# ARINC 658
## *Internet Protocol Suite (IPS) for Aeronautical Safety Services – Roadmap Document*

### *Updates to:*

**APPENDIX D – STANDARDIZATION GAP ANALYSIS DATA**

**11 January 2018**

**INTRODUCTION**

Industry stakeholders who participated in the development of the ARINC 658 roadmap document conducted a detailed analysis to understand and assess ATN/IPS-related standardization activities. In particular, the analysis identified gaps where the industry stakeholders believe that a standard is required but an associated standardization activity is not yet identified.  The primary objective of the analysis was to identify the need for new ATN/IPS-related ARINC Standards and to identify existing ARINC Standards that may require modification to support ATN/IPS.  However, having a comprehensive picture of ATN/IPS-related standardization efforts across standards organizations also helps to minimize duplication of effort and facilitates the identification of topics that might benefit from cross-organization

**IPS GAP ANALYSIS COLUMNS**

| | | |
|---|---|---|
| **A** | **Work Area** | Together, these columns organize the standardization activities with respect to the ATN/IPS work areas and sub-woek areas identified in Sections 3 and 4 of the ARINC |
| **B** | **Sub-work Area** | 658 Roadmap Document. |

**C**  **Work Type**  Activity work type, which may take one of the following values (using a pull-down menu):

| | |
|---|---|
| STD | Standard / Specification |
| GM | Guidance Material |
| ANA | Analysis |
| PRO | Prototype Implementation |
| VAL | Validation |
| VER | Verification |
| V&V | Verification and Validation |
| OPR | Operations |

**D**  **Work Status**  Status of the work activity, which may take on one of the following values (using a pull-down menu):

| | |
|---|---|
| Complete | Work activity is complete |
| In-Progress | Work activity is started and in-progress |
| Planned | Work activity is planned, but not yet started |
| Proposed | Work activity is proposed, but not yet planned or started |
| *GAP* | Identified work activity gap |
| *TBD* | Status is to be determined |

**E**  **A658 Section where gap is addressed**  A reference to the section in the A658 Roadmap Document where potential actions to address an identified gap are described.  The following color coding is used:

| | |
|---|---|
| # | A658 section in which a gap is described; the gap still exists at the time of this update |
| # | A658 section in which a gap is described; work activity to address the gap has been initiated, per the status in Column D |
| | No gap; a work activity was already initiated prior to the publiction of A658 |

| | | |
|---|---|---|
| **F** | **Standards Organization** | Taken together, these columns identify the Standards Development Organization and the associated working group and sub-working group (optional) associated with |
| **G** | **Working Group / Sub-group** | the specified standardization activity.  The Standards Development Organization is selected using a pull down menu, and the working group / sub-group entry is free |
| **H** | **Activity Description** | Description of the standardization activity (normal font, black text) OR a description of an identified gap (*italicized font, red text*) |
| **I** | **Artifact** | A document number, if known, for the planned output of the work activity. |
| **J** | **Dependencies** | Identification of other activities on which the standardization activity may be dependent. |
| **K** | **Planned Completion Date** | Date, if known, when the output of the work activity is exepxted to be completed. |
| **L** | **Additional Comments** | Additional commentary, clarification, or observations offered by industry participants |

