ASAS-TN2

Report of the Paris Seminar
14-15th April 2008

"ASAS Now!"

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1 Introduction

Phil Hogge welcomed delegates to the Seminar and reminded them of the Airborne Separation Assistance System (ASAS) Thematic Network 2 (TN2) objectives. He emphasised the fact that the development and acceptance of ASAS has moved a very long way since the Thematic Network started five years ago. ASAS is in operational use today, hence the title of the Seminar – ASAS Now!

UPS currently has three ASAS applications in operational use at Louisville – Flight Deck Merging and Spacing (FDMS), Cockpit Display of Traffic Information (CDTI) Assisted Visual Separation (CAVs), and Surface Area Movement Management (SAMM). These applications are certified on the B757, with the B767 to follow later this year. Also, a number of other airlines are beginning to show interest in finding areas where they could obtain benefits from using similar ASAS applications in Europe.

The maturity of the Package 1 applications is progressing well. But, even more important, ASAS applications are included in both the Single European Sky Air traffic management Research (SESAR) and FAA Next Generation transportation system (NextGen) roadmaps. Thus, a major milestone has been achieved.

The imperative now is to identify more opportunities to use these applications in the near term and to maintain the momentum so that they are further developed and used to build the future ATM system.

2 What is the ASAS-TN2?

ASAS-TN2 is a three-year project that is primarily a communication activity. The ASAS-TN2 is sponsored by the European Commission (DG Research).

ASAS-TN2 is a stand-alone project, following on from the work of its predecessor project ASAS-TN. The scope has now increased to address applications beyond Package 1.

ASAS-TN arose out of the ASAS work within the programme of Co-Operative Actions of R&D in EUROCONTROL (CARE-ASAS). It is organised within the work programme for Competitive and Sustainable Growth of the European Community, Key action 4, New Perspectives in Aeronautics, Target Platform 4, “More Autonomous Aircraft in the Future Air Traffic Management System.

The main objective of the ASAS Thematic Network is to accelerate the implementation of ASAS applications in European Airspace taking into account global applicability in order to increase airspace capacity and safety.

The work of the ASAS-TN2 is threefold:

- Five Workshops and a final seminar
- Web-based documentation; and
- Annual reporting of the status and maturity of ASAS application development.

The Workshops inform the application maturity reporting work.

The ASAS-TN2 is managed by a consortium led by EUROCONTROL that includes BAE Systems, ENAV, LFV, NLR, Thales Air Systems and Thales Avionics.

In addition to the above organisations, the ASAS-TN involves a very wide range of organisations (e.g. ATM stakeholders, Universities) including pilot and controller professional associations (ATCEUC, IFATCA, IFALPA and ECA).

3 ASAS-TN2 Seminar

3.1 Format of the seminar

Day 1 consisted of an introductory session and update of the progress and status of worldwide ADS-B/ASAS implementation and evolving airborne separations standards.

Day 2 consisted of a session describing the precise nature of ASAS with relation to the SESAR and NextGen operational concepts.

3.2 Day 1: Monday 14th April 2008:

09:30 – 10:00:

- Host welcome (Jean-Michel Craste, Thales Air Systems)
- Event Chairman (Phil Hogge, ASAS-TN2)

Session 1: 10:00 – 13:00: progress and status of implementation and standardisation
Chair: Tony Henley (BAE Systems) Secretary: Nico De Gelder (NLR)

This session reported on what happened on the ASAS domain since the last workshop six months ago. It provided an update on global ASAS activities concerning implementation, standardisation and validation.

The session also reported on how ASAS could enhance flight operations in the vision of airlines, including initiatives that are currently undertaken, and looked into long term ASAS strategies in the US & Europe.

- Review of earlier ASAS TN recommendations (Ken Carpenter, QinetiQ)
- CASCADE/RFG – progress on ADS-B/ASAS implementation and standards (Jörg Steinleitner, EUROCONTROL HQ)
- FAA – update on ADS-B/ASAS (Vinny Capezzuto, FAA)
- *Discussions*

- Canadian Implementation of ADS-B Out – (Jeff Cochrane, NavCanada)
- ASAS activities at the ICAO level: step(s) towards global standardisation (Jean-Marc Loscos, DSNA)
- Legal aspects (Francis Schubert, Skyguide)
- *Discussions*

14:30 – 17:45:

- Results of ASAS maturity assessment (Chris Shaw, EUROCONTROL EEC)
- UPS - use of ASAS Merging and Spacing at Louisville (Bob Hilb, UPS)
- SAS - ASAS experiments on the airport surface (Peter Larsson, SAS)

- *Discussions*
- *Coffee break*

- KLM - Operations at Schiphol: how does ASAS fit? (Edwin Kleiboer, KLM)
- ASAS self separation and cruise climb for business jets (Serge Lebourg, Dassault Aviation)
- AP23: long term ASAS beyond Package 1 (Dragos Tonea, EUROCONTROL HQ & Roberta Massiah, FAA)
- *Discussions*

3.3 Day 2: Tuesday 15th April 2008:

Session 2: 09:30 – 12:30 ASAS in European and US ATM plans
Chair: Jean-Claude Richard (Thales Avionics) Secretary: Giorgio Matrella (ENAV)

ASAS is no longer a stand alone concept but fully embedded into global ATM Concepts of Operation issued recently by major ATM initiatives such as NextGen and SESAR. This session addressed the various ways that SESAR and NextGen, from an institutional standpoint, and AIRBUS and Boeing, from an industrial standpoint, are implementing ASAS in their respective master plans and roadmaps.

- ASAS within SESAR master plan (D4, D5, D6) (Andy Barff EUROCONTROL EEC & Fraser McGibbon, BAE Systems)
- ASAS within NextGen Integrated Work Plan (Doug Arbuckle, NextGen JPDO (NASA)
- ASAS SESAR/NextGen relationship (Don Ward, FAA)

- *Discussions*
- *Coffee break*

- Boeing ASAS roadmap (John Brown)
- Airbus ASAS roadmap (Stéphane Marché)

- *Discussions*

Session 3: 14:00 – 17:00: ASAS where it is needed
Chair: Billy Josefsson (LFV) Secretary: Peter Howlett (Thales Air Systems)

This session focused on two themes: use of ASAS to prevent runway incursions, and long term ASAS strategies.

Runway incursions are a major safety issue, growing larger as a result of the traffic increase. An accident is simply "unacceptable" by all stakeholders. A study (CAST, 2002) found that the runway incursion problem can be reduced by as much as 95 percent with a combination of technologies that greatly enhance pilot situational awareness and provide conflict alerting to air traffic controllers and pilots. The first part of the session looked into different aspects and research results related to the role of ASAS in the prevention of runway incursions.

The session also provided an update on some ongoing research projects and looked into an example of ASAS flight deck implementation.

- RWY incursion facts and comparison US & Europe (Phil Hogge, ASAS TN2)
- EMMA2: Airport surface: runway incursion ATSA-SURF (Michael Roeder, DLR & Antonio Nuzzo, ENAV)
- NUP2+: Safe and efficient airport operations (Lars Lindberg, AVTECH)
- CRISTAL ITP Simulations and trials of ATSAW ITP in N. Atlantic (Johan Martensson, EUROCONTROL HQ)
- *Discussions*
- *Coffee break*
- Merging & Spacing Roadmap by MITRE (Randy Bone, MITRE)
- Equipment hosted in Electronic Flight Bags (EFBs) (Cyro Stone, ACSS)
- *Discussions*
- *Closing remarks*

A.Session 1: Progress and Status of Worldwide ADS-B/ASAS Implementation and Evolving Airborne Separation Standards

4 Introduction

This session was chaired by **Tony Henley** (BAE Systems) with **Nico de Gelder** (NLR) as the secretary.

The first part of this session reported on what has happened in the ASAS domain since the last workshop six months ago concerning implementation, standardization and validation:

- Review of earlier ASAS TN recommendations (Ken Carpenter, QinetiQ)
- CASCADE & RFG – Progress and Status of Implementation and Standardisation (Jörg Steinleitner, EUROCONTROL HQ)
- FAA ADS-B Program update (Vinny Capezzuto, FAA)
- Canadian Implementation of ADS-B Out (Jeff Cochrane, NavCanada).
- ASAS activities at the ICAO level: step(s) towards global standardisation (Jean-Marc Loscos, DSNA)
- Legal aspects (Francis Schubert, Skyguide)

The session also reported on how ASAS could enhance flight operations in the vision of airlines, including initiatives that are currently undertaken, and looked into long term ASAS strategies in the US & Europe:

- Results of ASAS maturity assessment (Chris Shaw, EUROCONTROL EEC)
- UPS - use of ASAS Merging and Spacing at Louisville (Bob Hilb, UPS)
- SAS – ASAS experiments on the airport surface (Peter Larsson, SAS)
- KLM - Operations at Schiphol: how does ASAS fit? (Edwin Kleiboer, KLM)
- ASAS self separation and cruise climb for business jets (Serge Lebourg, Dassault Aviation)
- AP23: long term ASAS beyond Package 1 (Dragos Tonea, EUROCONTROL HQ & Roberta Massiah, FAA)

5 Review of the briefings

5.1 Review of earlier ASAS TN recommendations (Ken Carpenter, QinetiQ)

Brief description

Over five years, eight Workshops and a seminar have produced about 60 recommendations. This volume made it impractical to discuss each recommendation individually, but there were recurring themes:

- Get ASAS into SESAR — the last 6 workshops
- Stakeholder involvement — 7 workshops
- Implementation plan/long term vision — 5 workshops
- The role of the RFG — 4 workshops
- ICAO — 4 workshops
- Trials — 4 workshops
- ASAS is integral to ATM & trajectory management — 4 workshops
- ADS-B development — 3 workshops
- Package 2 & 3 — 3 workshops
- Money — 2 workshops
- The need for procedures — 2 workshops
- Benefits — 2 workshops
- Surface applications — 2 workshops

12 recommendations do not fit this pattern, but only four of these were made in the last four years.

