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Together "We Set the Standard."

To	IPS Subcommittee	**Date**	July 15, 2020
From	P. J. Prisaznuk AEEC Executive Secretary pjp@sae-itc.org tel +1-443-254-0528	**Reference**	20-068/IPS-018 lth

Subject

Meeting Report
Internet Protocol Suite (IPS) Subcommittee
June 23-29, 2020

Summary

ARINC Industry Activities hosted meetings that took place June 23, 24, 29, 2020 as online sessions. June 25 and June 30 were reserved for meetings of EUROCAE WG-108 and RTCA SC-223.

The IPS Subcommittee reviewed inputs to **ARINC Project Paper 858:** *Internet Protocol Suite (IPS) for Aeronautical Safety Services – Technical Requirements.*

Airbus provided a new input on Cryptographic Key Management that was generally supported for inclusion in Section 4.0, Security.

Airtel ATN provided a new Appendix C, Ground IPS Gateway Considerations. The objective of this Appendix is to describe the key functions and services that an IPS ground system needs to provide to support all types of aircraft.

Honeywell is maintaining the ATN/IPS Task List and Gap Analysis. The document is posted to:

https://www.aviation-ia.com/activities/internet-protocol-suite-ips-aeronautical-safety-services.

The next meeting is scheduled for September 22-24, 2020. The meeting format will be similar to recent IPS Subcommittee meetings, namely a series of online sessions. Joint meeting time with EUROCAE WG-108 and RTCA SC-223 will be scheduled as the need arises.

Comments and Inquiries

Comments and questions on this report may be directed to Paul Prisaznuk, AEEC Executive Secretary and Program Director.

cc

AGCS, DLK, NIS, SAI

Meeting Report
IPS Subcommittee Meeting
June 23-29, 2020

IPS Subcommittee Meets Online

ARINC Industry Activities hosted the Internet Protocol Suite (IPS) Subcommittee meeting. The purpose of the meeting was to review inputs to **ARINC Project Paper 858** defining an Internet Protocol Suite (IPS) for the Aeronautical Telecommunications Network (ATN). This activity is authorized by APIM 15-004A.

Greg Saccone, Boeing, served as the American co-chair. Luc Emberger, Airbus, served as the European co-chair.

The IPS meeting agenda was accepted as presented. The agenda is reproduced as Attachment 1 to this report. The introduction is reproduced as Attachment 2 to this report.

Policies on Intellectual Property and the Development of ARINC Standards

Paul Prisaznuk, ARINC Industry Activities, provided an overview of the Policies on Intellectual Property (IP) and The Development of ARINC Standards.

He noted that by signing the attendance book at an ARINC IA meeting or by submitting material for consideration at the meeting, individuals confirm that they understand the policies and agree to comply with the same.

Copies of these policies are available on the ARINC IA website (*https://www.aviation-ia.com/activities/aeec*).

Related Presentations and Reports

The IPS Subcommittee received reports from several representatives that are involved in planning the transition to ATN/IPS services.

ICAO Role

Greg Saccone summarized ICAO activities pertinent to ATN/IPS. Greg reported that ICAO Document 9896 is the starting point for ATN/IPS development activities. Edition 3 will include new material defining IPS Addressing, IPS Mobility, and IPS Security. ICAO SARPS are expected to emerge in November 2022.

On the security front, ICAO is preparing three additional documents for ATN/IPS:

- **ICAO Doc 10090:** *Manual of Security Services for Aeronautical Communications*
- **ICAO Doc 10094:** *Manual of the Aeronautical Telecommunication Network (ATN) Secure Dialogue Service (SDS)*
- **ICAO Doc 10095:** *Manual of Public Key Infrastructure (PKI) Policy for Aeronautical Communications*

The IPS Subcommittee supported the need for continued coordination with ICAO.

