ARINC Project Initiation/Modification (APIM)

1.0 Name of Proposed Project APIM 13-007

Software Data Loading Specification Requirements for the Avionics Shop Environment.

1.1 Name of Originator and/or Organization

Ted Patmore, Delta Air Lines

2.0 Subcommittee Assignment and Project Support

2.1 Suggested AEEC Group and Chairman

Software Data Loading (SDL) Subcommittee

Ted Patmore Delta Air Lines

Rod Gates American Airlines

2.2 Support for the activity (as verified)

Airlines:

American Airlines

Delta Air Lines

Airframe Manufacturers:

Airbus

Boeing

Suppliers:

Aero Instruments
Auvation
Cascade Engineering
Honeywell International
SAGEM
Teledyne Controls
TechSAT

Others: TBD

2.3 Commitment for Drafting and Meeting Participation (as verified)

Airlines: Delta Air Airlines

Airframe Manufacturers: Boeing, Airbus

Suppliers: See above (Section 2.2)

Others: TBD

2.4 Recommended Coordination with other groups

AMC Working Groups concerned with avionics maintenance

3.0 **Project Scope** (why and when standard is needed)

With the advent of networked avionics systems integrated into aircraft (such as those that use the AFDX bus), it has become apparent that many of the avionics units cannot be loaded independent of the aircraft network. Therefore, they

cannot be loaded in the avionics shop environment. For newer e-enabled (network centric) aircraft (e.g. B787, A380, A350), the aircraft system was designed to have field loadable software (FLS) loaded at a central network point aboard the aircraft. A published data loading protocol standard, such as ARINC 615A may be used to load data at the aircraft central load point. However, the LRU itself uses a different protocol within the network to load data. This aircraft intranet data loading communication may take place between an on-board gateway server and an LRU. There are no published open standards that describe this LRU specific data loading specification.

For LRUs that are software loadable, avionics shop CMM maintenance procedures and return to service testing usually requires the ability to load data during testing, and in preparation for service after testing.

This proposed document will create guidance for LRU/SRU OEMs to supply technical information necessary to develop a data load solution to be used in the avionics shop (off aircraft) environment. The information for each LRU should be made available to airlines, and 3rd party test equipment suppliers that need to develop data loading elements of compliant component test solutions.

The capability of loading an LRU in the shop is important for airlines and MRO's because of the following:

- Test software is often required to be loaded as part of performing the return to service test of the LRU in the shop.
- The shop must have the capability to load software if the LRU resident software is corrupted or missing.
- Correct operational software should be loaded into the LRU before it is returned to the airline's organization spare component stock.
    - Pre-loading LRU software in the shop is to save installation time at the operator line station if possible.

The need for this guidance document is driven by the following:

- It has become apparent that in many cases, LRU specific data loading technical requirements are not currently published to enable the development of shop data loading equipment.
- Without the LRU specific data load specification, an aircraft network environment would need to be created as part of the shop test equipment.
- Using expensive aircraft network components, such as gateways and switches for shop test equipment, will be expensive and cost prohibitive.
- Diagnostics of the data load process may need to be performed at the LRU level.
- Customers should have the right to develop a data load solution on the customer's chosen equipment as an alternative to purchasing supplier produced equipment.

This guidance will be needed as soon as possible since e-enabled aircraft are already in operation. Operators and MRO's will need the ability to service these LRUs at the shop level within their organization.

The scope of the guidance in this document should also apply to any Software Loadable LRU that does not conform to a published data loading standard (such as ARINC 615 or ARINC 615A), even if it does not function as part of an e-enabled aircraft network.

For future aircraft equipment using loadable software, the document will include recommendations for future LRU design considerations for off-aircraft data loading.

3.1 Description

Until now, data loading of aircraft LRUs has been accomplished using equipment that confirms to ARINC standards such as ARINC 615. These standards use point to point protocols that function between the data loading equipment and the LRU. The data load function remains the same for the LRU weather it is installed on the aircraft, or in the avionics shop (off aircraft) environment.

However, LRUs that are installed on newer e-enabled (network-centric) aircraft often do not load directly from the data loading equipment. For these aircraft, the data loading equipment interfaces to the aircraft's network central load access point. The data load communication occurs between the data load equipment and the aircraft network system that is responsible for distributing the data to its intended load targets (LRU's). For example, a particular LRU data loading process may occur between an aircraft gateway device and the LRU using a protocol that is not the same as the protocol used by the data load equipment.

Many of the avionics LRUs for e-enabled (network-centric) aircraft are designed to be loaded while installed on the aircraft as part of the network in which they function. The project goal is to define a set of data loading technical specifications requirements that should be supplied by the OEM for all of the software loadable avionics components that they provide for operator aircraft. These technical specifications should clearly define data loading specifications at the LRU level. This information will allow for development of a data loading solutions used to load network centric avionics components in the shop and independent of the aircraft network. Documentation of the LRU data load specification will be required to develop LRU software loading solutions for the avionics shop environment.

