARINC 600. The position is specified from the point of view of each unmated connector. Attachment 5B provides detailed connector drawings.

Position	Left	Center	Right
ISSPU	6	6	3
Aircraft	2	5	5

2.2.2 ISS Control Panel

Pilot control of the ISS may be provided on a dedicated ISS control panel or multiple control panels. Guidance on the design of a control panel suitable for ISS is included in Section 6 of this document.

ISS control panels should use the standard Dzus mounting. Typical control panel sizes for different configurations are shown in Attachment 2.

2.0 INTERCHANGEBILITY STANDARDS

COMMENTARY

The Mythical "Standard Control Panel"

Control panels specific to the aircraft type sometimes vary between different airline configurations even for the same aircraft type. Therefore, it is very difficult to define a "Standard Control Panel" that is interchangeable between different manufacturers. However, form factor, connector and wiring can be standardized to allow "Standard Control Panel" provisions on the aircraft. Functional specifications for the ISS control panels are defined in Section 6 of this document.

2.2.3 ACAS/ATC/ADS-B Directional Antenna

The physical characteristics, mounting dimensions and connector type for the ACAS/ATC/ADS-B directional antenna are shown in Attachment 3.

COMMENTARY

Airframe manufacturers are strongly encouraged to implement antenna mounting provisions that accommodate antennas with flat mounting surfaces. While airframe designers may have some perfectly valid reasons for using antennas with different curvature at the bottom to match different fuselage diameters, they should take note of the airline wishes. The airlines wish to avoid the spare parts problem introduced by the use of such antennas.

Section 4 of this document provides further information on the ACAS/ATC/ADS-B antenna.

2.2.4 Weather Radar Antenna Unit (not applicable)

[Section not applicable - ARINC may delete at publication if there is no 2.2.5]

2.3 Weights

For the installation designer to provide proper structural design that can be used interchangeably with all manufacturers' units, this characteristic sets forth the maximum weight expected for each unit. This is, however, not to be misconstrued as a specification on the acceptable weight limits for the equipment. Manufacturers are asked to keep ARINC informed regarding any equipment intended to conform to this Characteristic and where the equipment units do not meet the ranges set forth below. Such information should be disseminated to the airlines and airframe manufacturers.

2G ISS Recommended Weights	Goal (kg)	Max (kg)
ISS Processor Unit		
4 MCU	8	10
6 MCU	10	15
ACAS/ATC/ADS-B antenna	1.3	1.5
Control Panel(s) each	1.8	2.0
APM (optional)	0.1	0.3

2.4 Standard Interwiring

The standard interwiring to be installed for the ISS is set forth in Attachment 5 of this document. This interwiring is intended to provide the degree of interchangeability specified in Section 1.5 of this document. Manufacturers are cautioned not to rely upon special wires, cabling or shielding for use with particular units, because they will not exist in the standard installation.

COMMENTARY

Standardized interwiring is perhaps the heart of all ARINC Characteristics. It is this feature which allows the airline customer to complete negotiations with the airframe manufacturer so that the latter can proceed with engineering and initial fabrication prior to airline commitment on a specific source of equipment. This provides the equipment manufacturer with many valuable months in which to put the final “polish” on his equipment in development.

The airlines wish to emphasize to manufacturers that they desire a single common solution for ISS, especially where it is Buyer Furnished Equipment (BFE) or selectable Supplier Furnished Equipment (SFE). The connectors and interwiring documented in this Characteristic reflect the airlines preference for this common solution.

This Characteristic also provides design guidance for highly integrated Supplier Furnished systems, but aircraft design considerations may result in deviations from this characteristic. In those cases, equipment manufacturers must consult with the airframe manufacturer or systems integrator for detailed interface requirements.

The airlines also wish to re-emphasize the desire that aircraft on which ISS is BFE or selectable SFE should be wired with both coax and fiber optic at time of manufacture, so that airlines are free to switch between ISS systems employing different wiring technologies without having to rewire the aircraft or change any connectors.

The reader should also consider the specific notes in Attachment 5 as they apply to the standard interwiring.

2.5 Power Circuitry

2.5.1 Primary Power Input

The aircraft power supply characteristics, utilization, equipment design limitations and general guidance material are set forth in ARINC 609.

2.5.2 ISS Processor Unit Power Input

The ISS equipment should be designed to use two 115 Vac 360-800 Hz variable frequency power inputs. One of these inputs, identified as the Emergency Bus Input, should be used to power only the circuitry necessary for the transponder function in order to minimize the power requirement from the essential bus. The other input should be used for functions not required to support transponder operation.

In the ISS Processor Unit, care should be given to maintain a maximum level of isolation between two power inputs. These inputs are protected by a single circuit breaker for each input, situated in the aircraft power distribution center. Power for Type I control panel should be supplied by the ISS Processor Unit.

Power for the Type II control panel comes directly from a circuit breaker or the power distribution system.

As an option, 28 Vdc may be used to supply power to the ISS.

2.5.3 Power Control Circuitry

There should be no master on/off power switching within the ISS. Any user desiring power on/off control for the unit should provide, through the medium of a switching function installed in the airframe, means of interrupting the primary AC power to the equipment. It may be noted that primary power on/off switches should not be needed in most installations and power should be wired directly to the equipment from the circuit breaker panel or power distribution system.

COMMENTARY

Although only one ISS Processor Unit of a dual installation may be operating at a time, users desire the inoperative unit to be held in a powered-up "standby" condition so that it's BITE may detect and annunciate any failures that would render it incapable of providing service when called upon.

2.5.4 The Common Ground

The wires connected to the ISS Processor Unit connector pins labeled "Chassis Ground" should be employed as the dc ground return to aircraft structure. It is not intended as a common return for circuits carrying heavy ac currents. Equipment manufacturers should design their equipment accordingly.

2.5.5 The AC Common

The wires connected to the ISS Processor Unit connector pins labeled "115 Vac Ret" should be grounded to the same structure that provides the dc chassis ground but at a separate ground stud. Airframe manufacturers are advised to keep ac ground wires as short as practicable in order to minimize noise pick-up and radiation. These pins should not be grounded internal to the ISS Processor Units.

2.5.6 Internal Circuit Protection

The basic master power protection means for the ISS Processor Unit will be external to the unit (utilize a circuit breaker or power distribution relay). Within the equipment, no master power protection means is to be provided, although circuit protection is acceptable where the set manufacturer feels this would improve the overall reliability of the equipment.

COMMENTARY

Airlines prefer protection means other than fuses and circuit breakers. However, if internal protection by fuses is employed, these fuses should not be accessible when the set is installed in the aircraft radio rack but should be replaceable only when the equipment goes through the service shop.

If circuit protection is provided by means of circuit breakers, the majority prefer that these be accessible on the front panel of the equipment so that they can be reset in service.

2.6 Standard Interfaces

The ISS equipment sends and receives data on several interfaces. Interoperability of equipment from different manufacturers requires that all communication interfaces are compatible with each other from the electrical and protocol point of view. Interfaces in this respect are interfaces to the avionics buses as well as the interfaces to the onboard applications requiring communication services.

2.6.1 Equipment Spacing

With the exception of ACAS/ATC/ADS-B antenna, the ISS should be designed to make allowance for up to 100 foot separation distance between the components of the system to allow maximum installation flexibility for the airframe manufacturers. For ACAS/ATC/ADS-B antennas, the airframe manufacturers should design cabling and distance to maintain cable loss of 2.5 ±0.5dB at 1030 MHz and 1090 MHz, including the connector losses.

2.7 Environmental/EMI Requirements

The ISS components should be specified environmentally in terms of RTCA DO-160 latest version. Because ISS components are located in different areas of the aircraft, different levels of environmental testing may be required. Tests applicable to each component are provided in Attachment 7.

2.8 Cooling

The ISS Processor Unit should be designed to accept, and airframe manufacturers should configure the installation to provide forced air cooling as defined in ARINC 600 (220 kg/hr per kW of power dissipation).

Unit Size	Air Flow (kg/hr at 40 deg C)	Average Power (watts)
4 MCU	16.5	100
6 MCU	33.0	150

The coolant air pressure drop through the equipment should be per ARINC 600, which specifies level 1 cooling (5 ±3 mm) or level 2 cooling (25 ±5 mm) at standard conditions of 101.3 kPa. This pressure drop does not include the drop through a returning orifice when such orifice is located external to the equipment case. A loss of in-flight cooling air for 345 minutes should not cause any loss of functionality. A partial reduction in duty cycle is acceptable during periods of no cooling air for higher ambient air temperatures or longer periods of no cooling air.

Other ISS components, such as control panels, should be designed for convection and conduction cooling. These units should not require forced-air cooling.

COMMENTARY

The specified cooling air flow rate is based on estimated average power dissipation. However, it should be noted that power dissipation during RF signal transmission will be higher than the estimated average. Thus, the specified air flow rate will be less than the rate recommended in ARINC 600 for the maximum dissipation.

Equipment failures in aircraft due to inadequate thermal management have plagued the airlines for many years. Section 3.5 of ARINC 600 contains information needed by airframe and equipment suppliers to prevent such problems in the future. The airlines regard this material as “required reading” for all potential suppliers of the ISS equipment as well as airframe manufacturers.

2.9 Grounding and Bonding

The ISS equipment and airframe installation should conform to the guidance material in Section 3.2.4 of ARINC 600 and Appendix 2 of ARINC 404A on the subject of equipment and radio rack grounding and bonding.

COMMENTARY

A perennial problem for the airlines is the location and repair of airframe ground connections whose resistances have risen as the airframe aged. A high resistance ground usually manifests itself as a system-level problem that is difficult to troubleshoot and therefore consumes an unreasonable amount of time and effort on the part of maintenance personnel to fix. Airframe manufacturers are urged, therefore, to pay close attention to assuring the longevity of ground connections. Close attention to the above-referenced material should be the first step.

2.10 Standardized Signaling

Electrical signal inputs and outputs of the ISS should be in the form of a digital format or switch contact. Standards should be established exactly to assure the desired interoperability of equipment.

Basic standards described below are applicable to all signals. Unless otherwise specified, signals should conform to the standards set forth in the sections below.

2.10.1 Digital Interfaces

The ISS should contain necessary digital interfaces and adequate spares to support growth functions over the foreseeable future. The recommended equipment ID for ISS is 068. This ID may be used with ARINC 429 and other data transfer mediums. See ARINC Specification 429 for additional information on this topic.

2.10.1.1 ARINC 429 Data Bus

ARINC Specification 429 and applicable ARINC Characteristics (e.g., ARINC 702A, 718A, 735A, 735B, 762) define data word formats, refresh rates and resolution.

2.10.1.2 ARINC 664 Ethernet Bus

ARINC Specification 664 defines the physical layer definitions for copper and fiber optic media used in aircraft installations. Exact data word formats, refresh rates and resolution, are to be defined by the airframe manufacturer. The ISS should be designed to accept different data formats and rates used by software data loading equipment.

2.10.1.3 AEEC 453 Radar Bus (not applicable)

[Section not applicable - ARINC may delete at publication if there is no 2.10.1.4]

2.10.2 Discrete Interfaces

2.10.2.1 Standard Open

The standard “open” signal is characterized by a resistance of 100,000 ohms or more with respect to signal common.

COMMENTARY

In many installations, a single switch is used to supply a logic input to several LRUs. One or more of these LRUs may utilize a pull-up resistor in its input circuitry. The result is that an “open” may be accompanied by the presence of 27.5 Vdc nominal. The typical signal range is 18.5 to 36 Vdc.

2.10.2.2 Standard “Ground”

A standard “ground” signal may be generated by either a solid state or mechanical type switch. For mechanical switch-type circuits, resistance of 10 ohms or less to signal common represents the “ground” condition. Semiconductor circuitry should exhibit a voltage of 3.5 Vdc or less with respect to signal common in the ground condition.

2.10.2.3 Standard “Applied Voltage” Output

The standard “applied voltage” is defined as having a nominal value of 27.5 Vdc. This voltage is considered “applied” when the actual voltage under the specified load conditions exceeds 18.5 volts (36 Vdc maximum) and is “not applied” when the equivalent impedance to the voltage source exceeds 100,000 ohms.

2.10.2.4 Standard Discrete Input

A standard Discrete Input should recognize incoming signals with two possible states, “open” and “ground”. The characteristics of these two states are defined in Sections 2.10.2.1 and 2.10.2.2 of this document. The maximum current flow in the steady “ground” state should not exceed 20 milliamps.

The “true” state may be represented by either of the two states (ground or open) depending on the aircraft configuration.

The maximum input capacitance to ground should be less than 1 microfarad.

COMMENTARY

The maximum input capacitance is specified because excessive input capacitance can cause current spikes of over 1 amp.

The logic sources for discrete inputs to the ISS are expected to take the form of switches mounted on the airframe component (flap, including gear, etc.) from which the input is desired. These switches can either connect the discrete input pins on the connector to airframe DC ground or leave them open circuit as necessary to reflect the physical condition of the related components.

The ISS is expected to provide the DC signal to be switched. Typically, this is done through a pull-up resistor. The ISS input should sense the voltage on each input to determine the state (open or closed) of each associated switch.

The values of voltages (and resistance) which define the state of an input is based on the assumption that the discrete input utilizes a ground-seeking circuit. The input may utilize an internal pull-up to provide for better noise immunity when a true "open" is present at the input. This type of input circuit is favorable among both manufacturers and users.

Because the probability is quite high that sensors (switches) will provide similar information to a number of users, unwanted signals may be impressed on the ISS inputs, especially when the switches are in the open condition. For this reason, equipment manufacturers should base their logic sensing on the "ground" state of each input. Manufacturers should ensure adequate signal isolation to prevent sneak circuits from contaminating the logic. Typically, diode isolation is used in the avionics equipment to prevent this from happening.

2.10.2.5 Standard Discrete Output

A standard Discrete output should exhibit two states, "open" and "ground" as defined in Sections 2.10.2.1 and 2.10.2.2. In the "open" state, provision should be made to present an output resistance of at least 100,000 ohms. In the "ground" state provision should be made to sink at least 20 milliamps of steady state current. Non-standard current sinking capability may be defined.

COMMENTARY

It is recognized that not all Discrete output needs can be met by the Standard Discrete output defined above. Some Discrete outputs may need to sink more current than the standard value specified above and will be defined in the appropriate section of this document.

The designer is cautioned that discrete input capacitance and discrete output slew rates can caused current spikes of over 1 amp.

Discrete outputs that need to source current should utilize the standard "Applied Voltage" output defined in Section 2.10.2.3. These special cases are noted in the text describing each applicable Discrete output function and in the notes to interwiring.

Although defined here, discrete outputs which provide a current output rather than a current sink are not "Standard Discrete Outputs."

2.10.2.6 Standard Program Pin Inputs

Program pins may be assigned on the ISS service connector for the purpose of identifying a specific aircraft configuration or to select (enable) optional performance. The optional operational function may be in effect at all times or only under certain conditions, such as when the aircraft is on the ground (identified by the enabling of the Air/Ground Discrete input). Every effort should be made to minimize the number of program pins used for the ISS.

Program pins may be used for a variety of purposes. Program pins enable a piece of equipment to be used over a greater number of airframe types. One way this is done is by identifying the unique characteristics of the airframe in which the unit is installed. Another is to identify the location (left, right, center) of the unit. Often program pins are used to enable (turn on) options for alternate or extended performance characteristics.

The encoding logic of the program pin relies upon two possible states of the designated input pin. One state is an "open" as defined in Section 2.10.2.1 of this document. The other state is a connection (short circuit i.e., 10 ohms or less) to the pin designated as the "Program Common" pin.

COMMENTARY

> Normally, the "primary" location or "usual," "common" or "standard" function is defined by the "open" logic and the optional response is programmed (encoded) by connection to Program Common.

One means of reducing the program pins to make use of an Airplane Personality Module (APM) (see Section 2.10.4) and another is to make the programmable aspects of the system to be encoded in the onboard loadable software.

2.10.3 Analog Interfaces

2.10.3.1 DC Panel Backlight Dimming Bus Input

0 to 10 Vdc signal input should be used to control the brightness of the control panel back lighted legends.

2.10.3.2 AC Panel Backlight Dimming Bus Input

As an alternate to the dc Backlight Dimming Bus, 0 to 5 Vac (360-800 Hz) can be used for panel backlighting.

2.10.3.3 Audio Output

Audio outputs should be programmable to deliver 0.625 to 80 mW into 600 ohm load at 1000 Hz. Default audio outputs settings should provide 10 mW (nominal) into 600 ohm load per RTCA DO-214. Audio levels should be customer selectable by user modifiable code or APM programmability.

2.10.3.4 Suppression Pulse

For certain ISS configurations, an ac coupled pulse signal may be necessary to provide mutual suppression of systems transmitting on ACAS/ATC frequencies. Details of the suppression pulse characteristics can be found in ARINC 735A.

2.10.4 Airplane Personality Module (APM)

If an APM is used in the ISS installation, the ISS Processor Unit (ISSPU) should be capable of interfacing with a Type II APM per ARINC 607. The APM is a memory device that can be used to configure each ISS's configuration in lieu of hardwire program pins. The APM can be used to store aircraft unique parameters, such as the 24-bit ICAO address, which otherwise would require dedicated program pins.

A dedicated APM is required to interface with each ISSPU. There are nine wires that interface each ISSPU to the APM. The ISSPU pins used for the APM interface are located in the Left Middle Plug (LMP) per Attachment 5C. The pin outs of the APM are shown in ARINC 607 Attachment 3.

The ISSPU should read the APM on power-up to determine each ISS's configuration settings. The ISSPU should have the ability to write data to the APM while the airplane is on the ground. This would require the use of an input device such as an ISS control panel or maintenance terminal.

2.11 Radome (not applicable)

[Section not applicable - ARINC may delete at publication if there is no 2.11]

2.12 WRAU Mounting Adjustments (not applicable)

[Section not applicable - ARINC may delete at publication if there is no 2.11]

3.0 SYSTEM CHARACTERISTICS

3.1 Purpose

This section describes the functional characteristics of a **second generation (2G ISS)** that contains the full complement of surveillance functions for traffic and terrain, i.e., configuration A. A description of ACAS, transponder, TAWS are included in subsections. The major functions of the ISS are:

Traffic Surveillance

- Traffic Alert and Collision Avoidance System (TCAS) functionality per FAA TSO-C119c
- ATC per RTCA DO-181**F**, TSO-C112c and additionally
  - Elementary Surveillance (per appropriate AIC)
  - Enhanced Surveillance (per appropriate AIC)
- ADS-B OUT per RTCA DO-260**C** and TSO C166b
- ADS-B/TIS-B/ADS-R IN per RTCA DO-317 and TSO C195

Terrain Surveillance

- GPWS, TAWS (per FAA TSO-C151b)
- Alert prioritization (per FAA TSO-C151b)

Distance Measuring Equipment (DME)

- **(per FAA Advisory Circular 90-100A)**
- **(per FAA Advisory Circular 90-108)**

3.1.1 ISS Growth

The ISS should be designed with sufficient growth capability in computer processing, memory and I/O ports necessary to support future growth applications.

3.1.1.1 ISS Display Growth Capability

The ISS should be designed to support 3D-display capability when display systems evolve to that level.

3.1.1.2 Runway Alerting

The runway alerting would provide advisory information to the pilots' enhanced situational awareness of the flight crews with respect to the runways.

3.1.1.3 Airport Map Display Function

The ISS may have an expanded terrain data base to include airport surface features as defined in RTCA DO-272. This data base can be used to provide airport map display function.

3.1.1.4 Uplinked Weather Function (not applicable)

[Section not applicable - ARINC may delete at publication if there is no 3.1.1.5]

3.2 Traffic Surveillance Functions (Applicable to all configurations)

3.2.1 TCAS/ACAS Functions

The Traffic Alert and Collision Avoidance System function in the ISS provides the basic traffic surveillance capability as defined in ARINC 735A. The basic TCAS/ACAS functions included:

- Active interrogation of transponders of other aircraft for traffic surveillance.
- Generating alerts for potential traffic conflicts.
- Coordination of avoidance maneuvers with other TCAS equipped aircraft.

