ARINC 858 introduction

AEEC DLK – ATN/IPS joint session
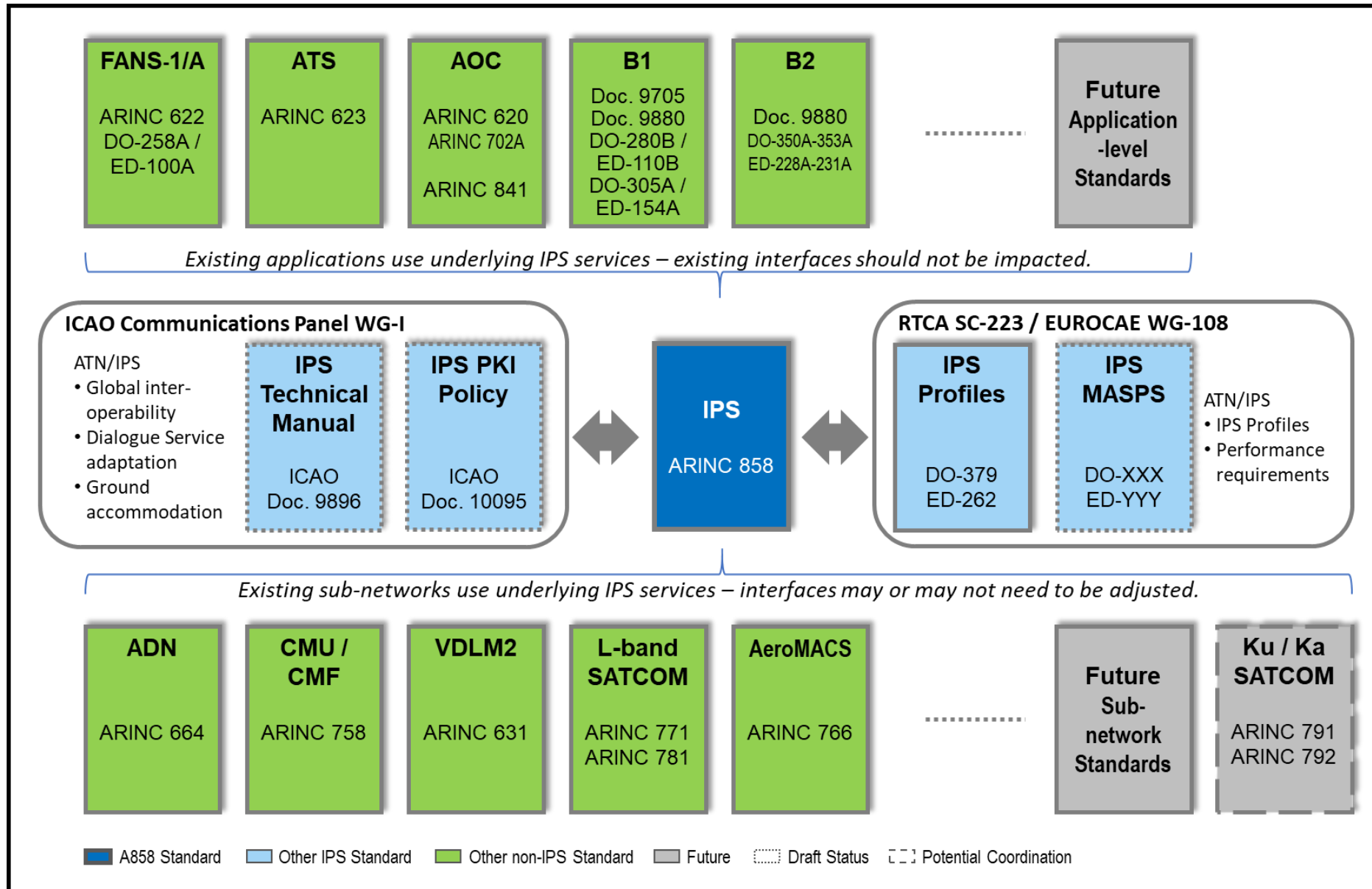
Luc Emberger

