ICNS 2014 Workshop

Integration of Advanced CNS Capabilities supporting NextGen/SESAR/CARATS

Introduction to the Workshop

With this year's ICNS, we would like to start a new approach for an even more intense knowledge exchange and for increased interaction between conference participants by establishing Interactive Workshops. The overall workshop topic will be split-up into three workshop themes where everybody can sign-up for active participation. The results of the three workshops will be summarized to the conference participants and captured into a workshop summary report. This document report will be advertised at the ICNS website where it will also be available for download.

Year after year, ICNS attracts both policy makers and excellent scientists from governments, industry, and research – just the right mixture to discuss hot topics and to find potential solutions. ICNS utilizes this concentration of policy makers and researchers by an appropriate split between Plenaries and Technical Sessions. The Interactive Workshop adds significant value to participation in ICNS.

We thank the ICNS Executive Committee and ICNS 2014 General Chair Rafael Apaza for including this Workshop in the schedule. We also acknowledge the leadership provided by the two Workshop Co-Chairs, John Gonda and Michael Schnell.

Background:

There are three advanced services being considered for implementation in the NextGen timeframe.   These include:

- Advanced Interval Management

- Dynamic RNP Operations based upon 4DTrajectory Data Link

- Consistent/accurate sharing of ATC WINDS

Underpinning each of these is a requirement for Advanced Data Communications for more dynamic/complex exchange of data.

Advanced services such as these will likely drive future cockpit design, including CNS data sharing, display and A/G communications. Since these advanced services are

likely to be incorporated into systems such as EFBs as well as the avionics currently sharing information to-from the aircraft via data communications, innovative pathways for interconnection among onboard platforms, such as WiFi, must be considered.

Subject	Name	Company
CNS/ATM Integration and Dynamic RNP	Aslaug Haraldsdottir	Boeing
Airbus Integrating CNS	Didier Delibes	Airbus
Initial 4D Trajectory Developments (MUAC)	Chris Adams	Eurocontrol/Maastricht
ARINC 660b	Sam Miller	MITRE/AEEC
View from the Cockpit	Rip Torn	Delta/IFALPA/ALPA
NAS Conops and Improvements	Rocky Stone	UNITED/RTCA
ATN Baseline 2 Alternatives	Aloke Roy	Honeywell
Global Harmonization and Communications	Andrew Onken	Rockwell Collins/ARINC

Workshop Plenary

On Day 3 of ICNS 2014 the morning Workshop Plenary was held. Workshop Chair John Gonda, Mitre, introduced the eight presentations which are included in the ICNS 2014 Proceedings and are not duplicated in this report. However, a brief summary of each is provided as are the biographies of the presenters.

Plenary Summaries

CNS/ATM Integration and Dynamic RNP (Aslaug Haraldsdottir, Boeing ATM)

Dr. Haraldsdottir stated that ATM solutions require collaboration among ground infrastructure, airplane capabilities and ATM procedures. The Air Transportation System Roadmap provides a detailed path toward the achievement of key capabilities through the 2031 timeframe. US and European domestic data link plans show that it will take a decade to reach convergence to support common applications.

Draft requirements to support dynamic RNP include aircraft systems that need to be modified, ATN System 2 implementation to support the uplink and downlink of information such as RF legs, fixed radius transitions and RNP values on a leg-by-leg basis. Flight deck displays may need to be modified to display RNP values to the flight crew.

Multiple standards committees (i.e., RTCA SC-214, SC-227, SC-186 and SC-206) will be involved to fully support Dynamic RNP, Advanced IM and ATC Winds.

Aircraft Manufacturer/FMS/Advanced RNP (Didier Delibes, Airbus)

Mr. Delibes described SESAR Project 9.49 as the federating project for the Airborne thread. P9.49 covers the development of and Airborne functional architecture which includes an Avionics roadmap, an Interoperability risk report and an Avionics Retrofit challenge report.

FMS, DISPLAYS and DATACOM are recurrent enablers for the new ATM functions in SESAR step 1. They are to be considered in OEM industrial product strategy and roadmaps. The need for a new MMR development has also to be anticipated. The EFB is not considered as auxiliary Displays in SESAR functional architecture, because of projects requirements for information in the forward field of view (EFB will be introduced in step2 for aircraft connection to SWIM).