3.2.2 ADS-B IN Applications

3.2.2.1 ADS-B IN Applications

The following is a list of ADS-B IN applications that the ISS should support. Refer to the latest revision of RTCA DO-317 (ASAS MOPS) for a detailed description of each application:

- Airborne (AIRB) Situational Awareness
- Enhanced Visual Acquisition (EVAcq)
- Airport Surface Situational Awareness (ASSA)
- Final Approach and Runway Occupancy Awareness (FAROA)
- Enhanced Visual Approach (EVApp)
- In-Trail Procedure (ITP)

3.2.2.2 Growth for Future ADS-B IN Applications

The following is a list of ADS-B IN applications that the ISS should support in the future. Growth provisions (memory, processor throughput, and wiring pin outs) should be provided to the best extent possible:

- Surface Situational Awareness with Indications and Alerting (SURF-IA)
- Interval Management (Merging & Spacing/Sequence & Merging)
- Interval Management with Wake Risk Management
- Dependent (Paired) Closely Spaced Parallel Approaches
- Independent Closely Spaced Parallel Approaches (ICSPA)
- ADS-B Integrated Collision Avoidance
- Lateral and Vertical Crossing & Passing

COMMENTARY

The list of future ADS-B IN applications was obtained from Version 2.0 of the FAA's "Application Integrated Work Plan (AIWP)" document.

3.2.3 Transponder Function (Applicable to Configurations A, B, and D)

The Mode S transponder functions in the ISS provide the basic traffic surveillance transponder capability as defined in ARINC 718A. The basic transponder functions include:

- Response to ATC interrogations, both ATCRBS and Mode S.
- Response to TCAS interrogations.
- Transmission of Elementary and Enhanced data parameters.

Additionally, the ISS transponder should have capability to transmit data parameters necessary to support ADS-B traffic surveillance functions.

ICAO Annex 10 (see section 1.8 ICAO reference documents) provides information about the filling of Ground Initiated Comm-B (GICB) registers in the transponder. It outlines how the data in the GICB registers is structured and which update rates apply.

3.3 Weather Surveillance Function (Not Applicable)

There are no weather radar functions defined for inclusion in the 2G ISS.

COMMENTARY

ARINC weather radar standards are provided in ARINC Characteristic 708A and ARINC Project Paper 7xx.

Section headers are provided in this document to retain organizational alignment with the original ISS definition, ARINC Characteristic 768.

3.4 Terrain Surveillance Function (Applicable to Configurations A, C, and D)

The terrain surveillance function of the ISS provides the flight crew with sufficient situation information and awareness to detect that a potentially hazardous terrain condition exists.

3.4.1 TAWS Functions

The TAWS function in the ISS should contain terrain data base to support enhanced terrain displays and alerts. It should be possible to indicate to the flight deck crew, through aural or visual annunciation, the current version of the terrain data base. The system should contain the following functions as described in ARINC 762:

- Basic GPWS functions: Modes 1 through 5
- Altitude Call Outs
- Extreme Attitude Alerting, such as excessive bank angle
- Terrain display based on terrain data base
- Forward looking terrain alerting based on terrain data base

The system performance and functionality is defined in the latest version of FAA document TSO-C151b for Class A equipment. Vertical terrain display data may be provided as a basic function of the ISS. Aircraft performance data may be used for terrain alerting.

3.4.2 Terrain Surveillance Growth Functions

The terrain surveillance function in the ISS should contain provisions to support growth capability related to future applications based on terrain and related data bases. The following sections describe example applications. This list is not intended to be fully inclusive.

3.4.2.1 Flight Plan Terrain Conflict Detection

By exchanging data with the FMS, the TAWS function should have provisions to detect terrain conflict along the flight plan when the flight plan is being entered into the FMS.

3.4.2.2 Aeronautical Data Base Function

The ISS should have provisions to supply data from its internal data bases (e.g., terrain data base and obstacle data base) to other systems that would use this data for functional enhancements.

The ISS should also have the capability to interface with a data base server which could be localized in the ISS or in a different subsystem.

COMMENTARY

At the time of this writing, a means is needed to exchange this data in a transparent way. This includes the definition of the data format and interface.

Manufacturers of ISS are encouraged to contribute to the definition of an appropriate standard (like ARINC 424 Navigation Data Base) for transparent interchange of aeronautical data for terrain and obstacle data.

Existing work in RTCA and EUROCAE must be recognized. Such standards today are RTCA DO-272 / ED-99 for aerodrome data bases and DO-276 / ED-98 for Terrain data bases. The ISS should have provisions to provide data from the terrain data base to other systems that might require terrain information for functional enhancements.

3.4.2.3 Enhanced Terrain Situation Awareness

The ISS should include provisions for enhanced terrain situation awareness. This can be provided due to the availability of improved data bases and display resolution. This may include functions such as:

- Topographic display mode.
- Obstacle icons.
- Advisory level alerting, including safe landing for final approach and alert prediction on current flight path.

3.4.2.4 Lateral Collision Prediction

In situations when the aircraft is facing steep terrain, a vertical pull-up maneuver may not be sufficient. The ISS should have provisions to implement a lateral collision prediction algorithm that annunciates to the flight deck crew that pull-up is not sufficient and provides the safest lateral direction to avoid the terrain.

3.4.2.5 Obstacle Collision Prediction

An obstacle collision prediction function may be included.

3.5 ISS Display

The ISS should provide surveillance information to **an integrated** display system. These may be as follows:

- Traffic surveillance and alerting information
- Terrain surveillance and alerting
- Status and fault indication

3.5.1 Traffic Display

The ISS should provide traffic surveillance information to the display and other aircraft systems over ARINC 664 or over ARINC 429 interface. The purpose of the traffic advisory display is to assist the flight crew in visually locating an intruder. In both cases the information should be according to Display Traffic Information File (DTIF) as defined in ARINC 735B to support Cockpit Display of Traffic Information (CDTI) functions associated with the ADS-B. For the ARINC 664 bus, the DTIF file should be formatted according to the ARINC 661, CDS interface.

3.5.2 Weather and Terrain Display (revise)

The terrain surveillance and alerting information for the TAWS function and the weather radar data and predictive windshear alerting information as well as system mode/status should be **integrated in the display system**. Refer to Section 3.7.1.1 for aircraft display interface definitions.

The ISS should generate four display images. These images are as follows:

- Captain’s plan-view image
- Captain’s vertical profile view image (optional)
- First Officer’s plan-view image
- First Officer’s vertical profile view image (optional)

The plan view images should contain either the weather information or the terrain information as selected by the flight crews. However, the ISS should integrate the weather vertical profile views with the vertical terrain data to provide to the display system a combined image of both weather and terrain vertical profile, if selected by the flight crews.

The image update rates are display specific and should be as fast as practicable.

3.5.2.1 Automatic Display Selection

The ISS should have provision to support automatic display mode selection to change the plan view displays to display either terrain or weather information based on the alert conditions. For this function, the ISS would send the specific alert condition based on the alert prioritization to the display system.

3.5.2.2 Ranges

This section does not set forth specific requirements for indicator display ranges. The input provisions make it possible for the equipment to select different ranges in any combination of 5-mile increments. However, ranges of 5, 10, 20, 40, 80, 160, 320, and 640 nm should be used whenever possible. The display system should be so designed that it automatically erases the displayed data when the range is changed.

COMMENTARY

The number and value of ranges used by various users have, traditionally, not been standardized. The flexibility of digital technology makes it even easier (although still costly!) to accommodate individual customer’s desires. Most of the later generation EFIS equipped aircraft use 10, 20, 40, 80, 160, 320, and 640 nm as standard ranges.

3.5.2.3 Automatic Range Change

The ISS should have provision to support automatic range changes when alert conditions are present to allow automatic selection of a more suitable range to view the alert conditions. For this function, the ISS would send the optimum range to be used for the specific alert condition to the display system.

3.5.2.4 Display Color

For terrain plan view displays, green, yellow and red (for terrain) and cyan (for large water surfaces) with different “dot” patterns similar to ARINC 762 TAWS equipment should be used in order to minimize re-training of the flight crews. If provided, the vertical profile displays brown should be used for terrain to avoid any confusion between the weather targets and terrain features. Solid Cyan should be used for large water surfaces.

3.5.2.5 Icons

The ISS should use icons to the maximum extent possible to display terrain and weather surveillance (turbulence and predictive windshear) alerts on the Navigation Displays. The icon data should be transmitted in ARINC 661, CDS format.

The recommended symbol used to represent the location of windshear consists of alternating red and black filled bands. For range selections of 20 nm and above, yellow and black radial lines from the edges of the icon area should be displayed to aid flight crews with the direction of the windshear which might not be visible due to small area of the windshear at the origin. For these ranges, the windshear icon can be solid red with black boundary.

3.6 Alerts

The ISS should provide alerting functions for the following surveillance functions: TCAS/ACAS, predictive/reactive windshear, and TAWS. The alerts should be aural and/or visual.

> Note: Future aural and/or visual alerts to support ADS-B IN applications may be needed.

3.6.1 Alert Prioritization

ISS configurations that contain the TAWS function should perform all alert prioritization for the surveillance systems. These include TCAS/ACAS, weather radar and TAWS. The alert prioritization, as a minimum, should satisfy the current prioritization scheme as shown in Attachment 6 of this document.

The ISS should also interface with the aircraft’s central alerting system to enable prioritization of the surveillance alerts at the aircraft level.

3.6.2 Alert Cancel

The ISS unit should have the capability to cancel all currently active aural alerts. The cancel command can be received over the input data buses. The advisory should remain cancelled until one of the following conditions exists:

- The currently active advisory becomes inactive and then becomes active again
- The currently active advisory is replaced by a different advisory

3.6.3 Aural Alert Outputs

The ISS should provide aural outputs in analog format suitable for interfacing with 600 ohm audio systems. It should also have provisions to transmit the aural alerts in digital audio format over ARINC 664 Ethernet.

3.6.3.1 Traffic Aural Alert Outputs

For TCAS alerts, the ISS should generate synthesized aural messages as defined in ARINC 735A.

3.6.3.2 Weather Surveillance Alert Outputs (not applicable)

There are no weather radar functions defined for inclusion in the 2G ISS.

COMMENTARY

ARINC weather radar standards are provided in ARINC Characteristic 708A and ARINC Project Paper 7xx.

Section headers are provided in this document to retain organizational alignment with the original ISS definition, ARINC Characteristic 768.

3.6.3.3 TAWS Aural Alert Outputs

For TAWS alerts, the ISS should generate synthesized aural messages as defined in ARINC 762. The ISS should also have provisions to generate other aural message associated with future growth functions that might be performed by the TAWS function, such as runway alerts.

3.6.4 Visual Alert Outputs

The ISS should provide data for visual alerts in the cockpit.

3.6.4.1 Traffic Visual Alert Outputs

Traffic visual alerts are used for alerting the flight crew to currently active traffic and resolution advisories. The Resolution Advisory (RA) Display is considered to be the visual alert display for the TCAS.

COMMENTARY

RTCA DO-185A requires aural alerts to be presented by voice announcements only and prohibits the use of aural advisory signals other than voice to alert flight crews to the presence of a TA or RA. RTCA DO-185A does not specify requirements for the visual (annunciator lights) since these are considered a customer option instead of a minimum requirement.

Resolution Advisory (RA) information indicates the action the aircrew should take (or avoid taking) to minimize the risk of collision. It should provide symbolic instructions for maneuvers necessary to assure safe vertical separation between the TCAS equipped aircraft and an intruder aircraft at their point of closest approach, in accordance with RTCA DO-185A. The advisory displayed may be “corrective” or “preventive” in nature depending upon the flight regime of the aircraft at the time the advisory is displayed.

The Resolution Advisory information would be contained in the DTIF generated by the ISS and transmitted over the ARINC 664 bus or ARINC 429 data bus as described in Section 3.5.1.

3.6.4.2 Weather Visual Alert Outputs (not applicable)

There are no weather radar functions defined for inclusion in the 2G ISS.

COMMENTARY

ARINC weather radar standards are provided in ARINC Characteristic 708A and ARINC Project Paper 7xx.

Section headers are provided in this document to retain organizational alignment with the original ISS definition, ARINC Characteristic 768.

3.6.4.3 TAWS Visual Alert Outputs

The ARINC 664 bus output from the ISS should contain TAWS alert condition to enable the display system to generate visual alerts as defined in ARINC 762.

3.6.5 Failure Annunciations

Regulatory specifications for some of the functions contained in the ISS require failure annunciations for loss of specific functions. The output buses from the ISS, either ARINC 664 bus or ARINC 429 traffic information bus, should contain functional failure data to enable the display system to generate appropriate loss-of-function annunciations.

These include but not limited to:

- Means of displaying to the flight crew that own TCAS equipment has failed.
- Means of displaying to the flight crew that the TCAS equipment has been inhibited, either automatically or through flight crew action.
- Means of displaying loss of PWS function either due to failure or through flight crew action.
- Means of loss of GPWS function.
- Means of loss of TAWS functions that depend on aircraft position information and the data base, either due to failure or through flight crew action.
- Means of loss of Transponder.
- Means of loss of the ADS-B OUT function.
- Means of loss of ADS-B IN application(s).

3.7 Aircraft Interfaces

The ISS aircraft interfaces may be analog, digital or discrete format. ARINC 664 bus or ARINC 429 data buses are used for the digital data. Some of the discrete signals are also transmitted and received over the digital buses. It should be noted that not all interfaces are necessary for specific configurations of the ISS.
See Attachment 5A.

3.7.1 Digital Interfaces

Digital data should be supplied to the ISS from a standardized digital source using ARINC 429 data buses or over an ARINC 664 bus. Proprietary buses are not recommended.

3.7.1.1 Display Interface

The display system interface definition is a function of the aircraft installation. It could be ARINC 664 bus for both transmit and receive of data. As an alternative it may be ARINC 664 bus for transmit of surveillance display data output from the ISS and ARINC 429 data buses for display control information from the display system. Example formats:

- ARINC 664 with ARINC 661 cockpit display interface
- ARINC 429
- Fiber optic digital video in XGA format. Note: these standards not yet defined.

No dedicated display interface for HUD is provided. It is assumed that the HUD will share the data supplied to the display system over the ARINC 664 bus or digital video interface.

3.7.1.2 Radio Altimeter

Radio altimeter altitude data should be supplied to the ISS from a digital source such as an ARINC 707 radio altimeter directly over ARINC 429 data buses or over the ARINC 664 bus. All Radio Altimeters on the aircraft, up to three, should be connected to the ISS. The following ISS functions use radio altitude data:

ISS Function	Use
TCAS	Compute TCAS sensitivity level To inhibit “descend” TCAS advisories when the aircraft is in close proximity to the ground To inhibit TCAS aural annunciations when the aircraft is in close proximity to the ground
TAWS	Supports various TAWS alerts and altitude callouts
ADS-B IN	May be used to activate output of ADS-B surveillance of surface tracks when in proximity to the airport surface

3.7.1.3 Barometric Altimeter

The ISS should receive air data from a digital air-data source such as an ARINC 706 Air Data Computer over an ARINC 429 data bus or over the ARINC 664 bus. Two air data sources should be connected to the ISS (with an analog source selection signal indicating what source to use). For the transponder function, the ISS should use the same barometric altitude source being used by the flight control system. The following ISS functions use barometric altimeter data:

ISS Function	Use
TCAS	Baro altitude used for collision avoidance algorithms
XPDR/ADS-B OUT	Report baro altitude, altitude rate, airspeed (IAS and TAS), mach number, and pressure setting to ATC ground stations
TAWS	TAWS Modes 1 thru 4 logic
ADS-B IN	Altitude rate, static air temperature, computed airspeed, and true airspeed for ADS-B IN applications where speed awareness is needed.

3.7.1.4 ILS/GLS Information

The ISS should interface with at least two Instrument Landing System (ILS)/GNSS Landing System (GLS) sources. The source could be MMR (ARINC 755), (ARINC

756), or ILS receivers (ARINC 710). Two ARINC 429 data bus receivers in the ISS should be dedicated for this function. The information can also be received over the ARINC 664 bus. The following ISS functions use ILS/GLS data:

ISS Function	Use
TAWS	Lateral and vertical deviation data for TAWS Modes 1, 2, 5, and 6 logic

3.7.1.5 GNSS Information

The ISS should interface with at least two Global Navigation Satellite System (GNSS) sources. The source could be MMR (ARINC 755), GNSS Navigation and Landing Unit (GNLU) (ARINC 756), GNSS Navigation Unit (GNU) (ARINC 760), or GNSS Receiver (ARINC 743A). Two ARINC 429 data bus receivers in the ISS should be dedicated for this function. The information can also be received over the ARINC 664 bus. The following ISS functions use GNSS information:

ISS Function	Use
TCAS	GNSS position for hybrid surveillance
XPDR/ADS-B OUT	Report GNSS position, velocity, time, altitude/height, vertical rate, and integrity (HIL/HFOM/VFOM) data to ATC ADS-B ground stations
TAWS	Terrain display and forward-looking terrain alerts
ADS-B IN	GNSS position, velocity, and associated quality indicators for use by ADS-B IN applications

3.7.1.6 FMS Information

FMS data should be supplied to the ISS from a digital source per ARINC 702A over ARINC 429 or ARINC 664 bus. At least two sources should be connected to the ISS.

The following ISS functions use FMS state information (e.g., latitude, longitude, Actual Navigation Performance (ANP), Required Navigation Performance (RNP), Magnetic Track, etc.):

ISS Function	Use
XPDR/ADS-B OUT	Flight ID FMS position, velocity, and integrity data used as backup to GNSS
TCAS	Climb performance data This input can be used in lieu of program pins/software option setting
TAWS	Lat/Long, ANP, and RNP used as backup to GNSS. Magnetic track used for Mode 5 alert logic
ADS-B IN	Wind conditions, Minimum Speeds

The following ISS functions use FMS intent data information (e.g., flight plan, etc.):

ISS Function	Use
TAWS	Flight plan data for path-based VSD terrain display.
ADS-B IN	FMS path data

3.7.1.7 IRS Interface

Attitude information and own state vector data to support the ADS-B functions should be supplied directly from a digital IRS source over ARINC 429 or over the ARINC 664 bus. At least two sources should be connected to the ISS.

IRS data should be supplied to the ISS from a digital source over ARINC 429 or ARINC 664 bus. At least two sources should be connected to the ISS. The following ISS functions use IRS information:

ISS Function	Use
TCAS	Inertial data for display smoothing. May optionally use heading/attitude data for intruder bearing tracking.
XPDR/ADS-B OUT	Inertial position (lat/long), velocity, vertical speed, and true track
TAWS	Several inertial parameters are used in TAWS alert logic

3.7.1.8 TCAS Interface with Mode S Transponder

For Configurations A, B and D, the interface between the TCAS and transponder subsystems is internal but should be designed to maximize system robustness. In the event of TCAS failure, the ATC function should remain operational if available.

For Configuration C the interface should be compliant with ARINC 735B, (RTCA DO-185B compatible transponder) using ARINC 429 data buses.

3.7.1.9 FCU/MCP Interface

The selected altitude and selected heading of the aircraft from the FCU/MCP should be provided to the ISS over the ARINC 429 data bus directly from the Flight Control System or over the ARINC 664 bus. The selected altitude information is used for Enhanced Surveillance. The selected heading information may be used for ADS-B OUT and/or ADS-B IN applications.

3.7.1.10 CMU/ATSU Interface

The ISS should be capable of interfacing with two CMU/ATSU units for data communication, either to receive uplinked data or to transmit data over the digital communication channels. This interface can be over ARINC 429 data buses (two for receiver and one for transmit) or over the ARINC 664 bus.

3.7.1.11 OMS Interface

The ISS should be capable of interfacing with two on-board maintenance systems for data maintenance information. This interface can be over ARINC 429 data buses (two for receiver and one for transmit) or over the ARINC 664 bus.

3.7.2 Discrete Data

The discrete data can be supplied as a discrete signal dedicated to a function or combined with the digital data supplied by an appropriate source.

3.7.2.1 Landing Gear Input

The ISS should accept data designating the position of the landing gear. This input can be used by the ISS to support various surveillance functions.

3.7.2.2 Air/Ground Input

The ISS should accept data indicating if the aircraft is on the ground or airborne.