June 2021
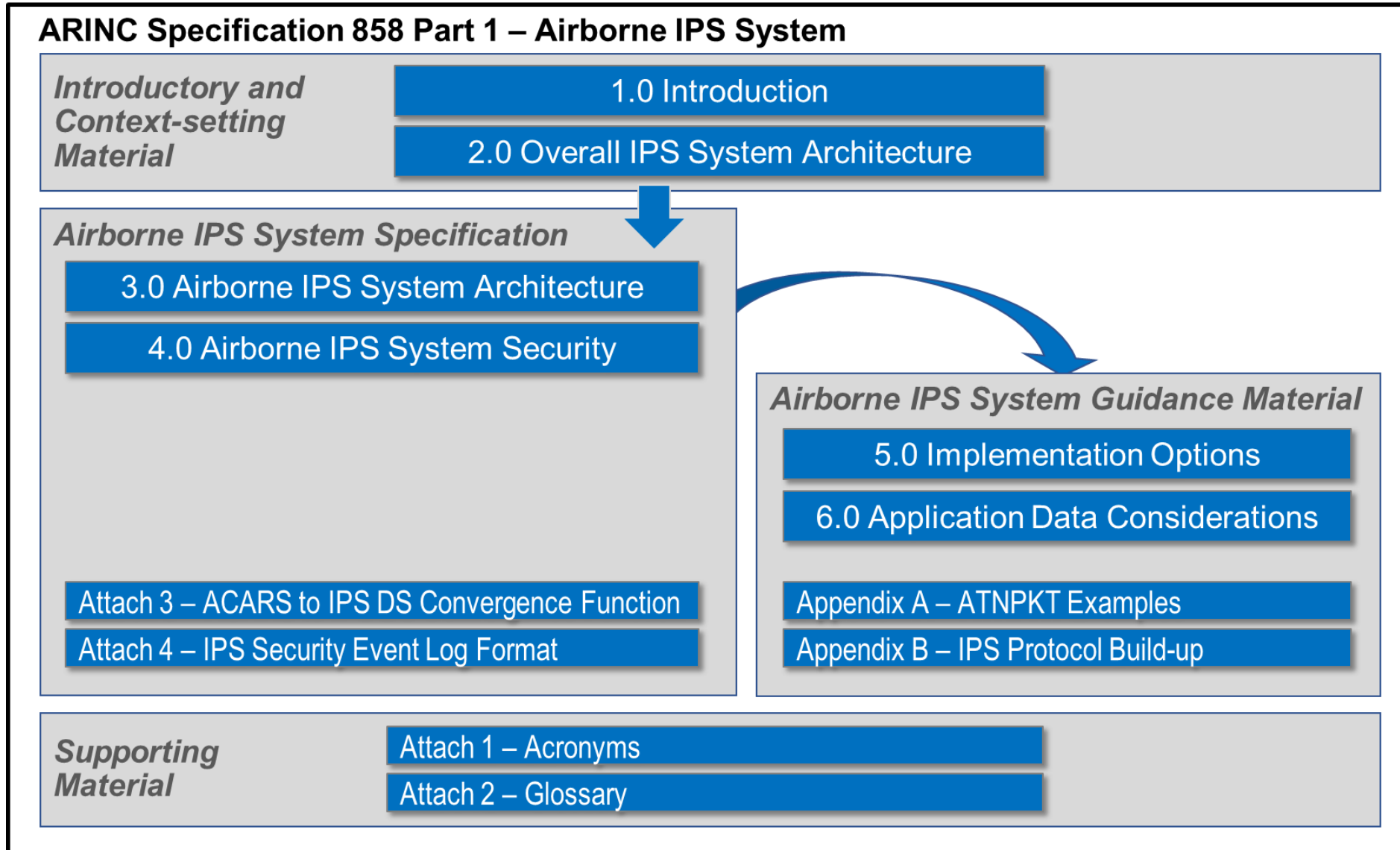
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