The Retrofit Analysis will consider the side benefits of mandates on aircraft retrofit ability for example, MMR upgrade for ADS-B-Out EU mandate which also benefis A-RNP and FANS 2/B with an EU mandate paving the way to FANS 3/C.

However, Retrofit impact can remain prohibitive for some aircraft configurations which needs to be taken into account in deployment scenarios and deployment incentives. Retrofit is deeply affected when hardware upgrades are needed. We need to anticipate retrofit with line fit hardware provisions.

Initial 4D Trajectory Developments (Chris Adams, Eurocontrol)

Mr. Adams described European trials as far back as 1997. The current CPDLC baseline became operational in 2003. Active participation is defining the 4DTRAD Concept of Operations, being the baseline for the i4D in the SESAR ATM Master Plan. There has been active participation in EUROCAE WG78/WG85 (Definition of new standards for data link and 4D navigation). Eurocontrol has been working with AIRBUS since early 2010 to define the air- ground interface to be used in SESAR.

Avionics Standardization, ARINC 660B (Sam Miller, MITRE)

Mr. Miller described the ARINC 660B document which identifies and describes the aircraft avionics capability necessary for operation in the evolving Communications Navigation Surveillance/Air Traffic Management (CNS/ATM) environment expected for the FAA NextGen program, Single European Sky ATM Research (SESAR) program and considerations of the Japan Collaborative Actions for Renovation of Air Traffic Systems (CARATS). These capabilities are intended to satisfy the industry's long-term CNS/ATM operational objectives.

ARINC 660B provides the airlines with a roadmap to future avionics equipage requirements based upon anticipated NextGen/SESAR operations. It includes both forward fit and retrofit concepts. Existing aircraft "generations" are examined with a focus on equipage for the operational environment.

The equipage impacts described in ARINC Report 660B are intended to provide the airlines with the necessary information to evaluate modernization proposals, and to support the overall goal of fleet commonality while meeting operational requirements.

NexGen Users (Rip Torn, Delta/ALPA/IFALPA)

Captain Torn stated that pilots and aircraft are the common thread to the Integration of Advanced CNS Capabilities supporting NextGen/SESAR/CARATS. They need to be included from Initial Design of new operations. It is clear that differing roles mean differing goals, however, the objective is service to the public through private means. Any new applications must have non-punitive error tolerance and repair.

The goals are to provide Better Service, Reasonable Cost, and Mutual Benefit with optimized roles in the Aviation System.

Operational Pilot (Rocky Stone, SC 206/United)

Captain Stone spoke about the history of the current NAS Conops and what barriers institutional and cultural barriers remain to change. He offered some suggestions as to how the future NAS could be optimized and how RTCA works to foster change. He concluded by asserting that the NAS is the safest airspace system but that efficiency could be improved with integrated CNS applications supporting new decision support tools.

ATN Baseline 2 Alternatives (Aloke Roy, Honeywell)

Mr. Roy reviewed the current ATN Baseline 1 architecture and illustrated two alternatives for ATN Baseline 2. In the first alternative, the air-ground VDL Mode 2 link would be replaced with an air-ground TCP/IP link, such as AeroMax, LDACS or satcom. In the second alternative, the air-ground link would still use TCP/IP but the ATN stack would move to the ground end of that link making for a simpler architecture with less complexity in the airborne communications stack. He proposed a review of the value propositions of each alternative.

Global Harmonization and Communications (Andrew Onken, Rockwell Collins ARINC)

Mr. Onken reviewed the current and future states of global air/ground communications. The Current State: European Link 2000+ Programme based upon ATN Baseline 1 while the FAA Data Communications program (Data Comm) is launching with FANS 1/A.

The Harmonized Future: there is a need for aircraft to have a single set of equipment that meets ATC needs worldwide. ATN Build 2 includes advanced services such as 4D Trajectories, Dynamic RNP, and Advanced Flight Interval Management with ATC winds. Initial version of SC-214/WG-78 documents are being published with the final version due in about 15 months.

There is a need for a continuing consensus that this is the goal and the means to achieve the goal. We now need solid plans for how to get from "The Current State" to "The Harmonized Future" that cover the three legs of the environment: Ground systems, Networks and Aircraft Systems.

There is a need for feedback from airframers/integrators/operators on their plans.

Interactive Session

The afternoon session was introduced by Workshop Chair, Dr. Michael Schnell, DLR.