The recommendations show the ASAS TN working as a pressure group to guide development in the desired direction. Much of what was desired has come to pass, or is in hand:

- SESAR & NextGen include ASAS in their long-term paradigms
- ASAS cooperates with CDM & trajectory management.
  It does not compete with them.
- We used to talk tentatively of ATSA and spacing.
- Now the focus is on airborne separation.

Key issues

- SESAR & NextGen both include ASAS in their ATM paradigm.
- To that extent, stakeholders are plainly involved.
- The long term vision is emerging, and it is for airborne separation. SESAR is providing an implementation plan.
- The RFG is playing a vital and central role. ICAO has been slower.
- The ASAS TN has been a forum facilitating global exchange of views, involving all players. It has promoted a wider understanding of ASAS, and thus promoted its development.

5.2 CASCADE/RFG – update on ADS-B/ASAS/Standards: Jorg Steinleitner (EUROCONTROL HQ)

CASCADE

Brief description

The EUROCONTROL CASCADE programme co-ordinates the implementation of the first set of ADS-B applications in Europe, taking into account the requirement of global interoperability. The Programme covers both ground and airborne surveillance applications.

The European implementation policy includes two steps. The first is voluntary implementation in "pocket areas" using existing (certified) equipment. The second is implementation based on an Implementing Rule ("SPI IR"), which is planned to be endorsed by the SES within 2009.

CRISTAL partnerships are in place in various regions to perform trials in partnership with stakeholders in local sites of Europe ("pocket areas") where the surveillance service can be improved. These pocket areas are the basis for a subsequent wider implementation. CRISTAL partnerships address both the Ground Surveillance infrastructure and the airborne surveillance applications. As part of the Pioneer Airline Project, airlines have requested or recommended approximately 70 ADS-B-NRA sites throughout the EU.

Regarding the certification of airborne equipment, the Pioneer Airline Project aims at obtaining certification of ADS-B out (ADS-B-NRA, using existing transponders, i.e. ED102/DO-260 or DO-260A) throughout 2008. The EASA certification material (AMC20-24) is expected to be issued formally this month (April 2008). It has already been accepted by NavCanada as means of compliance for ADS-B surveillance operations in the Hudson Bay area. All Airbus families are already approved.

The first implementations of airborne surveillance applications based on ASAS are expected in 2011. There are 4 ASAS applications in CASCADE; - ATSA-VSA (Enhanced Visual Separation on Approach), ATSA-SURF (Surface enhanced Traffic Situational Awareness), ATSA-AIRB (Airborne enhanced Traffic Situational Awareness), and ATSA-ITP (In Trail Procedure in Oceanic airspace).

There has been feedback from RFG/15 that the ADS-B-APT (ADS-B Airport Surface Surveillance) operational standards will be closely coordinated with the ATSA-SURF application – a hard deadline of end 2009 has been scheduled for the overall RFG "1.0" work.

Key issues in the presentation

- Implementation of ASAS in Europe has started. The first implementation sites in Europe are known. 20 airlines with more than 400 aircraft will be ADS-B pioneers. The first airworthiness approvals are imminent.
- All stakeholders should participate in the EC SES consultation process for the Surveillance Implementing Rule which includes ADS-B.
- International co-ordination takes place at the level of the programme leaders of US. Canada, Europe and Australia who meet regularly to ensure convergence on issues including ADS-B equipage.

Requirements Focus Group (RFG)

Brief description

The ADS-B standardisation work is driven by the Requirements Focus Group (with principal membership from EUROCONTROL, FAA, EUROCAE, RTCA and additional participation from Australia and Japan). The first major milestone has been achieved with the publication of the ADS-B standard for Non-Radar Airspace at the end of 2006.

The next three applications to be released will be ATSA-ITP, ATSA-VSA and ADS-B-RAD in that order.

- OSEDs are "frozen" for ADS-B-RAD and ATSA-ITP (i.e. they have reached full maturity, with the prospect of minor updates during integration as annexes to the Safety and Performance Requirements (SPR/INTEROP document).
- SPR/INTEROP assessments for all three applications are nearing completion and document integration is to commence.
- Target dates for EUROCAE/RTCA approval are April 2008 for ATSA-ITP, September 2008 for ATSA-VSA, and December 2008 for ADS-B-RAD.

Release of ADS-B-APT, ATSA-AIRB, ATSA-SURF and ASPA-S&M is planned for end 2009.

The RFG Package 1 application definition work is expected to complete end 2009. This will be followed by work on "package 1.5" addressing Enhanced ATSAW and spacing applications with a targeted IOC of 2013 which is compatible with SESAR IP2.

Key issues in the presentation

- The RFG is a powerful example of effective international cooperation and has successfully refined the methodology for generating standards.
- Steady progress is being made.

5.3 FAA – update on ADS-B/ASAS: Vinny Capezzuto (FAA)

Brief Description

The presentation gave an update of the Progress on the FAA ADS-B deployment Programme contract and the comments received on the "Notice of Proposed Rule Making" (NPRM) regarding aircraft equipage.

Specific progress Included:

Release of NPRM	**October 2007 / Complete**
Integrated Baseline Review	**October 2007 / Complete**
Preliminary Design Review	**November 2007 / Complete**
Critical Design Review	**February 2008 / Complete**
Close of NPRM Comment Period	**March 2008 / Complete**
Factory Acceptance Test for Broadcast Services	**April 2008 / Ongoing**
Key site equipment delivery, installation and checkout	**May 2008 / Equipment Delivery and Installation Ongoing**
Service Acceptance Test for Broadcast Services	**May 2008**
Initial Operating Capability of Broadcast Services	**August 2008**

For the Gulf of Mexico trial site, there have been several environmental impact issues limiting the installation of ground stations in Florida – to get round this they have a portable trailer version of the base station.

A key element of the concept is the uplinking of surveillance data to the flight deck.

The results of the NPRM were almost all positive in the sense that that acknowledge the need for ADS-B but many issues were raised in the 1372 replies. One of the major comment areas was a

call for the inclusion of ADS-B-In capability – not least because the Cost Benefit case depends on the additional applications that this provides.

Linked to this, the US budget process (the FY Conference Mark) has ***provided a separate $9,350,000 for the ADS-B program specifically to expedite air to air capabilities.***
The FAA is tasked with a proposal for the following additional activities:-

- En Route 3nm Separation.
- In-Trail Procedures.
- ATSA Conflict Detection on the Surface.
- Flight Deck Merging and Spacing.
- ASAS Forum (which it is planned would be modeled on the approach of the ASAS-TN2).

But note that the total cost will be closer to $21M.

Key issues in the presentation

- Significant US funding is in place.
- FAA has come a long way in last 5 years.
- The ADS-B ground network is progressing well.
- There is pressure from the community to extend to airborne surveillance as soon a possible.

5.4 Canadian Implementation of ADS-B Out – Jeff Cochrane, (NavCanada)

Brief description:

The presentation gave a brief introduction to NavCanada and went on to describe ADS-B developments:

NavCanada is a non-share capital organisation providing ANS services across 18m km^2 of Canadian Airspace. Its main objectives at present are to maintain its safety record within the top 10% of major ANSPs worldwide, while keeping its service charges to airlines within the bottom quartile by achieving a decline in long term operational costs.

The “high density hole” in radar coverage in the Hudson Bay area has led NavCanada to propose installation of radars to provide sufficient surveillance services to match the growth in air traffic. Its customers indicated a preference for ADS-B base stations (IATA), and in Feb, 2007, a contract was awarded. This will permit a transition from procedural operations, nominally 80Nm separation, to a 5Nm separation radar-like operation. It is expected to be operational for equipped aircraft on the 20th November 2008.