| Work Area | Sub-work Area | Work Type | Work Status | A658 Section where Gap is Addressed | Standards Organization | Working Group / Sub-group | Activity Description / *Gap Description* | Artifact | Dependencies | Planned Completion Date (MMM-YYYY) | Additional Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Application Interfaces | DSI (legacy) |  | In-Progress |  | ICAO | PT-I | ATNPKT definition for backward compatibility with existing dialog service-based OSI applications | Doc. 9896 | Doc. 9880 | Nov-2020 | Job Card: CP-DCIWG.006.01 |
|  |  | STD | *GAP* | 5.4.4 | ICAO | PT-I | *Mapping between OSI addresses and IPS address (see comment)* *Updates to DSI (?)* | Doc. 9896 | Doc. 9896 (IPS addressing) |  | 1. Consider multi-phased approach, where initial deployments use address mapping from OSI to IPS, but future deployments may be IPS addresses only. 2. May start in ICAO and move to RTCA/EUROCAE (SC-214/WG-78) |
|  | ACARS (legacy) | STD | *GAP* | 5.4.4 | ICAO | PT-I | *Provisions for accommodation of FANS messages* | Doc. 9896 |  |  |  |
|  |  | STD | *GAP* | 5.4.1.1 | ICAO | PT-I | *Encapsulation of FANS (e.g., A618) for IPS (e.g., mapping of FANS to IPS DS), including what parts of the ACARS message are included (e.g., SMI)* | Doc. 9896 | Doc. 9896 (above) |  |  |
|  |  | STD | *GAP* | 5.4.1.2.7 | AEEC | DLK | *Standardization of air-ground messaging layer for AOC (A620 non-safety) applications over IP (MIAM over IPS)* | ARINC 841 |  |  |  |
|  | Native IP (future) | STD | *GAP* | 5.4.4 | AEEC | IPS | *Support for native IP applications* | ARINC 858 |  |  |  |
| Mobility | Access Network | ANA | In-Progress |  | ICAO | PT-I / MSG | Mobility sub-group to analyze Mobility options for the Access Sub-Networks (Terrestrial (VDL-2 and LDACS), AeroMACS, and Satellite) and protocols (e.g. PMIPv6, other) | Working Papers | AeroMACS, L-DACS, SATCOM, and VDL Standards |  | Note that intra-subnetwork mobility is not part of PT-I responsibility. PT-I may review what is offered by each subnetwork. Otherwise, this is |
|  | Inter-subnetwork | ANA | In-Progress |  | ICAO | PT-I / MSG | Mobility sub-group to analyze Multi-link mobility options (e.g.,MIPv6, AERO, LISP) and recommend a candidate | Working Papers | LISP - SESAR 15.2.4 AERO - IETF RFC |  |  |
|  |  | STD | Planned |  | ICAO | PT-I / MSG | Mobility technical provisions | Doc. 9896 |  | Nov-2020 |  |
|  | Inter-region | STD | Planned |  | ICAO | PT-I / MSG | Mobility technical provisions | Doc. 9896 |  | Nov-2020 | Job Card: CP-DCIWG.006.01 |
| Upper Layers | Transport Options | ANA | In-Progress |  | ICAO | PT-I | Further refinement of transport options, whether UDP/TCP/etc. should both be supported, and including reliability extensions | Working Papers |  |  |  |
|  |  | STD | In-Progress |  | ICAO | PT-I | Document IPS transport provisions | Doc. 9896 |  | Nov-2020 |  |
|  | Supporting Services Identification | STD | In-Progress |  | ICAO | PT-I PT-I / MSG | Identify additional services necessary to support IPS, e.g. ICMP, local BGP, etc. | Doc. 9896 |  | Nov-2020 |  |
|  | Profile | STD | In-Progress |  | RTCA | SC-223 | IPS profile | DO-TBD |  | Jun-2018 | Date subject to WG-108 review and comments |
|  |  | STD | Planned |  | EUROCAE | WG-108 | IPS profile | ED-TBD |  | TBD |  |
|  | E2E Guidance | GM | Planned |  | EUROCAE | WG-108 | IPS End-to-End Interop guidnace (supporting certification) | ED-TBD |  | Dec-2020 |  |