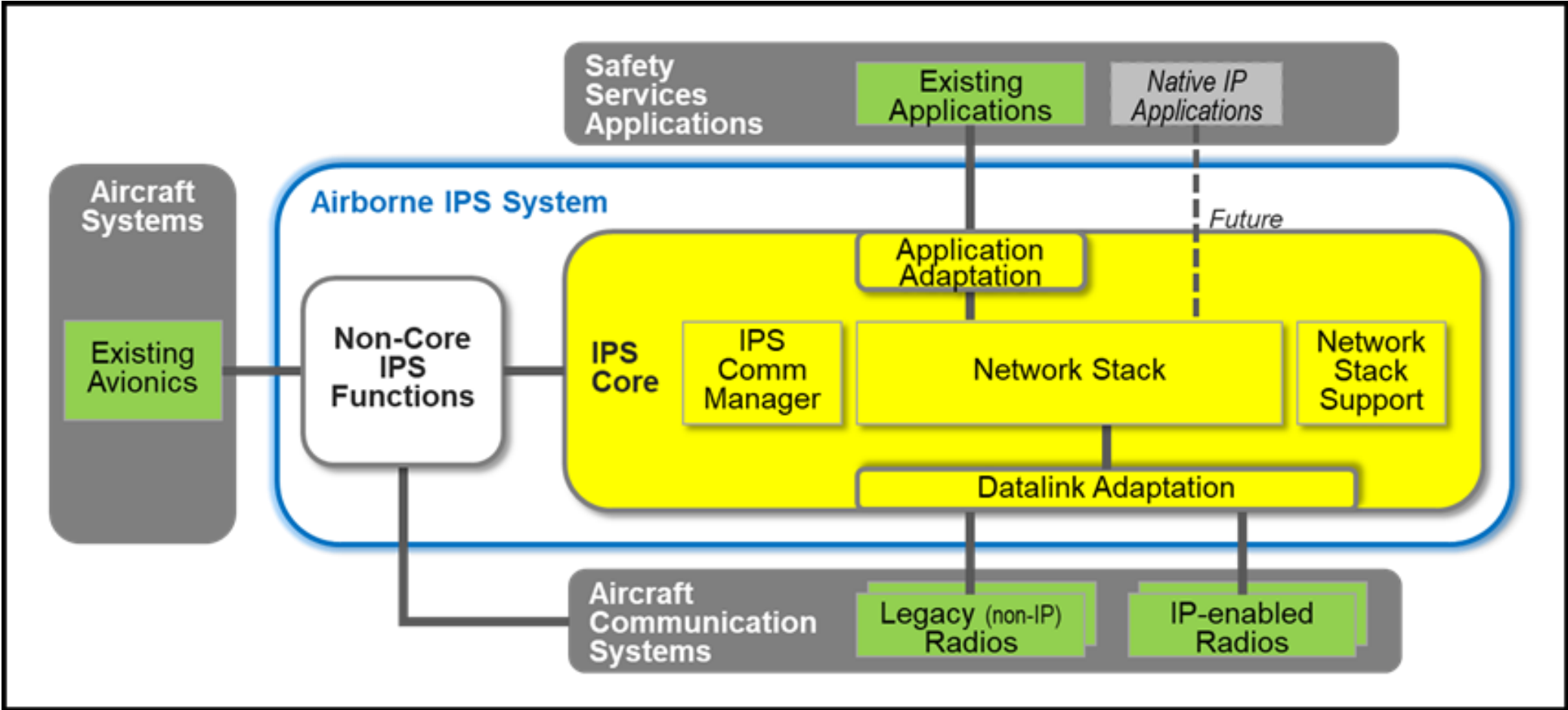# ARINC 858 introduction – links with other standards