The aim is to make use of existing aircraft equipment and the soon to be released European AMC20-24 will be accepted as means of compliance. Based on the benefit of more frequently granted User Preferred Trajectory from early-climbs, and not being stuck with procedural clearances, the proposed ADS-B coverage allows annual savings of $10m.

There is now a plan to extend the capability to the Greenland area and there is growing interest in the use of ASAS (see NAVCANADA ANS plan www.navcanada.ca).

Key Issues:

- NavCanada was able to reduce its rates by $50m Cnd in 2008, achieving value savings of 16 points below the rise in Consumer Price Index since 1999 costs.
- ADS-B Surveillance enabling radar like surveillance across Hudson Bay area.
- Significant benefits, using existing airborne equipment, for equipped aircraft.
- Reduction of IFR to IFR separation losses to 0.75 per 100,000,000 movements.
- Estimated $10m in fuel savings per year, and 360,000 less metric tonnes of GHG emissions.

- Advantages to 35,000 flights per year crossing this airspace, approximately 2000 individual aircraft
- Reserved, less efficient, airspace for non-equipped users.
- Expansion of ADS-B Services into non radar airspace over Greenland scheduled for operation by the end of 2009, with service benefits predicted to commence accruing in early 2010.

5.5 Issues from chaired discussions

Tony Henley, BAE Systems	Q. Vinny, could you expand somewhat more on the ASAS Forum?
Vinny Cappezuto, FAA	A: We are still in the brainstorming phase but we want to complement the ASAS-TN activities. The basic idea is to have 4 events per year, to involve universities to exchange information on the work they are doing, and to work together; they generate a lot of great ideas. These ASAS forums will be hosted by the universities or NASA and will strongly replicate what ASAS-TN is doing.
Michael Loeffler, Austro Control	Q: FAA is addressing the congestion of 1090MHZ. Jorg, what is EUROCONTROL/[CASCADE]'s point of view on that?
Jorg Steinleitner, EUROCONTROL HQ	A: Two years ago we performed a study on this topic and issued a paper on it. The main result in the EU is that 1090 is sustainable for the applications/timeframe we are looking at. Yes, somewhere in the future there will be a breakover point. This is the worst case scenario for 2015. Also, [remember that] TCAS and ACAS interrogations [will be] reduced by the inclusion of ADS-B.
Chris Adams, EUROCONTROL MUACC	Q. In the US there seems to be a plan to implement ADS-B, site by site. Vinny, (or anyone?!), do we have a similar plan for the EU?
Jorg	A. No, we are discussing with the various states/ANSPs. Maybe it is up to you to come up with an implementation plan. In the US, they are moving towards pre-operational status, hence the need for such a bubble diagram roadmap.
Chris	It seems we have an almost ad-hoc method in EU. We want to have a more detailed and structured roadmap.
Jorg	Yes. Your comments are most welcome, this is what CASCADE is for.
Fabrice Bresson, Air France	A (regarding the previous question on EU Implementation Plan status): In SESAR, there is a roadmap. Maybe that answers the Maastricht question.
Richard Faris, NATS	Q: I am surprised to see a proposal to reduce separation figures in standard en-route US airspace from 5nm to 3nm, with claims of a delay reduction. Where do the benefits come from? Surely the only source of savings are separation reductions at the TMAs.
Vinny	A. Many aircraft do not switch smoothly at the transition points for en-route into TMA, therefore [you need to channel them in more smoothly] to reduce the S-turns and other inefficiencies.
Mark Watson, NATS	Q Vinny, how many of the negative comments, received in response to NPRM, do you have to solve before you can get Congress to move forward?
Vinny	A: Every comment needs to be addressed. Solved is an interesting one, comments will be "solved" together with the community, in an interactive process. The FAA receives the recommendations and has to balance that with our operations, and therefore we need to ask the right things. It should be noted that everyone stated that ADSB has value – the strategy put forwards by the FAA needs to be balanced and understood.

5.6 ASAS activities at the ICAO level: step(s) towards global standardisation Jean-Marc Loscos, (DSNA)

Brief description:

The presentation gave an overview of ASAS activity at ICAO which started in 1995 at a SICASP meeting with the ASAS concept. This was followed at the 11th ANC/SCRPS-I meeting with a proposed airborne surveillance timeline.

Annex 10 now includes ADS-B SARP and no further amendments are foreseen until 2014.

Technical specifications and operational specifications are held up by the urgent need for agreed phraseology, and a concept of operation for airborne separation.

There are three relevant ICAO panels:

- SEPARATION AND AIRSPACE SAFETY PANEL (SASP)
- OPERATIONS PANEL (OPSP)
- AERONAUTICAL SURVEILLANCE PANEL (ASP) (formerly SCRSP)

SASP has produced ADS-B separation minima and is working on ITP parameters for PANS-ATM (DOC4444).

The operations panel (OPSP) is dealing with the concept of CDTI, and phraseology. This will lead to provision in PANS-OPS (Doc 8168).

The Aeronautical Surveillance Panel (ASP) is working on ADS-B requirements on 1090 MHz both for ground and airborne perspectives, as well as the development of the concept of Required Surveillance Performance.

Key Issues:

- The challenge for ICAO is how to ensure global interoperability of complex systems such as ASAS without dictating detailed or specific solutions to industry?
- For ASAS applications, will RSP and PANS be sufficient to derive architectural solutions?
- Is it preferable to gain some experience with such systems before the standardization? ICAO believes the answer is YES: (TCAS existed before ACAS was standardized and mandated)

5.7 Legal Aspects: Francis Schubert (Skyguide)

Brief description:

The presentation began by emphasising that there have been no recent changes in the legal perspective of ASAS applications. The basic legal principle of “pilot-in-command” of an aircraft applies. The pilot’s role in any incident precedes investigation into for example, ATCO, *equipment* or organizational responsibilities.

Basic principles for traffic separation:

- The pilot-in-command principle.
- See and avoid.

Inclusion of ASAS within the Traffic Conflict Management picture was described diagrammatically:

STRATEGIC CONFLICT MANAGEMENT	SEPARATION PROVISION	COLLISION AVOIDANCE
Airspace Organization and Management	Pilot maintained separation: ▪ Visual ▪ **ASAS**	Safety Nets: Airborne Collision Avoidance System (ACAS)
Demand and Capacity balancing	ATC Provided separation	Short Term Conflict Alert (STCA)

The application of the pilot in command principle in tort litigation can be harmful to the overall safety of the system: “it can destroy the ATC’s incentives to use due care”. It is necessary to avoid the channeling of responsibility – which can lead to counter intuitive notions.

For the new systems to work, the courts must clarify the rules governing liability of pilots and controllers. For this reason, the new legislation with regard to ASAS should be kept as simple as possible, in order to clearly define responsibilities – this reflects SESAR’s position on legal aspects of ASAS.

Key Issues:

- As recommended in SESAR document D3, new legislation set by ICAO with regard to ASAS should be as concise as possible, in order to clearly define responsibilities.
- Advanced technology should not be used as an excuse by ATC to ignore an aircraft and potential danger, but rather as a method to more closely monitor the aircraft's progress.

5.8 Issues from chaired discussions

Bob Hilb, UPS	Q. Jeff- regarding Greenland, and the track system into Husdon Bay, have you considered allowing random routing around the track system as an additional incentive to equip?
Jeff Cochrane, NavCanada	A. We have to maintain a track system until 100% ADS-B Out equipage, therefore the only benefit in the meantime could be to reduce the width of the tracks.
Bob	Maybe you could use the least desirable tracks for unequipped aircraft?!
Jeff	A. We prefer to have incentives to equip.
Fabrice Bresson, Air France	Q. Jeff – The Canadian AIC tells us to equip by 20 November 08, however the AMC20-24 is not issued yet, and it is difficult to certify from their framework for ADS-B Out in that timeframe. The question is; what will it imply for the airlines that are not equipped by the 20 November 2008? How will you manage it?
Jeff	A. In order to decide how to carve up the airspace over Hudson bay, we took into account the [likely] number of aircraft that could equip. Air France were online in the teleconferences; we agreed segregated airspace for those aircraft that are equipped, and also RNP separation standards. We are looking at a mix of segregated airspace and RNP separation standards, i.e. a block of airspace at and above FL350 with a lateral extent of the Hudson sector and out to the east, and the non-equipped aircraft have to fly below and around this airspace. The considerations have been put out to the users.
Fabrice	Q. What about those that are not basically ADS-B Out?
Jeff	A. Up to the customers.
Christian Dencke, ECA	Q1. (To Jean-Marc Loscos) – in your presentation you said ICAO should not dictate specifics to industry. I am a little surprised? Standards are necessary in detail if we want to have globally harmonised procedures? E.g. 8.33kHz radios – enormous difficulties were encountered due to the lack of standardisations. (some radios had 5 digits, others had 6 digits). Crew procedures were developed as gap fillers to overcome technical issues, all because the standards were not right. We should be cautious with our language, using terms such as dictate is counterproductive. Also, a better CPDLC standardisation would have helped a lot with global implementation. Q2. An issue on Required Surveillance Performance (RSP) is whether the Human factors should be included – I am convinced this is the case, that HMI needs to be taken into account, especially with RVSM – the problem is not only the technical specifications but

