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COMMITTEE A

Agenda Item 1: Air navigation global strategy
1.3: Air navigation roadmaps

INDUSTRY STANDARDS IN SUPPORT OF ICAO PROVISIONS

(Presented by ARINC, EUROCAE, RTCA
and SAE International)

EXECUTIVE SUMMARY

This paper presents the role of industry standards in support of ICAO provisions, in particular performance-based Standards and Recommended Practices (SARPs). It describes how ICAO may make better use of industry standards to complement ICAO provisions. This will allow ICAO the establishment of a coherent, effective and efficient system of standards, making best use of the available resources and expertise, thereby improving the overall quality and efficiency of the process and supporting the implementation of ICAO provisions.

Action: The Conference is invited to agree to the recommendations in paragraph 3.

1. INTRODUCTION

1.1 Industry standards provide a valuable source of expertise and technical knowledge and can and should be used complementary to the ICAO provisions in a performance-based approach to regulation and standardisation.

1.2 Industry standards represent consensus between the various stakeholders. Standards Developing Organizations (SDOs) provide the mechanism for the development and publication of the standards, including transparent, consensus-based and proven processes, which are open to all stakeholders and to worldwide participation. As a result, the industry standards are recognised and applied globally. These standards therefore are the cornerstone to enable international harmonisation and global interoperability.

1.3 Industry standards cover a broad range of systems, equipment, process, environmental and safety specifications required by the aviation community, including but not limited to the ICAO aviation system block upgrades (ASBUs), Global Air Navigation Plan (GANP) and Global Aviation Safety Plan (GASP).

1.4 Industry standards provide guidance and details on how to comply with the high-level ICAO provisions. As such, they should be recognised as acceptable means of compliance. Industry standards are developed by international groups of experts, open to contribution from stakeholders worldwide, and benefit from these global contributions. Therefore, industry standards are often used to support implementation of ICAO provisions.

1.5 The value of industry standards has been recognised in several previous ICAO Air Navigation Conferences and Assemblies, and some achievements have been realised since. However, more remains to be done to fully implement this approach, making best use of existing material and avoid overlapping activities. This paper outlines the achievements to date and proposed next steps.

2. DISCUSSION

2.1 Recommendation 6/13 of the Twelfth Air Navigation Conference (AN-Conf/12), *Development of Standards and Recommended Practices, procedures and guidance material*, recommended that ICAO establish and lead a suitable coordination with other SDOs in order to make the best use of the capabilities of these other SDOs and to make reference to their material, where appropriate, and requested ICAO to initiate studies to improve the verification and validation process required within ICAO before material developed by SDOs can be referenced in ICAO documentation.

2.2 Assembly Resolution A38-11 reiterated that Standards and Recommended Practices (SARPs) and Procedures for Air Navigation Services (PANS) shall be drafted using a clear, simple and concise language, consist of broad, mature and stable provisions specifying functional and performance requirements that provide for the requisite levels of safety, regularity and efficiency. The Assembly instructed the Council to utilise, to the maximum extent appropriate and subject to the adequacy of a verification and validation process, the work of other SDOs in the development of SARPs, PANS and ICAO technical guidance material, incorporated by reference into ICAO provisions. Before this, Assembly Resolution A37-15 had already called for a similar approach.

2.3 Progress of cooperation agreements

2.3.1 ICAO is currently referencing technical specifications developed by several internationally recognised organisations. ICAO has reinvigorated the Standards Round Table (SRT) as a coordination platform between ICAO and the SDOs as well as other stakeholders and initiated an even closer coordination with the major SDOs, the Core4 Team, focussing primarily on the standards that are published or under development and mapping them to the ICAO work programme. SDOs have also contributed actively to the development and update of the ASBUs.

2.3.2 An initial core group of SDOs – EUROCAE, RTCA, SAE and Arinc – has been recognised as international organisations in 2015 and updated individual cooperation agreements with ICAO were signed in December 2017 during the Second Global Air Navigation Industry Symposium (GANIS/2) event.

2.3.3 The four core SDOs and ICAO have signed a mutual commitment to make available to member States the standards which are referenced by ICAO provisions as part of the framework agreements, subject to an appropriate level of document protection.