3.7.2.3 Takeoff Power Input

The ISS should accept data indicating takeoff thrust is selected. This input is used by the ISS for predictive windshear activation logic.

3.7.2.4 Time Mark Input

The ISS should accept a time mark signal from the GNSS data source to support the ADS-B OUT function (if required).

3.7.2.5 RA/TA System Status Inputs

These inputs define the operational status of the RA/TA display systems.

3.7.2.6 Traffic Selector Inputs

These inputs can be used by the ISS to designate a given traffic among the list of traffic. This may be necessary when DTIF is activated and ADS-B traffic is available. This may be used to enable the flight deck crew to focus on a given traffic and to acquire detailed information on that traffic.

Please note the following convention for highlighting, selecting, and coupling has been applied throughout this document. The ARINC 768 use of these terms is shown below. This definition may differ from alternate industry definitions such as those used in RTCA DO-289.

A768	Alternate (DO-289)	Definition
Highlight	Select	Target for which additional information is requested by the flight crew. An example is an aircraft highlighted for which ownship desires position data (latitude, longitude, altitude).
Select	Couple	Target upon which a procedure is intended to be conducted. An example is an aircraft selected for which ownship intends to merge behind, in a merging and sequencing procedure.
Couple	No equivalent term	Target upon which a procedure is intended to be conducted with and where an automated maneuver has been launched. In order for a couple operation to take place, an intended target has been first selected. An example is an aircraft coupled which ownship has engaged its control system (flight control, FMS) to ensure a spacing procedure is carried out.

3.7.3 Programmable Data

The ISS should accept (onboard and offboard) the following two files:

- Installation Configuration Option file (also known as an Option Selection Software file)
- User Selectable Options file (also known as an Airline Selection Option file)

  Notes:

  1. The information contained in these two files can also come from a separate source onboard the airplane (e.g., via an ARINC 664 interface).
  2. As an alternative to these two dataloadable files, the ISS should use an ARINC 607 Type II APM for the programmable data contained in these two files.

The following tables summarize the options both the Installation Configuration Options as well as the User Selectable Options:

Table 3-1 – ISS Installation Configuration Options

Function	Parameter	Selectable Values	Description
TCAS	ACAS/ATC/ADS-B Antenna Coaxial Cable Loss (Upper)	Not used 0 to 1 db 1 to 2 db 2 to 3 db	Loss Through Upper Antenna Cable
TCAS	ACAS/ATC/ADS-B Antenna Coaxial Cable Loss (Lower)	Not used 0 to 1 db 1 to 2 db 2 to 3 db	Loss Through Lower Antenna Cable
TCAS	ACAS/ATC/ADS-B Antenna Coaxial Cable Delay	0 to 50 nsec 51 to 150 nsec 151 to 250 nsec 251 to 300 nsec	Differential delay between upper and lower ACAS/ATC/ADS-B antenna cable runs. The ISS should provide a means to recognize and compensate for differences in the length of RF cables to the upper ACAS/ATC/ADS-B antenna and the lower ACAS/ATC/ADS-B antenna. Programmable data should provide as much as 300 nanoseconds compensation.
TCAS	ACAS/ATC/ADS-B Antenna Coaxial Cable Delay Sign Bit	1 = Add Cable Delay to Bottom Antenna 0 = Add Cable Delay to Top Antenna	Add cable delay to either the top or bottom antenna
TCAS	Altitude Limit	0 to 62,000 ft	Aircraft 'can't climb' altitude limit (0 to 62,000 ft). This data indicates the altitude above which, under worst case conditions, the aircraft cannot climb at a rate of 1500 feet per minute or greater. These conditions are unique to each aircraft and are specified by the aircraft manufacturer. The ISS should monitor aircraft altitude to determine when the aircraft is climb limited so that an appropriate resolution advisory may be issued.
TCAS	Shared Antennas	1 = Enabled (share antennas) 0 = Disable (independent antennas)	Enabled when dual ISS installation share 1 set of upper/lower antennas
TCAS	Resolution Advisory (RA) Display Status Enable	1 = Disable RA Display Status Discrete Monitor 0 = Enable RA Display Status Discrete Monitor	Enables monitoring of the two RA display status discrete inputs
TCAS	TCAS On-Ground Mode	1 = TCAS in Standby mode when on ground 0 = TCAS in TA Only mode when on ground	Sets the TCAS to either "Standby" mode or "TA Only" mode when aircraft is On-Ground
TCAS	Aural Advisory Discrete Delay	1 = Add delay to Aural Advisory discrete output 0 = No delay	Reference ARINC 735B section 3.6.3. Intended for XPDR/TCAS configuration only (Config B)
TCAS ADS-B IN	Traffic Display Intruder Limit	0 to 63	Limits the number of intruders displayed (from 0 to 63)
TCAS ADS-B IN	Display All Traffic or Threat Traffic Only	1 = Display all intruders 0 = Display only TA and RA intruders	Provides the ability to display only TA and RA intruders

3.0 SYSTEM CHARACTERISTICS

Function	Parameter	Selectable Values	Description
TCAS ATC ADS-B	ACAS/ATC/ADS-B Antenna Monitoring Enable	1 = Enable Antenna Monitoring 0 = Disable Antenna Monitoring	Enables monitoring of the ACAS/ATC/ADS-B antennas to insure they are connected to the ISS Processor Unit
ATC	Max Cruising Airspeed Capability	000 = Not available 001 = 0 to 75 knots 010 = 75 to 150 knots 011 = 150 to 300 knots 100 = 300 to 600 knots 101 = 600 to 1200 knots 110 = more than 1200 knots 111 = not used	The designed maximum airspeed capability of the aircraft in which the ISS is installed
ATC	Mode S Address	24 bit Mode-S Address	Provides the aircraft's ICAO Mode S address
ADS-B OUT	Navigation Accuracy Category – Velocity (NACv)	000 = Unknown or ≥10m/s 001 = < 10 m/s 010 = < 3 m/s 011 = < 1m/s 100 = < 0.3 m/s	Indicates the velocity accuracy of the GNSS sensor
ADS-B OUT	Aircraft Emitter Category	0000 = Not available 0001 = < 15,500 lbs 0010 = 15,500 to 75,000 0011 = 75,000 to 300,000 0100 = High Vortex Large 0101 = > 300,000 0110 = High Performance 0111 = Rotorcraft 1000 through 1111 = Reserved for Set "B"	Indicates the type of aircraft the ISS is installed on. Ref DO-260B Table 2-19
ADS-B OUT	Aircraft Length/Width	0000 = No Data or Unknown 0001 = L ≤ 15m, W ≤ 23m 0010 = L ≤ 25m, W ≤ 28.5m 0011 = L ≤ 25m, W ≤ 34m 0100 = L ≤ 35m, W ≤ 33m 0101 = L ≤ 35m, W ≤ 38m 0110 = L ≤ 45m, W ≤ 39.5m 0111 = L ≤ 45m, W ≤ 45m 1000 = L ≤ 55m, W ≤ 45m 1001 = L ≤ 55m, W ≤ 52m 1010 = L ≤ 65m, W ≤ 59.5m 1011 = L ≤ 65m, W ≤ 67m 1100 = L ≤ 75m, W ≤ 72.5m 1101 = L ≤ 75m, W ≤ 80m 1110 = L ≤ 85m, W ≤ 80m 1111 = L > 85m, W ≤ 90m	Indicates the type of aircraft the ISS is installed on. Ref DO-260B Table 2-74 Assign the smallest Length/Width code for which the actual aircraft length is less than or equal to the upper bound length and for which the actual aircraft width is less than or equal to the upper bound width. If the aircraft is longer than 85 meters, or wider than 90 meters, then the Length/Width code of 1111 shall be used.
ADS-B OUT	Position Offset Applied (POA)	1 = Position Offset applied 0 = No offset applied	Offset applied (=1) when the position offset between the GNSS antenna and the DO-260B defined aircraft center has been applied to the latitude/longitude position information input to the ADS-B transmit function

3.0 SYSTEM CHARACTERISTICS

Function	Parameter	Selectable Values	Description
ADS-B OUT	GNSS Antenna Longitudinal Offset	Distance (in meters): 00000 = No Data 00001 = Position Offset Applied by Sensor 00010 = 2 00011 = 4 00100 = 6 00101 = 8 00110 = 10 00111 = 12 01000 = 14 01001 = 16 01010 = 18 01011 = 20 01100 = 22 01101 = 24 01110 = 26 01111 = 28 10000 = 30 10001 = 32 10010 = 34 10011 = 36 10100 = 38 10101 = 40 10110 = 42 10111 = 44 11000 = 46 11001 = 48 11010 = 50 11011 = 52 11100 = 54 11101 = 56 11110 = 58 11111 = 60	The GNSS Antenna Longitudinal Offset field provides information regarding the distance (in meters) of the GNSS Antenna(s) from the nose of the aircraft. Pick the midpoint between the antennas if two GNSS antennas are installed. Ref DO-260B Table 2-67
ADS-B OUT	GNSS Antenna Lateral Offset – Antenna #1 (GNSS-#1/Left System)	Distance (in meters): 000 = No Data 001 = Left 2 meters 010 = Left 4 meters 011 = Left 6 meters 100 = 0 meters 101 = Right 2 meters 110 = Right 4 meters 111 = Right 6 meters	The GNSS Antenna Lateral Offset field provides information regarding the distance (in meters) of the GNSS Antenna(s) from the longitudinal (roll) axis of the aircraft. Ref DO-260B Table 2-66
ADS-B OUT	GNSS Antenna Lateral Offset – Antenna #2 (GNSS-#2/Right System)	Distance (in meters): 000 = No Data 001 = Left 2 meters 010 = Left 4 meters 011 = Left 6 meters 100 = 0 meters 101 = Right 2 meters 110 = Right 4 meters 111 = Right 6 meters	The GNSS Antenna Lateral Offset field provides information regarding the distance (in meters) of the GNSS Antenna(s) from the longitudinal (roll) axis of the aircraft. Ref DO-260B Table 2-66
ADS-B OUT	ADS-B Transmit (Extended Squitter) Enable	1 = Disable extended squitter 0 = Allow extended squitter	Enables the ADS-B Transmit (Extended Squitter) function
ADS-B OUT	GNSS Time Mark Source	00 = No GPS Time Mark 01 = Onside GPS Time Mark Only 10 = Onside and cross-side GPS Time Mark 11 = Not Used	Indicates whether GNSS Time Mark input(s) are being provided to the ISS Processor Unit

3.0 SYSTEM CHARACTERISTICS

Function	Parameter	Selectable Values	Description
ADS-B OUT	System Design Assurance (SDA) Level	00 > $1x10^{-3}$ or Unknown 01 ≤ $1x10^{-3}$ per flt hour 10 ≤ $1x10^{-5}$ per flt hour 11 ≤ $1x10^{-7}$ per flt hour	System Design Assurance (SDA) of the aircraft's ADS-B transmit system
ADS-B IN	TIS-B Function Enable	1 = Activate the TIS-B Function 0 = Disable the TIS-B Function	Enables the TIS-B function
ADS-B IN	CDTI Function Enable	1 = Activate the CDTI Function 0 = Disable the CDTI Function	Enables the CDTI function
ADS-B IN	ADS-B Receive Function Enable	1 = Activate the ADS-B Receive Function 0 = Disable the ADS-B Receive Function	Enables the ADS-B Receive function
ADS-B IN	In-Trail Procedure (ITP) Function Enable	1 = Enable ITP Function 0 = Disable ITP Function	Enables the ITP function
TAWS	Terrain Display Water Color	1 = Blue 0 = Black	Color of sea-level water on the terrain display
TAWS	Reactive Windshear Enable	1 = Reactive Windshear Enabled 0 = Reactive Windshear Disabled	Enables the Reactive Windshear function
TAWS	Alternate Glideslope Cancel Logic	1 = Alternate Glideslope Cancel Enabled 0 = Alternate Glideslope Cancel Disabled	Enables the ability to cancel Mode 5 "Glideslope" alerts prior to the alert being activated
TAWS	Obstacles Alert Enable	1 = Obstacles Disabled 0 = Obstacles Enabled	Enables the Obstacles Alert function
TAWS	Reactive Windshear Caution Enable	00 = Caution Disabled 01 = Caution Enable Without Voice 10 = Caution Enable, Voice & Visual 11 = Invalid	Enables the Reactive Windshear Caution logic
TAWS	Runway Awareness and Advisory System (RAAS) Enable	1 = RAAS Enabled 0 = RAAS Disabled	Enables the RAAS function
TAWS	Number of Radio Altimeter Inputs	1 = 2 LRRAs 0 = 3 LRRAs	Identifies how many Low Range Radio Altimeter (LRRA) inputs are received by the TAWS function. Some aircraft have 2 LRRAs installed and some have 3 LRRAs installed.
TAWS	Audio Menu	4 bits (to allow for up to 64 different audio menus)	Provides selection of an "Audio Menu" that allows specific TAWS voice callouts to be heard for a given aircraft installation
TAWS	Path-Based Terrain Display Enable	1 = Enable 0 = Disable	Enables the TAWS Path-Based Terrain Display function
TAWS	GNSS Altitude Reference WGS-84	1 = Use label 370 (GNSS Height above ellipsoid) 0 = Use label 076 (GNSS Altitude above MSL)	The TAWS expects GNSS Altitude (label 076) be referenced to Mean Sea Level (MSL). However, some GNSS receivers only output GNSS height above a WGS-84 ellipsoid (label 370). If the GNSS being used supplies altitude referenced to WGS-84 instead of MSL, then the 'GNSS Altitude Reference WGS-84' option should be set.

Function	Parameter	Selectable Values	Description
All	Audio Level Adjustment	The number of bits assigned is a function of the number of parameters to be addressed.	Adjusts audio output level based on different flight deck ambient noise levels and the type of aural being provided. These adjustments apply to both the 600 ohm and 8 ohm audio outputs.
All	Aircraft Type	5 bits (to allow for up to 512 aircraft types)	Selects the aircraft type that the ISS in which the ISS is installed

Table 3-2 – ISS User Selectable Options

Function	Parameter	Values	Description
TAWS	2500 foot altitude callout	00 = No Callout 01 = 2500 10 = Radio Altimeter (Male) 11 = Radio Altimeter (Female)	Selects the aural to be heard at 2500 ft
TAWS	1000 foot altitude callout	00 = No Callout 01 = 1000 10 = 1000 (Baro) 11 = Invalid	
TAWS	500 foot altitude callout	00 = No Callout 01 = 500 10 = 500 (Smart) 11 = 500 (Baro)	
TAWS	Minimums Callout	000 = No Callout 001 = “Decision Height” (at minimum setting) 010 = “Minimums” (at minimum setting) 011 = “Minimum” (at minimum setting) 100 = “Minimums, Minimums” (at minimum setting) 101 = “Decide” (Male) (at minimum setting) 110 = “Decide” (Female) (at minimum setting) 111 = Invalid	
TAWS	Approaching Minimums Callout	000 = No Callout 001 = “Approaching Decision Height” 010 = “Approaching Minimums” 011 = “Plus Hundred” 100 = “Fifty Above” (Male) 101 = “Fifty Above” (Female) 110 = Invalid 111 = Invalid	
TAWS	Peaks Enable	0 = Peaks Enabled 1 = Peaks Disabled	
TAWS	Bank Angle Enable	0 = Bank Angle Disabled 1 = bank Angle Enabled	
TAWS	Bank Angle Selection	00 = No Bank Angle 01 = HI Bank Angle 10 = Standard Bank Angle 11 = Variable Bank Angle	Selects the Bank Angle aural callout

Function	Parameter	Values	Description
TAWS	Low Altitude Callouts (Selection)	0000000000000001 = 5 ft 0000000000000010 = 10 ft 0000000000000100 = 20 ft 0000000000001000 = 30 ft 0000000000010000 = 35 ft 0000000000100000 = 40 ft 0000000001000000 = 50 ft 0000000010000000 = 60 ft 0000000100000000 = 80 ft 0000001000000000 = 100 ft 0000010000000000 = 200 ft 0000100000000000 = 300 ft 0001000000000000 = 400 ft 0010000000000000 = Reserved 0100000000000000 = Reserved 1000000000000000 = Reserved	Setting of a specific bit will enable the aural callout when that altitude is reached.

3.7.3.1 Aircraft Climb Performance Inputs

It is important that the ISS unit be informed when the aircraft is not able to perform a maneuver (such as climbing at a rate in excess of 1500 feet per minute) it might otherwise select to avoid a collision. The preferred method is for the ISS to receive this data from the ARINC 702A Flight Management System (FMS) (over an ARINC 429 data bus or over the ARINC 664 bus). If this data is not available from the FMS, then the ISS should obtain this information via the ISS Installation Configuration Options file.

3.7.3.2 Aircraft Performance Altitude Limit

This section was deleted by Supplement 2.

3.7.3.3 Cable Delay

This section was deleted by Supplement 2.

3.7.3.4 TA Display Intruder Limit

This section was deleted by Supplement 2.

3.7.3.5 Source Integrity Level (SIL)

ADS-B position sources must provide integrity on their reported position to be used for aircraft separation applications. The integrity of a position source must be established in conjunction with FAA guidance. Currently, the only position sources with an established Source Integrity Level (SIL) are GPS sensors that meet TSO-C129, TSO-C145, or TSO-C146. Future revisions of this document may address additional position sources (e.g., Hybrid GNSS/IRS, Dual DME).

The SIL values are set as follows:

IF Fine Latitude (label 111) and Fine Longitude (label 121) are available from the GNSS source,

THEN set SIL = 3 and SIL Supplement = 0 (e.g., per hour).

IF Hybrid Labels are available from the Hybrid source,

THEN set SIL = 3 and SIL Supplement = 0 (e.g., per hour).

IF FMS is providing the Navigation information and the FMS is operating in at least a DME/DME navigation mode,

THEN set SIL = 2 and SIL Supplement = 1 (e.g., per sample).

OTHERWISE, set SIL = 0 and SIL Supplement = 1

Notes:

1. In general, most existing FMS systems do not provide information regarding the current mode of navigation. It is expected that in the future FMS systems will need to provide current mode of navigation information in order to be useful sources of ADS-B data.
2. The information in this section was derived from ARINC 718A-3, except that information for hardware program pins is replaced with software option settings.

3.7.3.6 Navigation Accuracy Category - Velocity (NACv)

Velocity Accuracy is a dynamic quantity that may be computed by the position source. For this version of ARINC 768**A**, only GNSS sources may provide non-zero NACv. The aircraft manufacturer must validate that the GNSS sources installed are capable of supporting a Velocity Accuracy of 10 m/s or better. Guidance for establishing this performance can be found in RTCA DO-260B, Appendix J. Results of such validation are then provided to the transponder via the dataloadable Installation Configuration Options as stated above.

The final encoding of the NACv subfield in Register 09 Hex and 65 Hex is established as follows:

IF “Horizontal Velocity Figure of Merit” data (e.g., GNSS Label 145) is available and data is Valid,

THEN establish the NACv subfield encoding based on the “Horizontal Velocity Figure of Merit” data in accordance with the following:

000 = Unknown or ≥10m/s

001 = < 10m/s

010 = < 3 m/s

011 = < 1m/s

100 = < 0.3 m/s

OTHERWISE proceed as follows:

IF Fine Latitude and Longitude data (e.g., GNSS Label 111 and 121 or Hybrid Label 256 and 257) are available and data is Valid,

THEN set the encoding of the NACv subfield in accordance with the encoding indicated by the Installation Configuration Options table above

OTHERWISE set the NACv subfield encoding to ZERO

Note: The information in this section was derived from ARINC 718A-3, except that information for hardware program pins is replaced with software option settings.

3.8 General Maintenance

The ISS should include appropriate data loading capability consistent with the philosophy and techniques used on the airplane installation.

3.8.1 Data Loading

The ISS operational software and data bases (e.g., configuration data) will be on-board loadable in accordance with ARINC 615A. ARINC 665 loadable software standards apply for software part numbering, configuration, and media identification. The software load time for operational software and data bases should not exceed 15 minutes.

COMMENTARY

It is recognized that some minimal level of “boot” software would be non-loadable to provide the basic loading interface.

