ARINC Project Initiation/Modification (APIM)

1.0 Name of Proposed Project APIM 13-004C

Supplement 4 to ARINC Specification 825: General Standardization of CAN (Controller Area Network) for Airborne Use

1.1 Name of Originator and/or Organization

Boeing, Airbus, GE Aviation and CAN Working Group

2.0 Subcommittee Assignment and Project Support

2.1 Suggested AEEC Group and Chairman

CAN Working Group

Thomas Joseph, GE Aviation

2.2 Support for the activity (to be verified)

Airlines: **None verified**

Airframe Manufacturers: Boeing, Airbus

Suppliers: Panasonic, GE Aviation, Esterline CMC Electronics & Vector Informatik, RS Aerotech, Ltd**., Excalibur**

Others: Stock Flight Systems, Microflight

2.3 Commitment for Drafting and Meeting Participation (to be verified)

Airlines:

Airframe Manufacturers: Boeing, Airbus

Suppliers: Panasonic, GE Aviation, Esterline CMC Electronics & Vector Informatik**, Excalibur**

Others: Mentor Graphics, Stock Flight Systems, Microflight

2.4 Recommended Coordination with other groups

GAIN, NIS, SAI and SDL Subcommittees

3.0 Project Scope (why and when standard is needed)

This APIM 13-004C covers the work to be performed for the standardization of CAN Flexible Data Rate (FD). CAN FD was initially planned in APIM 13-004 but was de-scoped from ARINC 825 Supplement 3 and deferred in Supplement 4.

3.1 Description

In the time since ARINC 825 was published, there have been requests for guidance and extensions to ARINC 825. The initial interest is due to the standardization of the CAN FD protocol by SAE that was developed by Bosch. The SAE standard has been developed for the commercial CAN 2B specification. These new technologies, once specified for ARINC 825 are backward and forward compatible with ARINC 825 implementations.

CAN with Flexible Data-rate (FD). CAN FD allows for increased data-rates and/or message length to increase up to 8 times message length of an ARINC 825 message. Since speed and message length of ARINC 825 have previously been considered a limitation, the ability of to use CAN FD at the essentially the same node cost would make ARINC 825 significantly more attractive to network designers.

In addition, many aviation implementations of CAN were made prior to the ARINC 825 standard. As a result, wire level protocols were not followed and resulted in degraded operation or even bus failure. While compliance with the ARINC 825 standard, wire and higher level protocols would have avoided these issues. There were not sufficient cautions of the consequences of not complying with the guidance in ARINC 825 as well as reliance on one part of the standard.

Data Integrity is essential for reliable data exchange. Recently the FAA published AC-XX proposal, based on the Technical Report DOT/FAA/TC14-49 with resource material on Data Integrity. ARINC 825 uses CRC as Data Integrity mechanism. Arguments in this report mention ARINC 825 and should be validated in order to provide relevant information for the FAA.

Supplement 4 will be based upon the need to greatly increase the speed/bandwidth of ARINC 825 and the possibility of providing a protocol and service implementation conformance matrix that could be used by system designers, suppliers and maintainers. Such an approach has been successfully used in other shared media networks to create a common understanding of the network and to assure interoperability.

Further, this group will be able to consider gateways to other networks if this group were to identify a gateway pair to be specified. To be successful, expertise from external gateway networks would be required to participate in the development of gateway guidelines. Should this opportunity arise, this APIM would be amended with the proposed gateway terms of reference. Increasing data load will make the networks more transparent from an application point of view and limit required CPU bandwidth required.

The following benefits have been identified for ARINC 825 Supplement 4:

- Support of single network interoperability with latest CAN network protocols
- Faster software data loading to/from ARINC 664 Part 7 and CAN
- CAN to ARINC 664 Part 7 and to other CAN networks like ARINC 812 Galley Inserts
- Less need for buffering and other methods between networks of differing bandwidth and speeds
- Common Latency Methodology - Develop a standard method of computing parameter latency over multiple networks
- Develop a network bandwidth management policy similar to what is defined in a QoS policy.
- Security Issues between and among networks

3.2 Planned usage of the envisioned specification

Note: New airplane programs must be confirmed by manufacturer prior to completing this section.

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

Airbus: (aircraft & date) **Future derivative**

Boeing: (aircraft & date) **TBD**

Other: (manufacturer, aircraft & date)

Modification/retrofit requirement yes ☒ no ☐

Specify: New functions for Airbus & Boeing to be developed

Needed for airframe manufacturer or airline project yes ☒ no ☐

Airbus future derivative

Mandate/regulatory requirement yes ☐ no ☒

Program and date: (program & date)

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

Specify Enhance and extend ARINC Standards

When is the ARINC standard required? **End of** 2017

What is driving this date? Incorporation of new technologies such as CAN FD in a standard rather than an ad-hoc implementation

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

If NO please specify solution:

Are Patent(s) involved? yes ☐ no ☒

If YES please describe, identify patent holder: _____

3.3 Issues to be worked

Supplement 4 will include definition of the following:

- CAN with Flexible Data-Rate (FD)
- Timing, Bandwidth Management, Latency, and Jitter
  - Timing Model - Develop a bus leveling metric and calculation method for end to end latency building on ARINC 825
- Common latencies
  - Common latency methodology - Develop a standard method of computing parameter or signal latency over the network and networks end to end
- Wire level protocols (physical layer parameters)
- Safety, reliability and failure analysis - Develop the guidelines in these areas based on topics covered in ARINC 825
- Protocol and service implementation conformance matrix
- CAN Security - Document characteristics that may affect higher level system security
- System and Network Interoperability
  - Interfacing to other networks
  - ARINC 429 Interfaces
  - ARINC 664 Ethernet, Part 7 conversions
  - Possible external gateway networks

- Set forth requirements to include ICD functionality

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: GE Aviation, Panasonic, UTC Aerospace, Stock Flight Systems, Vector Informatik

4.2 Specific project benefits (Describe overall project benefits.)

ARINC 825-1 and ARINC 825-2 provided a basis for the implementation of CAN in aviation. ARINC 825-3 provided the technical updates to support Boeing 777X.

ARINC 825-4 will standardize the CAN FD technologies prior to implementation in industry. This will enhance the long-term usability of ARINC 825 by providing guidance and standardization for inter-operation of networks at the interface specification level and extend the specification to emergent technologies.

4.2.1 Benefits for Airlines

Airlines and other maintainers of aircraft infrastructure will benefit by being able to learn a single set of specifications for implementations resulting in reduced training, increased productivity resulting from the predictability of the bus, and increased reliability and speed of the bus.

4.2.2 Benefits for Airframe Manufacturers

Designers of aircraft sub-systems will benefit from this update as it will provide more assurance that CAN will perform in a predictable manner. The design guidance will assure consistent and workable bus implementations. The speed and/or message length will reduce complexity and cost.

4.2.3 Benefits for Avionics Equipment Suppliers

Equipment suppliers will have high assurance that parts and protocols compliant to ARINC 825-4 will perform as expected when connected into sub-system and system assemblies such as CAN and other related networks at significantly higher speeds and/or message lengths.

5.0 Documents to be Produced and Date of Expected Result

Supplement 4 to ARINC Specification 825, **December** 2017

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 825	~~8~~ **6**	~~24~~ **12**	**February 2016**	**April 2018**

In addition to the proposed meetings identified above, the CAN Working Group will have virtual meetings between physical meetings in order to accelerate development of the standard and ensure on-time release of the proposed Supplement 4.

6.0 Comments

None.

6.1 Expiration Date for the APIM

April 2018

Completed forms should be submitted to the AEEC Executive Secretary.