2.4 The role of industry standards in support of regulatory requirements and ICAO provisions is manifold. First it should be recognised that standards provide a more flexible instrument to the regulator to make use of detailed technical specifications providing the “how to comply” with the higher-level regulatory requirements. In this sense, standards are often referred to as soft law, used as acceptable means of compliance and are complementary to the regulations. Today, standards are well recognised and utilised by the aviation community as they are developed in open, consensus-based processes, with the participation and contribution of all interested parties.

2.5 SDOs have established strong relationships with the major national and regional air traffic management (ATM) modernisation programmes such as SESAR in Europe, NextGen in the United States or CARATS in Japan. In this context, standards bridge the gap between operationally validated and performance-measured research and development results and providing a level playing field for harmonised implementation of capabilities applying the validated standards. In addition, whenever possible, SDOs join their efforts to produce technically harmonised documents, which become globally

applicable as they benefit from the buy-in of the global community. To this end, some of the major SDOs have put in place cooperation agreements and joint standards-development procedures amongst themselves.

2.6 In Europe and the United States, the regulators make extensive use of industry standards in support of regulatory provisions. This approach is based on the regulatory frame focusing on high-level essential requirements while referring to technical specifications to show compliance against these essential requirements. In this manner, standardisation can be both reactive to regulatory requirements but also be considered in future regulations.

2.6.1 The benefit of this approach is clear: the regulator defers to a second level of documentation, which is more flexible and can more easily adapt to a changing environment when needed, promoting the acceptance and adoption of innovative solutions by the community. The regulator benefits from the broad representation of experts and the expertise offered through the SDO process. In addition, the separation between the high-level essential requirements and the technical standards accelerates the development of both levels of provisions, avoids redundancy and duplications of efforts, and allocates the community's resources appropriately.

2.6.2 SDOs are well placed to address the challenges of a changing environment, where disruptive and new technologies emerge and new and different stakeholders enter the aviation sector. The SDOs. The SDOs provide an open, transparent platform for discussion and standard development. At the same time, through the participation of a wide range of stakeholders and the essential coordination efforts with the regulators and industry, the SDOs are well aware of the overall vision and strategy in aviation at global and regional levels and are key for proper alignment and execution.

2.6.3 The increasing role of military stakeholders in SDO activities benefits both the military's aim of making more use of civilian standards and at the same time contributes to innovation and knowledge transfer as the military shares their experience and brings new and innovative technologies to the civilian realm. ICAO should make more and better use of standards to benefit from this broad representation of experts, by which its own expertise will be increased and the quality of the overall system of ICAO provisions and supporting material will be improved.

2.7 ICAO and the SDOs should coordinate on a verification and validation process in order to guarantee the quality of deliverables and to ensure that they are fit for purpose in being referenced in ICAO provisions. This can be achieved through a combination of several interrelated methods.

2.7.1 By SDOs: During the standards-development process the standard is indeed validated at several steps:

a) proposing a standardisation activity — assessment of the maturity level of the technology, pre-validation;

b) drafting deliverables though a consensus-driven approach, validation by experts' inputs and judgements;

c) wide and public consultations, validation through review by a wider expert community;

d) transparent comment resolution process;

e) approval of due process; and

f) publication of the deliverable and implementation; validation through feedback loop to SDO and regular periodic review of all deliverables.

2.7.2 SDOs monitor the process compliance as well as the progress of the development compared to the target dates and scope. Some of these items are subject to close monitoring of key performance indicators.

2.7.3 The validation by ICAO should concentrate on the question of whether the deliverable is fit for purpose and whether it is appropriate and comprehensive enough to support the relevant ICAO provisions. The intent of this validation step is not to reopen the discussions on the content of the deliverable.

2.8 In the context of the ICAO-led SRT, the SDOs have mapped their deliverables and activities to the ICAO work programme. The result of this exercise has been presented to ICAO and will continue to be monitored, updated and implemented. Some examples of standards supporting ICAO provisions are cited in the appendix.