The ISS should be designed to allow separate software loading of individual functions. It should provide isolation between the software functions to allow modification to one function without affecting another. The ISS should provide compatibility testing to ensure that loadable software and data are compatible with the ISS hardware and other functional software configurations.

Mechanisms should be provided to ensure the integrity of the loaded data. The equipment should be capable of reporting its current version to the OMS/CMS.

3.8.2 On-Board Maintenance Interface

The ISS should have an On-board Maintenance System (OMS) interface capability per ARINC 624 using ARINC 429 or ARINC 664 bus.

3.9 Distance Measuring Equipment (DME)

The 2G ISS is expected to provide the DME functions further defined in ARINC Characteristic 709A: *Precision Distance Measuring Equipment (P/DME).*

4.0 ACAS/ATC/ADS-B ANTENNA

4.1 Introduction

The ISS will have two directional antennas for ACAS/ATC/ADS-B functions. This section describes the characteristics of these antennas.

4.2 RF Characteristics

The ACAS/ATC/ADS-B antenna RF characteristics should conform to ARINC 735A.

4.3 Antenna Installation

Two ACAS/ATC/ADS-B antennas should be provided on the aircraft for each ISS processor unit. These antennas should be installed on the top and bottom of the fuselage as close to the longitudinal center line as practical. The two antennas should be located as close to the same fuselage station as practical and the horizontal displacement should not exceed 25 feet. The transmission line delay exhibited by the cable length to the top antenna should be equal to the transmission line delay exhibited by the cable length to the bottom antenna within ± 50 ns.

COMMENTARY

The airlines are very concerned about drag induced by a non-flush antenna. Drag can be equated with aircraft operating equivalent weight, which in turn can be correlated with increased fuel burn and operating costs. The designer should note that the airline customers will look with favor upon antennas which protrude very little.

4.3.1 Cable Losses

For the TCAS subsystem, losses in the coaxial cable connecting the transponder to either antenna will impact the receiver sensitivity as well as the transmitter power output. For this reason, antenna cable losses for each coaxial cable, including cable connectors, should be less than 3 dB at 1030/1090 MHz.

4.3.2 Differential Cable Loss

Differences in signal level at any one input with respect to the other inputs of the directional antenna should not vary more than 0.5 dB at the computer unit. This value, which includes connectors, is expected to hold true with cable aging.

4.3.3 Differential Phase Delay

The differential phase delay among the coaxial cable and connectors which connect the ACAS/ATC/ADS-B unit to the directional antenna should be limited to one wavelength (approximately eight inches) at 1090 MHz.

4.3.4 Connectors

The connectors should be a Type C (TNC). They should be color coded at the antenna end to reduce probability of misconnection. Color coding is specified in Attachment 3B.

4.3.5 ACAS/ATC/ADS-B Systems Physical Isolation

The installation designer should also be aware of the need for physical isolation from DME antennas. This is necessary to protect receiver input circuitry from high energy RF pulses and to minimize the mutual radiation effects on each antenna. 20

dB of isolation will provide sufficient protection. This corresponds to 2.5 wave lengths or 30 inches.

4.3.6 Continuity Check

Each antenna element should present a specified dc voltage to perform a continuity check to verify that the antenna is installed and connected to the right terminal.

4.4 Environmental Considerations

The antennas will be mounted in the forward part of the fuselage, collocated top and bottom, on or very near the centerline of the airframe. Attachment 7 provides standards for lightning strike protection that may apply to the installation.

The bottom mounted antenna is vulnerable to erosive and corrosive environments. It should be designed to withstand highly corrosive spray and liquids that accumulate in the bottom interior of the airplane.

COMMENTARY

The maximum height of the installed directional antenna is expected to be approximately 1.3 inches. Because of its aerodynamic shape (see Attachment 3B), it is not considered susceptible to icing effects in the general area of the proposed installation. Other factors of the installation may merit the consideration of anti-icing provisions.

5.0 WEATHER RADAR ANTENNA UNIT (NOT APPLICABLE)

There are no weather radar functions defined for inclusion in the 2G ISS.

COMMENTARY

ARINC weather radar standards are provided in ARINC Characteristic 708A and ARINC Project Paper 7xx.

Section headers are provided in this document to retain organizational alignment with the original ISS definition, ARINC Characteristic 768.

6.0 CONTROL PANEL

6.1 Introduction

It is expected that ISS controls will be integrated with the Cockpit Display System (CDS) in new aircraft. For aircraft with dedicated controls, three different types of control panels are defined for the ISS. The control panel selection depends on the ISS configuration. The ISS control panels are defined as follows:

Type I: Controls all surveillance functions. This control panel is intended for ISS configurations that contain weather radar, TAWS and TCAS/Transponder functions.

Type II: Controls TCAS/Transponder functions. This control panel is intended for ISS configurations with TCAS and transponder functions.

Type II control panels may be used for ISS configurations that contain both radar and TCAS/Transponder functions, if it is desirable to maintain cockpit commonality with aircraft without ISS.

6.2 Form Factors and Connectors

Control panels should be packaged as a 5.75 inch wide Dzus mounted panels. Detailed outline drawings with example panel layouts are shown in Attachment 2 of this document. The standard connectors are specified in Table 6-1.

Table 6-1 - Control Panel Connectors

CONTROL PANEL CONNECTOR DEFINITIONS				
	System #1 Connector	System #1 Mating Connector	System #2 Connector	System #2 Mating Connector
Type I	MS3472W16-23P	MS3476W16-23S	MS3472W16-23PW	MS3476W16-23SW
Type II	M83723-72R16247	M83723-75R16247	M83723-72R16248	M83723-75R16248

6.3 Control Functions

The following are typical controls that might be incorporated on the standard control panels:

- System selector
- Transponder standby/on switching
- Transponder code selectors
- Transponder “Ident” pulse (SPI) On/Off
- Transponder altitude reporting On/Off
- Self-test On/Off for various functions
- TAWS control for various functions
- Radar modes
- Radar gain
- Radar elevation/tilt
- Vertical profile direction control
- Traffic control for various functions
- TCAS Mode function

- TA ONLY
- TA/RA
- Flight ID

6.4 Interface

The control panel should interface with each ISS Processor Unit using two ARINC 429 buses, one input and one output.

6.5 Brightness Control

6.5.1 Panel Light Brightness Control

The control panels should be designed to accept a 0-10 Vdc sense input or 0-5 Vac, 360-800 Hz, lamp input for controlling the backlighting of the legends on the control panel. Separate pins are assigned for these inputs. The 0-10 Vdc input is primarily intended for panels employing Light Emitting Diodes (LED) for panel lighting. 0-5 Vac is intended to power the incandescent panel lighting directly. This input can also be used as a sense input for panels employing the LED lighting.

COMMENTARY

Traditionally the control panel is connected to the aircraft dimming bus for back lighting of the legends using incandescent light bulbs. Current LED technology allows much more reliable means of backlighting with much lower power dissipation, compared to incandescent. This also allows simplification of aircraft dimming control by generating a low power dc sense voltage to be used by the panels. LED panel lighting with sense voltage input is recommended for new aircraft designs.

6.5.2 Annunciation Brightness Control

If the control panel contains annunciations, its brightness can be controlled by discrete input, either open/ground or 12-26 Vdc. The open/ground is primarily intended for panels employing Light Emitting Diodes (LED) for annunciators. The 12-26 Vdc discrete is intended to power the incandescent annunciators directly. This input can also be used as a sense input for panels employing the LED annunciators.

6.6 Control Panel Power

Type I control panel should be powered from the ISS Processor Unit. The characteristics of this power are to be determined by the manufacturer.

The Type II control panel should be powered from the aircraft 115 Vac, 360-800 Hz primary supply. Power supply transients of the amplitudes and duration defined in ARINC 413A and RTCA DO-160D should not result in the control panel output containing false setting of the control functions.

6.7 Human-Centered Design

The control panel selection should be of a type that minimizes inadvertent operation.

7.0 BUILT-IN TEST AND MAINTENANCE CONSIDERATIONS

7.1 General

The ISS should support at least one of the following Built-In Test Equipment (BITE) capabilities as defined by AEEC standards:

- ARINC Report 624
- ARINC Report 604

The ISS Processor Unit should interface to the Central Maintenance System (CMS). It should report the status of all ISS units to the maintenance display device (Multi-Purpose Control and Display Unit (MCDU) or Multi-Function Display (MFD)) for the purpose of providing a fault log formatted in accordance with either ARINC 624 or ARINC 604. The fault logging method should be compatible with the Crew Management System (CMS) on the aircraft in which the ISS will be installed. A means should be provided for the aircrew and/or maintenance crew to print the maintenance log on the cockpit printer.

There should be no cockpit annunciation of failure unless it causes loss of function. Sufficient margin should be used to preclude nuisance failure messages. Discrepancies in ISS operation caused by power bus transients, EMI, ground-handling, servicing interference, abnormal accelerations or turbulence should be recorded as events, not as faults.

7.1.1 Fault Classification

System faults should be classified based on their effect on the system as debilitating or non-debilitating. Fault displays should also indicate the most probable correction of the problem.

A system debilitating failure is any non-recoverable failure which prohibits the ISS from performing any basic required function. Cockpit failure annunciation is provided for a system debilitating failure. A system debilitating failure will be logged in BITE memory. If recoverable, crew action may be necessary.

A non-system-debilitating failure is any BITE-detected failure which is auto-recoverable within specified/acceptable operational limitations (of short duration and requiring no crew action for recovery) and which has no adverse impact on the required functions of the ISS. A non-system-debilitating failure will be logged in BITE memory but need not be cockpit annunciated.

7.1.2 BITE Capability

BITE in the ISS should be capable of detecting at least 95% of the faults or failures which can occur within the ISS units, and as many faults as possible associated with other interfaces.

BITE should be initiated from the flight deck. All ISS functions should be tested with BITE.

BITE should be functioning to the extent practical when the ISS is in “standby” mode. Failures should be stored in non-volatile memory and reported to the on-board maintenance system.

BITE should operate continuously during flight. Monitoring of the results should be automatic, and the BITE should automatically test, detect, isolate and record intermittent and steady state failures. The BITE should display system condition and indicate any faulty Line Replaceable Unit (LRU) upon activation of the self-test routine. In addition, BITE should display faults which have been detected during in-flight monitoring.

BITE should closely relate to bench testing. Error modes encountered on the aircraft should be reproducible in the shop. Error messages recorded by BITE should assist bench testing.

No failure occurring in the BITE subsystem should interfere with the normal operation of the ISS.

7.1.3 Return to Service Testing

When an ISS is installed on the aircraft, some form of end-to-end system testing should be available for two primary reasons:

- To provide an operational verification of the system functions prior to return to service.
- To reduce unnecessary removals of the ISS when the fault was actually in another part of the system.

As an end-to-end test, the procedure should verify integrity of all LRUs as well as their interfaces with other systems.

COMMENTARY

Airlines prefer test results to indicate the probable cause of a failure. Emphasis on end-to-end system testing leads to a desirable increase in Mean Time Between Unscheduled Removal (MTBUR), especially for removals that are not related to an LRU fault.

7.2 TCAS/ACAS Functional Test

The ISS should provide an internal “functional test” feature for TCAS/ACAS as described in RTCA DO-185B. Such a feature could involve the injection into the receiver front-end of low level interrogation and simulated responses, generated internally when the test is initiated.

The ISS should monitor the RA display status.

The ISS should begin to transmit the “test data” to the indicators when the functional test sequence is initiated. This transmission should be maintained for a period of 8 ± 0.5 seconds.

The ISS should cause one cycle of the appropriate test results aural to be activated at the end of the TCAS/ACAS functional test sequence. The ISS should provide only aural annunciation if it has completed its functional tests and has not detected a failure. Example annunciation is “TCAS SYSTEM TEST OK”. The ISS should provide only aural annunciation if any of the test criteria are not satisfied. Example annunciation is “TCAS SYSTEM TEST FAIL”. If the ISS terminates the system functional test for any reason before completion of all of its tests, it should inhibit the aural annunciation.

COMMENTARY

The intended purpose of the short functional test sequence is to provide an in-flight or on-ground method of quickly verifying the functionality of the TCAS/ACAS system. The above defined sequence verifies that the RA systems status discrete from the RA displays are functional, causes representative TCAS/ACAS data to be displayed and causes an aural message to be annunciated at the end of the test sequence to verify the functionality of the TCAS/ACAS aural warning system.

The airlines note previous unsatisfactory experience with antenna performance monitoring and fault annunciation. However, they believe that attention to this subject should be renewed because of the likely increase in maintenance problems that will follow the introduction of antenna diversity. Previous attempts at antenna monitoring have revealed difficulties. However, equipment manufacturers are urged to pay particular attention to this area.

7.3 Transponder/ADS-B OUT Functional Test

The self-contained fault detection should incorporate non-volatile memory and logic to identify true hardware faults based on the historical trends.

Performance monitoring of the ISS should cause a failure to be annunciated when the unit is assigned all zeros or all ones in the address code.

COMMENTARY

It is possible that some in-flight faults may reset during power interruption or during ground and not easily detected on the ground. This condition may allow the suspect unit to remain on board the aircraft. A threshold exceedance monitor is an effective method to detect and set a flag when one of these transient faults exceeds an acceptable rate of occurrence. Some airlines may choose to deactivate such a monitor.

7.4 Radar Functional Test (not applicable)

There are no weather radar functions defined for inclusion in the 2G ISS.

COMMENTARY

ARINC weather radar standards are provided in ARINC Characteristic 708A and ARINC Project Paper 7xx.

Section headers are provided in this document to retain organizational alignment with the original ISS definition, ARINC Characteristic 768.

7.5 TAWS Functional Test

The ISS should monitor the TAWS processing circuitry in the ISS Processor Unit. The TAWS functional test should report failures in the input data and faults within the TAWS function. A test pattern may be generated during the functional test mode to test TAWS display interfaces. The self-test function should be capable of displaying the terrain data base version.

7.6 Provisions for Automatic Test Equipment

To enable Automatic Test Equipment (ATE) to be used in bench testing and maintenance, internal circuit functions not available at the unit service connector and considered by the equipment manufacturer necessary for ATE may be brought to pins on an auxiliary connector of a type selected by the equipment manufacturer. This connector should be fitted with an adequate number of contacts needed to support ATE functions. The connector should include a protective cover suitable to protect these contacts from damage, contamination, etc., while the unit is installed in the aircraft. The manufacturer should observe ARINC 600 for unit projections, etc., when choosing the location for this auxiliary connector.

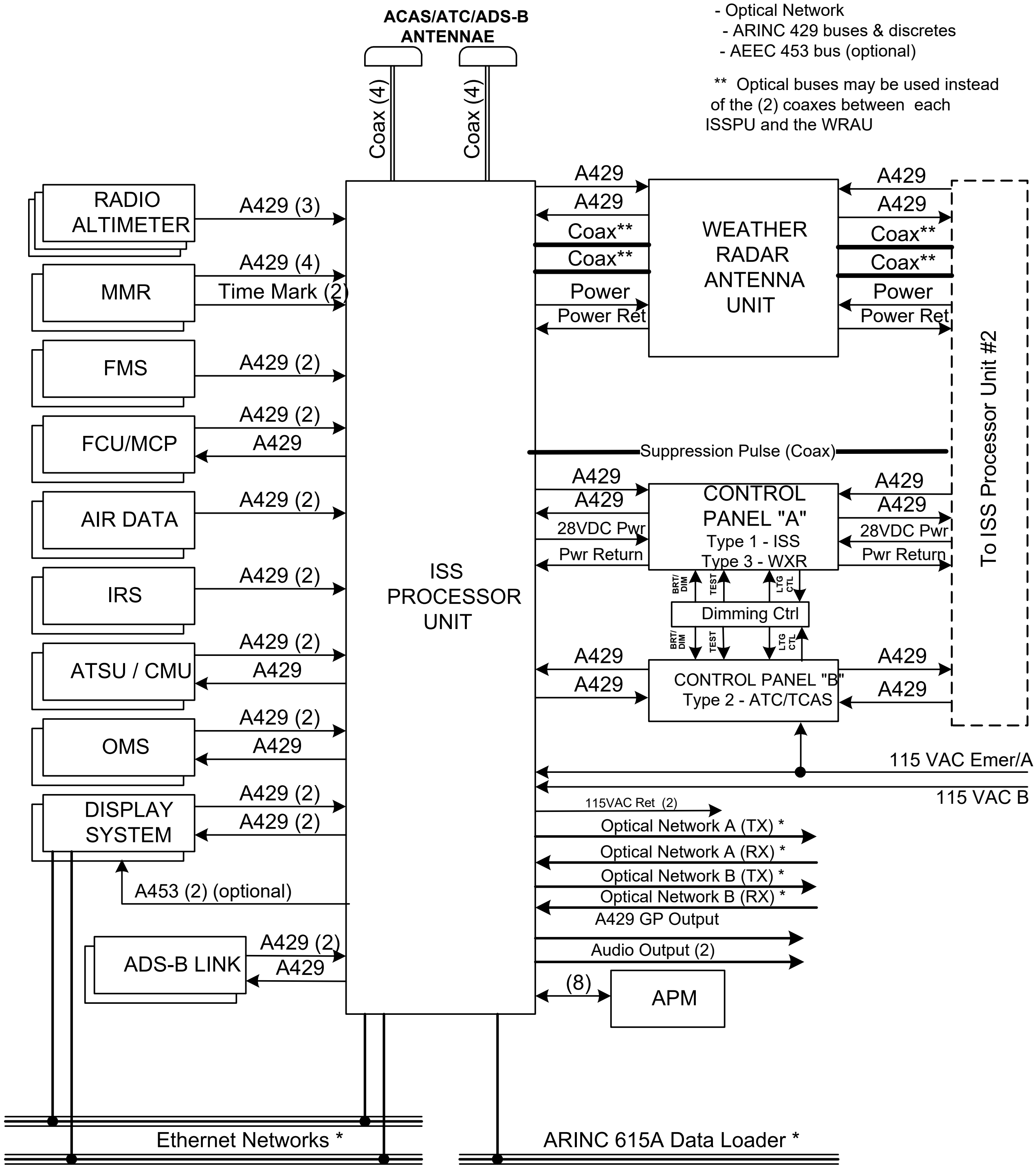
ATTACHMENT 1
ISS CONFIGURATIONS

ATTACHMENT 1 ISS CONFIGURATIONS

Configuration "A": ACAS, XPDR, WXR/PWS, and TAWS

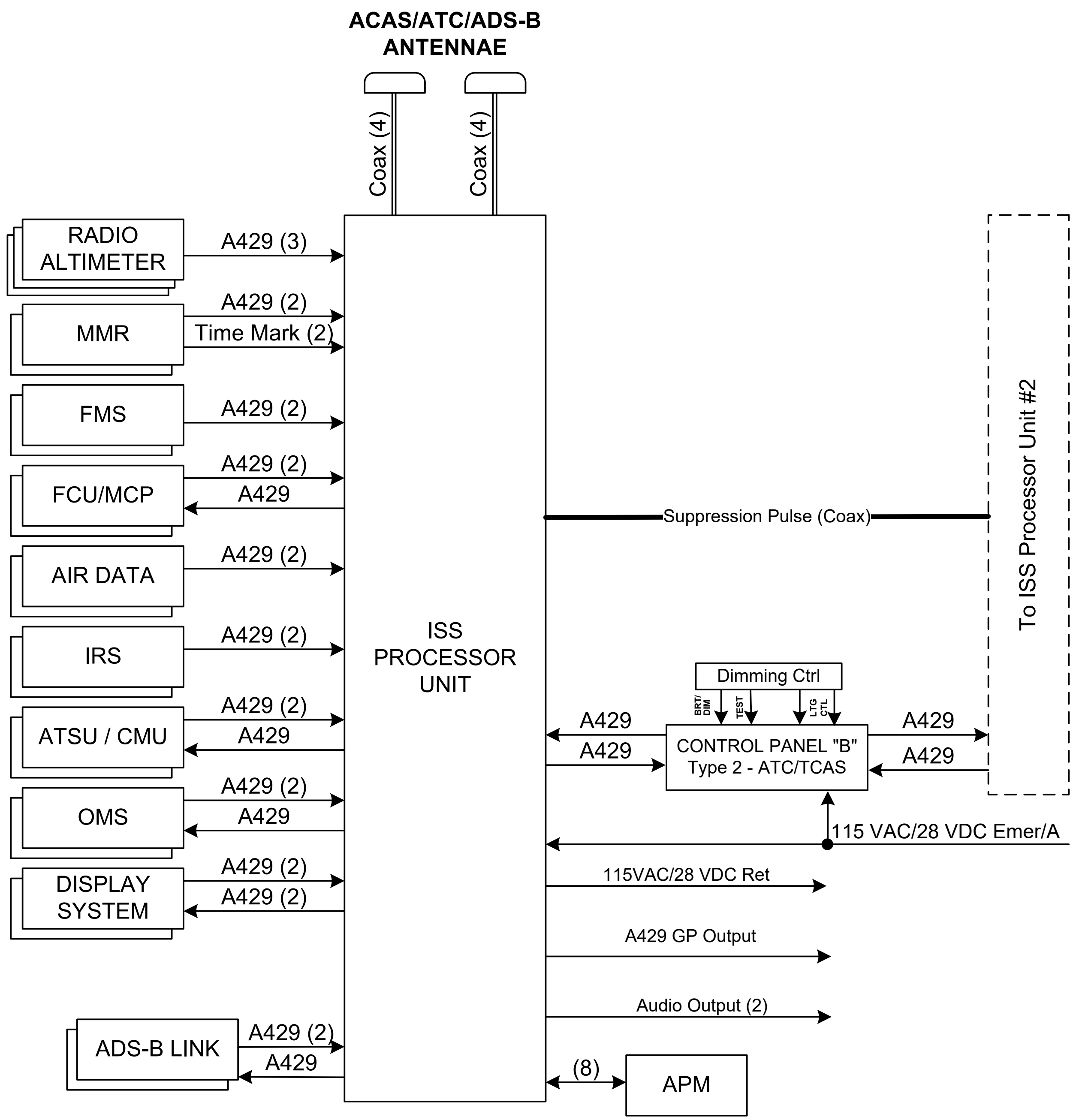
* ISSPU interface with other aircraft systems can be done through one, or a combination of, the following:
- Quadrax Ethernet
- Optical Network
- ARINC 429 buses & discretes
- AEEC 453 bus (optional)