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Standards Groups Relationship to IPS

ARINC specification 858 Part 1 – Airborne IPS System

Airborne IPS system / « IPS Core » high level view

ARINC 858 air-ground links interfaces – security considerations

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ARINC 858 and radio interfaces / VDL2

- At the edge of the Airborne IPS system, interactions with « external » systems are identified , in particular with the radios.

- Radio (physical links) are connected to the Airborne IPS system either directly (if needed via an adaptation function), either via an "External Comm Manger" (i.e. when the radio is shared between IPS and other protocol stacks, which is the case for VDL).

ARINC 858 includes:

- The "external Comm manager" component high level description (functional)

- High level concept for IPS encapsulation over VDL (to be aligned with DLK specification)

- Radio management function / radio interface

- Security considerations for air-ground links

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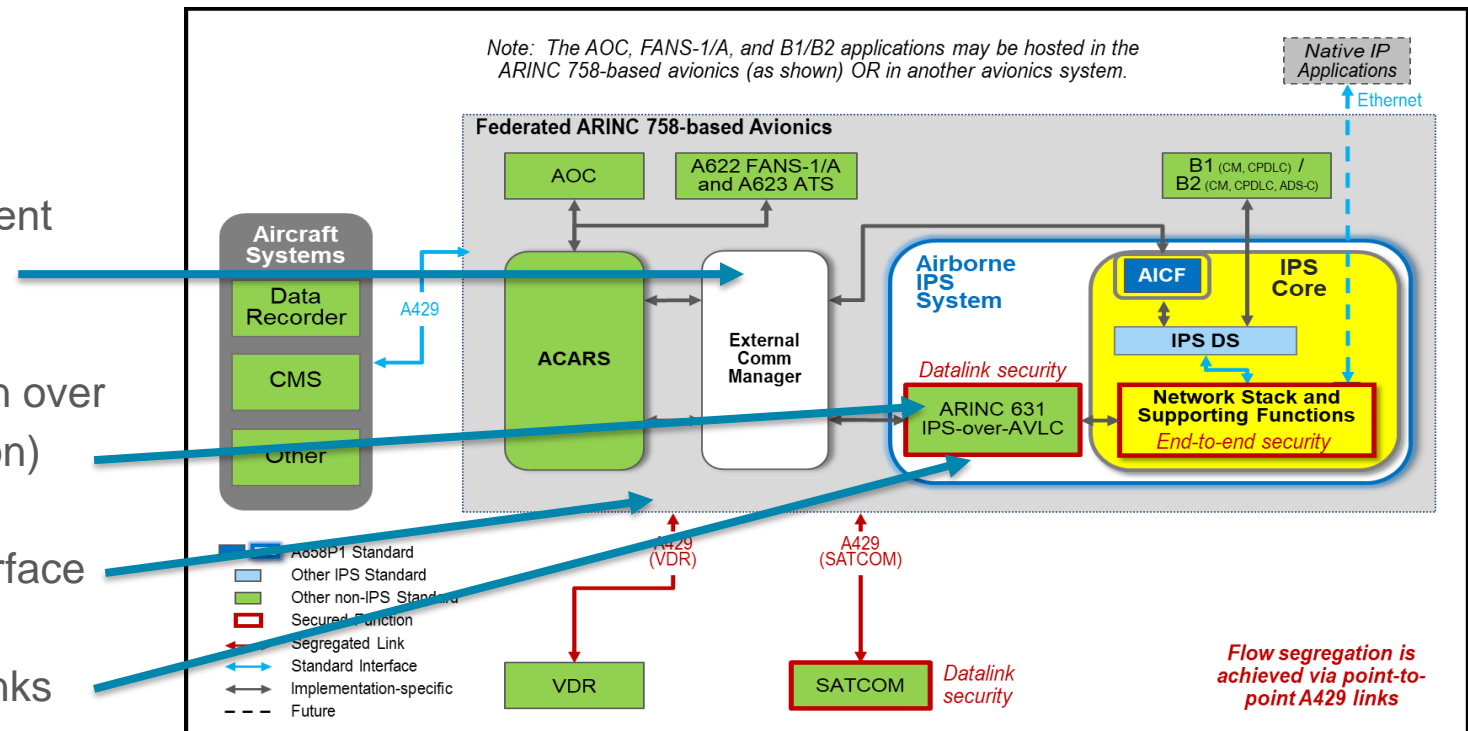
3.3.7 Coordination with an External Communications Management Function

« External Communication Management» function:

- Manages Communications/radios in particular for links shared with other protocols

- Distributes radio link status amongst various users

- Manages Radio modes (e.g Voice Data)