RTCA and EUROCAE Role

Aloke Roy, Honeywell, and Stephane Pelleschi, Collins Aerospace, provide a summary report of joint RTCA SC-223 and EUROCAE WG-108 activities. These activities are responsible for the definition of ATN/IPS profiles and the definition

of Minimum Aviation Performance Standard (MASPS) for ATN/IPS. The current focus of RTCA SC-223/WG-108 activity is the preparation of ATN/IPS MASPS by the end of 2020. AEEC IPS Subcommittee participants were invited to joint drafting sessions held on June 24, 25, 30, 2020.

IPS Terminology

Mike Olive, Honeywell, reported that IPS Terminology has been coordinated in dedicated meetings involving representatives of ICAO WG-I, EUROCAE WG-108, RTCA SC-223 and AEEC's IPS Subcommittee. The IPS Terminology is reflected in Attachment 2 to ARINC Project Paper 858, Glossary.

ARINC Project Paper 858 – IPS Technical Requirements

Mike Olive, Honeywell, introduced the latest draft of **ARINC Project Paper 858:** *Internet Protocol Suite (IPS) for Aeronautical Safety Services – Technical Requirements Document.* Mike serves as the Industry Editor and contributor of technical content. The document is organized as follows:

1.0 Introduction
2.0 ATN/IPS Overall Architecture
3.0 Airborne IPS System Architecture
4.0 Security
5.0 Airborne Implementation Options
6.0 Airborne Application Data Considerations
Attachment 1 – List Of Acronyms
Attachment 2 – Glossary
Attachment 3 – ACARS to IPS Dialogue Service Convergence Function
Attachment 4 – Air-Ground IPS Management Messages
Appendix A – ATNPKT Message Format Examples
Appendix B – IPS Protocol Build-up
Appendix C – IPS Ground Architecture Considerations

Strawman materials were posted to the AEEC SharePoint site prior to the meeting. Each section of the document was discussed with key points summarized below.

Section 1.0 – Introduction

Section 1.0, Introduction, describes the overall organization and content of ARINC Project Paper 858. Mike Olive reported that this section is stable. The IPS Subcommittee expressed support for Section 1.0.

Section 2.0 – Overall IPS System Architecture

Section 2.0, Overall IPS System Architecture, describes the overall aviation data comm infrastructure. This includes air, ground, and space communications. The major subsections are as follows:

2.1 System Overview
2.2 IPS System Functions
2.3 IPS Protocol Architecture
2.4 IPS Deployment
2.5 Assumptions and Constraints

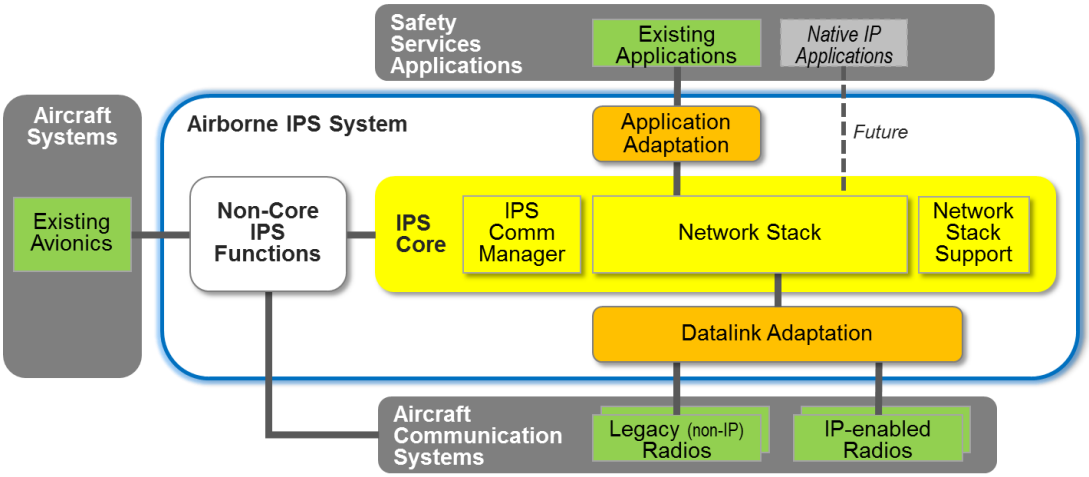
Mike Olive reported this section is stable. The IPS Subcommittee expressed support for the content of Section 2.0.