** Optical buses may be used instead of the (2) coaxes between each ISSPU and the WRAU



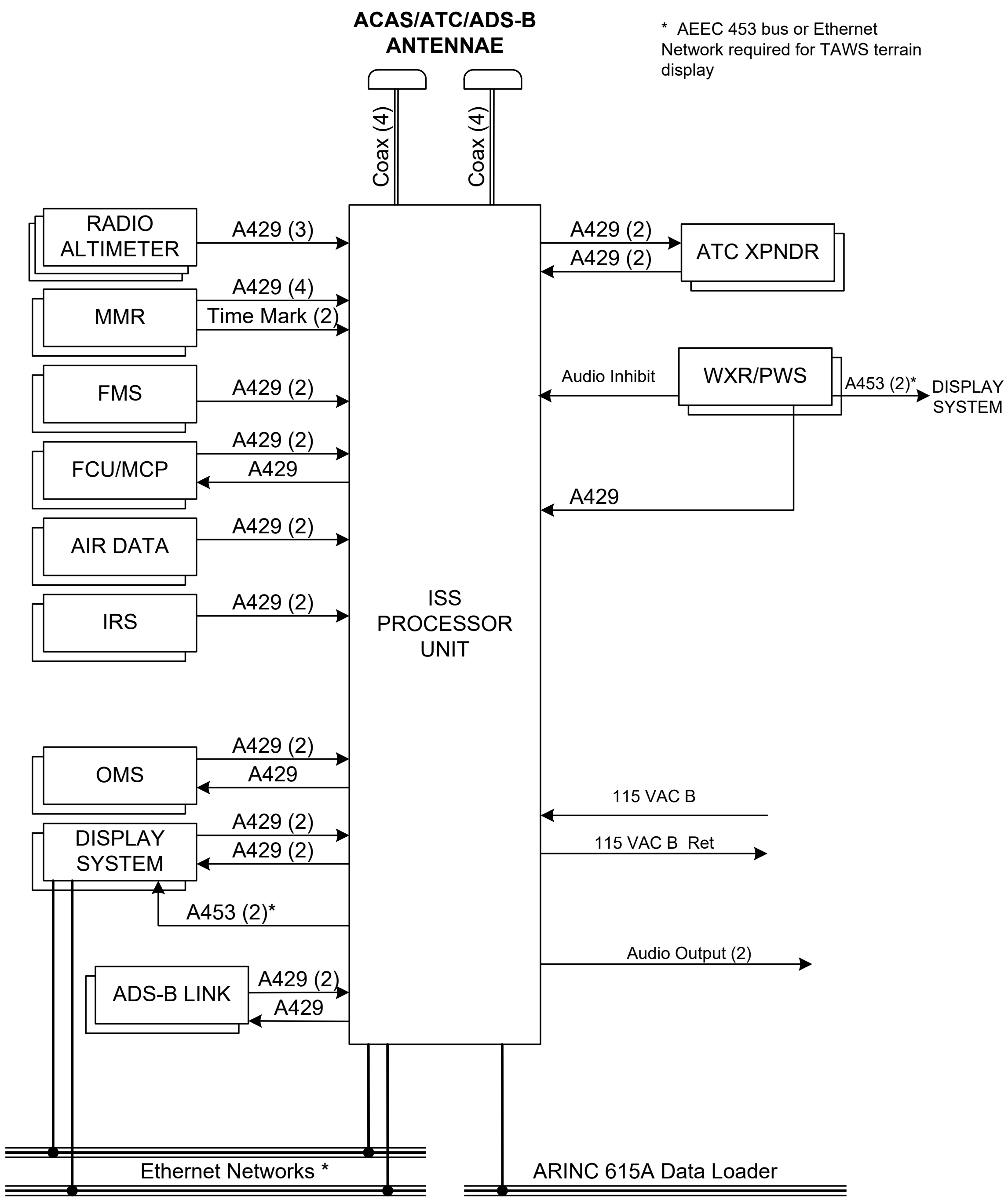
ATTACHMENT 1
ISS CONFIGURATIONS

Configuration "B": ACAS and XPDR



ATTACHMENT 1
ISS CONFIGURATIONS

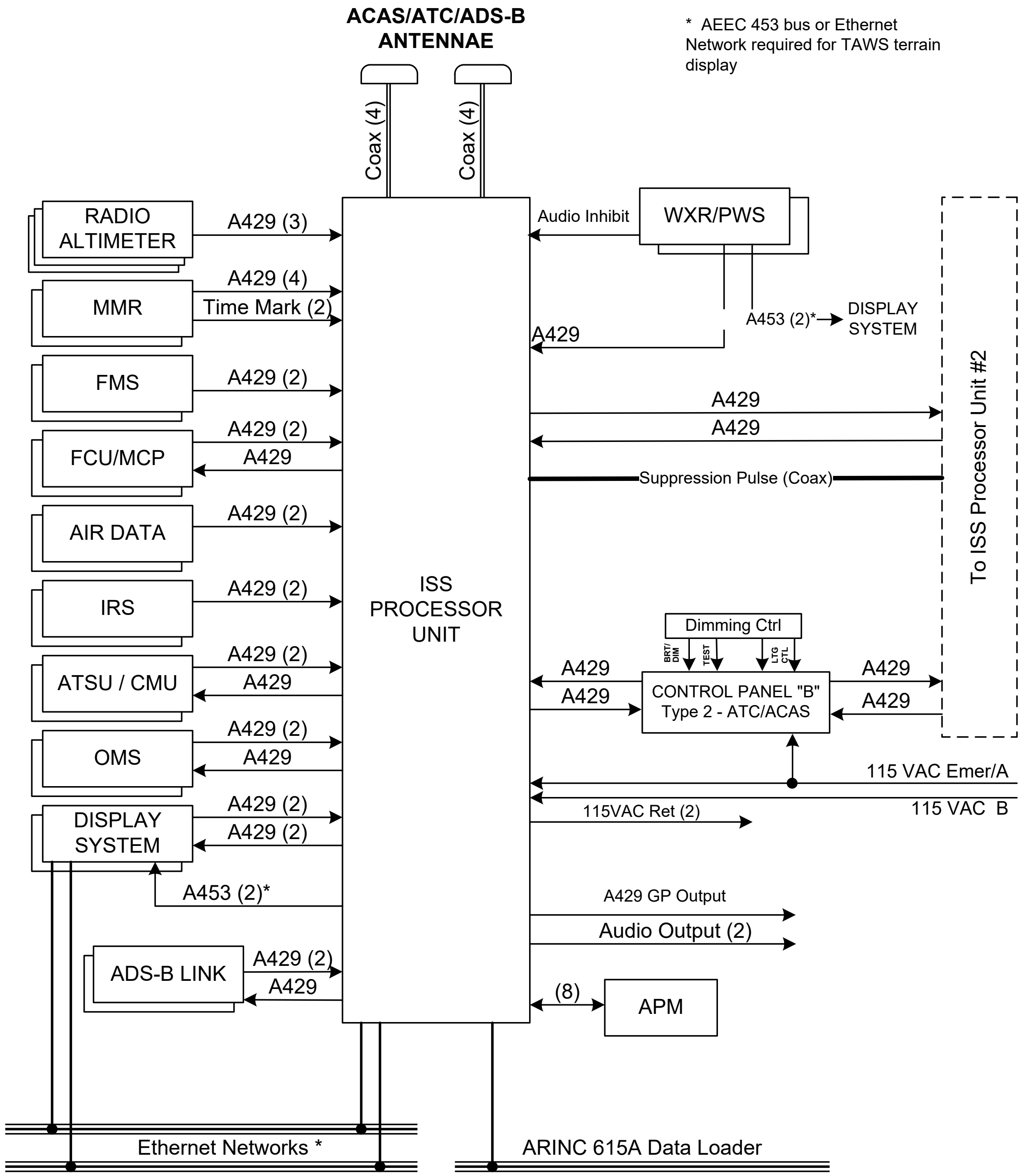
Configuration "C": ACAS and TAWS



Note: In legacy systems, the display selection between TAWS and WXR is outside the ISS. A more federated approach can be achieved when the WXR sends all information, including display data to the ISS. This enables the ISS to perform the display selection function.

ATTACHMENT 1
ISS CONFIGURATIONS

Configuration "D": ACAS, XPDR, and TAWS

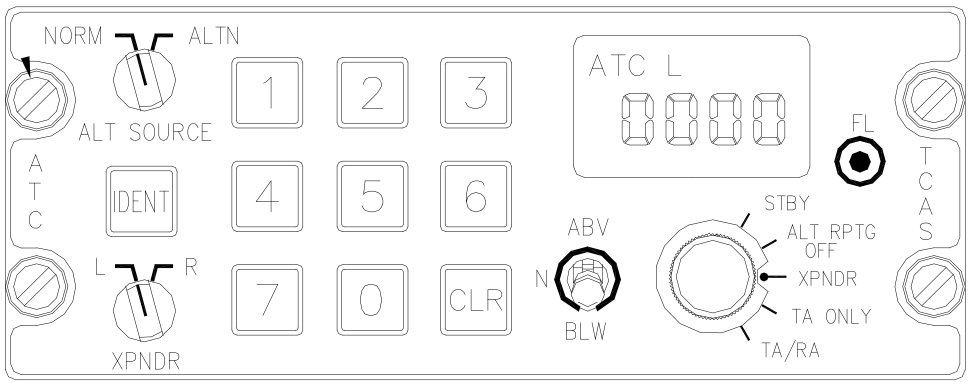


Note: In legacy systems, the display selection between TAWS and WXR is outside the ISS. A more federated approach can be achieved when the WXR sends all information, including display data to the ISS. This enables the ISS to perform the display selection function.

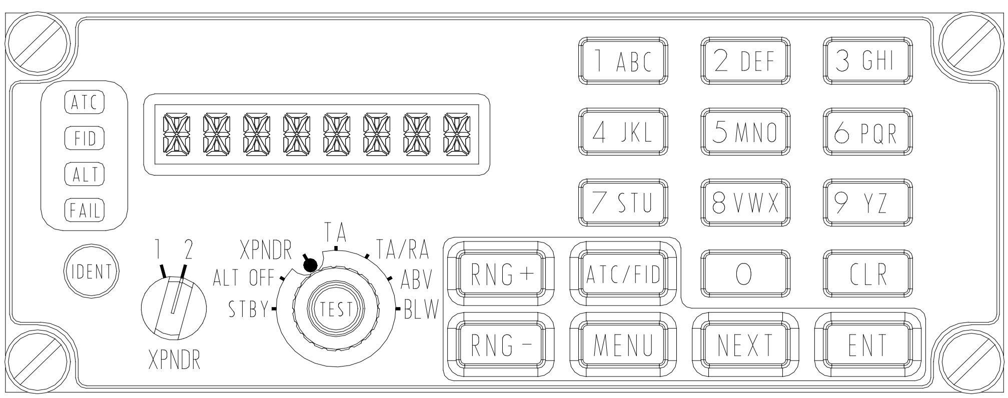
ATTACHMENT 2A EXAMPLE CONTROL PANEL LAYOUT – TYPE I

ATTACHMENT 2B EXAMPLE CONTROL PANEL LAYOUT – TYPE II

TYPE II Control Panel without Flight ID function



TYPE II Control Panel with Flight ID function

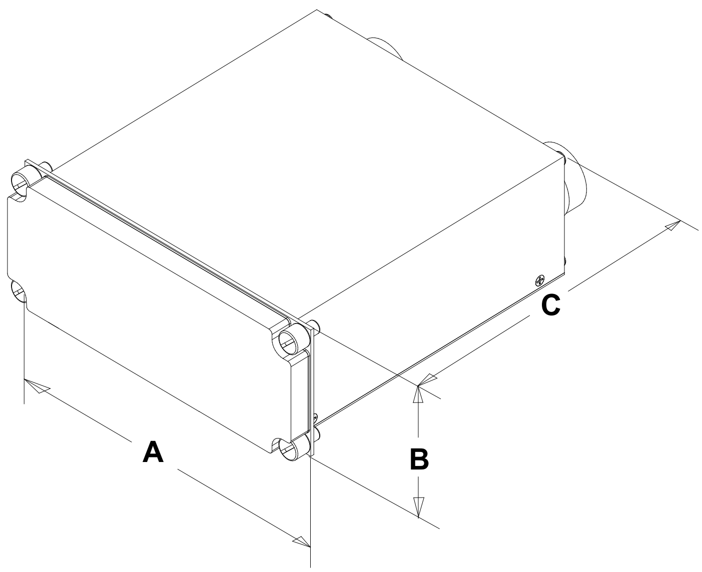


ATTACHMENT 2C EXAMPLE CONTROL PANEL LAYOUT – TYPE III (NOT APPLICABLE)

TYPE III Control Panel (Weather Radar)

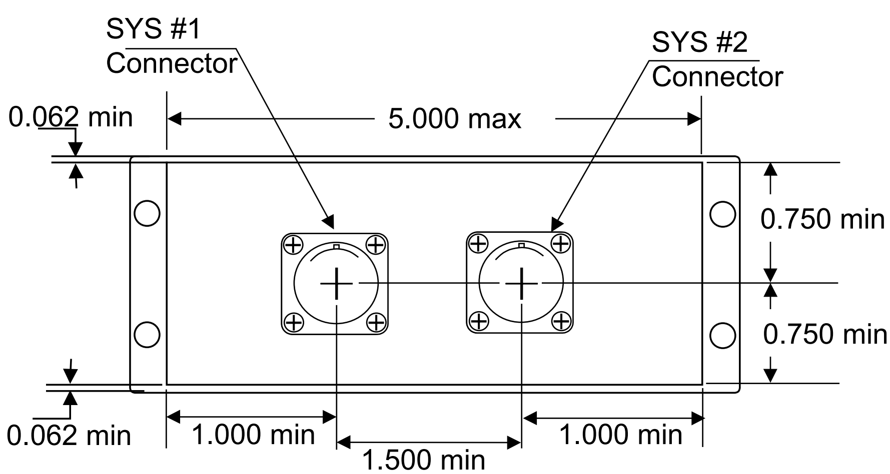
(Content of this attachment not required for 2G ISS - This attachment is here to retain organizational alignment with the original ISS definition - ARINC Characteristic 768)

ATTACHMENT 2D CONTROL PANEL DIMENSIONS

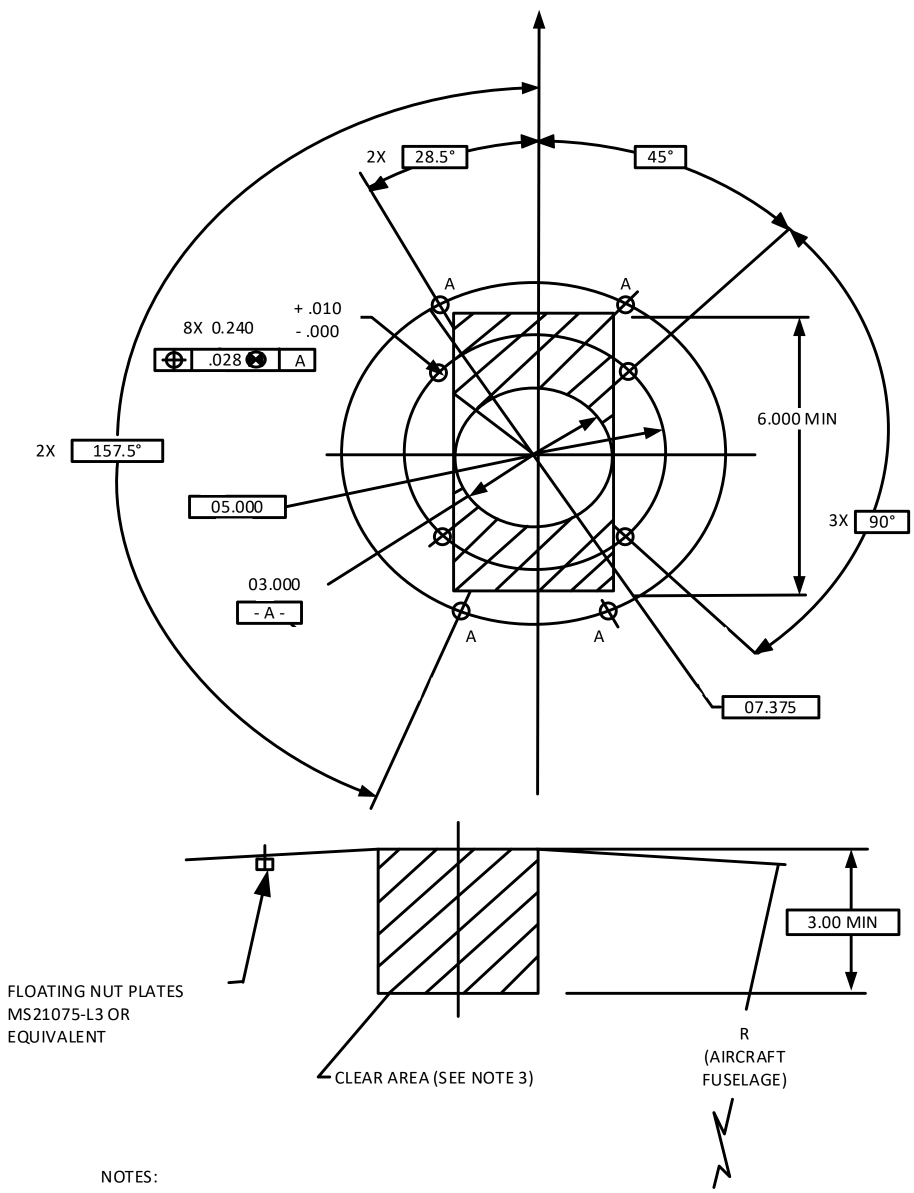


Note: The "B" dimension can be smaller. However, control panel dimensions must comply with MS 25212 Dzus mounting provisions and allow space for the installation of a blank spacer to fill the unused space.