	also the fact the total performance does include the human.
Jean-Marc Loscos, DSNA	A. There are other examples where ICAO did not follow the correct process. E.g. Mode S transponders and the network were specified in great detail. But nobody implemented it – no one ever used it. ICAO should not go into too many details until we are sure they are required and will be used. There is a specific problem with CDTI and Multi-Purpose Traffic Displays, a number of considerations: (1) how can you make rules/standards if traffic displays are not standardized (fusion of ACAS and ASAS data); ICAO should not tell the manufacturers the way to do it – maybe it is the French way but I did not find "Dictate" offensive. (2) if you include the HMI it takes much more time to agree on standards, for example you have to model the human being and (3) you cannot have it soon and thorough – it is difficult to get consensus when there are over 200 member states of ICAO – it would be a lot more simple if we did not have to include the Human in the HMI.
John Brown, Boeing	Q. Jean-Marc, To what extent will ADS-B information be allowed as input for ACAS (track info, etc...)? It seems that ICAO is softening its position on this issue.
Jean-Marc	A. ICAO will try to put the words, if you can do it, then do so; it will not be mandated, nor prohibited. ICAO's position is to try not to forbid it. Therefore the text will be very limited. ICAO tries to protect the operational use of ACAS. And yes ACAS can be improved if it has access to more parameters, but parameters can only be included if they do not affect the independence of ACAS.
Mete Celiktin, EUROCONTROL HQ	Q. Jean-Marc, you mentioned that you have a personal preference for the name Sequencing & Merging (S&M) instead of Merging and Spacing (M&S). Could you extend a bit on that? Why do you have a preference to name the application M&S?
Jean-Marc	A. I prefer the word spacing to sequencing because the aircraft will do the spacing. Today, we do not use ASAS to sequence – the controller determines the sequence.
Bob Hilb, UPS	Q. Jean-Marc, when talking about Required Surveillance Performance (RSP) it is more important to know where the aircraft is going (intent) than knowing only its position. Are there any thoughts of moving beyond position information?
Jean-Marc	A. We are in the process of defining RSP and are not there yet – prefer to wait for the first applications to emerge. Probably your Merging and Spacing work will be very valuable for RSP standardisation. The parameters I showed in the presentation were with regard to ground position. Intent can come later.
Jeff	Q. Do you see a change in the cost of underwritten ANSP services with the advent and implementation of ADS-B systems? Especially for NavCanada.
Francis Schubert, Skyguide	A. Premium is based on risk. Risk is changing, responsibilities will not only shift to the flight crew but also partly to the manufacturers. And based on past experience with insurers it will probably add up. Yours is a special case as it has the highest airspace coverage in the world. As the uptake increases, the cost could be divided by organisation, but this does not always happen.

5.9 Results of ASAS maturity assessment - Chris Shaw (EUROCONTROL EEC)

Brief description:

The global maturity of nineteen applications based on Automatic Dependent Surveillance Broadcast (ADS-B), has been assessed by the European Commission sponsored Airborne Separation Assistance System (ASAS) Thematic Network 2 project. A group of twelve European operational and technical ASAS specialists from industry, service providers and research (BAE Systems (UK), ENAV (Italy), LFV (Sweden), NLR (The Netherlands), Thales Air Systems (France), Thales Avionics (France) and EUROCONTROL) judged maturity based on a set of commonly agreed metrics and their experience in the field.

For each application, maturity scores in the range 0 to 4 were assigned for each of the following metric types: (i) Operational concepts, (ii) Benefits and constraints, (iii) Safety, (iv) Procedures and human factors, (v) Systems, HMI and technology and (vi) Transition issues. The maturity assessment was reviewed externally by peers in Europe, USA and Australia. This is the third annual assessment since 2006.

In the period October 2006 to January 2008, the percentage of European flights sampled that were Mode-S equipped increased from 95.3 % to 97.0 %. ADS-B Extended Squitter indicated capability as a percentage of Mode-S equipped flights increased from 57.3% to 78.3% in the same period.

Results indicate that one of the most mature applications is 'ATC surveillance in non-radar areas' with a total score of 23.0 out of a possible 24 (operational daily in Bundaberg, Australia since 2007). The airborne traffic situational awareness applications 'In-trail procedure in procedural airspace' and 'Enhanced visual separation on approach', and the Airborne spacing application 'Sequencing and merging' also seem to have made progress with total scores of 19 and above. The applications judged to be relatively immature are 'Aircraft derived data for ground tools' (ADS-B surveillance category) and 'Vertical crossing and passing' (Airborne separation category) with total scores less than 7.

Over the year from March 2007 to February 2008 the maturity scores of fourteen out of nineteen applications increased (compared with fifteen the previous year) including a new application In-trail Merge (Airborne separation category). 'Sequencing and merging' (Airborne spacing category) showed the greatest annual change in total score from 17 to 20.5 after FAA gave UPS/ACSS operational approval in December 2007.

Over the period from March 2006 to February 2008 the maturity scores of seventeen out of nineteen applications increased. The total maturity score of the airborne spacing application 'sequencing and merging' increased the most over the two year period from 15.5 to 20.5. The two applications with the lowest scores also matured at the slowest rate over the two year period: 'Aircraft derived data for ground tools' (ADS-B surveillance category) and 'Vertical crossing and passing' (Airborne separation category) did not change maturity score. The lack of change in score of Aircraft derived data for ground tools over the three year period implies the application needs to be revisited in the context of SESAR and NextGen.

When grouped in order of increasing ASAS functionality, the maturity tends to decrease on average. The relatively high initial airborne self-separation scores given in 2006 can perhaps be explained by the free flight research initiatives in the US and Europe during the previous decade with airborne separation category applications catching up more recently.

Key Issues:

- Out of 19 applications assessed, 9 have maturity scores of at least 12 (out of 24)
- Maturity has 'accelerated' from 10% increase in total scores (2006-7) to 13% (2007-8)
- Maturity cases:
  - Highest: ADS-B-NRA (operational Australia)
  - Lowest: ASEP-VC&P (score 6/24)
  - Fastest: ASPA-S&M (UPS M&S operational approval for Louisville, US)
- Versions 1, 2 & 3 of report on ASAS-TN2

- website (http://www.asas-tn.org/reports)

5.10 UPS - Use of ASAS Merging and Spacing at Louisville - Bob Hilb (UPS)

Brief description:

The presentation focused on the UPS trial of ASAS gate to gate certified procedures.

UPS has been drawing on its knowledge of surface supply chain management in transforming random and sometimes chaotic processes to managed and scheduled flows. It has implemented an early form of merging and spacing flow management at Louisville.

The use of the ASAS Merging and Spacing application on the flight deck (FDMS) has enabled implementation of idle power, low noise, low emission RNP Continuous Descent Arrivals (CDAs).

The benefits are many. From a systems approach, the correct scheduling of aircraft to within a few seconds enables reduction of the heavy use of CPDLC for Traffic advisories. With the CDTI on UPS aircraft, they have seen an average reduction in terminal area flight distance of 2nm.

107 B-757 and B-767 aircraft were previously equipped with CDTI, but five B-757's have now been equipped with the ACSS SafeRoute package allowing already mentioned FDMS, CDTI Assisted Visual Separation (CAVS) and additionally Surface Area Movement Management (SAMM).

UPS also stated that Airline Based En-Route Sequencing and Spacing (ABESS) allows time based separation accurate to within seconds at the point of delivery with minimal and early flight speed adjustments, issued via ACARS (ultimately via ATC Datalink). This operational technique utilises all surveillance sources to predict aircraft sequence and build schedules for arrival.

Key Issues:

- UPS's implementation of CDA's at Louisville has confirmed the ability to save fuel, lower noise levels and lower emissions in the TMA.
- Airline Operations Centre is currently using ABESS to provide speed, spacing and aircraft-to-follow assignments to flight crews.
- CAVS Display is a small unit costing ~$2-3k.
- Affordable retrofit via bundled applications in EFB's.
- Next Steps for CAVS (CDTI Assisted Visual Separation):
  - Remove wake vortex separation responsibility from controller: currently, IMC's mean ATCO's set a buffer in the approach separation standards.
  - Use FDMS (Flight Deck Merging and Spacing) for runway stagger against parallel approaching aircraft.
  - Eventually overcome the wake turbulence inhibition of 1.5nm against parallel approaching aircraft.
- Five 757's equipped with SafeRoute, with Surface Area Movement Management (SAMM) in the EFB providing surface situational awareness and tracking of other ground and airborne traffic in the TMA via ADS-B and next year TIS-B broadcasts.
  - Runway Incursion Alerts will be incorporated next year in addition to potential conflicts with traffic.