Section 3.0 – Airborne IPS System Architecture

The IPS Subcommittee reviewed Section 3.0, Airborne IPS System Architecture. The major section topics are as follows:

3.1 Introduction
3.2 Core IPS – Application Adaptation
3.3 Core IPS Functions
3.4 Core IPS – Datalink Adaptation
3.5 Non-Core IPS Functions
3.6 Airborne IPS System Interfaces
3.7 Core IPS Performance Requirements

Section 3.0 describes the airborne IPS system architecture, interfaces, and its relationship to applications and equipment. The protocols to be used among and between functions are being defined. The IPS Subcommittee supported the high-level IPS system context diagram as shown below:



Addressing requirements and mobility requirements were discussed at length. IPv6 addressing is expected to be used in all ATN/IPS communication. Because some of the core functions are expected to be defined by other standards bodies, they will be described by the appropriate reference to the applicable standard. The remaining core functions are expected to be defined in ARINC Project Paper 858.

Frequentis provided comments within the draft that were discussed, resolved, and will appear in the next draft of ARINC Project Paper 858. This topic will be discussed further at the next meeting.

Section 4.0 – Airborne IPS System Security

The IPS Subcommittee reviewed Section 4.0, Airborne IPS System Security. This section describes the security scope for the airborne ATN/IPS router by identifying its security perimeter and the security environment. This section focusses on the security measures only for the core IPS system within the avionics systems environment.

The content of this section is being developed with careful consideration of the guidance provided by ICAO WG-1 Security Subgroup, RTCA SC-223, and EUROCAE WG-108. The organization of Section 4.0 is as follows:

4.1 Introduction
4.2 Security Architecture Overview

4.3 System Security Mechanisms

4.4 Security Support Functions

4.5 Secure Design and Implementation Guidance

It is widely recognized that the IPS system will need to support multiple security sessions simultaneously for ATS and AOC applications. This will involve security sessions necessary for establishing a connection and additional security required for handovers during the flight. Datagram Transport Layer Security (DTLS) will require multiple security session exchanges. ICAO WG-I Security Subgroup is in the process of defining DTLS requirements. DTLS overhead is viewed to be a concern. A Message Integrity Check (MIC) is recommended for every DTLS session. The MIC will need to be fully standardized to avoid interoperability issues.

Section 4.3.1.3, Message Integrity Check (MIC) Generation, was discussed at length. The IPS Subcommittee expressed the view that the material presently included in this section is out of place. It should reside with DTLS guidance. This section was marked for future removal from the document at such time that it is placed in the appropriate industry standards document.

Section 4.4.1, Cryptographic Key Management, was discussed at length. Timo Warns, Airbus, provided a significant input that completely revises this section and provides content for its subordinate sections. Timo suggested two approaches for the key management function. The airborne IPS system can implement the function locally for its own purposes, or it can leverage a centralized key management function that is made available for use by multiple on-aircraft systems. The local key management function is described in detail in Section 4.4.1.1. The centralized key management function is described in Section 4.4.1.2. Guidance on security data logging is also provided. The Airbus inputs was accepted for inclusion in ARINC Project Paper 858.

The Airbus presentation on Cryptographic Key Management is reproduced as Attachment 3 to this report.

Security configuration management was discussed. The content of Section 4.4.3 was viewed to be repetitive with Section 3.5.4, both of which address security configuration management. Text from this section was moved to Section 3.5.4.

The IPS Subcommittee recognized that IPS security needs to be fully aired within ICAO, EUROCAE, and RTCA fora. ICAO was widely viewed as the authoritative document for IPS security requirements.