Maximum Dimensions in Inches (mm)			
	A	B	C (excluding connectors)
Type I	5.75 (146)	4.125 (105)	5.00 (127)
Type II	5.75 (146)	3.50 (89)	5.00 (127)
Type III	5.75 (146)	2.625 (67)	6.00 (152)



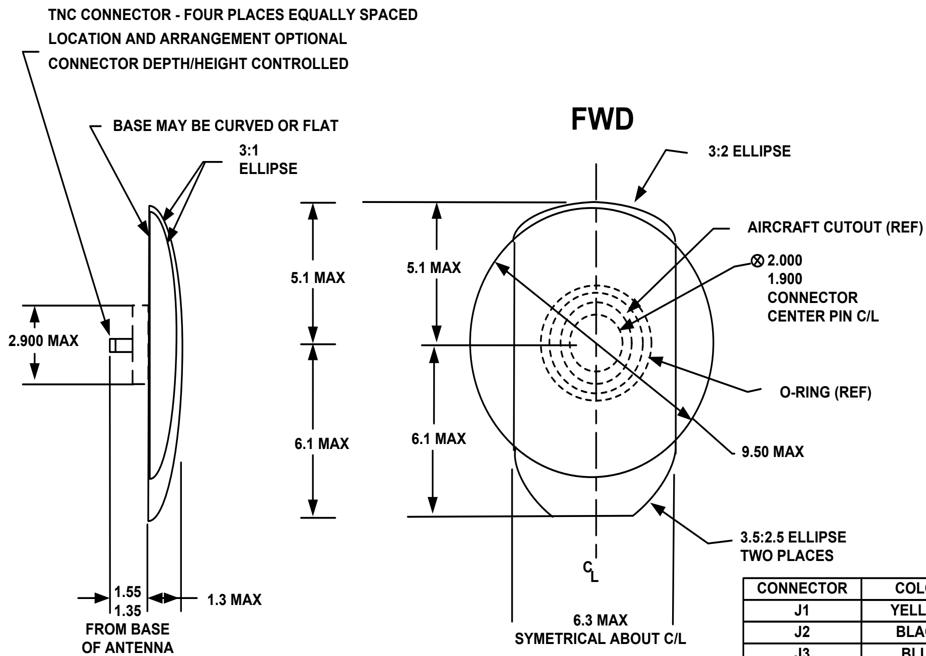
ATTACHMENT 3A ACAS/ATC/ADS-B ANTENNA MOUNTING LAYOUT



NOTES:

1. ALL DIMENSIONS SHOWN IN PLAN VIEW.
2. ALL ANTENNA INSTALLATIONS MUST USE FOUR HOLES LABELED "A".
   ADDITIONAL UNMARKED HOLES MAY BE USED AS SPECIFIED BY THE INSTALLATION.
   IF THE ANTENNA INSTALLATION REQUIREMENTS ARE NOT KNOWN, ALL FOUR UNMARKED HOLES ARE EXPECTED TO BE DRILLED TO SUPPORT ALL ANTENNA DESIGNS.
3. THIS AREA MUST BE FREE OF AIRCRAFT ELEMENTS (e.g., DUCTING, STRUCTURE, ETC.) TO ALLOW FOR ANTENNA CABLE ROUTING.

ATTACHMENT 3B ACAS/ATC/ADS-B ANTENNA OUTLINE ENVELOPE

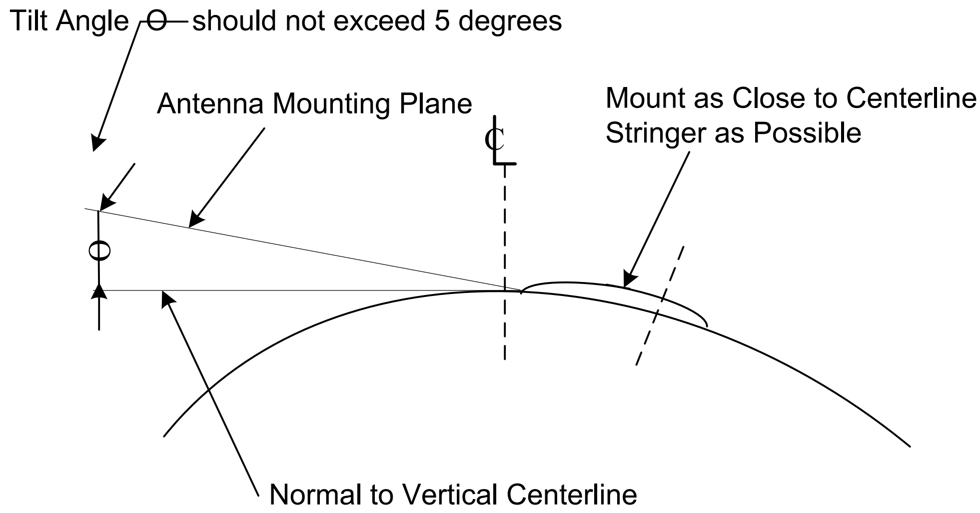


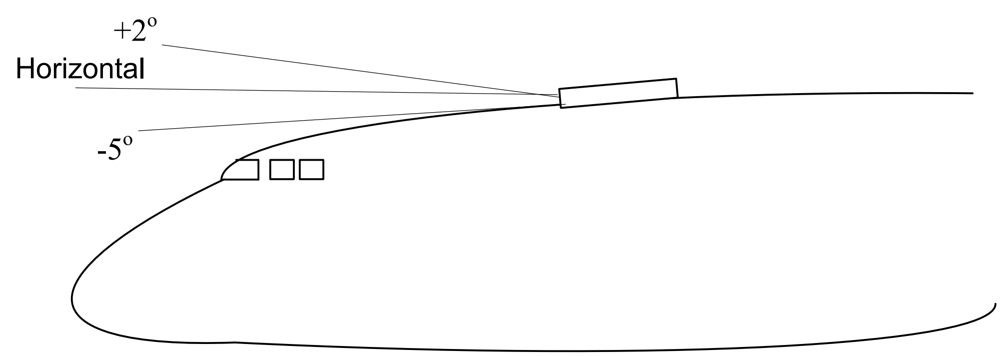
CONNECTOR	COLOR
J1	YELLOW
J2	BLACK
J3	BLUE
J4	RED

NOTE: ALL DIMENSIONS IN INCHES

ACAS/ATC/ADS-B Antenna Outline Envelope

ATTACHMENT 3C ACAS/ATC/ADS-B ANTENNA – AIRCRAFT INSTALLATIONS





Aircraft Fuslage Sections

Note: Mount antenna such that when installed, the fore/aft alignment deviates no more than +2 to -5 degrees with respect to horizontal plane during normal cruise.

ATTACHMENT 4 WEATHER RADAR ANTENNA MOUNTING SPECIFICATIONS (NOT APPLICABLE)

(Content of this attachment not required for 2G ISS - This attachment is here to retain for organizational alignment with the original ISS definition - ARINC Characteristic 768)

ATTACHMENT 5A INTERWIRING OVERVIEW

This attachment identifies ISS connector pins and their use with applicable configurations

Note: “Spare” means not allocated at current time. Pin may be defined in the future.
“Reserved” means manufacturers may use them for private or airframe-specific functions.
“Provision” is like a spare, but more fully defined. I/O type and/or function may be partly defined.

ISS - Function	Pin	Comments	Note	Applicable Configurations
ISS/WXR CP Output (A)	LMP-1A	A429 TX		A
ISS/WXR CP Output (B)	LMP-1B	A429 TX		A
ISS/WXR CP Input (B)	LMP-1C	A429 RX		A
ISS/WXR CP Input (A)	LMP-1D	A429 RX		A
Display #1 Out (A)/ Digital Audio Output #1 (A)	LMP-1E	A429 TX	TCAS TA/RA Display #1 (DTIF) or Digital Audio Output #1 (A) (A380)	A, B, C
Display #1 Out (B)/ Digital Audio Output #1 (B)	LMP-1F	A429 TX	TCAS TA/RA Display #1 (DTIF) or Digital Audio Output (B) (A380)	A, B, C
Display #1 Input (B)	LMP-1G	A429 RX	CDTI or EFIS CP	A, B, C
Display #1 Input (A)	LMP-1H	A429 RX	CDTI or EFIS CP	A, B, C
Audio Output #1 (hi)	LMP-1J	0-10V		A, B, C
Audio Output #1 (lo)	LMP-1K	0-10V		A, B, C
Audio Inhibit Output	LMP-2A	DOUT		A, B, C
W/S Fail Lamp Output	LMP-2B	DOUT		A, C
W/S Caution Output	LMP-2C	DOUT		A, C
W/S Warn Output	LMP-2D	DOUT		A, C
DOUT provision	LMP-2E	DOUT		
DOUT provision	LMP-2F	DOUT		
DOUT provision	LMP-2G	DOUT		
DIN provision	LMP-2H	DIN		
DIN provision	LMP-2J	DIN		
DIN provision	LMP-2K	DIN		
DOUT provision	LMP-3A	DOUT		
DOUT provision	LMP-3B	DOUT		
DOUT provision	LMP-3C	DOUT		
DOUT provision	LMP-3D	DOUT		
DIN provision	LMP-3E	DIN		
DIN provision	LMP-3F	DIN		
Air/Gnd Discrete Input	LMP-3G	DIN		A, B, C
DIN provision	LMP-3H	DIN		
DIN provision	LMP-3J	DIN		
DIN provision	LMP-3K	DIN		
DOUT provision	LMP-4A	DOUT		
DOUT provision	LMP-4B	DOUT		
DOUT provision	LMP-4C	DOUT		
Qual-A #1 Input	LMP-4D	DIN		A
Qual-A #2 Input	LMP-4E	DIN		A
Gear Down Input	LMP-4F	DIN		A, B, C
W/S Inhibit Input	LMP-4G	DIN		A, C

ATTACHMENT 5A
INTERWIRING OVERVIEW

ISS - Function	Pin	Comments	Note	Applicable Configurations
DIN provision	LMP-4H	DIN		
DIN provision	LMP-4J	DIN		
Spare	LMP-4K	DIN		
WRAU Output (A)	LMP-5A	A429 TX		A
WRAU Output (B)	LMP-5B	A429 TX		A
WRAU Input (B)	LMP-5C	A429 RX		A
WRAU Input (A)	LMP-5D	A429 RX		A
FCU Output (A)	LMP-5E	A429 TX	potential provision or spare	A, B, D
FCU Output (B)	LMP-5F	A429 TX	potential provision or spare	A, B, D
MMR #1 ILS Input (B)	LMP-5G	A429 RX		A, C
MMR #1 ILS Input (A)	LMP-5H	A429 RX		A, C
Air Data #1 Input (A)	LMP-5J	A429 RX		A, B, C
Air Data #1 Input (B)	LMP-5K	A429 RX		A, B, C
DIN reserved	LMP-6A	DIN		
DIN reserved	LMP-6B	DIN		
DIN reserved	LMP-6C	DIN		
DIN reserved	LMP-6D	DIN		
IRS #1 Input (A)	LMP-6E	A429 RX		A, B, C
IRS #1 Input (B)	LMP-6F	A429 RX		A, B, C
MMR #1 GPS Input (B)	LMP-6G	A429 RX		A, B, C
MMR #1 GPS Input (A)	LMP-6H	A429 RX		A, B, C
453 Bus #1 Output (A)	LMP-6J	A453 TX		A, C
453 Bus #1 Output (B)	LMP-6K	A453 TX		A, C
ATC/ACAS CP Output (A)/ RMP #1 Output (+)	LMP-7A	A429 TX	Radio Management Panel Output #1 (+) (A380)	A, B, C
ATC/ACAS CP Output (B)/ RMP #1 Output (-)	LMP-7B	A429 TX	Radio Management Panel Output #1 (-) (A380)	A, B, C
ATC/ACAS CP Input (B)/ RMP #1 Input (-)	LMP-7C	A429 RX	Radio Management Panel Input #1 (-) (A380)	A, B, C
ATC/ACAS CP Input (A)/ RMP #1 Input (+)	LMP-7D	A429 RX	Radio Management Panel Input #1 (+) (A380)	A, B, C
ADS-B #1 Input (A)	LMP-7E	A429 RX		A, B, C
ADS-B #1 Input (B)	LMP-7F	A429 RX		A, B, C
ADS-B #2 Input (B)	LMP-7G	A429 RX		A, B, C
ADS-B #2 Input (A)	LMP-7H	A429 RX		A, B, C
OMS #1 Input (A)	LMP-7J	A429 RX		A, B, C
OMS #1 Input (B)	LMP-7K	A429 RX		A, B, C
Spare	LMP-8A	DOUT		
Spare	LMP-8B	DOUT		
Spare	LMP-8C	DOUT		
Spare	LMP-8D	DOUT		
FCU/MCP #1 Input (A)	LMP-8E	A429 RX		A, B, D
FCU/MCP #1 Input (B)	LMP-8F	A429 RX		A, B, D
FMS #1 Input (B)	LMP-8G	A429 RX		A, B, C
FMS #1 Input (A)	LMP-8H	A429 RX		A, B, C
CMU #1 Input (A)	LMP-8J	A429 RX	provision for ACARS data link	A, B, D
CMU #1 Input (B)	LMP-8K	A429 RX	provision for ACARS data link	A, B, D
Rad Alt #1 Input (A)	LMP-9A	A429 RX		A, B, C
Rad Alt #1 Input (B)	LMP-9B	A429 RX		A, B, C
GP A429 Output #1 (B)	LMP-9C	A429 TX		A, B, C
GP A429 Output #1 (A)	LMP-9D	A429 TX		A, B, C
ADS-B Output #1 (A)	LMP-9E	A429 TX		A, B, C
ADS-B Output #1 (B)	LMP-9F	A429 TX		A, B, C

ATTACHMENT 5A
INTERWIRING OVERVIEW

ISS - Function	Pin	Comments	Note	Applicable Configurations
Reserved	LMP-9G			A, B, C
Spare	LMP-9H			
MMR #1 TimeMark (+)	LMP-9J	RS-485 RX		A, B, D
MMR #1 TimeMark (-)	LMP-9K	RS-485 RX		A, B, D
Reserved	LMP-10A			A, B, C
Reserved	LMP-10B			A, B, C
Reserved	LMP-10C			A, B, C
Reserved	LMP-10D			A, B, C
Reserved	LMP-10E			A, B, C
Reserved	LMP-10F			A, B, C
Reserved	LMP-10G			A, B, C
Reserved	LMP-10H			A, B, C
Program Pin	LMP-10J	PP		A, B, C
Program Pin	LMP-10K	PP		A, B, C
Reserved	LMP-11A			A, B, C
Program Pin	LMP-11B	PP		A, B, C
Program Pin	LMP-11C	PP		A, B, C
Program Pin	LMP-11D	PP		A, B, C
Program Pin	LMP-11E	PP		A, B, C
Program Pin	LMP-11F	PP		A, B, C
Program Pin	LMP-11G	PP		A, B, C
Program Pin	LMP-11H	PP		A, B, C
Program Pin	LMP-11J	PP		A, B, C
Program Pin	LMP-11K	PP		A, B, C
Suppression Pulse (Coax)	LMP-1T			A, B, C
Reserved Clear Air Turbulence Detection (Coax)	LMP-2T			
Reserved	LMP-12E			
Reserved	LMP-12F			
Display #1 NW TX(+)	LMP-13E	Ethernet		A, B, C
Display #1 NW RX(+)	LMP-13F	Ethernet		A, B, C
Display #1 NW RX(-)	LMP-14E	Ethernet		A, B, C
Display #1 NW TX(-)	LMP-14F	Ethernet		A, B, C
Reserved	LMP-15E			
Reserved	LMP-15F			
OMS Output (A)	RMP-1A	A429 TX		A, B, C
OMS Output (B)	RMP-1B	A429 TX		A, B, C
WXR CP #2 Input (B)	RMP-1C	A429 RX		A
WXR CP #2 Input (A)	RMP-1D	A429 RX		A
Display #2 Out (A)/ Digital Audio Output #2 (A)	RMP-1E	A429 TX	TCAS TA/RA Display #2 (DTIF) or Digital Audio Output #2 (A) (A380)	A, B, C
Display #2 Out (B)/ Digital Audio Output #2 (B)	RMP-1F	A429 TX	TCAS TA/RA Display #2 (DTIF) or Digital Audio Output #2 (B) (A380)	A, B, C
Display #2 Input (B)	RMP-1G	A429 RX	CDTI or EFIS CP	A, B, C
Display #2 Input (A)	RMP-1H	A429 RX	CDTI or EFIS CP	A, B, C
Audio Output #2 (hi)	RMP-1J	Audio Out		A, B, C
Audio Output #2 (lo)	RMP-1K	Audio Out		A, B, C
Reserved A429 Input (A)	RMP-2A	A429 RX	(e.g. WXR CP #3)	
Reserved A429 Input (B)	RMP-2B	A429 RX	(e.g. WXR CP #3)	

ATTACHMENT 5A
INTERWIRING OVERVIEW

ISS - Function	Pin	Comments	Note	Applicable Configurations
453 Bus #2 Output (B)	RMP-2C	A453 TX		A, C
453 Bus #2 Output (A)	RMP-2D	A453 TX		A, C
Rad Alt #3 Input (A)	RMP-2E	A429 RX		A, B, C
Rad Alt #3 Input (B)	RMP-2F	A429 RX		A, B, C
MMR #2 GPS Input (B)	RMP-2G	A429 RX		A, B, C
MMR #2 GPS Input (A)	RMP-2H	A429 RX		A, B, C
OMS #2 Input (A)	RMP-2J	A429 RX		A, B, C
OMS #2 Input (B)	RMP-2K	A429 RX		A, B, C
DOUT provision	RMP-3A	DOUT		
DOUT provision	RMP-3B	DOUT		
Reserved	RMP-3C	DOUT		
DIN provision	RMP-3D	DIN		
DIN provision	RMP-3E	DIN		
DIN provision	RMP-3F	DIN		
Reserved	RMP-3G			
Reserved	RMP-3H			
Reserved	RMP-3J			
Reserved	RMP-3K			
DOUT reserved	RMP-4A	DOUT		
DOUT reserved	RMP-4B	DOUT		
DOUT reserved	RMP-4C	DOUT		
DIN reserved	RMP-4D	DIN		
DIN reserved	RMP-4E	DIN		
DIN reserved	RMP-4F	DIN		
DIN reserved	RMP-4G	DIN		
DIN reserved	RMP-4H	DIN		
DIN reserved	RMP-4J	DIN		
DIN reserved	RMP-4K	DIN		
XT 1 Input (A)	RMP-5A	A429 RX		C
XT 1 Input (B)	RMP-5B	A429 RX		C
TX 1 Output (B)	RMP-5C	A429 TX		C
TX 1 Output (A)	RMP-5D	A429 TX		C
Spare	RMP-5E			
Spare	RMP-5F			
MMR #2 ILS Input (B)	RMP-5G	A429 RX		A, C
MMR #2 ILS Input (A)	RMP-5H	A429 RX		A, C
Air Data #2 Input (A)	RMP-5J	A429 RX		A, B, C
Air Data #2 Input (B)	RMP-5K	A429 RX		A, B, C
Reserved ATE	RMP-6A			
Reserved ATE	RMP-6B			
Reserved ATE	RMP-6C			
Reserved ATE	RMP-6D			
Reserved ATE	RMP-6E			
Reserved ATE	RMP-6F			
Reserved ATE	RMP-6G			
Reserved ATE	RMP-6H			
Reserved ATE	RMP-6J			
Reserved ATE	RMP-6K			
Reserved A429 Output (A)	RMP-7A	A429 TX		
Reserved A429 Output (B)	RMP-7B	A429 TX		
Reserved A429 Input (B)/ ATC/ACAS CP/ RMP Input #2 (B)	RMP-7C	A429 RX	ATC/ACAS CP/ RMP Input #2 (B) (A380)	
Reserved A429 Input (A)/	RMP-7D	A429 RX	ATC/ACAS CP/	