- …

For dual-stacked avionics implementations that support both ACARS and IPS stacks, an External Communications Management Function (CMF) may be necessary for coordinating parallel operation of IPS and ACARS network protocols. For example, the External CMF provides a means for IPS and ACARS communication managers to negotiate and manage access to shared air-ground access network assets (e.g., VDLM2 radios) that are used for both IPS and ACARS communications. For example, the External CMF ensures that FANS-1/A application traffic being sent via IPS over VDLM2 takes precedence over lower priority AOC traffic being sent via ACARS over a shared VHF data radio. In addition, the External CMF provides the IPS Communications Manager with access to functions that may be provided by an existing ACARS communications manager, including but not limited to:

- Link management for cases where that function is not embedded in the radio itself (e.g., AVLC for VDLM2)
- Radio status for cases where the existing communications manager provides the primary interface to a radio, (e.g., VDR)
- Overall connectivity status (i.e., COMM, NOCOMM) that is reported to end users of the airborne communication systems
- Radio voice/data mode switching (e.g., VDR).

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3.4.2 IPS Accommodation for Non-IP-enabled Radios – VHF Digital Link Mode 2

Basic principles to carry IPv6 packets into AVLC:

- Specific VDL2 enhancements expected, to implement segmentation/reassembly of IPv6 packets

- Details and protocols to be defined in A631
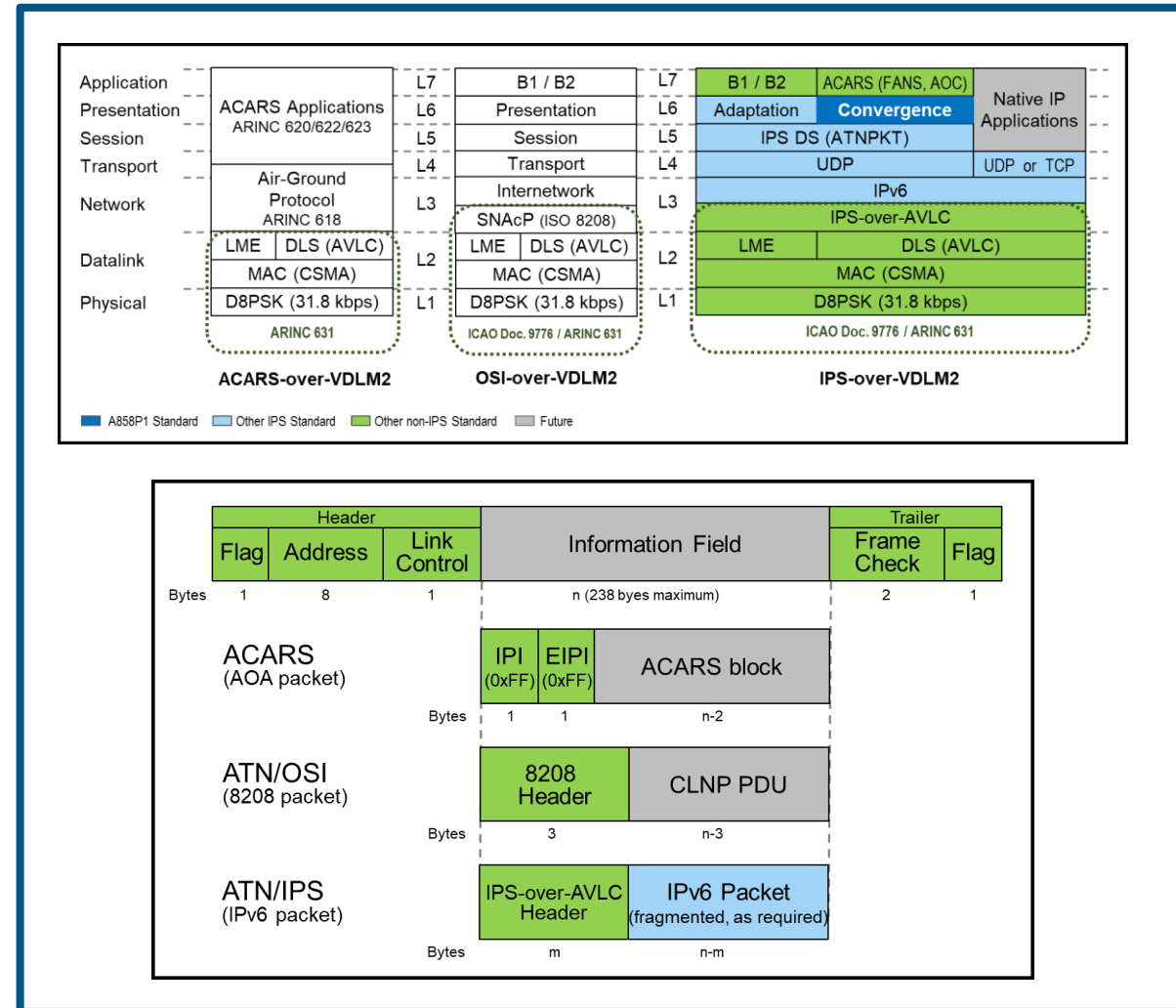
ARINC Specification 631 (Supplement 9 and later) is expected to include the VDLM2-specific enhancements necessary to support IPS-over-AVLC, including provisions for link layer security and segmentation/reassembly of IPv6 packets that are exchanged over VDLM2 using AVLC frames. Segmentation is necessary since the 238-byte maximum size of an AVLC frame information field (i.e., between the header and trailer) is smaller than the minimum Layer 2 MTU size of 1280 bytes per the IPS Profiles (RTCA DO-379 and EUROCAE ED-262).