Section 5.0 – Airborne IPS System Implementation Options

The IPS Subcommittee reviewed Section 5.0, ATN/IPS Airborne Implementation Options and Radio Interfaces. This section is expected to provide design guidelines for new aircraft in development and aircraft presently in service. The IPS Subcommittee recognized a wide range of hardware architectures for hosting ATN/IPS services some of which are presently installed on aircraft in service. The top-level outline is as follows:

5.1 Overview and Assumptions

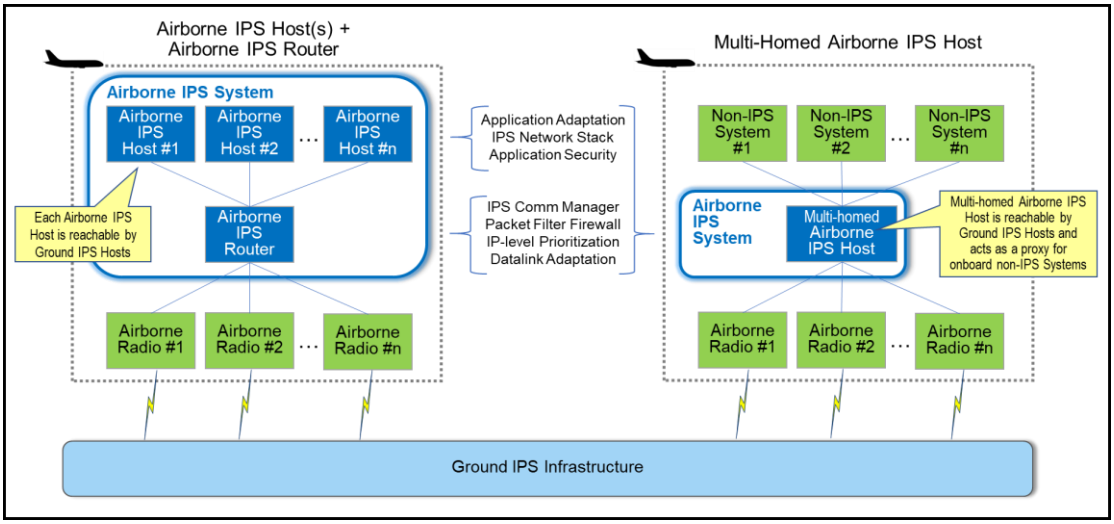
5.2 Implementation Examples

5.3 Interface Considerations

5.4 Dual-Stack Considerations

5.5 Airborne IPS Router versus Multi-homed Airborne IPS Host Considerations

Section 5.5 is a new section that was added to provide guidance on IPS Hosts and IPS Routers. A new Figure 5-10 was introduced as follows:



This material was supported. Section 5.0 will be discussed further at the next meeting.

Section 6.0 – Airborne Application Data Considerations

Section 6.0 – Airborne Application Data Considerations, describes the following:

6.1 B1/B2
6.2 FANS-1/A
6.3 Other ACARS Messages
6.4 AOC Applications (non-ACARS)
6.5 Future Safety Services Applications

One of the basic goals of the application interface is to support the use of existing applications over IPS without requiring changes to those applications. This offers the benefit of not changing end systems on the aircraft, and it facilitates commonality and reuse of existing procedures. The IPS Subcommittee expressed support for this section.

Attachment 1 – List of Acronyms

The acronym list from ARINC Report 658 is harmonized with the list jointly discussed and produced with ICAO Working Group I. There were no comments on this attachment.

Attachment 2 – Glossary

The glossary from ARINC Report 658 is harmonized with the terminology jointly discussed and produced with ICAO Working Group I. There were no comments on this attachment.

Attachment 3 – ACARS to IPS Dialogue Service Convergence Function

Legacy ACARS protocols are expected to be used in the ATN/IPS infrastructure. This attachment specifies the ACARS to IPS Dialogue Service Convergence Function (AICF), including its interfaces and functional elements. The AICF adapts ACARS applications to the IPS Dialogue Service (IPS DS), which provides a mechanism for exchanging application messages over the IPS communications infrastructure. Airbus provided comments to clarify the language in this attachment that were generally supported for inclusion in the draft.