5.11 SAS - ASAS experiments on the airport surface Peter Larsson, (SAS)

Brief Description

Scandinavian Airlines' field trials with EFB/VMMR/FMS connected on B737NG were a part of NUP2+, a partner project partially funded by the EU. It was a long process to mature into its current

status in being ready for regular trials in May 2008. A few separate ground operations trials were conducted in autumn 2007. EASA STC for technical provisions were obtained in March 08. Three out of a total of four aircraft are installed and deactivated April 2008. A fourth aircraft is planned for installation in July 2008. They are awaiting operational approval for use of the systems, which are EFB based and use MMR.

Peter emphasised that the pilots want to be given a chance to spot and correct their own mistakes in small deviations from their allocated taxi routes, before the ATCO is alerted.

A possible scenario was demonstrated (diagrammatically) whereby an infringing vehicle is present within the runway zone (45m from the runway centre line) with an inbound landing aircraft on final approach 25 seconds away from touchdown. The vehicle and ATCO are issued with an automated "caution" message before receiving a full "warning" when the inbound aircraft is 15 seconds from touchdown. The pilot is alerted last of all 8 seconds from touchdown.

There is high potential for the system in the reduction of runway incursions (proportional to aircraft equipped) via increased situational awareness, alongside fewer misunderstood clearances which eases the RT frequency blockage. The snowball effect continues with conformance monitoring and optimisation of the flow of traffic when coordinated with DMAN or AMAN/redundancy – the result is a distributed system.

Key issues in the presentation

Areas of potential:

- Incursion mitigation – proportional to penetration
- Increased situational awareness
- Less misunderstanding of clearances/instructions
- Less RT frequency blockage
- Conformance monitoring
- Deviation alerts
- Optimizing flow of traffic
- Redundancy – distributed system

Areas for improvement:

- For the trial, the HMI is not optimally located – it is on the side of the pilot.

5.12 Issues from chaired discussions

Lars Lindberg, AVTECH	Q. Bob – with the trajectory engine EFB, did you compare the optimum trajectory and the proposed trajectory?
Bob Hilb, UPS	A. No, no cost comparisons are done on that yet. NASA Langley is working on trajectory algorithms, combining the two. But we wanted to get it (CDA's) into operations, so we had to make a compromise.
Lars	Q. We saw a very big difference in the optimum top of descent between 737's and A320's on the descent profiles for CDA's.
Bob	A. We force every aircraft to fly the same CDA profile – this was to push the requirements through the mill as easily as possible. We force everyone on a fixed flight path angle, which is determined on a daily basis. For forward fit solutions this may differ, you should think of two different trajectories one for high density operations in combination with FDMS and one for lower density operations when individual aircraft can really optimise their flight profile.
Rene	Q. what would happen if FedEx and UPS both flew into Louisville – can both operate CDA's?

Verbeek, NLR	Will ABESS still work?
Bob	A. No, For airports with multiple operators this function has to be taken over by the FAA. The functionality is different and needs to be managed by one system. An Arrival Manager (AMAN) will have to do the pre-conditioning of traffic. [As we heard yesterday] this is part of Vinny's program; to have recommendations for speed to be set in the system.
Jean-Pierre Nicolaon, Consulting ATM	Q. Bob, in your presentation you mentioned that M&S (Merging and Spacing) could relieve the controller of their wake-vortex separation responsibility. Could you expand on this regarding the time based spacing concept?
Bob	A. Using time based separation for wake turbulence, we can provide separations at such precise intervals that we will always get consistent delivery with the on board tools. Another significant observation is that we have seen no unstable approaches using this process. Also, level-off bust is *eliminated* because there are no level-offs in CDA's.
Tom Graff, FAA	Q. I had the impression that 107 UPS aircraft were equipped, now just 5 B757 are equipped?
Bob Hilb, UPS	A. Indeed 107 aircraft were originally equipped with ADS-B out/in. But the manufacturing of this equipment was sold to Garmin, and they were not interested to further develop it. So a new bid was requested, and ACSS was the winner. And now 5 aircraft are equipped with the ACSS equipment. The 757's will be using the original equipment until FDMS systems are installed – 767's have the MMS already.
Edwin Kleiboer, KLM	Q. Peter, previous experience with Dutch controllers indicates that there is an issue with putting together datalink messages. What is the experience at LFV when composing datalink message for the taxi route and subsequent taxi clearances?
Peter Larsson, SAS	A. During the trials we use both voice and datalink, so for the trials we need to increase the staff.
Edwin	In the end we should lower the task load per flight.
Peter	Yes, but also consider that today a lot of repeats [of taxi instructions by voice] do occur.
Claes Rundberg, LFV	Our experience with taxi clearances is that clearances via voice are not perfect. In a CPDLC environment the controller clicks on his screen to create the taxi routes, and this worked very well from a human factors point of view.
Jean-Marc Loscos, DSNA	Q. I am curious whether we should investigate ATSA-SURF without alerting? Is there a merit, capacity or safety benefits? Or do you have to go for alerting?
Peter Larsson, SAS	A Long term there should be gains for capacity, not just safety aspects, in combination with DMAN systems. E.g. aircraft taking off from runway intersections, or on final you already know which runway exit to use.
Tony Henley, BAE Systems	There is an issue over deviation alerting being quite simple, but alerting relative to other traffic is much more difficult.
Lars	I will talk tomorrow about efficiency. A range of simulations have been performed and many line pilots have participated. Since 2002 – there has been Rockwell Collins research, validations and operational trials – the numbers will be there. Results so far look very good. It is basically a logistic system issue: arrivals and departures interacting with surface operations.
Peter Larsson, SAS	Q. Bob, did you fix the speed schedule on top of the fixed vertical path for FDMS operations? With varying wind this becomes an energy management issue?
Bob Hilb,	A. We are defining the descent angle on a nightly basis. The speed schedule is fixed for the

UPS	first aircraft. The top of descent is altered every night.
Mike Wood, FlyBe/ELFAA	Q. Bob, do you use the 1090 ASAS information for enhancing the TCAS system - does that design compromise or enhance the functionality of the system?
Bob	A. We use a dual processor system. TCAS is a totally separated function; it just shares the processor. There is an integrity monitor going on at all times, whereby the distance from the TCAS system is fed into the Surveillance Processor to verify the integrity of the [GPS-derived] ADS-B position information.

5.13 KLM - Operations at Schiphol: how does ASAS fit? Edwin Kleiboer, (KLM)

Brief description:

In terms of movements, Schiphol is the 4th busiest airport in the EU.

Using PRNAV and CDAs at Schiphol today would enable 33 arrivals per hour, short of current demands, and notably the prediction for 2020 sets the level at 40 per hour. KLM believes that ASAS applications in terms of merging, spacing and sequencing can lead to implementation of CDAs without sacrificing capacity, which needs expansion.

The KDC (Knowledge Development Centre) ASAS project was launched in February 2008 to address how ASAS can benefit the Schiphol concept evolution.

Anticipated benefits include on ground under Low Visibility Conditions – safety, separation responsibility with the flight crew, vacation of sensitive areas etc. There are also improvements to the departure procedure – Slow traffic, GS awareness.

The proposed Extended TMA around Schiphol with greater flow management efficiency enabled by the M&S application of ASAS, will be coupled with CDAs in the final approach phase also bringing environmental benefits.

These proposed improvements will allow increased ATC productivity and more efficient use of the TMA airspace. Implementation will be driven by safety and business cases.

It is believed that the ITP application of ASAS focuses on oceanic implementation only for now, so it has not been considered for Schiphol.

Key Issues:

- Schiphol allows for 33 arrivals per hour, assuming the use of PRNAV and CDAs.
- Sufficient for operations today, however by 2020 the real traffic levels will reach 40 per hour.
- Six Workshops investigating Improvements from ASAS applications started earlier this year.
- A short list of applications produced could include recommendations for operational trials.
- The ultimate goal for Schiphol is implementation of CDAs on without any loss of capacity.
- KLM believes that ASAS spacing, sequencing and merging will support this.
- KLM also believes that a Single European Sky Implementation Rule (SES IR) on ADS-B Out is an essential prerequisite for ASAS enabled traffic situational awareness on surface moving map displays.

5.14 ASAS self separation and cruise climb for business jets - Serge Lebourg (Dassault Aviation)

Brief description:

The business aviation community wishes for all airspace to be "managed". The ATC Role is essential for the safety of operations, and the pilot should have improved systems and technology to maintain the collision avoidance role.

Given that light business jets fly above other civil aircraft, it is ideal in this low density airspace environment to use cruise climb at and above FL410 for an estimated 5% fuel saving.

In an environment where both aircraft are operating cruise climbs, both ascending and descending, it is easier for the pilot to carry out the vertical separation, since it is easier to monitor a relative separation task than for the ATCO who has absolute FL's in mind for mainstream sectors.

Business Jets operate from small runways that are typically uncontrolled class G airspaces, and therefore ASAS would address the very real concern of safety of operations.