2.9 The coordination of all standardisation activities is necessary and ongoing. ICAO has put in place the SRT. The SRT is important as it develops and maintains a mapping of SDO activities to the ICAO work programme including status, scope and timelines of the deliverables. This is paramount as it helps to coordinate the timely availability of the standards. At regional level, there are several examples of the importance and success of such coordination groups (e.g. European ATM Standards Coordination Group (EASCG), European UAS Standards Coordination Group (EUSCG)). The experience from these very active coordination efforts is already used as input to the SRT work or as regional input to the GANP update.

2.10 SDOs will continue to monitor and adapt their work programme to offer to ICAO possible candidates for referencing.

3. CONCLUSION

3.1 The role of industry standards in support of ICAO provisions should evolve to use industry standards to supplement its own provisions. This will establish a coherent, effective and efficient system of standards that make best use of the available resources and expertise. This will improve the overall quality and efficiency of the process and the resulting provisions and avoid duplication of efforts and discrepancy of resulting requirements and finally support a global and harmonised implementation of ICAO provisions.

3.2 The Conference is invited to

a) reiterate support for the AN-Conf/12 recommendations and Assembly resolutions in force;

b) recommend that ICAO follow a performance-based approach in the development of ICAO provisions, incorporating industry standards by reference, subject to a validation of the standards being fit for purpose;

c) recommend that ICAO make more and better use of industry standards developed by other recognised Standards Development Organisations (SDOs); and

d) recommend that ICAO continue the Standards Round Table (SRT) coordination work with the SDOs.

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APPENDIX

EXAMPLES OF SDO DELIVERABLES SUPPORTING ICAO PROVISIONS

This Attachment provides a list of examples of SDO activities and deliverables, published or under development, supporting ICAO provisions. It is not intended to be exhaustive.

A.1 EUROCAE

- **Annex 3**
  - WG-76 AIS/MET Datalink Services
- **Annex 4**
  - ED-76, ED-77 Aeronautical Data Processing
- **Annex 6**
  - Flight Recorders:
    - ED-112A MOPS for Crash Protected Airborne Recorder Systems (and previously ED-55, ED-56A)
    - ED-155 MOPS Lightweight Flight Recording Systems
  - Location of an airplane in distress:
    - ED-237 MASPS for Criteria to detect In-Flight Aircraft Distress Events to trigger Transmission of Flight Information (linked to GADSS; first time that draft ED was provided to ICAO to include in SL)
    - ED-62B MOPS for aircraft emergency locator transmitters (406 MHz and 121.5 MHz – optional 243 MHz)
  - Navigation Data:
    - ED-76 Standards for Processing Aeronautical Data
    - ED-77 Standards for Aeronautical information
  - ED-250 Runway Overrun Awareness and Alerting System ROAAS (support to GASP / ICAO WP Annex 6 (also EASA → EU-OPS, ETSO expected; this is a good example of forward looking standardisation before the regulatory requirement is in force)
- **Annex 10**
  - DME ED-57 pulse spectrum measurement + new MASPS (WG-107)
  - ILS ED-46B, 1/WG7/70, ED-47B, ILS receiver, VOR ED-52, ED-22B; GNSS ED-72A; MLS ED-36B ……
  - GNSS, GBAS, Multifrequency, Multiconstellation (WG-28 and 62)
  - AeroMACS: ED-222, ED-223, ED-227
  - SATCOM: ED-242 and 243
  - Annex 10 Vol. IV: Basic SURF IA (possible future EUROCAE activity)
  - TCAS ED-143 (WG-75)
  - Mode S Transponders: ED-73E
  - ADS-B: ED-102A
  - Multilateration systems: ED-117, ED-142
  - ELT: 121.5 MHz and 406 MHz
- **Annex 11**
  - ED-76, ED-77 Aeronautical Data Processing
  - Provisions on remotely operated ATS: Remote & Virtual Tower (WG-100)
- **Annex 14**,

- Vol. 1 (Aerodrome Design and Operations) Routing and Guidance function: WG-41 A-SMGCS
- Vol 1: ED-99C Aerodrome mapping databases
- ED-76, ED-77 Aeronautical Data Processing (vol 1 and vol 2)