| | | | | | | IPS-related Standardization Activities | | | | |
| Work Area | Sub-work Area | Work Type ⩗ | Work Status ⩗ | A658 Section where Gap is Addressed | Standards Organization ⩗ | Working Group / Sub-group | Activity Description / *Gap Description* | Artifact | Dependencies | Planned Completion Date (MMM-YYYY) | Additional Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lower Layer Interfaces | AeroMACS | STD | Complete | | ICAO | PT-S | AeroMACS SARPS | Annex 10 | | Complete | |
| | | STD | Complete | | ICAO | PT-S | AeroMACS Technical Manual and Guidance | Doc. 10044 | | Complete | |
| | | STD | Complete | | RTCA | SC-223 | AeroMACS Profile | DO-345 | | Complete | |
| | | STD | Complete | | RTCA | SC-223 | AeroMACS MOPS | DO-346 | | Complete | |
| | | STD | Complete | | AEEC | AeroMACS | AeroMACS Transceiver and Installation | ARINC 766 | | Complete | |
| | | STD | *GAP* | 5.4.1.2.4 | AEEC | AeroMACS | *AeroMACS architecture concepts (for segregation) to support IPS may not be defined adequately for developers* | ARINC 766 | | | If dual connectivity with ACD and AISD is required in the radio. |
| | LDACS | STD | In-Progress | | ICAO | PT-T | LDACS SARPS | Annex 10, Vol III | | Dec-2018 | Job Card: CP-DCIWG.010.01 |
| | | STD | In-Progress | | ICAO | PT-T | LDACS Technical Manual | Doc. TBD | | Dec-2018 | Job Card: CP-DCIWG.010.01 |
| | | GM | Planned | | ICAO | PT-T | LDACS Guidance Material | Doc. TBD | | Dec-2022 | Job Card: CP-DCIWG.010.01 |
| | | STD | Planned | | EUROCAE | WG-82 | Development of MOPS/MASPS | Doc. TBD | | | |
| | | STD | *GAP* | 5.4.1.2.5 | AEEC | TBD | *LDACS transceiver and interfaces* | ARINC TBD | | | |
| | SATCOM (current) - Performance Class B | STD | Planned | | ICAO | PT-T | Update SARPs (generic) and Technical Manual, including technology-specific parts (e.g., INMARSAT and Iridium) | Doc. 9925 (new part) Annex 10 Vol3 Ch4 | | TBD | |
| | | STD | Planned | | EUROCAE | WG-82 | MOPS / MASPS updates for IPS | ED-TBD | | TBD | |
| | | STD | Planned | | RTCA | SC-222 | MOPS / MASPS updates for IPS | DO-262x / DO-343x | | TBD | |
| | | STD | In-Progress | | AEEC | AGCS | MK3 Aviation SATCOM Systems Form/Fit/Function - additional work currently in progress to focus on ACARS (which may support accommodation) | ARINC 771 ARINC 781 | | TBD | |
| | | STD | *GAP* | 5.4.1.2.6 | AEEC | AGCS | *Updates (as necessary) and architecture concepts to support IPS* | ARINC 771 ARINC 781 | | | Some intiial placeholder text in planned next versions (2018), but future update expected to fully address IPS. |
| | SATCOM (future) - Performance Class A | STD | Proposed | | ICAO | PT-T | SATCOM Class A Technical Manual and Guidance and SARPS | Doc. TBD | | TBD | Proposal presented by Eurocontrol during ICAO CP/2 in October 2016. Draft Job Card presented during ICAO CP/2 in WP02. |
| | | STD | In-Progress | | EUROCAE | WG-82 | MOPS / MASPS updates for IPS | ED-TBD | | TBD | |
| | | STD | *GAP* | 5.4.2 | RTCA | SC-222 | *Extension of current MOPS/MASPS to accommodate future SATCOM and IPS* | DO-TBD | | | |
| | | STD | *GAP* | 5.4.1.2.6 | AEEC | AGCS | *Updates (as necessary) and architecture concepts to support IPS* | ARINC 771 ARINC 781 | | | |

| | | | | | | IPS-related Standardization Activities | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Work Area** | **Sub-work Area** | **Work Type** ▽ | **Work Status** ▽ | **A658 Section where Gap is Addressed** | **Standards Organization** ▽ | **Activity Description / *Gap Description*** | **Artifact** | **Dependencies** | **Working Group / Sub-group** | **Planned Completion Date (MMM-YYYY)** | **Additional Comments** |
| | | | | | | | | | | | |
| Lower Layer Interfaces (continued) | VDLm2 | STD | In-Progress | 5.4.1.2.3 | AEEC | Updates for VDLm2 support of IPS, e.g., modifications to  VDL Tech Manual to address connectionless VDLm2 exchange, and | ARINC 631-8 Doc. 9776 input | | Joint VDL Group | 1-Jun-2019 | APIM 17-002 |
| | | STD | *GAP* | 5.4.4 | ICAO | *Updates for VDLm2 support of IPS, e.g., modifications to  VDL Tech Manual to address connectionless VDLm2 exchange, and address IP packets in VDLm2.* | Doc. 9776 | | PT-M (?) | | |
| | | STD | *GAP* | 5.4.2 | RTCA | *Updates for VDLm2 support of IPS, e.g., modifications to  VDL Tech Manual to address connectionless VDLm2 exchange, and address IP packets in VDLm2.* | DO-224C (MASPS) DO-218B (MOPS) | | SC-214 / VDLSG | | EUROCAE WG-92 (responsible for ED-92) meets jointly with RTCA SC-214 VDLSG. |
| | | STD | *GAP* | 5.4.2 | EUROCAE | *Updates for VDLm2 support of IPS, e.g., modifications to  VDL Tech Manual to address connectionless VDLm2 exchange, and address IP packets in VDLm2.* | ED-92B (MOPS) | | WG-92 | | |
| Naming and Addressing | Naming | STD | In-Progress | | ICAO | Define naming convention and DNS requirements | Doc. 9896 | Coordination with RTCA SC-223 | PT-I | Nov-2020 | Job Card: CP-DCIWG.006.01 |
| | Addressing | STD | In-Progress | | ICAO | Define addressing | Doc. 9896 | Coordination with RTCA SC-224 | PT-I | Nov-2020 | Job Card: CP-DCIWG.006.01 |
| | IPv6 Transition Ph1 | ANA | In-Progress | | AEEC | Roadmap for IPv6 transition in aviation | ARINC 686 | | NIS | Oct-2018 | APIM 17-001 |
| | IPv6 Transition Ph2 | STD | Proposed | | AEEC | Updates to standards for IPv6 transition as identified during the roadmap activity | ARINC 664pX(other parts and/or new part) | | NIS | | APIM 17-001 (proposed Phase 2) |
| | Administration | OPR | *GAP* | 5.4.4 | ICAO | *Processes for on-going administration of IP names and addresses* *IP database management/translations* | | | PT-I (?) | | |
| | | OPR | *GAP* | 5.4.5 | OTHER | *Same as above but for AOC* | | | IATA | | |

