ARINC IA Project Initiation/Modification (APIM)

Name of proposed project **APIM #: 05-004**

Supplement to **ARINC Report 666:** *Electronic Distribution of Software*

Suggested Subcommittee assignment

Future Concepts for Maintenance Subcommittee

Project Scope

This project will rework the ARINC specification for electronic distribution of airplane loadable software parts (666). The effort will:

- Correct problems within original specifications
- Resolve conflicts with emerging, preferred media-less operations
- Incorporate Standards for Digital Signatures and Web Services
- Set the stage for enhanced airplane software delivery, load and management

Suggested updates to ARINC Report 666, although driven by interests and designs of newer airplane programs, will accommodate both new current airplane programs. The initial report served well to build interest and justification for media-less distribution of Airplane software. However, current specifications do not align with contemporary and future industry needs. Industry level attention to refine ARNC 666 is intended to bring Electronic Distribution of Software (EDS) into reality.

Project Benefit

Since ARINC Report 666 was released, the infrastructure for electronic commerce among business partners has evolved from a fairly expensive custom solution between specific partners, to a relatively affordable set of solutions involving multiple partners. The World Wide Web Consortium (W3C) has released standards governing much of this infrastructure.

General e-commerce solutions include Commercial Off –The –Shelf (COTS) software products from multiple, reputable vendors. As well, “open source” options offer free components of some solutions. While advancement of e-commerce infrastructure and tools continues, driven by commercial marketplace forces, the industry offers sufficient discipline to control electronic distribution of loadable airplane software parts. The aviation industry has a unique opportunity to take advantage of the e-commerce technologies now available.

Expected benefits from applying these include:

- Interoperability
  Application of the W3C “web services” architecture standard will

enable interoperability among partners using different computing platforms or different computing languages. Airlines will have option of COTS or internally developed application to manage software parts and airplane loads. Such management will include receiving a secure authenticated part, archiving it, and routing the part strategically to its fleet for timely loads as initiated by airline technicians.

- IP Protection
  Use of W3C “extensible markup language” (XML) to package loadable software parts or airplane configuration data, allows use of W3C SOAP standard messaging protocol, available with the web services COTS. Electronic distribution of software will assure message integrity with the SOAP digital signature standard, and will provide for encryption of message content during transfer to protect intellectual property rights.

- Package Validity
  W3C XML “schemas” may specify the format and data requirements for all packages and package contents associated with electronic distribution of software. COTS will be able to validate all items against their official specifications. Airlines will have confidence that the packages and data are valid before applying them. Using XML schemas allow for future growth or changes in airline and industry requirements.

- Equipment Independence
  Loadable software parts defined in XML allows part definition to be independent of computing platform, media type, and operating system file structure. This enables long-term retention of the long-lived parts. Airlines, airframers, and suppliers will not have to change the XML definitions of parts as storage equipment grows obsolete, replaced with next generation products and platforms.

- Part Longevity
  Packages, parts, and other assets electronically distributed, if signed according to the W3C XML signature standard, will have the integrity of the package and contents, ensured. Digital signatures use strong cryptography that employs public/private-key pairs, and certificate authorities to bind the public keys to their business entity owners. Independent of how the package was delivered to an airline (secure data link or on a CD), the airline will always be able to verify that the package has not been altered in any way and that it came from the expected airframer or supplier. If an airline places the part in storage the part can be verified, that it has not been altered. The airline will be able to tell the part definition has not “gone bad” after being stored 20 years on a hard drive, without having to convert the part to binary file form, run CRC checks or

attempt to load it.

Collectively, these W3C technologies permit airlines to automate more of their processes for managing loadable software parts. An airplane may be equipped with onboard maintenance functions to receive electronically distributed software, enabling a technician, to remotely:

- Interrogate airplane configuration
- Prepare configuration update
- Send updated airplane software parts for planned load

Each step can be secured to ensure airplane software configuration is complete without corruption.