Participant (Mr. Gonda):
Mr. Onken, what do you see as issues in evolving from an AOC air-ground data link infrastructure to an ATN Baseline 2 architecture to support ATC?

Mr. Onken:
In the US, both air-ground data link service providers have signed service-level agreements to provide ATC services. In Europe, both service providers have been providing ATC services for a decade, so I see no problems in continuing in the future.

Participant (Mr. Gonda):
Do you expect the ground stations to be subjected to DO-278 requirements or some other test process?

Mr. Onken:
DO-278 has not been levied on the ATC ground stations. Quality standards have been imposed via the service-level agreements with a quality standards set thereby.

Participant (Don Kaufman, Honeywell):
Mr. Delibes, the pilots have requested user interfaces that are as intuitive as an iPhone while providing substantial user benefits. What is SESAR doing along these lines that might be translated back to the US?

Mr. Delibes:
The primary objectives of SESAR as set out by the European Commision are operational efficiency and safety. Benefits for the pilots is to have an HMI in the cockpit that is more user friendly. When there is a transfer of responsibility to the cockpit it will require coordination among the participants to develop the acceptability of such procedures. Both pilots and controllers will need to be involved. The detailed implementation will still be the responsibility of the aircraft manufacturer in terms of its cockpit design and integration and certification.

Participant (Dr. Nikos Fistas, Eurocontrol):
Mr. Onken, what is your view of IP for future ATC networks given the ICAO support of IPS?

Mr. Onken:
The development of the ATN standards took a long time to develop, implement, and gain acceptance. The use of IP networks for ATC needs to be fielded and more widely

accepted. The IPS standards need to go through some of the rigorous steps that the OSI standards did as the ATN was being standardized for ATC.

Participant (Mr. Chris Wargo, Mosaic ATM):

The difficulty in implementing IPS continues to be Mobile IP. The current ATN implementation uses character-oriented ground infrastructure to deliver messages. How can we leverage IPS in the future?

Mr. Onken:

Mr. Onken confirmed that ground-ground delivery uses a character-oriented message routing system but that even that system uses IP to carry traffic across existing networks.

Mr. Roy:

Mr. Roy discussed the several issues involved with mobility: AeroMacs and Swift Broadband do not need mobility services because of their implementations. LDACS will require mobility but is far enough out to allow time to develop mobility solutions.

He reinforced the idea that service-level agreements should be the long-term answer to the acceptability of communications networks for quality of service, rather than relying on the specification of process validation, like DO-278.

Participant (Mr. Gonda):

Mr. Onken, do you feel that SC214/WG72 is sufficient to cover IP networks?

Mr. Onken:

In short, yes.

Participant (Mr. Wargo):

Where does the dialog service terminate in the various avionics systems, e.g., FMS or elsewhere?

Mr. Roy:

It depends on the avionics architecture. The dialog service is indeed implemented in various avionics units depending on the aircraft avionics architectures. However, it is clear that the user interface must take maximum advantage of alleviating the pilot from entering information that could otherwise be provided by the avionics itself.

Participant (Dr. Fistas):

There is wide range of perspectives on the panel members remaining: aircraft manufacturer, avionics supplier and communications service provider. What is the most

important thing that needs to happen in aviation communication from your perspective?

Mr. Delibes:

Data communications is central to all future upgrades to C, N, and S applications.

Mr. Roy:

Reliable communications is indeed essential to future applications. However, current focus of defining complete applications, end-to-end. We need to reach a good balance of moving forward with acceptable portions of the system as opposed to the Big Bang.

Mr. Onken:

Harmonization is the key for communications in particular. And so if we select a subset of capabilities it needs to be useful around the world so that we can avoid having to implement one subset here, another there, and end up having to implement everything.

Mr. Delibes:

Agreed but didn't say that as it is a given for him. But in the future we will have SWIM in addition to ATC and AOC data communications which will bring security issues forward for solution.

Participant (Mr. Gonda):

Does ARINC 660B include a description of the types of interfaces between advanced Surveillance applications and Comm applications.

Mr. Roy and Mr. Delibes:

It depends on the avionics architecture. Federated architectures with box-level integrations provide different challenges for new application interfaces. Integrated architectures may provide more flexibility to implement new application interfaces.