| | | | | | | IPS-related Standardization Activities | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I | J | K | L |
| Work Area | Sub-work Area | Work Type | Work Status | A658 Section where Gap is Addressed | Standards Organization | Working Group / Sub-group | Activity Description / *Gap Description* | Artifact | Dependencies | Planned Completion Date (MMM-YYYY) | Additional Comments |
| Security | Risk Analsis | ANA | In-Progress | | ICAO | PT-I | Notional end-to-end risk analysis for IPS | Working Papers | | 43435 | |
| | | GM | Planned | | ICAO | PT-I & Sec. Panel | | Doc. 9896 | Doc. 10044 | Nov-2020 | Job Card: CP-DCIWG.007.01 |
| | End-to-End - Dialogue Service | STD | Complete | | ICAO | PT-I / SSG | Secure Dialog Service (SDS), end-to-end Dialogue Service application-layer security applicable to both OSI and IPS | Doc. 10094 | | Complete | Complete without validation; complete with validation by Dec-2018 |
| | | GM | In-Progress | | ICAO | PT-I / SSG | Secure Dialog Service (SDS) Concept of Operations | Doc. 10094 | | Dec-2018 | |
| | | GM | In-Progress | | ICAO | PT-I / SSG | Secure Dialog Service (SDS) guidance material | Doc. 10094 | | Jun-2019 | |
| | | VAL | In-Progress | | FAA | WJHTC | SDS validation | Validation Report | | Dec-2018 | |
| | End-to-End - non-Dialog Service | STD | Proposed | | TBD | TBD | Secure Session Service (SSS), end-to-end non-Dialogue Service application layer security (e.g. FANS, ACARS ) using the ATN security protocol | Working Paper for PT-I/SSG | RTCA SC-223 | TBD | |
| | | VAL | Proposed | | TBD | TBD | SSS validation | | | TBD | |
| | PKI | STD | Complete | | ICAO | PT-S | AeroMACS PKI Certificate Policy, which includes certificate/CRL profiles. Expected to be reusable for SDS. | Doc. 10044 | ATA Spec 42 WMF Certificate Profile & Certificate Policy | Complete | |
| | | VAL | Complete | | WMF | AWG | AeroMACS test certificates | | | Complete | |
| | | STD | *GAP* | 5.4.4 | ICAO | PT-I / SSG | *Updates to current AeroMACS PKI CP to support IPS at large* | Doc. TBD | | | |
| | | STD | In-Progress | | ICAO | SecP / iNNOVA | Security requirements for air-ground | Doc. TBD | | TBD | |
| | | GM | *GAP* | 5.4.1.2.8 | AEEC | NIS | *Key loading and key management necessary for LRU installation and maintenance (e.g., key replacement) -- updates necessary for IPS (all systems)* | ARINC 842 | | | Requires future APIM |
| | Network Layer Security | STD | In-Progress | | ICAO | PT-I | Definition of the security solution for the network  level, including for AOC traffic (VPN) | Doc. 9896 | | | |
| | Aircraft Security Reliance on Ground Security | GM | In-Progress | | EUROCAE | WG-72 (SC-216) | | | | | |
| | | GM | In-Progress | | EUROCAE | WG-108 | IPS End-to-End guidnace supporting certification | ED-TBD | | | |
| | | GM | *GAP* | 5.2 ? | OTHER | ARAC (?) | *Address this topic and provide recommendations to FAA/EASA* | | | | |
| | | GM | *GAP* | 5.2 | FAA | | *FAA/EASA regulation update or new process?? Impact on certification if aircraft has reliance on the ground* | | | | |
| | | GM | *GAP* | 5.2 ? | EASA | | *FAA/EASA regulation update or new process?? Impact on certification if aircraft has reliance on the ground* | | | | |
| | Security Management | STD | *GAP* | 5.4.2 | OTHER | TBC | *Overall security processes regarding incident management, logging/analysis, Aviation ISAC, etc.* | | | | |
| | Security Policy | STD | Planned | | ICAO | PT-I / SSG | ICAO Overall Security Policy Requirements | Doc. 10095 | | TBD | Job Card: CP-DCIWG.007.01 |

