ARINC Project Initiation/Modification (APIM)

1.0 Name of Proposed Project APIM 19-008CB

New ARINC Project Paper 748: Airborne Weather Radar with Advanced Antenna Technology

1.1 Name of Originator and/or Organization

Boeing / Jessie Turner

2.0 Subcommittee Assignment and Project Support

2.1 Suggested AEEC Group and Chairman

Systems Architecture and Interfaces (SAI) Subcommittee

SAI Chairmen: Rich Stillwell

Weather Radar Working Group Chairman: Mohammed Ahmed, Boeing

2.2 Support for the activity

Airlines: American, Delta, FedEx, Lufthansa, TAP Portugal, United, UPS

Airframe Manufacturers: Airbus, Boeing

Suppliers: Collins, Garmin, Honeywell, Gables

Others:

2.3 Commitment for Drafting and Meeting Participation

Airlines: FedEx

Airframe Manufacturers: Airbus, Boeing

Suppliers: Collins, Gables, Garmin, Honeywell

Others:

2.4 Recommended Coordination with other groups

None

3.0 Project Scope

3.1 Description

This project calls for a new Weather Radar ARINC Project Paper 748 to support new, ARINC 664 network-based, aircraft designs.

ARINC Characteristic 708A “Airborne Weather Radar with Forward Looking Windshear Detection Capability” was last updated with Supplement 3 in 1999. The ARINC 708A-3 architecture has the WXR antenna and antenna drive under the nose radome, and interconnected, via a waveguide, to a Receiver/ Transmitter (that contains the RF front-end and processing) installed in a tray inside the pressure vessel.

In the last 10 years, suppliers have designed and fielded newer WXR system installations that are not compliant with ARINC 708A (or any other standard). In these WXR installations, the RF front end is installed within a Receiver/Transmitter Module (RTM) under the nose radome and is interconnected with a standalone ARINC 600 rack-mounted WXR processor in the EE bay. Also, no separate waveguide installation is required for these newer WXR installations. [Note: This type of newer WXR architecture (with an RTM under the nose radome) is documented in the ARINC 768 Integrated Surveillance System (ISS) characteristic, but ARINC 768 has an ISS Processor Unit in lieu of a standalone WXR Processor in the EE bay].

Although these newer WXR installations provide cost and Size, Weight, and Power (SWaP) benefits over-and-above the ARINC 708A WXR installations, these newer, standalone WXR installations do not follow an industry standard and are not interchangeable between suppliers. Consequently, if one supplier's WXR system needs to be swapped-out to install another supplier's WXR system, extensive aircraft changes are required to be made (e.g., the WXR Processor's ship-side connector, RTM ship-side connector, and wiring between the WXR Processor and RTM need to be changed). This has a significant impact if an airframer or airline wants to switch between WXR equipment suppliers.

For future network-based aircraft, the WXR system installation needs to be standardized so that these extensive aircraft changes are not required. The working group should consider an interface definition for accommodating the receipt and transmission of raw weather data. The Working Group's goal is to develop a WXR system that installs an Electronically Scanned Antenna (ESA) under the aircraft's nose radome.

Weather radar meetings held in 2020 and 2022 revealed several technical challenges and trade-offs related to moving from the traditional mechanically sweeping antenna to a fixed mount ESA. The group has discussed several ESA geometries including single panel ESA, dual panel ESA, and three panel ESA. Panel size and geometry will have a direct influence on weather radar performance. This all comes at some cost and with tradeoffs. Therefore, the scope of this APIM is expanded to include an ESA feasibility study and an attachment to ARINC Project Paper 748. The feasibility study is expected to contain objective criteria and quantitative data for ESA performance in different configurations.

3.2 Planned usage of the envisioned specification

New aircraft developments planned to use this specification — yes ☒ no ☐

Specify: Next new Boeing air transport aircraft

Next new Airbus air transport aircraft

Modification/retrofit requirement — yes ☐ no ☒

Specify:

Needed for airframe manufacturer or airline project — yes ☒ no ☐

Specify: Next new Boeing air transport aircraft

Mandate/regulatory requirement — yes ☐ no ☒

Is the activity defining/changing an infrastructure standard? yes ☐ no ☒

Specify:

When is the ARINC Standard required? May 2025

What is driving this date? Target design date

Are 18 months (min) available for standardization work? yes ☒ no ☐

Are Patent(s) involved? yes ☐ no ☒

If YES please describe, identify patent holder:

3.3 Issues to be worked

It is expected that the following specific items will be addressed as part of the WXR standard development (and others as they arise):

1) Standardize a WXR Electronically Scanned Antenna (ESA) installation under the nose radome. The goal is that the ESA would support RF transmit/receive, processing, and input/output functions, thus, negating the need for a separate WXR processor in the EE bay. Whether this goal can be met will be determined during standards development.

2) The ESA installation would standardize the following:
   a. Installation mounting
   b. Maximum volume
   c. Connector(s) and pinouts to support power input and ARINC 664 network-based connections (e.g., fiber, and others if required)
   d. Antenna pattern field of view
   e. Operational frequencies

3) Expected system reliability for the new installation needs to be determined and should be improved over current WXR installations (single and dual installations).

4.0 Benefits

4.1 Basic benefits

Operational enhancements? yes ☐ no ☒

For equipment standards:

a. Is this a hardware characteristic? yes ☒ no ☐

b. Is this a software characteristic? yes ☐ no ☒

c. Interchangeable interface definition? yes ☒ no ☐

d. Interchangeable function definition? yes ☒ no ☐

If not fully interchangeable, please explain: Not applicable

Is this a software interface and protocol standard? yes ☐ no ☒

Specify:

Product offered by more than one supplier yes ☒ no ☐

Identify: Collins Aerospace, Garmin, Honeywell

4.2 Specific project benefits (Describe overall project benefits.)

4.2.1 Benefits for Airlines

- Supplier system interchangeability

4.2.2 Benefits for Airframe Manufacturers

- Common installation(s)/solution(s), less variability
- Supplier system interchangeability

4.2.3 Benefits for Avionics Equipment Suppliers

- Provide equipment that can be installed on multiple aircraft platforms, across multiple aircraft OEMs.

5.0 Documents to be Produced and Date of Expected Result

ARINC Project Paper 748: Airborne Weather Radar System with Advanced Antenna Technology, March 2025.

5.1 Meetings and Expected Document Completion

The following table identifies the number of meetings and proposed meeting days needed to produce the documents described above.

Activity	Virtual Mtgs	F2F Mtg-Days (Total)	Expected Start Date	Expected Completion Date
ARINC Project Paper 748 Weather Radar	24	6 (15)	October 2019	March 2025

6.0 Comments

Regularly scheduled web conferences are planned.

6.1 Expiration Date for the APIM

October 2025

Completed forms should be submitted to the AEEC Executive Secretary , Sam. Buckwalter (sam.buckwalter@sae-itc.org).