ATTACHMENT 5A
INTERWIRING OVERVIEW

ISS - Function	Pin	Comments	Note	Applicable Configurations
ATC/ACAS CP/ RMP Input #2 (A)			RMP Input #2 (A) (A380)	
IRS #2 Input (A)	RMP-7E	A429 RX		A, B, C
IRS #2 Input (B)	RMP-7F	A429 RX		A, B, C
Reserved ATE	RMP-7G			
Reserved ATE	RMP-7H			
Reserved ATE	RMP-7J			
Reserved ATE	RMP-7K			
XT 2 Input (A)	RMP-8A	A429 RX		C
XT 2 Input (B)	RMP-8B	A429 RX		C
TX 2 Output (B)	RMP-8C	A429 TX		C
TX 2 Output (A)	RMP-8D	A429 TX		C
FCU/MCP #2 Input (A)	RMP-8E	A429 RX		A, B, D
FCU/MCP #2 Input (B)	RMP-8F	A429 RX		A, B, D
FMS #2 Input (B)	RMP-8G	A429 RX		A, B, C
FMS #2 Input (A)	RMP-8H	A429 RX		A, B, C
CMU #2 Input (A)	RMP-8J	A429 RX	provision for ACARS data link	A, B, D
CMU #2 Input (B)	RMP-8K	A429 RX	provision for ACARS data link	A, B, D
Rad Alt #2 Input (A)	RMP-9A	A429 RX		A, B, C
Rad Alt #2 Input (B)	RMP-9B	A429 RX		A, B, C
GP A429 Output #2 (B)	RMP-9C	A429 TX		A, B, C
GP A429 Output #2 (A)	RMP-9D	A429 TX		A, B, C
CMU Output (A) or ADS-B Output #2 (A)	RMP-9E	A429 TX	provision for ACARS data link or ADS-B Output #2 (A) (A380)	A, B, D
CMU Output (B) or ADS-B Output # 2 (B)	RMP-9F	A429 TX	provision for ACARS data link or ADS-B Output # 2 (B) (A380)	A, B, D
Spare	RMP-9G			
Program Pin	RMP-9H	PP		A, B, C
MMR #2 Time Mark Input (+)	RMP-9J	RS-485 RX		A, B, D
MMR #2 Time Mark Input (-)	RMP-9K	RS-485 RX		A, B, D
Program Pin	RMP-10A	PP		A, B, C
Program Pin	RMP-10B	PP		A, B, C
Reserved	RMP-10C			A, B, C
Program Pin	RMP-10D	PP		A, B, C
Reserved	RMP-10E			A, B, C
Reserved	RMP-10F			A, B, C
Reserved	RMP-10G			A, B, C
Reserved	RMP-10H			A, B, C
Reserved	RMP-10J			A, B, C
Reserved	RMP-10K			A, B, C
Program Pin	RMP-11A	PP		A, B, C
Program Pin	RMP-11B	PP		A, B, C
Program Pin	RMP-11C	PP		A, B, C
Program Pin	RMP-11D	PP		A, B, C
Program Pin	RMP-11E	PP		A, B, C
Program Pin	RMP-11F	PP		A, B, C
Program Pin	RMP-11G	PP		A, B, C
Program Pin Common	RMP-11H	PP		A, B, C
SDI Position 1	RMP-11J	PP		A, B, C
SDI Position 2	RMP-11K	PP		A, B, C
WRAU-A (Coax)	RMP-1T			A

ATTACHMENT 5A
INTERWIRING OVERVIEW

ISS - Function	Pin	Comments	Note	Applicable Configurations
WRAU-B (Coax)	RMP-2T			A
Reserved	RMP-12E			
Reserved	RMP-12F			
Display #2 NW TX(+)	RMP-13E	Ethernet		A, B, C
Display #2 NW RX(+)	RMP-13F	Ethernet		A, B, C
Display #2 NW RX(-)	RMP-14E	Ethernet		A, B, C
Display #2 NW TX(-)	RMP-14F	Ethernet		A, B, C
Reserved	RMP-15E			
Reserved	RMP-15F			
Fiber Optic CAT (TX)	LBP-1	fiber optic		A, C
Fiber Optic Network A (TX)	LBP-2	A664		A, B, C
Fiber Optic Network A (RX or BiDi)	LBP-3	A664		A, B, C
Fiber Optic Spare	LBP-4	fiber optic		
Fiber Optic Spare	LBP-5	fiber optic		
Fiber Optic WRAU (TX)	LBP-6	fiber optic		A
Fiber Optic WRAU (RX or BiDi)	LBP-7	fiber optic		A
Fiber Optic Spare	LBP-8	fiber optic		
Fiber Optic CAT (RX or BiDi)	LBP-9	fiber optic		A, C
Fiber Optic Network - B (TX)	LBP-10	fiber optic A664 P7		A, B, C
Fiber Optic Network - B (RX or BiDi)	LBP-11	fiber optic A664 P7		A, B, C
Fiber Optic Spare	LBP-12	fiber optic		
115 Vac A/Emer (Ret)	LBP-13	Power		A, B, D
115 Vac A/Emer (In)	LBP-14	Power		A, B, D
Chassis Ground	LBP-15			A, B, C
Quadrax Network A	LBP-16	Ethernet A664		A, B, C
Quadrax Network B	LBP-17	Ethernet A664		A, B, C
CP Pwr (Ret)	RBP-1	power out		A, B, C
28 Vdc (Pos)	RBP-2	Power		B
28 Vdc (Ret)	RBP-3	Power		B
spare	RBP-4			
CP Pwr (Out)	RBP-5	power out		A, B, C
spare	RBP-6			
WRAU Pwr (Ret)	RBP-7	power out		A
115 Vac B (Ret)	RBP-8	Power		A, C
WRAU Pwr (Out)	RBP-9	power out		A
115 Vac B (In)	RBP-10	Power		A, C
Chassis Ground	RBP-11			A, B, C
615A Data Load	RBP-12	Ethernet		A, B, C
Spare	RBP-13	Ethernet		

ATTACHMENT 5B
ISS CONNECTOR POSITIONING

ATTACHMENT 5B INTERWIRING OVERVIEW

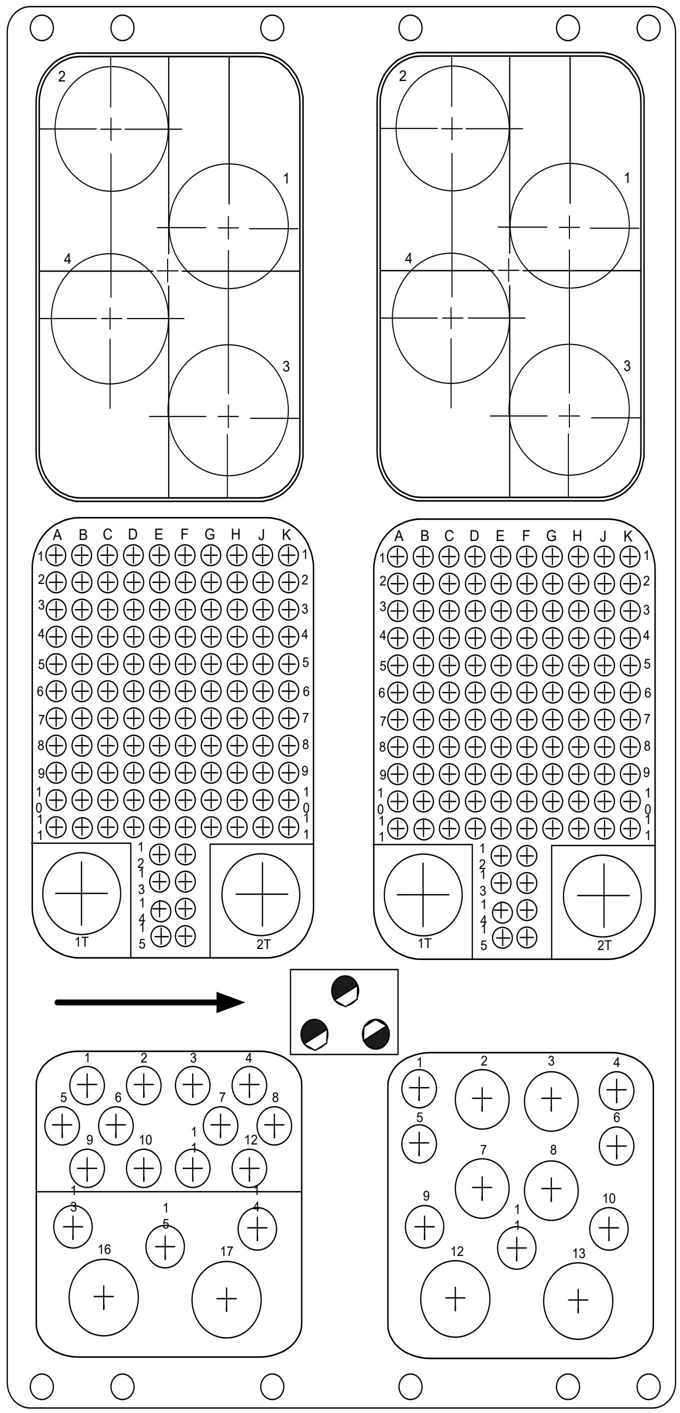
LEFT TOP PLUG (LTP)
CONTACT ARRANGEMENT 11
SIZE 1 COAX

RIGHT TOP PLUG (RTP)
CONTACT ARRANGEMENT 11
SIZE 1 COAX

LEFT MIDDLE PLUG (LMP)
CONTACT ARRANGEMENT 14
SIZE 22 SIGNAL
SIZE 8 COAX

RIGHT MIDDLE PLUG (RMP)
CONTACT ARRANGEMENT 14
SIZE 22 SIGNAL
SIZE 8 COAX

INDEX PIN CODE #158
LIGHT PORTION INDICATES KEY HOLE IN RECEPTACLE (LRU)

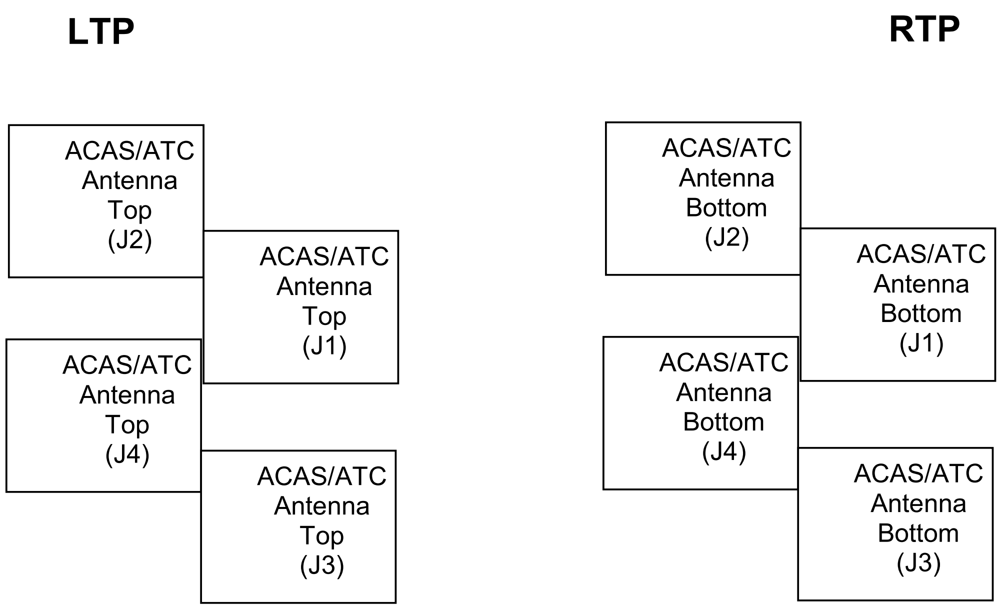


LEFT BOTTOM PLUG (LBP)
CONTACT ARRANGEMENT 17F12Q2
FIBER OPTIC
SIZE 16 POWER
SIZE 8 QUADRAX

RIGHT BOTTOM PLUG (RBP)
CONTACT ARRANGEMENT II - IIQ2
SIZE 20 POWER
SIZE 16 POWER
SIZE 12 POWER
SIZE 8 QUADRAX

Receptacle Side (Rear View of ISS Processor Unit)

ATTACHMENT 5C ISS PIN ALLOCATION



ATTACHMENT 5C
ISS PIN ALLOCATION

LMP

<table>
<tr><th></th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th><th>G</th><th>H</th><th>J</th><th>K</th></tr>
<tr><td>1</td><td>ISS/WXR
CP Output
(A)</td><td>ISS/WXR
CP Output
(B)</td><td>ISS/WXR
CP Input
(B)</td><td>ISS/WXR
CP Input
(A)</td><td>Display #1
Out
(A)</td><td>Display #1
Out
(B)</td><td>Display #!
Input
(B)</td><td>Display #1
Input
(A)</td><td>Audio
Output #1
(hi)</td><td>Audio
Output #1
(lo)</td></tr>
<tr><td>2</td><td>Audio
Inhibit
Output</td><td>W/F Fail
Lamp
Output</td><td>W/S
Caution
Output</td><td>W/S
Warn
Output</td><td>Discrete
Output</td><td>Discrete
Output</td><td>Discrete
Output</td><td>Discrete
Input</td><td>Discrete
Input</td><td>Discrete
Input</td></tr>
<tr><td>3</td><td>Discrete
Output</td><td>Discrete
Output</td><td>Discrete
Output</td><td>Discrete
Output</td><td>Discrete
Input</td><td>Discrete
Input</td><td>Air/Gnd
Discrete
Input</td><td>Discrete
Input</td><td>Discrete
Input</td><td>Discrete
Input</td></tr>
<tr><td>4</td><td>Discrete
Output</td><td>Discrete
Output</td><td>Discrete
Output</td><td>Qual-A
#1
Input</td><td>Qual-A
#2
Input</td><td>Gear
Down
Input</td><td>W/S
Inhibit
Input</td><td>Discrete
Input</td><td>Discrete
Input</td><td>Spare</td></tr>
<tr><td>5</td><td>WRAU
Output
(A)</td><td>WRAU
Output
(B)</td><td>WRAU
Input
(A)</td><td>WRAU
Input
(A)</td><td>FCU
Output
(A)</td><td>FCU
Output
(B)</td><td>MMR #1
ILS Input
(B)</td><td>MMR #1
ILS Input
(A)</td><td>Air
Data #1
Input (A)</td><td>Air
Data #1
Input (B)</td></tr>
<tr><td>6</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>IRS #1
Input
(A)</td><td>IRS #1
Input
(B)</td><td>MMR #1
GPS Input
(B)</td><td>MMR #1
GPS Input
(A)</td><td>453 Bus
#1 Output
(A)</td><td>453 Bus
#1 Output
(B)</td></tr>
<tr><td>7</td><td>ATC/ACAS
CP Output
(A)</td><td>ATC/ACAS
CP Output
(B)</td><td>ATC/ACAS
CP Input
(B)</td><td>ATC/ACAS
CP Input
(a)</td><td>ADS-B #1
Input
(A)</td><td>ADS-B #1
Input
(B)</td><td>ADS-B #2
Input
(B)</td><td>ADS-B #2
Input
(A)</td><td>OMS #1
Input
(A)</td><td>OMS #1
Input
(B)</td></tr>
<tr><td>8</td><td>Spare</td><td>Spare</td><td>Spare</td><td>Spare</td><td>FCM/MCP
#1 Input
(A)</td><td>FCM/MCP
#1 Input
(B)</td><td>FMS #1
Input
(B)</td><td>FMS #1
Input
(A)</td><td>CMU #1
Input
(A)</td><td>CMU #1
Input
(B)</td></tr>
<tr><td>9</td><td>Rad Alt
#1 Input
(A)</td><td>Rad Alt
#1 Input
(B)</td><td>GPS A429
Output #1
(B)</td><td>GPS A429
Output #1
(A)</td><td>ADS-B
Output #1
(A)</td><td>ADS-B
Output #1
(B)</td><td>Reserved</td><td>Spare</td><td>MMR #1
TimeMark
(+)</td><td>MMR #1
TimeMark
(-)</td></tr>
<tr><td>10</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Program
Pin</td><td>Program
Pin</td></tr>
<tr><td>11</td><td>Reserved</td><td>Program
Pin</td><td>Program
Pin</td><td>Program
Pin</td><td>Program
Pin</td><td>Program
Pin</td><td>Program
Pin</td><td>Program
Pin</td><td>Program
Pin</td><td>Program
Pin</td></tr>
<tr><td>12</td><td rowspan="4" colspan="4">Suppression
Pulse
(Coax)</td><td>Reserved</td><td>Reserved</td><td rowspan="4" colspan="4">Reserved
Clear Air
Turbulence
Detection
(Coax)</td></tr>
<tr><td>13</td><td>Display
#1 NW
Tx (+)</td><td>Display
#1 NW
Rx (+)</td></tr>
<tr><td>14</td><td>Display
#1 NW
Rx (-)</td><td>Display
#1 NW
Tx (-)</td></tr>
<tr><td>15</td><td>Reserved</td><td>Reserved</td></tr>
</table>