These specifications will also be required for any Software Loadable LRU that does not conform to a published data loading standard (such as ARINC 615 or ARINC 615A), even if it does not function as part of an e-enable aircraft network.

3.2 Planned usage of the envisioned specification

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

Use the following symbol to check yes or no below. ☒

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

Modification/retrofit requirement yes ❑ no ☒

Needed for airframe manufacturer or airline project yes ☒ no ❑

Specify: Airlines need for organic shop loading

Mandate/regulatory requirement yes ❑ no ☒

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

When is the ARINC Standard required?
_____(TBD)_____

What is driving this date? _____(state reason)_____

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

- Define data loading at the aircraft network level.
- Define data loading at the LRU level.
- List and describe all attributes that define a complete data loading standard for an LRU.
    - List and describe all hardware attributes
        - Connections to the LRU
            - Published connector standards
        - Published standard of the physical layer bus used
        - Description of physical layer bus (when not fully defined by a currently published standard)
        - Cable specifications (including discretes and communication buses).
        - Discrete signal requirements and characteristics
        - All LRU Hardware state requirements to enable data loading
    - List and describe all Software Attributes
        - Communications protocol description requirements
        - IP addressing (if used) requirements
        - All LRU Software state requirements to enable data loading
    - Processes and regulatory issues
        - Guidance to create processes for checking integrity of shop data load function.
        - Guidance to create processes that comply with regulatory issues regarding the process of data loading LSAPs in the shop environment.
        - Integrity and validation assurance level must match that established for on-wing LSAP data loading. The LRU must have a complete load that matches that required for aircraft installation.

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 ❑

Specify: Interface for test bench and shop loading provisions and data loading protocol

Product offered by more than one supplier yes ☒ no ❑

Identify: All LRU OEMs (e.g., Boeing, Airbus, Thales, Honeywell, Rockwell Collins, Hamilton Sundstrand, Teledyne, etc.)

4.2 Specific project benefits (Describe overall project benefits.)

4.2.1 Benefits for Airlines

Airlines will benefit by having the ability to load LRUs, including those that are used in e-enabled aircraft networks, in the shop environment. This capability is required by avionics shops to be able to perform maintenance and troubleshooting on software loadable LRUs.

Although, the aircraft central point data loading network could be simulated to create an aircraft environment, it would not be practical or cost effective to require all of the aircraft network components (gateways, routers, switches, etc.) for a shop test setup, because these are very expensive aircraft parts. This setup would not be cost effective for the airlines.

Specifying a standard way for OEMs to publish LRU data load technical information as an open standard will make it possible to have multiple test equipment and ATE manufacturers supply test solutions to the airlines. Also possible is in-house development of data load solutions within the Airlines.

4.2.2 Benefits for Airframe Manufacturers

By supplying technical information format guidance, as proposed by this document application, the airframe manufacturers will be able to offer their customers a more robust maintenance plan for aircraft and aircraft avionics components. This component maintenance guidance document will foster a greater state of involvement and awareness of LRU data loading requirements by all aircraft maintenance stakeholders, including airframe manufacturers. They will understand that operators will need options for obtaining this capability.

4.2.3 Benefits for Avionics Equipment Suppliers

By supplying technical information format guidance, as proposed by this document project application, the suppliers of avionics components will understand better what is required by their customers to make their product shop loadable and thus maintainable. This can save the OEM time and effort in the

long run by including shop data loading issues as part of the engineering development cycle of a product. The OEM will not have to re-engineer, or add support documentation the product later when it becomes apparent that shop loading, without an aircraft network, is a necessary part of the component's maintainability, and the operators will need options for obtaining this capability.

5.0 Documents to be Produced and Date of Expected Result

ARINC Project Paper 8XX: *Software Data Loading Specification Requirements for the Avionics Shop Environment*

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
ARINC Project Paper 8XX: *Software Data Loading Specification Requirements for the Avionics Shop Environment*	*3 four-day meetings per year (See notes)*	*24 (2 year total)*	*5/2013*	*5/2015*

Notes: 1. Additional web conferences will be organized on an "as needed' basis.

2. Meeting schedule includes existing work of the SDL Subcommittee Projects (APIMs 08-005, 10-008A, 10-016A, 11-008)

3. All projects are worked concurrently

The ARINC Industry Activities staff will support all meetings and facilitate web/teleconferences as needed as scheduling permits.

6.0 Comments

The SDL Subcommittee meets 3 times a year, 3-4 days each meeting. Projects are worked concurrently under the direction of individual industry editors. Strawman and draft documents are modified between meetings, and each project is reviewed at each meeting for comment, input, and modification.

6.1 Expiration Date for this APIM

April 2015

For IA staff use only

Date Received: IA staff : _____

Potential impact: _____

*(**A**. Safety **B**. Regulatory **C**. New aircraft/system **D**. Other)*

Resolution: _____

Authorized, Deferred, Withdrawn, More Detail Needed, Rejected)

Assigned to SC/WG:_____

Submit completed form to the AEEC Executive Secretary.