3.5.3 Radio Management Function

Radio Management function:

ATN/IPS includes a comprehensive multi-link concept.

This concept aims at improving the overall performance (latency, availability) by combining several links.

To support this concept, it is envisaged that more data are exchanged between the radio and the IPS Airborne system:
- « Link Up » and « Link Down »
- RF signal quality or similar information

It may also include some « control » or tuning capabilities

> The Radio Management function monitors the state of all datalinks (e.g., via status reports from the Airborne Radios) and the health of the Airborne Radios (i.e., it verifies that no reception of status changes of the datalinks is not caused by a non-operative radio). The Radio Management function conveys radio status to the IPS Communications Management and Health Management functions.
>
> For each installed IPS-capable Airborne Radio, the Radio Management function shall monitor the availability of air-ground communication, i.e., "Link Up" and "Link Down" events (or equivalent), and report to the Multilink Decision Engine function (described in Section 3.3.6.1). Additionally, the Radio Management function may monitor other parameters (e.g., RF signal quality) that are made available by the Airborne Radio, and it may also provide control (e.g., radio tuning) for some Airborne Radios (e.g., VDR). Status and control capabilities are specific to each air-ground access network and are defined in the respective radio-specific standards.

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5.3.2.4 Air-Ground Link Security Implementation Considerations

Two secure channels need to contribute to the protection of ATN/IPS:

- End-to-end secure channel on application layer (end-to-end, DTLS)
- Secure channel between ATN/IPS partitions (aircraft, ACSP, CSP, ANSP/AOC)
  - → **Air-Ground: Radio security ("link layer" from ATN/IPS perspective)**
  - → Ground-ground security
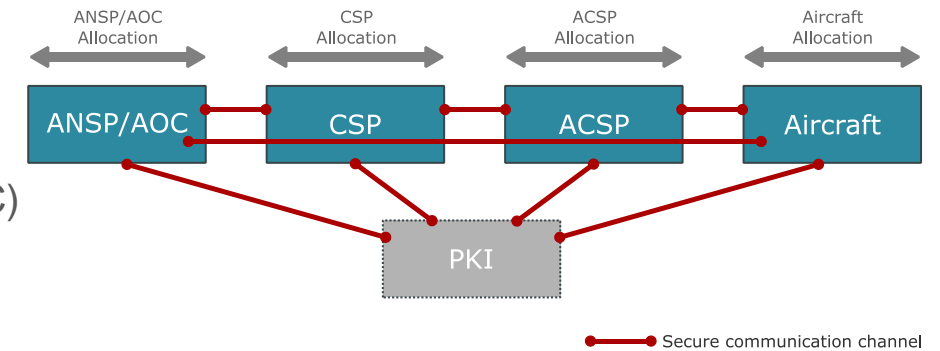
Drivers for this need are

