ARINC Project Initiation/Modification (APIM)

1.0 Name of Proposed Project — APIM 16-011

Next-Generation Cabin Equipment Network Bus

1.1 Name of Originator and/or Organization

Cabin Systems Subcommittee (CSS)

2.0 Subcommittee Assignment and Project Support

2.1 Suggested AEEC Group and Chairman

Cabin System Subcommittee (CSS)

Dale Freeman, Delta Air Lines

2.2 Support for the activity (as verified)

Airlines: Delta, TAP Portugal, United

Airframe Manufacturers: Airbus, Boeing

Suppliers: Amphenol, Astonics, Diehl, Esterline, ITT Cannon, KID Systeme, Lumexis, Molex, Panasonic, Rockwell-Collins, Radiall, Souriau, TE Connectivity, Thales, W. L. Gore, Zodiac Seats France, Zodiac, ZII

2.3 Commitment for Drafting and Meeting Participation (as verified)

Airlines: Delta

Airframe Manufacturers: Airbus, Boeing (TBC)

Suppliers: Amphenol, Astonics, Diehl, Esterline, ITT Cannon, KID Systeme, Lumexis, Molex, Panasonic, Rockwell-Collins, Radiall, Souriau, TE Connectivity, Thales, W. L. Gore, Zodiac Seats France, Zodiac, ZII

2.4 Recommended Coordination with other groups

NIS Subcommittee, SAI Subcommittee

3.0 Project Scope (why and when standard is needed)

3.1 Description

ARINC Specification 485 defines a standard bus and messaging protocol used extensively for cabin equipment. However, ARINC 485 has outlived its usefulness. Originally intended for status and simple ON/OFF control, this bus does not provide adequate performance for current and emerging equipment with more sophisticated controls and smart microcontrollers. A higher performance networking alternative is needed. The alternative definition must consider minimizing conductors for the LAN, maximizing data throughput, and leveraging of existing COTS LAN technologies.

The CSS investigated and discussed trade-offs among proven, commercial solutions. The determination was that IEEE 802.3bw, which is a single twisted pair 100 Mbps Ethernet link was the best alternative.

This APIM authorizes the following activities:

- Develop Supplement 4 to ARINC Specification 664 Part 2 to define the physical and network layers for 100BaseT1 and 1000BaseT1 Ethernet,

based on IEEE 802.3 bw (100BaseT1) and 802.3 bp (1000BaseT1). 100BaseT1 supports full duplex 100 Mbps performance over a single twisted pair. There are proven components available from multiple sources. 1000BaseT1 is a relatively new capability with promise for future performance enhancement.

- Develop a new ARINC Project Paper 8xx to define a new data bus applicable to cabin systems, initially for the following cabin functions:
  (1) In-Seat Network. Define physical interface (connectors and cabling), electrical interfaces, bus protocols, and messaging protocols for an Ethernet in-seat network, including seat equipment components such as electronic control unit, seat actuator controller, seat electronics, and in-seat lighting. The messaging protocols will expand on similar messaging developed for communications between seat components in ARINC 485 Part 2.
  (2) Cabin Lighting System Interfaces. Define standard physical interfaces (connectors and cabling), electrical interfaces, bus protocols, and messaging protocols for Ethernet networks for lighting system components.
- Consider developing a “legacy mode” to be used via the new physical layer to allow existing LRUs to maintain the currently-defined ARINC 485 messaging for seat elements.

3.2 Planned usage of the envisioned specification

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

Airbus: all new

Boeing: 777X (in-seat network)

Modification/retrofit requirement yes ☐ no ☒

Specify: Airlines are retrofitting cabin systems into their existing fleets.

Needed for airframe manufacturer or airline project yes ☒ no ☐

Specify: driven by the need to provide common definitions for the airplane programs and retrofit programs

Mandate/regulatory requirement yes ☐ no ☒

Program and date: No mandate

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

Specify:

When is the ARINC Standard required? Per aircraft program

What is driving this date? Aircraft Development Schedules

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

If NO, please specify solution: Not applicable

Are Patent(s) involved? yes ☐ no ☒

If YES please describe, identify patent holder: Not applicable

3.3 Issues to be worked

- Definition of standard Ethernet physical layer for commercial aircraft applications
- Definition of standard IP network layer for commercial aircraft applications
- Connectors and cabling and electrical interfaces for an Ethernet in-seat network
- Bus protocols for in-seat equipment, similar to ARINC 485, Part 2
- Connectors and cabling and electrical interfaces for Ethernet networking for lighting components
- Bus protocols for lighting system components
- Network security considerations

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: _____

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

Product offered by more than one supplier yes ☒ no ☐

Identify:

4.2 Specific project benefits (Describe overall project benefits.)

A higher-performance data bus to cabin peripherals using the same universal interface would support implementation of new, smarter systems while reducing development cost and time to implement new functions.

Definition of bus implementation for in-seat networks and cabin lighting would preclude custom network implementations, reduce design and development time, and simplify integration testing for these components.

4.2.1 Benefits for Airlines

- Equipment interoperability between suppliers
- Reduction in development cost, improved reliability, and therefore reduced cost for the airlines

4.2.2 Benefits for Airframe Manufacturers

- Equipment interoperable between suppliers
- Flexibility and reduced costs by working from the same set of guidelines
- Reduction of time and cost for new developments due to reuse of proven solutions

4.2.3 Benefits for Avionics Equipment Suppliers

- Eliminates the need to design custom provisions for each installation
- Reduction of time and cost for new developments due to reuse of proven solutions

5.0 Documents to be Produced and Date of Expected Result

- Supplement 4 to ARINC Specification 664 Part 2
- ARINC Project Paper 8XX

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	Mtgs	Mtg-Days (Total)*	Expected Start Date	Expected Completion Date
Supplement 4 to ARINC 664P2	6	18	Oct 2016	Mar 2018
ARINC Project Paper 8XX	6	18	Nov 2016	Mar 2019

* Meeting days reflect CSS meetings responsible for multiple ARINC Standards. In addition to the in-person meetings identified above, web conferences will be called to support specific project goals.

6.0 Comments

ARINC Specification 800 Parts 2 and 3 may need to be updated to define connector and cable components necessary for a new cabin bus. Should this be the case, this APIM will be updated to reflect the scope and schedule changes.

6.1 Expiration Date for this APIM

April 2019

Completed forms should be submitted to the AEEC Executive Secretary.