Participant (Mr. Wargo):

For future unmanned aircraft, do you see any impact on data link for ATC?

Mr. Roy:

There are long-term implications to aviation and I believe communications will have to be standardized and provided as a commodity. The current UAS implementations depend on ground-ground communications between ATC and pilot with the command and control air-ground link being specific to the UAS. In the future, there may need to be some standardization in this area but the opportunities for satellite, wide-area data, etc. will have to be taken into consideration.

Participant (Mr. Norman Fujisaki):

Mr. Onken, there have been congestion issues with VDL Mode 2 in Europe. Is there a plan for multiple VDL Mode 2 frequencies?

Mr. Onken:

There is a plan for multiple VDL Mode 2 frequencies and the plan provides for backward compatibility with upgraded or non-upgraded aircraft. This is not unlike what we have been doing with ACARS VHF for many years and view managing aircraft on two or four frequencies as easy compared to the ten frequencies being managed in the US for ACARS.

Mr. Delibes:

The current problems referred to by the participant is not due to lack of frequencies but the proximity of ground stations given the geography in Europe. Eurocontrol has additional plans to address these issues as well.

Question (Mr. Roy):

For Dr. Fistas, your presentation this morning talked about integration; what are the opportunities for integration in, for instance, the many radios carried aboard aircraft.

Dr. Fiskas:

Indeed the radios and antennas are an opportunity for integration. There is legitimate concern about common mode failures affecting multiple applications. However, investigations are under way to find solutions to such concerns. While there are people who are concerned about integration of comm, nav and surveillance functions, it my belief that this will come in the future.

Mr. Delibes, what is the Airbus view of CNS integration?

Mr. Delibes:

We believe in integration of CNS functions. In fact, there are active moves to eliminate redundant systems, such as ADF. However, we have significant requirements for the CNS functions reaching the level of 10 minus 9 which is a catastrophic level.

Participant (Mr. Wargo):

There are now applications sending position information across the Comm channel which is redundant with the ADS applications. This looks to be an opportunity to integration and reduction of redundancies.

Participant (Mr. Gonda):

The USAF tried to define the JTRS as a software-defined radio which was intended to be all things to all people and failed. This may be an example of the Big Bang previously

mentioned. Perhaps the step-by-step approach with a multi-mode radio for Comm and Surveillance will be able to succeed.

Participant (Mr. Tom Redling, L3):

The military is using cognitive radios which uses white-space between channels for communication. While this is not deterministic, it is being developed and is working.

Participant (Mr. Wargo):

What is the status of LDACS? Are standards being developed?

Dr. Fiskas:

Some prototypes of LDACS 1 are being investigated but standards are not under way yet and so we need to continue to use the VDL Mode 2 implementation in the meanwhile.

Conclusions:

This Workshop has proven that ICNS attendees appreciate the opportunity to interact with the presenters on a more formal basis than at the networking opportunities provided within the conference. However, a more convenient format needs to be found to allow better coordination between Workshop Plenary and Interactive sessions. Also, the topics need to be more focused than the wide ranging set of topics at this revival of the ICNS Workshops.

- The ICNS Workshop should have a theme and be more focused on that topic.

- The ICNS Workshop should be a single session with the Interactive Session immediately following any Presentations.

- The ICNS Workshop should not compete with the Plenary or Technical sessions but have dedicated schedule time.

- Future ICNS Conferences should include Workshops that follow these recommendations.

Biographies

Chris Adams
Eurocontrol/Maastricht

Mr. Adams is an Operational Eurocontrol ATC Controller. Lead for the Ground portion of the i4D Project at the Maastricht Upper Airspace Center, the Netherlands. Member of EUROCAE WG 78 developing the Baseline 2 Data Comm Standards.