Airlines supporting effort

Proposed chairman: Rod Gates, American Airlines
Lead airline: American Airlines
Airlines expressing interest:
American Airlines (Rod Gates)
Delta Airlines (Charles Harkey)
United Airlines (Krista Dial)
UPS (Greg Kuehl)

List of airlines expressing interest but unable to support: (TBD)

Boeing will be supporting this effort, as well as the following avionics vendors:

Honeywell, Hamilton Sundstrand, Rockwell Collins

Airbus has also expressed concurrence with updating ARINC 666

Additionally, COTS vendors are expected to take interest in this effort.

Issues to be worked

This revision of ARINC 666 will address the following issues:

- Definition of XML schemas for signed “crates,” signed loadable software parts, signed loadable software transport media parts, and signed “assets” for the files identified in sections 3.1.3 through 3.1.8 and 4.1.3 through 4.1.9 of ARINC Report 666.
- Definition of XML schemas for basic management of loadable software parts on an airplane, including actual configuration report, authorized configuration report, and authorized push configuration reports.

- Determination of whether ARINC or airframe manufacturers will host the W3C XML “namespace” for the electronic distribution of software schemas.
- Agreement on configuration management practices for these schemas.
- Identification of additional elements for future consideration, with plans to develop and incorporate them on an incremental basis.

Recommended Coordination with other groups

The revised ARINC Report 666 should be coordinated with:

- Software Data Loading (SDL) Subcommittee
- Electronic Data Security (EDS) Subcommittee
- Aircraft Data Network (ARINC 664) Subcommittee
- Navigation Database Subcommittee
- Digital Certification Subcommittee

Projects/programs supported by work

The Boeing intends to discontinue use of physical media, due to cyclic obsolescence of the media and support equipment. Accordingly, Boeing has launched an internal project “Boeing Electronic Distribution of Software” (BEDS), to support production and delivery of the 7E7 airplane as well as current production airplanes. BEDS is Boeing’s implementation of ARINC Report 666.

BEDS, although designed for general use within Boeing, will continue to support older airplanes production program with “physical media” to meet requirements, of airlines unprepared to interface with BEDS. Physical Media distribution will also be supported for supplying “spare” copies of Loadable Software parts, as requested. Suppliers are expected to be eager partners in a media-less supply chain for loadable software parts. General design and specifications have been considered for BEDS and targeted to align with parallel efforts within AIRBUS. The specification recorded in ARINC 666 should complement and stabilize project developments within Boeing, AIRBUS, and associated partners, as well as accommodate emerging industry trends in technology.
Timetable for projects/programs.

Boeing will provide a preliminary draft of the revision of ARINC 666 - 5/2005. . This draft will be reinforced by preliminary findings of the BEDS developments, including “proof-of-concept” test reports.
General industry contribution and agreement requested -10/2005.
Boeing targets incorporation of BEDS based processes in production operations for existing airplane programs, early 2006.

The 7E7 program intends to introduce BEDS to airline customer in the second half of 2006.

The new ARINC standard will be needed, in final form, 6/2006. It is hoped to be approved at the 10/2006 general meeting.

Documents to be produced and date of expected result

ARINC Report 666 on 6/2006

Comments

In support of Airlines, and business partners, to accommodate this schedule, Boeing encourages and will support close industry collaboration in establishing design and conventions for “media-less” environment. Support tools are expected to be found appropriate. The design of these tools should respect industry level interests to facilitate adoption of emerging technologies and resources (equipment).

Meetings

The following table identifies the number of meetings and proposed meeting days needed to produce the documents described above. It is likely that as this activity progresses, additional elements will be identified for future consideration. These would result in additional appendices to be developed after the 6/2006 revision has been completed.

Activity	Mtgs	Mtg-Days
Electronic Distribution of Software	6	18 (3 Days each Mtg.)

For IA staff use

Date Received 01/18/05 IA staff assigned: Roger Goldberg_____

Potential impact: B, C
(A. Safety B. Regulatory C. New aircraft/system D. Other)

Forward to committee(s) (AEEC, AMC, FSEMC): AMC____ Date Forward: 01/26/05

Committee resolution: 1____
(0. Withdrawn 1. Authorized 2. Deferred 3. More detail needed 4. Rejected)

Assigned Priority: B____ Date of Resolution: 02/02/05

A. – High (execute first) B. – Normal (may be deferred for A.)

Assigned to SC/WG FCM Subcomittee