- **Annex 15**
  - ED-76, ED-77 Aeronautical Data Processing
  - ED-99C, ED-119B Aerodrome mapping databases
  - App 8 13th edt reproduces parts of ED-98B User requirements for terrain and obstacle data
  - ED-98C contains definitions from ICAO Annex 15
- **Other ICAO provisions**
  - ADS-B WG-51: Support to Doc 9994 (Airborne Surveillance Applications) and Doc 325 (ITP using ADS-B)
  - Datalink Services (WG-78): ED-228, ED-229, ED-230, ED-231 in support of Dyn. RNP, Advanced FIM
  - DOC 9896 Edt.2 ED-137B Voice over IP
  - Doc 4444: ED-159, ED-194, ED-110B
  - EFB Manual Doc 10020: WG-106

A.2 RTCA

- **Annex 3: No Current References**
  - Future work includes the new scope for WG-76 which is likely to be joint with SC-206.
- **Annex 6 Part I:**
  - Electronic Navigation Data Management - RTCA DO-200A and RTCA DO-201A (joint with EUROCAE ED-76 and ED-77 (no revs)) (xviii, 7-5)
  - HUD or Equivalent Displays - Reference to RTCA and EUROCAE documents contained in Doc 9365 (page 4-5, 6-19)
- **Annex 6 Part II: (Same as Part I)**
  - RTCA DO-200A and DO-201A (joint with EUROCAE ED-76 and ED-77 (no revs)) (xvii, 3.7-1,
  - Reference to RTCA and EUROCAE documents contained in Doc 9365 (page 2.2-2,2.4-8,
- **Annex 6 Part III: (Same as Parts I and II)**
  - Reference to RTCA and EUROCAE documents contained in Doc 9365 (page II-2-4, II-4-14, III-2-1, III-4-11)
  - RTCA DO-200A and DO-201A (joint with EUROCAE ED-76 and ED-77 (no revs)) (II-5-4)
- **Annex 10 Volume 1: Radio Navigation Aids**
  - SBAS GNSS - RTCA DO-229C (except as superseded) (App B-70, ATT D-3, ATT D-14-15)
  - ILS - RTCA DO-195 (ED-46B) and DO-143 (1/WG 7/ 70) and DO-192 (ED-47B) (ATT C-13)
  - Receiver Test procedures for the VOR - RTCA DO-196 (ED-22B) (ATT C-44)
  - GNSS Receivers - RTCA DO-208 (ED-72A) (ATT D-3)
  - Interoperability of GBAS - RTCA DO-253A (ATT D-3, ATT D-17)

- GNSS RF Characteristics: RTCA DO-229D (ATT D-14-15)
- GBAS GNSS RTCA DO-245 (ATT D-17)
- GBAS Data Structure RTCA DO-246B (ATT D-23)
- Error Budget for MLS (RNAV) Equipment - RTCA DO-198 (ATT G-36, ATT G-38)

- **Annex 10 Volume 2: None**
- **Annex 10 Volume 3:**
  - Interface to other AMS(R)S Equipment - RTCA DO-215 (I-4-3)
  - Data packet service performance - RTCA DO-270 (I-4-4)
  - Antenna Radiated Signals Testing - RTCA DO-160D (ED-14D) Note- EUROCAE ED-14D not referenced (I-6-12, I-6-14)
  - 121.5 MHz ELTs - RTCA DO-183 (ED-62) (II-5-2)
  - 406 Mz ELTs - RTCA DO-204 (ED-62) (II-5-3)
- **Annex 10 Volume 4: Surveillance and Collision Avoidance Systems**
  - RTCA DO-181E (ED-73E) (2-7)
  - RTCA DO-185B (ED-143) (4-1, 4-12, 4-23)
  - RTCA DO-185, DO-185 A (4-12, 4-23)
  - RTCA DO-300 (4-48, 4-49)
  - RTCA DO-260B (ED-102A) (5-3, 5-4, 5-5)
  - RTCA DO-289 (7-1)
- **Annex 10 Volume 5: None**
- **Annex 11:**
  - Aeronautical Data: RTCA DO-200A (ED-76) (2-12)
- **Annex 14 Volume 1:**
  - Aerodrome mapping: DO-272B (ED-99C) (2-1)
  - Aeronautical Data: RTCA DO-200A (ED-76) (2-1)
  - Aeronautical Data: RTCA Do-201A (ED-77) (2-2)
- **Annex 14 Volume 2:**
  - Aeronautical Data: RTCA DO-200B(ED76B) (2-1)
  - Aeronautical Data: RTCA-201A (ED-77) (2-1)