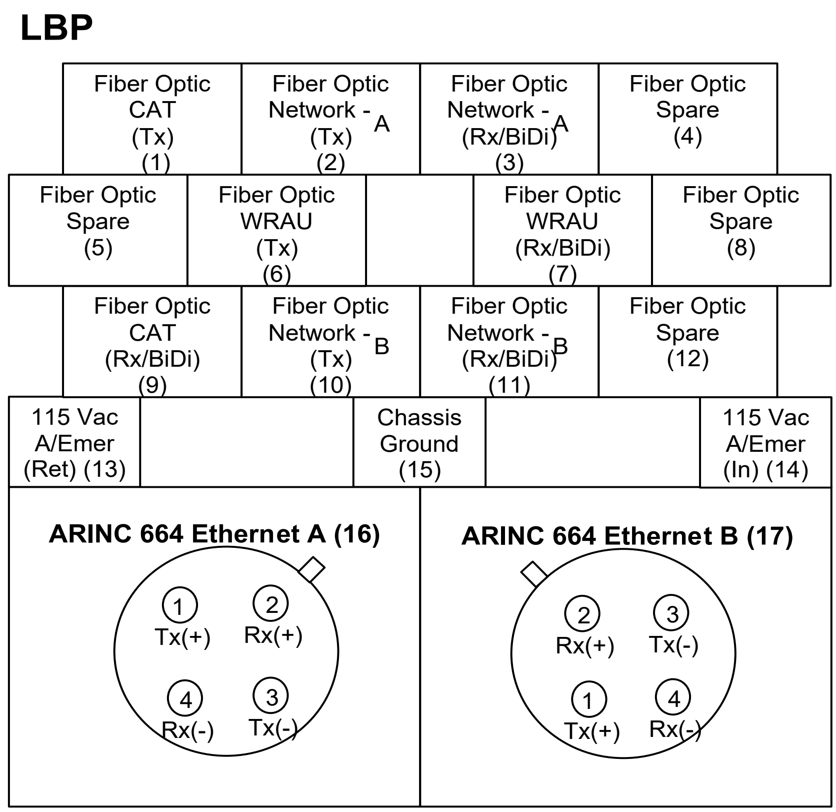
ATTACHMENT 5C
ISS PIN ALLOCATION

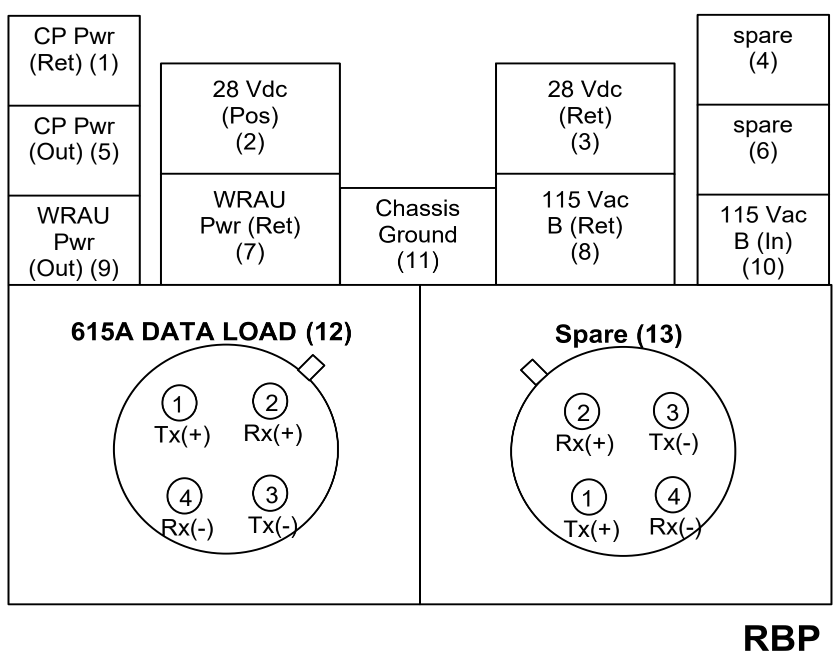
RMP

<table>
<tr><th></th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th><th>G</th><th>H</th><th>J</th><th>K</th></tr>
<tr><td>1</td><td>OMS Output (A)</td><td>OMS Output (B)</td><td>WXR CP #2 Input (B)</td><td>WXR CP #2 Input (B)</td><td>Display #2 Out (A)</td><td>Display #2 Out (B)</td><td>Display #2 Input (B)</td><td>Display #2 Input (A)</td><td>Audio Output #2 (hi)</td><td>Audio Output #2 (lo)</td></tr>
<tr><td>2</td><td>Reserved</td><td>Reserved</td><td>453 Bus #2 Output (B)</td><td>453 Bus #2 Output (A)</td><td>Rad Alt #3 Input (A)</td><td>Rad Alt #3 Input (B)</td><td>MMR #2 GPS Input (B)</td><td>MMR #2 GPS Input (A)</td><td>OMS #2 Input (A)</td><td>OMS #2 Input (B)</td></tr>
<tr><td>3</td><td>Discrete Output</td><td>Discrete Output</td><td>Reserved</td><td>Discrete Input</td><td>Discrete Input</td><td>Discrete Input</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>4</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>5</td><td>XT 1 Input (A)</td><td>XT 1 Input (B)</td><td>TX 1 Output (B)</td><td>TX 1 Output (A)</td><td>Spare</td><td>Spare</td><td>MMR #2 ILS Input (B)</td><td>MMR #2 ILS Input (A)</td><td>Air Data #2 Input (A)</td><td>Air Data #2 Input (B)</td></tr>
<tr><td>6</td><td>Reserved ATE</td><td>Reserved ATE</td><td>Reserved ATE</td><td>Reserved ATE</td><td>Reserved ATE</td><td>Reserved ATE</td><td>Reserved ATE</td><td>Reserved ATE</td><td>Reserved ATE</td><td>Reserved ATE</td></tr>
<tr><td>7</td><td>Reserved A429 Output (A)</td><td>Reserved A429 Output (B)</td><td>Reserved A429 Input (B)</td><td>Reserved A429 Input (A)</td><td>IRS #2 Input (A)</td><td>IRS #2 Input (B)</td><td>Reserved ATE</td><td>Reserved ATE</td><td>Reserved ATE</td><td>Reserved ATE</td></tr>
<tr><td>8</td><td>XT 2 Input (A)</td><td>XT 2 Input (B)</td><td>TX 2 Output (B)</td><td>TX 2 Output (A)</td><td>FCU/MCP #2 input (A)</td><td>FCU/MCP #2 input (B)</td><td>FMS #2 Input (B)</td><td>FMS #2 Input (A)</td><td>CMU #2 Input (A)</td><td>CMU #2 Input (B)</td></tr>
<tr><td>9</td><td>Rad Alt #2 Input (A)</td><td>Rad Alt #2 Input (B)</td><td>GP A429 Output # 2 (B)</td><td>GP A429 Output # 2 (A)</td><td>CMU Output (A)</td><td>CMU Output (V)</td><td>Spare</td><td>Program Pin</td><td>MMR #2 Time Mark Input (+)</td><td>MMR #2 Time Mark Input (-)</td></tr>
<tr><td>10</td><td>Program Pin</td><td>Program Pin</td><td>Reserved</td><td>Program Pin</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>11</td><td>Program Pin</td><td>Program Pin</td><td>Program Pin</td><td>Program Pin</td><td>Program Pin</td><td>Program Pin</td><td>Program Pin</td><td>Program Pin Common</td><td>SDI Position 1</td><td>SDI Position 2</td></tr>
<tr><td>12</td><td rowspan="4" colspan="4">WRAU-A (Coax)</td><td>Reserved</td><td>Reserved</td><td rowspan="4" colspan="4">WRAU-B (Coax</td></tr>
<tr><td>13</td><td>Display #2 NW Tx (+)</td><td>Display #2 NW Rx (+)</td></tr>
<tr><td>14</td><td>Display #2 NW Rx (-)</td><td>Display #2 NW Tx (-)</td></tr>
<tr><td>15</td><td>Reserved</td><td>Reserved</td></tr>
</table>

Note: Spare – Pin not used. To be assigned in future Supplement.
Reserved – Manufacturer use

ATTACHMENT 5C
ISS PIN ALLOCATION





ATTACHMENT 5D
ISS CONTROL PANEL – TYPE I
PIN ASSIGNMENT

ATTACHMENT 5D ISS CONTROL PANEL – TYPE I PIN ASSIGNMENT

Pin	Signal Name	Signal Type	In/Out
A	CP POWER RETURN	ANALOG	INPUT
B	RESERVED		
C	ARINC 429 RX (+)	DIGITAL	INPUT
D	DAY/NIGHT DIM	ANALOG	OUTPUT
E	DIMMING CONTROL (-)	ANALOG	OUTPUT
F	DIMMING CONTROL (+)	ANALOG	OUTPUT
G	5 VAC DIMMING INPUT	ANALOG	INPUT
H	5 VAC DIMMING RETURN	ANALOG	INPUT
J	CONFIRMATION CONTROL (+)	ANALOG	OUTPUT
K	CONFIRMATION CONTROL (-)	ANALOG	OUTPUT
L	SPARE		
M	ARINC 429 TX (+)	DIGITAL	OUTPUT
N	RESERVED		
P	CP POWER	ANALOG	INPUT
R	RESERVED		
S	ARINC 429 RX (-)	DIGITAL	INPUT
T	SPARE		
U	SPARE		
V	TEST	DISCRETE	OUTPUT
W	SPARE		
X	SPARE		
Y	ARINC 429 TX (-)	DIGITAL	OUTPUT
Z	CHASSIS GND	ANALOG	INPUT

Note: All pins are #20 AWG except pin Z (#16 AWG)

ATTACHMENT 5E ISS CONTROL PANEL – TYPE II PIN ASSIGNMENT

Pin	Signal Name	Signal Type	In/Out
1	5 VAC PANEL LIGHTS HI	ANALOG	INPUT
2	5 VAC PANEL LIGHTS LO	ANALOG	INPUT
3	115 VAC POWER HI	ANALOG	INPUT
4	115 VAC POWER LO	ANALOG	INPUT
5	(a) ARINC 429 RX B (b) ANTENNA TRANSFER	(a) DIGITAL (b) DISCRETE	(a) INPUT (b) OUTPUT
6	DC GROUND	ANALOG	INPUT
7	STANDBY/ON	DISCRETE	OUTPUT
8	CHASSIS GROUND	ANALOG	INPUT
9	FUNCTIONAL TEST/FCDE	DISCRETE	INPUT
10	WARNING AND CAUTION	DISCRETE	OUTPUT
11	AIR/GND SWITCH #1	DISCRETE	OUTPUT
12	TRANSPONDER FAIL LOGIC #2	DISCRETE	INPUT
13	5 VAC INDICATOR LIGHTING HI	ANALOG	INPUT
14	5 VAC INDICATOR LIGHTING LO	ANALOG	INPUT
15	AIR/GND SWITCH #2	DISCRETE	OUTPUT
16	AIR/DATA SOURCE	DISCRETE	OUTPUT
17	FLIGHT ID DISABLE	DISCRETE	INPUT
18	BRIGHT/DIM CONTROL	ANALOG	INPUT
19	(a) ARINC 429 RX A (b) ALT FAIL INPUT	(a) DIGITAL (b) DISCRETE	(a) INPUT (b) INPUT
20	TRANSPONDER FAIL LOGIC #1	DISCRETE	INPUT
21	LAMP TEST	DISCRETE	INPUT
22	ARINC 429 TX A	DIGITAL	OUTPUT
23	ARINC 429 TX B	DIGITAL	OUTPUT
24	AIR/GND DISCRETE	DISCRETE	INPUT

Note: Pins 5 and 19 are multi-function pins.

ATTACHMENT 5F ISS CONTROL PANEL – TYPE III PIN ASSIGNMENT

(Content of this attachment not required for 2G ISS - This attachment is here to retain organizational alignment with the original ISS definition - ARINC Characteristic 768)

ATTACHMENT 5G-A WEATHER RADAR ANTENNA UNIT (WRAU) PIN ASSIGNMENT – COPPER WIRE (NOT APPLICABLE)

(Content of this attachment not required for 2G ISS - This attachment is here to retain organizational alignment with the original ISS definition - ARINC Characteristic 768)

ATTACHMENT 5G-B RADAR ANTENNA UNIT (WRAU) PIN ASSIGNMENT – FIBER OPTIC (NOT APPLICABLE)

(Content of this attachment not required for 2G ISS - This attachment is here to retain organizational alignment with the original ISS definition - ARINC Characteristic 768)

ATTACHMENT 5H ALTERNATE LEFT BOTTOM PLUG (LBP) – (A380/A350 CONFIGURATION)

(Content of this attachment not required for 2G ISS - This attachment is here to retain organizational alignment with the original ISS definition - ARINC Characteristic 768)

ATTACHMENT 6 BASIC ALERT PRIORITIZATION

ALERT PRIORITIZATION SCHEME per FAA TSO-C151b			
Priority	**Description**	**Alert Level** [2]	**Comments**
1	Reactive Windshear Warning	W	
2	Sink Rate Pull-Up Warning	W	continuous
3	Excessive Closure Pull-Up Warning	W	continuous
4	RTC Terrain Warning	W	
5	(Reserved - V_1 Callout)	I	
6	(Reserved - Engine Fail Callout)	W	
7	FLTA Pull-Up warning	W	continuous
8	PWS Warning	W	
9	RTC Terrain Caution	C	continuous
10	Minimums	I	
11	FLTA Caution	C	7 second period
12	Too Low Terrain	C	
13	PDA (“Too Low Terrain”) Caution	C	
14	Altitude Callouts	I	
15	Too Low Gear	C	
16	Too Low Flaps	C	
17	Sink Rate	C	
18	Don’t Sink	C	
19	Glide slope	C	3 second period
20	PWS Caution	C	
21	Approaching Minimums	I	
22	Bank Angle	C	
23	Reactive Windshear Caution	C	
Mode 6 [1]	TCAS RA (“Climb”, “Descend”, etc.)	W	continuous
Mode 6 [1]	TCAS TA (“Traffic, Traffic”)	C	continuous

Notes:

1. These alerts can occur simultaneously with TAWS voice callout alerts.
2. W= Warning, C= Caution, A= Advisory, I= Informational

ATTACHMENT 7 SUMMARY OF ENVIRONMENTAL TEST GUIDLINES

Environmental Requirement	ISS Line Replaceable Unit (LRU)		
RTCA DO-160D Section	**ISS Processor Unit (Includes APM)**	**ISS Control Panel**	**L-Band Antenna**
LRU Location	Internal - Electrical Equipment Bay	Internal - Flight Deck	External - Top and Bottom Fuselage
Section 1.02 Equipment Classification	Essential	Essential	Essential
Section 1.03 4.5 Temperature Tests			
4.5.1 Ground Survival Low Temperature Test / Operating Low Temperature Test	A2 (-55 deg/ -15 deg C)	A2 (-55 deg/-15 deg C)	D2 (-55 deg C)
4.5.2 Ground Survival High Temperature Test / Short-Time Operating High Temperature Test	A2 (+85 deg/ +70 deg C)	A2 (+85 deg/+70 deg C)	D2 (+85 deg C)
4.5.3 Operating High Temperature Test	A2 (+70 deg C)	A2 (+70 deg C)	D2 (+70 deg C)
4.5.4 In-Flight Loss of Cooling	Z - 345 minutes (+40 deg C)	Cat X	Cat X
4.6 Altitude, Decompression and Overpressure Tests			
4.6.1 Altitude Test	Cat A2 15k ft (4.6km)	Cat A2/D1 50k ft (15.2km)	Cat D2 50k ft (15.2km)
4.6.2 Decompression Test	8000 ft (2400m) to 50k ft (15.2km)	8000 ft (2400m) to 50k ft (15.2km)	Cat X
4.6.3 Overpressure Test	- 15k ft (170 kPa)	- 15k ft (170 kPa)	Cat X
5.0 Temperature Variation	Cat B (5 deg C/min)	Cat B (5 deg C/min)	Cat A (10 deg C/min)
6.0 Humidity	Cat A (48 hrs)	Cat A (48 hrs)	Cat C (144 hrs)
7.0 Operational Shock and Crash Safety	Cat B	Cat B	Cat B
8.0 Vibration (Change 1)	Instrument Panel, Console, & Equipment Rack Cat S Curve B	Instrument Panel, Console, & Equipment Rack Cat R2 Curve B/B1	Fuselage Cat S Curve C
9.0 Explosion Proofness	Cat X	Cat X	Cat X
10.0 Waterproofness	Cat X	Cat X	Cat S
11.0 Fluids Susceptibility	Cat X	Cat X	Cat F
12.0 Sand and Dust	Cat X	Cat X	Cat D
13.0 Fungus	Cat X	Cat X	Cat F
14.0 Salt Spray	Cat X	Cat X	Cat S (35 deg C/48 hours)
15.0 Magnetic Effects	Cat Z	Cat Z	Cat X
16.0 Power Input (Change 2)	Cat A(WF) (note 3)	Cat A(WF) Type II only (note 3)	Cat X

ATTACHMENT 7
SUMMARY OF ENVIRONMENTAL TEST GUIDELINES

Environmental Requirement	ISS Line Replaceable Unit (LRU)		
RTCA DO-160D Section	**ISS Processor Unit (Includes APM)**	**ISS Control Panel**	**L-Band Antenna**
17.0 Voltage Spike	Cat A	Cat A	Cat A (note 2)
18.0 Audio Frequency Susceptibility (Change 2)	Cat A(WF) (note 3)	Cat A(WF) Type II only (note 3)	Cat X
19.0 Induced Signal Susceptibility	Cat C	Cat C	Cat C (note 2)
20.0 Radio Frequency Susceptibility (Radiated and Conducted) (Change 1)	CS – R RS – R Pulse - R	CS – R RS – R Pulse – R	CS - R RS - R Pulse - R (note 2)
21.0 Emissions of Radio Frequency Energy	Cat B Cat M (note 4)	Cat B Cat M (note 4)	Cat H (note 2)
22.0 Lightning Induced Transient Susceptibility (Change 3) (note 5)	B3K33 (note 1)	XXK33	XXK44 (note 1, note 2)
23.0 Lightning Direct Effects	Cat X	Cat X	Cat 1A
24.0 Icing	Cat X	Cat X	Cat A
25.0 Electrostatic Discharge (ESD)	Cat A	Cat A	Cat A

Notes:

1. Lightning induced transient susceptibility. Pin injection test for primary power lines and chassis grounds. As a minimum, test at 1 MHz.
2. Applicable to active antennas only. Otherwise Cat X (no test performed).
3. For equipment designed for 115 Vac 400 Hz fixed frequency, Cat A (NF) may apply.
4. As determined by airframe manufacturer.
5. Waveform H may be required for unshielded cable.

Refer to RTCA DO-160 current version.

ATTACHMENT 8 ACRONYM LIST

ABV	Above
ACAS	Airborne Collision Avoidance System
ADS-B	Automatic Dependent Surveillance – Broadcast
ADS-R	Automatic Dependent Surveillance – Rebroadcast
AEEC	Airlines Electronic Engineering Committee
AGL	Above Ground Level
AIRB	Airborne
AIWP	Application Integrated Work Plan
ANP	Actual Navigation Performance
APM	Airplane Personality Module (ARINC 607)
ASAS	Airborne Separation Assurance System
ASSA	Airport Surface Situational Awareness (ASSA)
ATC	Air Traffic Control
ATCRBS	Air Traffic Control Radar Beacon System
ATE	Automatic Test Equipment
AZIM	Azimuth
BFE	Buyer Furnished Equipment
BiDi	Bi-Directional
BITE	Built-In Test Equipment
BLW	Below
CDS	Cockpit Display System
CDTI	Cockpit Display of Traffic Information
CFDS	Central Fault Display System
CFIT	Controlled Flight Into Terrain
CMC	Central Maintenance Computer
CMS	Crew Management System
CMU	Communications Management System
CP	Control Panel
CRC	Cyclic Redundancy Check
DDM	Difference in Depth of Modulation
DH	Decision Height
DIN	Data Input
DITS	Digital Information Transfer System
DN	Down
DOUT	Data Output
DTIF	Display Traffic Information File
ED	EUROCAE Document
EFIS	Electronic Flight Information System
EGPWS	Enhanced Ground Proximity Warning Computer

ATTACHMENT 8
ACRONYM LIST

ELAN	Ethernet Local Area Network
EIA	Electronic Industries Association
EVAcq	Enhanced Visual Acquisition
EVApp	Enhanced Visual Approach
FAROA	Final Approach and Runway Occupancy Awareness
FCU	Flight Control Unit
FLTA	Forward Looking Terrain Avoidance
FMC	Flight Management Computer
FMS	Flight Management System
FWD	Forward
G/S	Glideslope
GICB	Ground Initiated Comm-B
GLS	GNSS Landing System
GND	Ground
GNLU	GNSS Navigation and Landing Unit
GNSS	Global Navigation Satellite System
GNU	GNSS Navigation Unit
GP	General Purpose
GPWS	Ground Proximity Warning Computer
GPS	Global Positioning System
GSE	Ground Support Equipment
HUD	Head-Up Display System
Hz	Hertz
ICSPA	Independent Closely Spaced Parallel Approaches
ILS	Instrument Landing System
ISO	International Organization for Standardization
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISS	Integrated Surveillance System
ISSPU	ISS Processor Unit
ITP	In-Trail Procedure
LBP	Left Bottom Plug (ARINC 600)
LED	Light Emitting Diode
LMP	Left Middle Plug (ARINC 600)
LRU	Line Replaceable Module
LTP	Left Top Plug (ARINC 600)
MAX	Maximum
MASP	Minimum Aviation System Performance Standards
MCDU	Multi-Purpose Control and Display Unit
MCU	Modular Concept Unit
MCP	Mode Control Panel

ATTACHMENT 8
ACRONYM LIST

MDA	Minimum Descent Altitude
MFD	Multi-Function Display
MIN	Minimum
MMR	Multi-Mode Receiver
MOPS	Minimum Operational Performance Standards
MSL	Mean Sea Level
MTBF	Mean Time Between Failure
MTBUR	Mean Time Between Unscheduled Removal
NACv	Navigation Accuracy Category – Velocity
ND	Navigation Display
NFF	No Fault Found
OMS	On-board Maintenance System
PDA	Premature Descent Alert
PFD	Primary Flight Display
POA	Position Offset Applied
PP	Program Pin
PWS	Predictive Windshear
RA	(1) Radar Altimeter (2) Resolution Advisory
RAAS	Runway Awareness and Advisory System
RBP	Right Bottom Plug (ARINC 600)
RMP	Right Middle Plug (ARINC 600)
RNP	Required Navigation Performance
RTC	Required Terrain Clearance
RTP	Right Top Plug (ARINC 600)
RWS	Reactive Windshear
RX	Receive
SDA	System Design Assurance
SDI	Source/Destination Identifier
SFE	Supplier Furnished Equipment
SIL	Source Integrity Level
SSR	Secondary Surveillance Radar
SURF-IA	Surface Situational Awareness with Indications and Alerting
SYS	System
TA	Traffic Advisory
TAD	Terrain Awareness Display
TAWS	Terrain Awareness and Warning System
TAWC	Terrain Awareness and Warning Computer
TCAS	Traffic Alert and Collision Avoidance System
TCM	TAWS Configuration Module
TIS-B	Traffic Information Service - Broadcast
TSO	Technical Standard Order

ATTACHMENT 8
ACRONYM LIST

TX	Transmit
UAT	Universal Access Transceiver
VD	Vertical Display
VDL	VHF Digital Link
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio
W/S	Windshear
XPDR	Transponder