| Work Area | Sub-work Area | Work Type | Work Status | A658 Section where Gap is Addressed | Standards Organization | Working Group / Sub-group | Activity Description / *Gap Description* | Artifact | Dependencies | Planned Completion Date (MMM-YYYY) | Additional Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Performance | QoS | STD | Planned | | ICAO | PT-I / MSG | Map ATN QoS to IPS DIFFSERV (should be defined as an end-to-end mechanism) | Doc. 9896 | Doc. 9880 Doc. 10044 | Nov-2020 | |
| | QoS | STD | *GAP* | 5.4.1.1 | AEEC | IPS | *Detailed QoS mechanisms for segregating ATS and AOC traffic (part of ATN/IPS router form factor / architecture??)* | ARINC 858 | | | |
| | Compression | STD | In-Progress | | ICAO | PT-I | ATNPKT update to include compression provisions | Doc. 9896 | | | |
| | Compression | STD | In-Progress | 5.4.1.1 | AEEC | IPS | Standardization of proposed compression techniques | ARINC 858 | | | |
| | RCP (B2) | STD | Complete | | RTCA | SC-214 (WG-78) | SPR | DO-350A DO-306 | | | |
| | RCP (Beyond B2) | STD | *GAP* | New 1/11/2018 | ICAO | ODLWG | *RCP/RSP updates for beyond B2* | Doc. 9869 | | | |
| | RCP (Beyond B2) | STD | *GAP* | 5.4.3 | RTCA | SC-214 (WG-78) | *SPR update for beyond-B2 services* | | | | |
| | | STD | Planned | | ICAO | PT-I / MSG | Multi-link technical provisions | Doc. 9896 | SESAR 15.2.4 | Nov-2020 | |
| | Multi-link | STD | *GAP* | 5.4.1.1 | AEEC | IPS | *Detailed definition of multi-link based on ICAO definition.* | ARINC 858 | SESAR 15.2.4 Doc. 9896 | | The CMU standard would need to refer to the IPS router standard for the specification of the multilink functional specification, I.e., the CMU is one instance of an IPS router. |
| | MASPS | STD | *GAP* | ~~5.4.3~~ (TBC) | OTHER | TBD | *IPS MASPS* | TBD | | | Need is to be confirmed |
| | MOPS | STD | Planned | | RTCA | SC-223 | IPS MOPS | DO-TBD | | Dec-2019 | Concerns raised by IPS participants regarding the need for an IPS MOPS - further discussion required going forward. |
| Form / Fit / Interfaces | CMU | STD | *GAP* | 5.4.1.2.2 | AEEC | DLK | *CMU specification updates to support IPS (e.g., including segregation, new interfaces, data logging, traffic shaping/filtering, etc.)* | ARINC 758 | | | Although A758 is open, the current APIM does not include IPS; a future APIM will be necessary |
| | IPS Router | STD | In-Progress | 5.4.1.1 | AEEC | IPS | Specification for an IPS-specific router or router function (e.g., including segregation, new interfaces, etc.) | ARINC 858 | | | |
| Ground Systems | OSI/IPS and ACARS/IPS Gateway | GM | In-Progress | 5.4.4 | ICAO | PT-I | Technical definition of what needs to maintained between OSI and IPS in order to maintain application correlation. (Ground requirements RTCA/EUROCAE involvement?) | TBD | | | |
| | | STD | In-Progress | 5.4.1.1 | AEEC | IPS | Definition of ACARS-IPS gateway function | ARINC 858 | | | |
| | IPS NW Topology | ANA | Planned | | ICAO | PT-I | Discuss network topologies and proposals (e.g., DSP-centric solution) | Working papers | | | |
| | | GM | *GAP* | 5.4.5 | OTHER | Regional CAAs | *Regional implementation of IPS based on the ICAO standard* | | | | |