A.3 SAE

- **Annex 6, Part 1**
  - Underwater Locating Devices, AS6254
- **Annex 16, Volume 1**
  - Standard Atmospheric Absorption, ARP866A
- **Aircraft Noise Measurement (A-21):** AIR1751, AIR5715, AIR1845, AIR1905, ARP876F, ARP1846A, AIR5662, AIR1672B, ARP866A, ARP4721, ARP5534 in support of Doc 9501, Vol 1, Doc 9889, and Doc 9911
- **Aircraft Engine Emission Measurement (E-31):** ARP1179, ARP1256, ARP1533, AIR4068A, AS681, AIR6241 in support of Doc 9501, Vol 2
- **Aircraft Ground De-icing/Anti-icing (G-12):** AS6285, AMS1424N, AMS1428J, ARP4902B, ARP6257, AS6286, AS5681, AS6332 in support of Doc 9640
- **Aircraft Fuelling (AE-5):** ARP5789, ARP5818, ARP5918, AS5877A in support of Doc 9977
- **Child Restraint Systems (SEAT):** ARP6316, AS5276/1, ARP4466 in support of Doc 10049

- **Passenger Safety (S-9, A-20):** ARP577E, ARP503F in support of Doc 10086
- **Lithium Battery Packaging Performance (G-27):** AS6413

A.4 ARINC IA

Name & Short explanation	Linked ICAO deliverable
ARINC 424-22 Navigation System Data Base	IFPP, 9613
ARINC 618-8 Air-Ground Character-Oriented Protocol Specification	9880, 9896
ARINC 618-9 Air-Ground Character-Oriented Protocol Specification	9880, 9896
ARINC 619-5 ACARS Protocols for Avionic End Systems	
ARINC 620-9 Data Link Ground System Standard and Interface Specification	Annex 10
ARINC 622-5 ATS Data Link Applications Over ACARS Air-Ground Network	ADS-B SARPS, ICAO 4444
ARINC 631-7 VHF Digital Link (VDL) Mode 2 Implementation Provisions	9776
ARINC 633-3 AOC Air-Ground Data and Message Exchange Format	4444, 8643
ARINC 658 Internet Protocol Suite for Aeronautical Safety Services Roadmap Document	9896
ARINC 660B CNS/ATM Avionics, Functional Allocation and Recommended Architectures	9750
ARINC Project Paper 686: Roadmap for Transitioning to IPv6 in Aviation	9896
ARINC 702A-5 Advanced Flight Management Computer System	CNS/ATM SARPS, 9613
ARINC 714A Mark 4 Airborne SELCAL	Annex 10
ARINC 743A-5 GNSS Sensor	
ARINC 743B GNSS Landing System Sensor Unit (GLSSU)	
ARINC 743C GLSSU with VHF Data Broadcast Receiver	
ARINC 758-3 Communications Management Unit (CMU) Mark 2	ATN SARPS, VDL SARPS, 9896
ARINC 758-4 Communications Management Unit (CMU) Mark 2	ATN SARPS, VDL SARPS, 9896
ARINC 766 AeroMACS Transceiver and Installation Standards	9896
ARINC 771-1 Low Earth Orbit (LEO) Satcom (Iridium NEXT)	AMS(R)S SARPS, 9925
ARINC 781-7 Mark 3 Aviation Satellite Communication System, Aircraft Installation Provisions	AMS(R)S SARPS, 9925
ARINC 813 Embedded Interchange Format for Terrain Database	9881
ARINC 815 Embedded Interchange Format for Obstacle Database	9881
ARINC 816 Embedded Interchange Format for Airport Mapping Database	
ARINC 823-1 P1- Datalink Security Part 1 ACARS Message Security	9896
ARINC 823-1 P2- Datalink Security Part 2 Key Management	9896
ARINC 841 Media Independent Aircraft Messaging	
ARINC 842-2 Digital Signature and PKI	9896, 10044
ARINC Project Paper 858 Internet Protocol Suite for Aeronautical Safety Services - Technical Requirements	9896

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