- Outcomes of the security risk analyses already discussed at ICAO
- Expected DOC 10145 outcomes
- Expected MASPS security requirements
- Security architecture considered for ARINC 858

ARINC 858 identifies two options for securing the "link layer":

- Implementation at radio system level
  (expected for SATCOM, LDACS, and AeroMACS)
- Implementation by the IPS airborne system,
  given that proper segregation is implemented to
  demonstrate the equivalent protection

Since the communication radios connect to local airborne networks in the aircraft control domain, the security architecture presented in Section 4.0 shows that the Airborne Radio systems represent the first point of entry for an external threat to the aircraft. Consequently, a secure channel between the Airborne Radio systems and the peer radio access endpoints on the ground is necessary to ensure authentication and integrity of air-ground message exchanges in support of an overall defense-in-depth security strategy.

Two approaches to protecting the air-ground communications can be envisaged:

- Secure the radio system itself,
- Ensure that all radio traffic is protected by security measures hosted by the Airborne IPS System.

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ATN/IPS security

ATN/IPS standards overall roadmap

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ATN/IPS A/G Standardization Roadmap (rev. 2021-05-14)

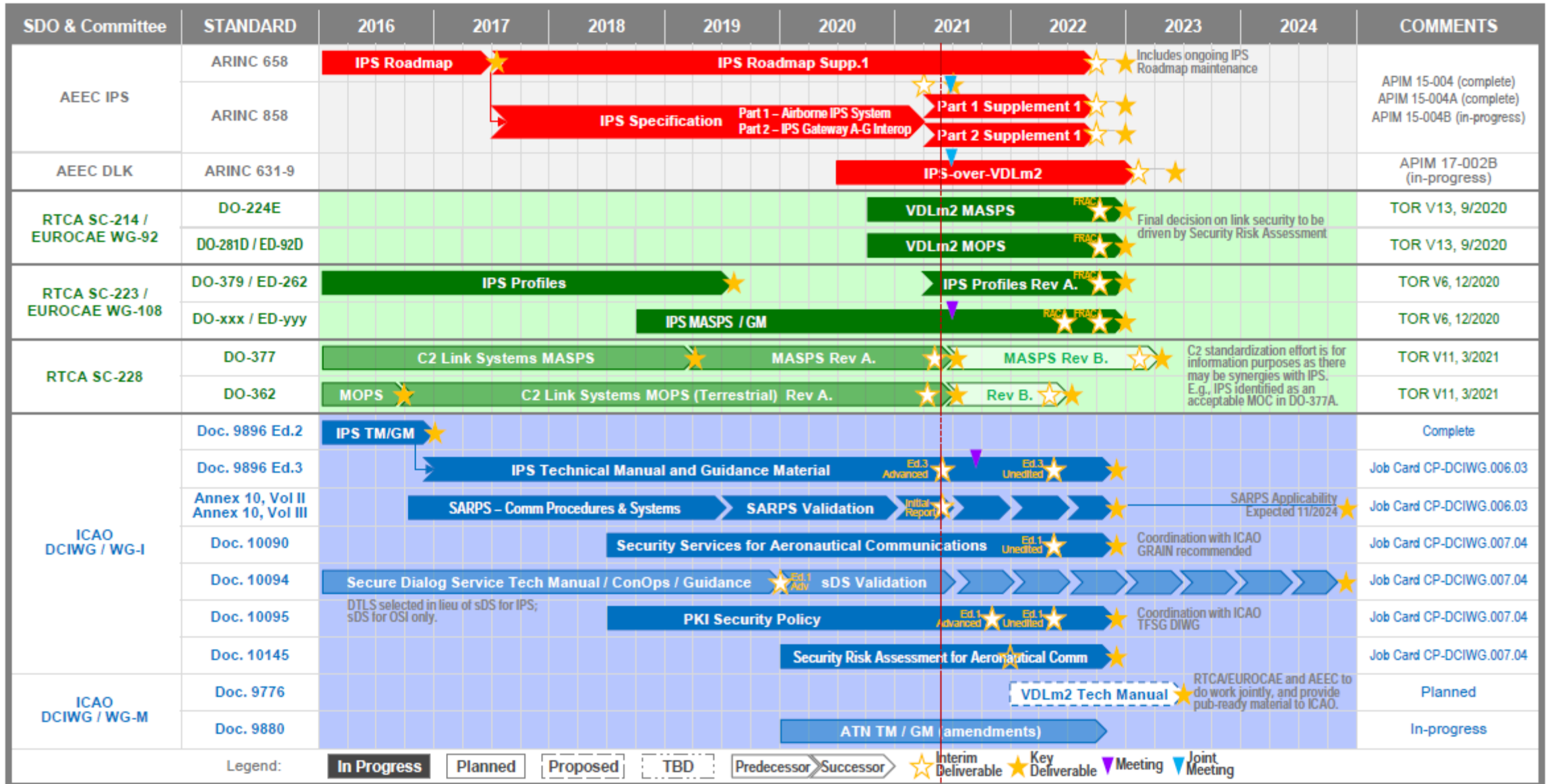| SDO & Committee	STANDARD	2016	2017	2018	2019	2020	2021	2022	2023	2024	COMMENTS
AEEC IPS	ARINC 658	IPS Roadmap		IPS Roadmap Supp.1							Includes ongoing IPS Roadmap maintenance
	ARINC 858			IPS Specification	Part 1 – Airborne IPS System / Part 2 – IPS Gateway A-G Interop		Part 1 Supplement 1 / Part 2 Supplement 1				APIM 15-004 (complete) / APIM 15-004A (complete) / APIM 15-004B (in-progress)
AEEC DLK	ARINC 631-9					IPS-over-VDLm2					APIM 17-002B (in-progress)