Attachment 4 – Air-Ground IPS Management Messages

This attachment specifies the air-ground management messages to be exchanged between the air and ground after a secure session is established. These messages, which must be implemented by both the air and ground IPS peers, support remote key management and provide information necessary for proper operation of ground-based IPS Transition Gateways. There were no comments on this attachment.

Appendix A – ATNPKT Message Format Examples

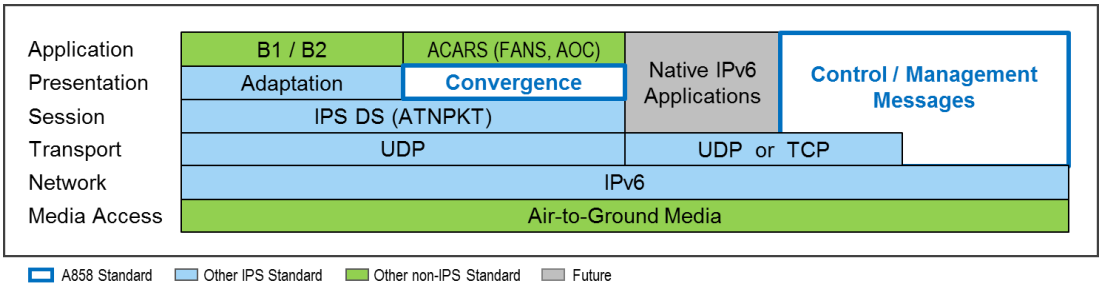
Appendix A provides information pertinent to the use of ATN Packets (ATNPKT) specified by ICAO Doc 9896. The IPS Dialogue Service (IPS DS) uses the ATNPKT message format to convey information between peer airborne and ground IPS DS entities. The airborne entity is defined by ARINC Project Paper 858. The ground entity may be a Ground IPS Host or an IPS Gateway, described further in Appendix C to ARINC Project Paper 858.

There were no comments on this appendix. Future changes are dependent on ICAO WG-I amendment proposals.

Appendix B – IPS Protocol Build-Up

This appendix provides a top-level overview of the IPS protocol build-up from one stack layer to another. This material is provided as general guidance for implementers of both airborne and ground IPS systems.

The IPS stack is shown below:



IPS Protocol Stack Overview

Appendix B provides detail for three classes of messages:

- Session Establishment Messages (Section B-2)
- IPS Management Messages (Section B-3)
- Application Messages (Section B-4)

There were no comments on this appendix. Future changes are dependent on ICAO WG-I Security Subgroup decisions on DTLS and MIC.

Appendix C – Ground IPS Architecture Considerations

Ground IPS Architecture Considerations were discussed at length. The idea is to place the complexity within the IPS ground system and minimize the level of complexity on the aircraft. This should also reduce the frequency of changes to the aircraft.

Fryd Wrobel, Airtel ATN, presented a proposal to update to Appendix C for discussion. He reported that the current title, “Ground IPS System Architecture Considerations,” does not match the current scope, Ground IPS Gateway Air-Ground Interoperability Considerations

Fryd proposed a new scope that would include the description of essential IPS ground services (e.g., name resolution, authentication/security services, mobility services, etc.) and potential deployment of these ground services, presented from the perspective of the Airborne IPS System. Then, a description of IPS Gateway functionality can follow.

He added that if the agreed scope will include IPS Gateways, then it will be necessary to describe the context and functions of the IPS Gateways before providing detailed guidance. He suggested the following high-level concepts as a starting point:

- IPS Gateways provide network level translation (e.g., IPS to OSI) and not application level translation(e.g., ATN/IPS to FANS/ACARS).
- An IPS Gateway must present itself as an IPS Host (i.e., a native IPS Host cannot distinguish an IPS Gateway from another native IPS Host).
- When facing other networking technologies, an IPS Gateway acts as a transparent proxy for the applications and must distribute network reachability information in the given network domain.