Didier Delibes
Airbus/SESAR

Mr. Delibes has a background of Engineer in Automatics & Electrotechnics. He started his career in 1986 in the Airbus design office to work on Auto Flight Control system, where he led their development on the A330/A340 program. He then moved to the Airbus Product integrity department where he led the Avionics Certification for the A340-500/-600, A318 and A380. Mr. Delibes is now in the Airbus ATM Engineering program, Head of ATM deployment, working on the Sesar and NextGen programs. He is also chairman of the ICCAIA CSN/ATM committee; and active member of the ICAO ATM Requirement & Performance Panel and ICAO Technical Team that developed the GANP

Aslaug Haraldsdottir
Technical Fellow, The Boeing Company

Dr. Haraldsdottir holds a Ph.D. in Mechanical Engineering from the University of Michigan, and has over 30 years of experience in industry and academia in the areas of air traffic management operational concepts and systems analysis, dynamic systems modeling, simulation and control theory. Her current interest is in air traffic management system operational concepts, technical performance modeling, and system architectures for high-density airspace, with a particular focus on air/ground integration and advanced avionics. She is part of the Boeing Commercial Airplanes Avionics team, and serves as the Chief Scientist for the Boeing SE-2020 Team, which is composed of 15 major ATM industry organizations supporting the FAA's NextGen research and development mission. She has authored over 80 technical publications, and is frequently a speaker at industry conferences and workshops. In 2009 she received the Society of Women Engineers Achievement Award, and in 2010 she became an Honorary Member of the Icelandic Engineering Association.

Sam Miller
Mitre/AEEC

Mr. Miller is currently in the Performance-Based Navigation (PBN) Standards and Procedures Group at MITRE in which he provides aircraft flight management systems, navigation and regulatory guidance expertise for the MITRE enterprise. His focus is on

PBN operations and components that will facilitate implementation of the Next Generation Air Transportation System (NextGen). Specifically, he has contributed expertise on modern flight management systems (FMS) capabilities and how they will function in a four-dimensional trajectory-based operational environment. Additionally, he has conducted research on FMS operational differences and the effect of the varying methodology on Air Traffic's desire for a consistent and predictable aircraft flight path while in controlled airspace. He is also a member of or chairs numerous aviation industry working groups at ICAO, RTCA and the Performance-based Aviation Rulemaking Committee (PARC). Mr. Miller was previously a pilot and flight deck engineer at the Boeing Company and also a retired member of the USAF.

Andrew Onken
Rockwell Collins

Mr. Onken is a Senior Program Manager; he has over 20 years of work experience and has been with ARINC Incorporated 17 years. For 14 years, he has been in systems engineering at ARINC and was a key member of the ARINC GLOBALink development team that designed and fielded the world-wide VDL Mode 2 service. He was the Senior Principal Engineer overseeing all ARINC GLOBALink Air Traffic Services programs before and during the Harris DCIS Team win of the FAA Data Communications Integrated Services program award; he is now Sr. Program Manager. Andrew managed the ground station engineering team as they successfully developed a new generation of low-cost ground stations supporting multiple VHF services. He was successful in leading teams during the CPDLC Miami Trials and Link2000. Andrew holds a Bachelor of Science in Electrical Engineering.

Aloke Roy
Honeywell

Mr. Roy is a Senior Program Manager with Honeywell Advanced Technology. He currently manages data communication, information security and radio technology development programs supporting Honeywell Aerospace. He has held a number of business development and program management positions. He was Systems Engineering Director at ARINC and oversaw development of satcom, HF, VDL, ATIS, and PDC standards and services. Currently, Mr. Roy chairs ICAO ACP Working Group "S" and RTCA Special Committee 223 which are developing the Aeronautical Mobile Airport Communication System requirements and operational performance standards.

Capt. Robert E. (Rip) Torn
Delta/IFALPA/ALPA

Captain Torn is an active pilot today for Delta Airlines flying the B757 and B767 in domestic and international operations. He has almost 25 years and has also flown the

B-737, MD-88 and served as Flight Engineer on the B-727 and L1011 there. A former US Air Force reconnaissance and training pilot he has several thousand hours in the RF-4 and the T-37/ T-38 aircraft.

He is attending as a representative for the Air Line Pilots Association- International (ALPA-I) where he serves as the chair of the Air Traffic Services (ATS) and is also coordinator for NextGen projects. In addition he is the International Federation of Air Line Pilots Associations (IFALPA) as their ATS committee chair and representative to the International Civil Aviation Organization (ICAO) on several technical panels and working groups. He continues his work with the RTCA technical committees and the NextGen Advisory Committee- Subcommittee.

Rip lives in Austin, TX with his family.

Capt. Rocky Stone
United/RTCA

Captain Stone is an operational pilot for United Airlines. His many duties include work as an Airline representative to various standards and government-industry groups; he is currently the industry chair of RTCA SC 186 (ADS-B) and RTCA SC 206 (Aviation Information Services).