Dassault prefer UAT or VDL4 to 1090ES. UAT/VDL4 has the advantage of an extra message; this is the trajectory intent as logged by the on board flight crew in the FMS – i.e. waypoints – or the TCP of the aircraft (which can of course vary from its flight plan).

There can be simply implemented gains to flight route efficiency via Trajectory Advisories automatically generated to the pilot via the Electronic Flight Bag.

Key Issues:

- Business aviation sees an opportunity for a pan European, unique airspace sector tailored for high altitude large business jets.
- Above FL410 there is a need for cruise climb to get an estimated 5% fuel saving.
- In cruise climb airspace, ASAS self separation applications could be ideal for simplifying the separation problem by use of a relative rather than absolute position.

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5.15 AP23: long term ASAS beyond Package 1 Dragos Tonea, (EUROCONTROL HQ) & Roberta Massiah, (FAA)

Brief description:

AP23 overview

AP23 is a joint FAA/EUROCONTROL activity, including NASA, that is focused on long term ADS-B and ASAS applications. It is working within the visions of NextGen and SESAR to develop concepts for the use of ADS-B and ASAS. Terms of Reference were signed in 2007 and six meetings have been held so far. The first public release of daft documents was in December 2007 (FAA-EUROCONTROL steering committee for R&D- CCOM). There are five deliverables:

- D1 – General data exchange
- D2 – Methodology to prioritize applications for AP23
- D3 – Concept of Use for ASAS
- D4 – Draft proposal for a second set of ADS-B/ASAS applications ("Package 2")
- D5 - Draft White Paper on issues surrounding airborne separation

Interaction between AP23 and implementation

AP23 works with the EUROCONTROL CASCADE Programme and the FAA's SBS Program. In the FAA, an Application Integrated Work Plan outlines a cohesive evolution plan from the present to the NextGen vision (2025). The SBS supports the RFG, and Working Group 1 of RTCA SC186 for applications outside the scope of Package 1. The SBS programs plans to launch an ASAS Forum, meeting regularly like the ASAS TN, to discuss ASAS research activities.

It is essential to have a cohesive plan for the introduction of ASAS applications that places all the required developments relevant events on a common timeline: airspace changes; definition and approval of procedural changes; development of the avionics capabilities; and introduction of the applications.

Package 2

The process of identifying Package 2 has begun. The proposed method has been published (D2), and a draft report D4 is available for comment on a preliminary basis. AP23 is adopting an aircraft centric approach; is using SESAR and NextGen as the framework; and is determined to be transparent and provide feedback to contributors. The scope of Package 2 has been identified: the use of ASAS for the transfer of separation, SESAR ATM capability levels 4 & 5.

The first step was to elicit submissions for proposed applications from the aviation community via a web-based template (~10,000 e-mail addresses), which yielded some 100 proposed applications. These were not each unique, and they varied greatly in completeness and detail. In order to progress, they were sorted and AP23 is concentrating on those classified as airborne separation (ASEP), self-separation (SSEP) and surface applications.

In order to reconcile the multitude of proposed applications, AP23 is currently in the process of a functional analysis. Applications can be broken down into:

- A (hopefully small) number of application elements: basic ASAS-enabled capabilities of an ASAS aircraft. Applications are an integration of one or more application elements and applied to a specified environment with appropriate procedures. The elements are actions that are operationally meaningful.
- ASAS functions: the processes, calculations, and monitoring tasks that must be supplied by the ASAS avionics system to enable the application element.
- A definition of the environment.

The present lists of application elements and ASAS functions for ASEP and SSEP applications were presented.

The way forward

AP23 is now seeking feedback from the ASAS Package 2 contributors on its Package 2 work so far. Comments were requested in time for the next AP23 meeting in July 2008. AP23 wishes to validate the approach & start identifying lead applications to drive new avionics requirements generation. A second feedback cycle is planned for the autumn.

The next release of AP23 material will be in December 2008 to FAA-EUROCONTROL steering committee for R&D CCOM.

Key Issues:

- AP23 is working on three key deliverables.
  - Concept of Use for ASAS - Not complete, but a substantial draft is available.
  - Draft proposal for a second set of ADS-B/ASAS applications ("Package 2") - A less mature draft is available.
  - White Paper on issues surrounding airborne separation - to discuss the difficulties.
- For package 2, AP23 is concentrating on airborne separation and self-separation.
  - To test the need for a next generation ADS-B, and set demanding requirements to avoid further revision

- 96 ADS-B applications were suggested for Package 2
  - AP23 has rationalised them into clusters of similar applications.
  - AP23 is now performing a functional analysis of the applications, identifying ASAS functions and application elements, which, when combined with an operational environment, can be used to "build" applications.

5.16 Issues from chaired discussions

Mete Celiktin, EUROCONTROL HQ	Q. "SESAR D5/6 is being finished now: how do you plan to address some of the developments you are doing in the context of AP23 in SESAR?"
Dragos Tonea, EUROCONTROL HQ	A. AP23 operates in the D3 framework. AP23 will not come up with a list of applications, but with application elements and ASAS functions that are needed. From AP23 we will try to promote this to JU, AP23 will not make any statements on applications; applications are dependent on the environment.
Tony Henley, BAE Systems	This should be captured as an action received for ASAS TN2.
Lars Lindberg, AVTECH	Q. Serge, you are talking about 4.5 deg approaches when landing in middle of the runway. Is it RNP (Required Navigational Performance) or ILS (Instrument Landing System)?
Serge Lebourg, Dassault Aviation	A. It can be GLS (GNSS Landing System)…based on Satellite Based Augmentation System (SBAS). The Falcon is certified for 6.5 deg approaches, so 4.5 degrees is not a big issue. In addition the aircraft also have to come from the side, and it will be an automatic approach with pilots monitoring via the HUD. In the case of go-around of preceding traffic, one has to monitor that traffic, especially its wake.
Rene Verbeek, NLR	Q. 10 yrs ago I did a similar study on these types of operations – the conclusion was no operational benefit. Aircraft landing behind need more spacing because of the extra time needed when aircraft are landing at the middle of the runway (and taking even longer to vacate).
Serge	A. Since then technology has changed. We can [now] gain a benefit. Between two large aircraft, we can put a small aircraft, [overcoming the wake vortex problem].
Christian Denke, ECA	Q. There were several remarks in the speech I did not understand. Some issues sounded controversial. Maybe there is a misunderstanding? I am certain that as long as airspace is shared, common operational rules are needed. Cruise climb is something I support, but ASEP or SSEP can only be done under clearly defined rules: it was always said that rules were needed.
Serge	A. No, that was not the point of the slides. The purpose is not to change the rules, but to demonstrate that there are some safety objectives that are needed. Currently there is no safety objective for separation and collision avoidance, but we need a formal methodology. You can only certify UAVs if you have safety objectives and operational concepts. We want to have technology to enable the pilot to have the ability to implement collision avoidance. We need to stop the methodology that safety is only based on 'see and avoid'. And for sure we will need operational rules.
Jean-Marc Loscos, DSNA	Q. Dragos and Roberta: in itself, ASAS may not really be interesting – what *is* [interesting], is when you take one application and couple it with CDAs, etc. You still want to promote ASAS Package 2 in isolation, but will it be possible to select only the good functions? Or is there a concern that we would have written a document only accessible to this community? (Should AP23 take the view that ASAS package 2 is solely ASAS and in isolation?)
Dragos Tonea,	A. No, Package 2 is not developed in isolation. In D4, ASAS is defined as being within a

	4D environment (as stipulated in D3). There are many different types of environment. ANSPs wanting multiple solutions [will want to] select a pick of functions. It is therefore important that the operational objectives are not blanketed; that they can be tailored to individual solutions. The key is interoperability of the systems installed.
Lars	Q. Why is progress so slow? I remember 12 yrs ago in Florida, we were discussing Conflict detection – Bob, how do we stop talking about this at these meetings?
Bob Hilb, UPS	A. Bureaucracy is very difficult to overcome in order to implement change. You need to know the aircraft's intent? That is a different approach than with radars. We have spent many years coming up with good concepts, but the transition to the solutions is the difficult obstacle to overcome. Hopefully the key now is to keep the momentum going.
Tony	Q. It is OK to have an EFB display of a taxi map. But when there's traffic on it moving unpredictably you need to watch it. But you also have to be able to look out of the window?
Edwin Kleibor, KLM	A. Based on our experience with moving airport maps you need to have clear procedures in place to ensure that pilot and co-pilot do not taxi with both heads down. One needs to [maintain] visual [awareness] out of the window at all times.
Bob	A. A quick glance can give you that extra information and awareness. The pilot usually only needs this when the aircraft approaches near to the runway. Therefore the map acts as an extra 'driver aid', in addition to looking out of the window for information. The FAA already stipulated that it does not want pilots to be managing the flight with their heads stuck down in the EFB.