Fryd proposed a new outline for Appendix C as follows:

- Introduction
- Aircraft Configurations and Datalink Applications
- IPS Gateway Overview
- Gateways between IPS and ACARS
  - Principle of operation
  - Mapping of A620 Messages to AICF Interface
  - Example scenarios
- Gateways between IPS and OSI
  - Principle of operation
  - Advertisement of Proxy Addresses
  - Application Messages Forwarding
  - Special Consideration for CM application
  - Example scenarios

The IPS Subcommittee supported the need to reorganize Appendix C. However, it would like to see new material for review, discussion, and acceptance before removing the current Appendix C from the document.

A temporary note was added to Appendix C stating that the material is undergoing reorganization and content revisions. A revised input from Airtel ATN is expected for review at a future meeting.

The Airtel ATN presentation is reproduced as Attachment 4 to this report.

ATN/IPS Tasks and Gap Analysis

Mike Olive is maintaining the ATN/IPS Task List and Gap Analysis coordinated with Standards Development Organizations (SDOs). This document is posted to the IPS web pages, *https://www.aviation-ia.com/activities/internet-protocol-suite-ips-aeronautical-safety-services.*

After a brief discussion, the IPS Subcommittee yielded to the IPS Leadership Group, comprised of chairs of the respective AEEC, EUROCAE, ICAO, and RTCA technical groups. An updated Roadmap and Gaps Analysis document will be presented at the next meeting.

Future Work Program

The next meeting is scheduled for September 22-24, 2020. The meeting format will be a series of online sessions.

A mature draft of ARINC Project Paper 858 is expected to emerge in late 2020 or early 2021. The goal is to present the document to the AEEC Executive Committee for adoption consideration in May 2021.

Comments and questions on ATN/IPS activities should be directed to Paul Prisaznuk, AEEC Executive Secretary and Program Director, (*pjp@sae-itc.org*).

Attendees

Abdo, Kanaan	ALTYS Technologies
Acar, Guray	ESA ESTEC
Bauge, Timothy	Thales
Bharj, Danny	Inmarsat
Chen, Angela	MITRE Corporation
D'humieres, Francois	Frequentis AG
Dlouhy, Ron	Collins Aerospace
Emberger, Luc	Airbus
Gandolfi, Catherine	European Aviation Safety Agency
Graefe, Jonathan	Collins Aerospace
Haindl, Bernard	Frequentis AG
Henzl, Martin	Honeywell, Inc.
Jain, Ravi	Federal Aviation Administration
Jasiukajc, Zbigniew	SITAONAIR
Juergens, Tyler	Gulfstream Aerospace Corporation
Kilbourne, Todd	Mosaic ATM
Ladron, Daniel	The Boeing Company
Leonardon, Laurent	Collins Aerospace
Maiolla, Vaugh	ICAO
Mcparland, Tom	Basic Commerce And Industries, Inc.
Morrison, Rebecca	RTCA, Inc.
Muraca, Peter	Federal Aviation Administration
Niraula, Madhu	Collins Aerospace
Olive, Michael	Honeywell, Inc.
Pasupathy, Ganesh	American Airlines
Pelleschi, Stephane	Collins Aerospace
Phillips, Brent	Federal Aviation Administration
Popescu, Liviu	EUROCONTROL
Prisaznuk, Paul	SAE ITC, ARINC IA
Reisinger, Joe	Astronautics Corp of America
Roy, Aloke	Honeywell, Inc.
Saccone, Greg	The Boeing Company
Segers, Robert	Federal Aviation Administration
Skorepa, Michal	Honeywell, Inc.
Tamalet, Stephane	Airbus
Tran, Hoang	Federal Aviation Administration
Vanguardia, Michael	The Boeing Company
Varkonyi, Bela	Frequentis AG
Wargo, Chris	Mosaic ATM
Warns, Timo	Airbus
Weger, Roberto	SITTI
Wrobel, Fryderyk	Airtel ATN
Zeng, Dongsong	MITRE Corporation