RTCA SC-214 / EUROCAE WG-92	DO-224E						VDLm2 MASPS				TOR V13, 9/2020
	DO-281D / ED-92D						VDLm2 MOPS				TOR V13, 9/2020
RTCA SC-223 / EUROCAE WG-108	DO-379 / ED-262		IPS Profiles				IPS Profiles Rev A.				TOR V6, 12/2020
	DO-xxx / ED-yyy			IPS MASPS / GM							TOR V6, 12/2020
RTCA SC-228	DO-377	C2 Link Systems MASPS			MASPS Rev A.			MASPS Rev B.			TOR V11, 3/2021. C2 standardization effort is for information purposes as there may be synergies with IPS. E.g., IPS identified as an acceptable MOC in DO-377A.
	DO-362	MOPS	C2 Link Systems MOPS (Terrestrial) Rev A.					Rev B.			TOR V11, 3/2021
ICAO DCIWG / WG-I	Doc. 9896 Ed.2	IPS TM/GM									Complete
	Doc. 9896 Ed.3		IPS Technical Manual and Guidance Material				Ed.3 Advanced / Ed.3 Unedited				Job Card CP-DCIWG.006.03
	Annex 10, Vol II / Annex 10, Vol III		SARPS – Comm Procedures & Systems		SARPS Validation		Initial Report				SARPS Applicability Expected 11/2024. Job Card CP-DCIWG.006.03
	Doc. 10090				Security Services for Aeronautical Communications		Ed.1 Unedited				Coordination with ICAO GRAIN recommended. Job Card CP-DCIWG.007.04
	Doc. 10094	Secure Dialog Service Tech Manual / ConOps / Guidance				Ed.1 Adv / sDS Validation					Job Card CP-DCIWG.007.04
	Doc. 10095	DTLS selected in lieu of sDS for IPS; sDS for OSI only.			PKI Security Policy		Ed.1 Advanced / Ed.1 Unedited				Coordination with ICAO TFSG DIWG. Job Card CP-DCIWG.007.04
	Doc. 10145				Security Risk Assessment for Aeronautical Comm						Job Card CP-DCIWG.007.04
ICAO DCIWG / WG-M	Doc. 9776							VDLm2 Tech Manual			RTCA/EUROCAE and AEEC to do work jointly, and provide pub-ready material to ICAO. Planned
	Doc. 9880					ATN TM / GM (amendments)					In-progress

Legend: In Progress | Planned | Proposed | TBD | Predecessor › Successor | ☆ Interim Deliverable | ★ Key Deliverable | ▼ Meeting | ▼ Joint Meeting

Time Now

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