B. Day 2 - Session 2: ASAS in Future European and US ATM Concepts

6 Introduction

Session 2: 09:30 – 12:30 ASAS in European and US ATM plans
Chair: Jean-Claude Richard (Thales Avionics) Secretary: Giorgio Matrella (ENAV)

ASAS is no longer a stand alone concept but fully embedded into global ATM Concepts of Operation issued recently by major ATM initiatives such as NextGen and SESAR. This session addresses the various ways that SESAR and NextGen, from an institutional standpoint, and AIRBUS and BOEING, from an industrial standpoint, are implementing ASAS in their respective master plans and roadmaps.

- ASAS within SESAR master plan (D4, D5, D6) (Andy Barff (EUROCONTROL EEC & Fraser McGibbon, BAE Systems)
- ASAS within NextGen Integrated Work Plan (Doug Arbuckle, NextGen JPDO)
- ASAS SESAR/NextGen relationship (Don Ward, FAA)

- *Discussions*
- *Coffee break*

- Boeing ASAS roadmap (John Brown)
- Airbus ASAS roadmap (Stéphane Marché)

- *Discussions*

7 Review of the briefings

7.1 ASAS in the SESAR Master Plan: by Fraser McGibbon and Andy Barff (BAE Systems & EUROCONTROL EEC)

Brief description

The SESAR Master Plan contains the roadmaps for the operational evolutions, enabler development and deployment, and supporting aspects (e.g. regulation and legislation) to implement the SESAR 2020 Target Concept. It considers the lifecycle from feasibility to deployment, supported by an analysis of the associated benefits, funding, finance and risks.

The presentation reported on how ASAS has been included in the various roadmaps, covering SESAR's six service and capability levels. For levels 0 and 1, SESAR has identified ATSAW in flight and on the surface, ATSA-ITP and ATSA-VSA, as well as localised implementations of "manual" ASPA-S&M. These are planned to be available for operations from 2009.

For levels 2 and 3, ASPA-S&M is planned to be available from 2013 and ASEP-ITP (as an initial step towards implementing Airborne Separation applications) from 2018. Finally, for levels 4 and 5, which are the long term goals of SESAR, ASEP-C&P is planned to be available from 2020, and ASEP Wake Vortex spacing and Self Separation from 2025.

The presentation also highlighted the Research and Development that has been identified in the Master Plan, which will be carried out under the SESAR Joint Undertaking (SJU). The urgency of the R&D for service levels 2 and 3 was noted, as was the importance of agreeing in greater detail on what is required in the long term (for levels 4 and 5) in order that "innovative" R&D can be started under the SJU and the technology available when needed. For ASAS, this includes agreement on the applications that will be required in the long term.

The presentation ended with a discussion of some of the key risks to the Master Plan, which were seen to be particularly relevant to ASAS.

Key issues in the presentation

- SESAR provides a great boost for ASAS applications by prescribing an environment which lends itself to many ASAS applications.
- The SESAR technical developments in terms of ADS and datalink both bring significant opportunities to accelerate the safe implementation of ASAS applications.
- Under SESAR, we need to ensure that communication and dissemination of ASAS progress is maintained.

7.2 ASAS within NextGen Integrated Work Plan: Doug Arbuckle (NextGen - JPDO)

Brief description

This presentation described how Aircraft Separation Assistance Systems (ASAS) applications are represented in the NextGen Integrated Work Plan (IWP) v0.2 (see <http://www.jpdo.gov>. The briefing began with an overview of the NextGen planning framework being used by the U.S. Joint Planning and Development Office (JPDO), followed by an explanation of how the IWP was constructed. The briefing then provided a description of the various Operational Improvement (OI) "pathways" that are contained in the IWP. For many of the OI pathways, potential OI linkages and possible OI date changes that should be considered in a future version of the NextGen IWP were noted. The author's perspective on how the various OI pathways could/should be linked in a future

version of the NextGen IWP was also provided. The briefing concluded with the current year's plan for continued IWP development.

Key issues in the presentation

- 7-10 OI "pathways" are identified in the IWP, but they are not linked among themselves to the degree that seems possible or appropriate.
- Some pathways appear to be relatively well-covered – these tend to be in application areas that are relatively well-defined, such as Flight Deck Merging and Spacing.
- Some pathways appear to be incomplete or immature – these tend to be in application areas that are not well-defined at present, such as Aircraft-Reliant Separation Management.
- A few pathways have no long-term OIs, indicating that they may not fully reflect the NextGen ConOps.
- The IWP doesn't communicate the relative uncertainty across the major timeframes of NextGen (Near-term: 2008-2012, Mid-term: 2013-2018, and Long-term: 2019-2025); nor the JPDO expectation that transition paths will change, perhaps significantly, in the Mid-term and Long-term periods.
- All of the above implies many opportunities for improving future versions of the IWP.

7.3 Comparing NextGen to SESAR: by Donald Ward, (FAA)

Brief Description

The United States and Europe share a common challenge – they operate highly-complex, dense airspaces in support of their national economies. While similar in challenge, they are quite different in structure, management, and control. Both share a system built on a safety-referenced infrastructure. Where the US has developed a single system that spans the entire continent, Europe is a patchwork of service providers, systems, and airspaces defined by the boundaries of sovereign states.

Both systems are built on strong legacy infrastructures that must migrate to a new operational paradigm. As the operational concepts were developed, each region recognized the need to distribute the decision-making process, address safety risks, and augment the role of the human with improved integrated automation. These changes will support new capacity-enhancing operational concepts and enable the unencumbered growth of the air transportation system.

Key Issues in the Presentation

The briefing first considered NextGen and SESAR at a philosophical level, addressing "why" the programs are necessary and reviewing the scope for each endeavour. Then the presenter identified similarities and differences in the regional environments (as discussed above) and summarized the key characteristics of each program.

After the high-level comparison, the presenter further examined the NextGen modernisation effort. A quick review of the NextGen nine functional areas followed: Trajectory Based Operations; Airport Operations; Position, Navigation and Timing Services (PNT Services); Surveillance Services; Net-Centric Services; Weather Information Services; Safety Management; Adaptive Security; and Environmental Management.

To conclude the briefing, the presenter covered the implementation plans for NextGen and SESAR and showed the various activities in place to ensure harmonization. Specifically:

- JPDO Global Harmonisation Work Group.
- Memorandum of Cooperation between the FAA and Eurocontrol.
- Memorandum of Understanding between the FAA and European Commission.
- Work groups and demo programs.

7.4 Issues from chaired discussions

Edwin Kleiboer KLM	Q. ASAS and RTA functions, are they complementary? In my view, they should co-exist, as we need time based operations. Could you expand on this statement?
Andy Barff, EUROCONTROL EEC	A. In D5, there still seem to be statements that indicate that 4D techniques and ASAS techniques are alternatives: in fact they are complimentary. Absolute time techniques such as RTA can build sequences and relative time can manage the spacing once the sequence is built. There are still two Trajectory Management camps in SESAR in spite of all our efforts explaining that there is no competition.
Doug Arbuckle, JPDO	A. The US view is we need to do both. Our work indicates that [choosing one or the other] is false; [instead] both functions are required. Need to have a separation provision as well, and there does seem to be an algorithm that currently exists that might be able to do it.
Phil Hogge, ASAS-TN2	Q. SESAR talks about Self Separation in a mixed mode environment. NextGen talks about Flow Corridors. Is one more ambitious than the other?
Doug.	A. We know very little about Flow Corridors, and little about Self Separation. There needs to be a lot more collaborative work in order to emerge with a common view.
Andy	A. Implementation of Self Separation in managed airspace presently seems to be complicated, although in low density sectors such as the high altitude airspaces, it seems feasible. Self-separation will first become established in low density areas, with many advantages, especially in being able to provide an ATM capability without the ground infrastructure. After an initial implementation in those areas we might be able to implement it in medium density airspace. Presently it is quite challenging to imagine it in high density airspace. There are unlikely to be self-separation areas bounded from managed airspace: instead Self-separation is likely to infiltrate managed airspace. [We can imagine] in managed airspace, some [aircraft] under controller and some Self Separating. [It] might be [that we are] able in low to medium [density airspace], to have aircraft that are Self Separating, maybe UAVs, but it seems impossible to imagine a high density environment without envisaging problems. We simply need more [operational] experience.
Christian Denke, European Cockpit Association	Q. [On the subject of the long term] visions of Self Separation, given we are still in the early development stages: In my own opinion as a pilot, from yesterday's presentations, my hopes were that the modern visions would bring about a very dynamic user oriented system that would bring many benefits with respect to flexibility. Some of the visionary projects [seem, unfortunately, to describe a] need to maintain or introduce *stronger* rigidity, with regard to the renegotiation of Trajectories once the situation has changed. [Previously I found it] very positive to hear Andy Barff's overtaking Crossing & Passing presentation - I remember when C&P was nearly thrown out due to foreseen over complexity. Yet I wonder **do we see that for the simple geometries of the overtaking [application], there maybe could be a push for [similar] development of the other applications to increase the flexibility?** In-Trail procedure seems to talk so much more about the rigidity of the applications, and I would prefer to have a [Crossing and Passing] application pressed forward.
Andy	A. There is some flexibility within the 4D concept – the agreed trajectory is flexible – it is subject to revision either by the controller or the pilot. Flexibility may be exploited during ASAS applications such as monitoring of closely spaced parallel runway operations in the TMA environment where the relative speeds are slow and pilots have a clear vision using the CDTI to monitor and intervene on speeds. Yesterday, In Dragos's AP23 discussions, they've got the C&P, but also the monitoring of the close spaced situations, parallel approaches, overtaking etc. AP23 might be the right

	place where those issues may be further addressed.
Dragos Tonea, EUROCONTROL HQ	A. The environment will have a big impact on the nature of the applications. Certification will depend on the environment. We need to look at this in AP23 on how to solve this. Some applications may perform better in a specific environment. We can envisage some applications being certified to a completely different level when considering mixed airspace, [as opposed to] low density [airspace].
Geoff Barker, NavCanada	Q. How are you organising the interaction between the service providers and those who have to manage oceanic routes; between the FAA and single ANSP, and the multiple relative European ANSPs?
Don Ward, FAA	A. [With general issues such as] 4D contracts, a lot of this work is done with MOUs, whereas with [specific issues such as] oceanic, there seems to be a lot more bilateral work. Some work is very structured, but it tends to break down into bilateral initiatives.
Phil	There seems to be a big opportunity for ASAS applications in oceanic airspace as there are such long transitions.
Andy	SESAR did not have an oceanic remit. Therefore the oceanic concepts are only hinted to.
Don	[re: Oceanic applications progress] It's happening sooner anyway because of the pressures: there have already been some analysis of altitude changes and route changes; there are some significant savings they have found. Lots of work is on a collaborative basis.
Christian	Q2. I'm anxious about human out of the loop. Auto virtual tower. How does this bring benefits to safety and capacity? Can you expand on the benefits?
Doug	A. It is not something you would see at most main airports. We are talking about small airfields which do not have towers that do not have enough traffic to justify a "staffed" virtual tower. If people aren't needed all the time, just use a call centre mentality – use the ATCOs when they are needed. It's simply a more [cost] effective form of ATM.
Jean-Marc Loscos, DSNA	Q. [Regarding] UAVs, you presume that their introduction could push need for ASEP. Isn't it more a "collision avoidance" than a "separation" issue that we [ICAO] need to assess? Also, looking at ASEP's new application cases within AP23, maybe it's not suitable for aircraft with very specific performances?
Andy	In D5 and D6, it is quite rightly emphasized that the research has to focus on the issue of UAVs. So far they have not been widely used outside of segregated airspace, but now border patrols are proposed within managed airspace. I would hope we would apply the same separation standard whether the aircraft are manned or unmanned. At the moment, there are only 500ft collision sense avoid algorithms for UAVs!. They should at least be subject to the normal separation standards as with all civil traffic in managed airspace. So: do UAVs need sophisticated systems to integrate them safely into the mixed environment? If so, such systems must have an impact on the commercial aircraft, and their better equipment can be migrated to civil aircraft for ASEP applications. There seems to be a lot of work there, a high priority in the JU, and lots of questions still.
Tony Henley, BAE Systems	It is not acceptable that the UAVs [community] only looks at collision avoidance. In WG73 I am trying to promote the need for people to stamp out use of the term "Sense and Avoid".

7.5 Boeing ASAS roadmap by John Brown

Brief description

Those of us working in the ASAS community tend to regard associated functions standing alone. But there is a real need to understand how and when ASAS operational applications will integrate with all other aspects of the evolving ATM environment. The steps that Boeing is taking in its approach to adoption of ASAS functions are as follows:

- Engage industry to influence development that will impact our airplanes and our customers' operations.
- Actively support the move to DO-260A once standards and requirements stabilize.
- Understand technical and operational limitations of information placement and use.
- Develop CDTI retrofit solutions so that the benefits of forward-fit solutions relying on high levels of equipage can be realized.
- Prepare appropriate forward-fit solution.
- Build business case to support commitment decisions.

Key Issues in the presentation

The issues that Boeing's approach to adoption of ASAS is addressing are as follows:

- There is a continuing need for stabilization of standards for aircraft equipment. DO-260A affects both transmit and receive sides.
- Safety and performance requirements are evolving only slowly, and many of the more beneficial applications have still to be addressed. Requirements affect avionics design assurance as well as architecture decisions. How far will a single thread system take us?
- Globally-harmonized standards are highly desirable. Requirements emerging from different ANSP/regulatory sources not entirely consistent with each other.
- Dual link standards at best place reliance on the ground system for air-to-air functions and at worst render many aircraft electronically invisible.
- To achieve large-scale equipage, retrofit solutions must be found. It may not be economically viable to upgrade displays in some of the current fleet to accommodate CDTI.
- The utility of displays outside the forward field of view for ASAS applications must be researched.
- There is a need to define acceptable interactions between ADS-B and TCAS.
- The business case for operators is still uncertain.

7.6 Airbus ASAS roadmap by Stéphane Marché

Brief description

The objective of the presentation is to update ASAS Thematic Network on the status of Airbus ADS-B development.

The presentation adopts the same structure as for ASAS TN 2007 and highlights a number of items corresponding to recent achievements.

The ultimate objective of Airbus is to provide ASAS solutions for the whole fly by wire family.

To achieve this, a step by step approach has been established.

Step 1: ADS-B Out

Certification was achieved for use of ADS-B in Non Radar Airspace operations (ED126/DO303):

- In 2007 for A380 (with DO-260A)
- Early 2008 for A320, A330 and A340 aircraft (with DO-260)

Step 2: ATSAW (Air Traffic Situational Awareness)

- Solutions are ready for A320, A330, A340 and A380 aircraft. Development has started with a target date for certification on A320, A330 and A340 of 2009.
- ATSAW will provide short term benefits, for example to detect climb opportunities and obtain better flight levels over oceans, without change in controller / pilot roles and responsibilities. With In Trail Procedures (ITP) additional benefits will be gained but will require a new procedure.
- The CRISTAL ATSAW project demonstrated good acceptance of ATSAW by controllers and pilots.
- Flight tests have started on A320 flight test aircraft with very good feedbacks from Airbus pilots who can evaluate airborne traffic situational awareness in real conditions.
- On March 26, the ATSA-ITP procedure was tested in the Reykjavik airspace involving an Airbus A340/600 test aircraft and an SAS A330 aircraft. Icelandic airspace is ideal as it provides radar coverage, thus ensuring complete safety of the trial. The flight test confirmed acceptance of the procedure by pilots and controllers. In flight as well as ground surveillance recordings will be analysed and a report is expected by mid 2009.

Step 3 / 4: ASAS Spacing and ASAS Separation

- An initial technical definition is ready for ASAS Spacing on A320, A330, A340 aircraft. Only a software change will be necessary compared to ATSAW. The target is 2013 which corresponds to the mid term timeframe of SESAR where ASAS Spacing is introduced. The main constraint is not on the aircraft but airspace changes and ground system updates are needed.
- ASAS Separation is an essential element of future concepts (NextGen, SESAR) for which operational definitions must be refined.

Key issues in the presentation

- Step 1 of the Airbus strategy is completed: The whole Airbus fly by wire fleet is now certified for Non Radar Airspace operations (ED126/DO303). Airbus is in the process of developing ATSAW (Step 2) and significant feasibility demonstrations have been completed since one year.
- For further steps (ASAS Spacing and ASAS Separation), airspace, procedural and ground system changes are pre-requisites. The benefits will be obtained if all stakeholders move in the same direction and in the same timeframe. To meet their long term objectives, SESAR and NextGen should coordinate ATM actors developments to ensure economic viability of future ASAS developments.

7.7 Issues from chaired discussions

Tom Graff, FAA	Q. Is Airbus being very progressive here? Is a customer forcing this movement? Or is airbus trying to be proactive?
Stéphane Marché, Airbus	A. We have had very good feedback from customers, and in addition, Airbus has made a business case which helped decide we should equip early.
Tom	Q. Implementation of ATSAW and Surface moving maps on traffic. What dates?
Stéphane	A. There will definitely be something by 2012. Maybe earlier. But we need to establish more

	on the quality of ADS-B; that [study] will be done this year.
Phil Hogge	The moving map is already certified. We just need certification of the targets on the display.
Bob McPike, NATS	Q. ITM (In trail Merge) and ITF (In trail Follow) manoeuvres; are you now viewing these as ATSA-ITF or ASEP-ITF in oceanic airspace?
Stéphane	The airborne function involved in separation is very similar to that for spacing, but procedures may not be. With spacing on approach, we would have a requirement to have a controller in the background monitoring the ATSA spacing (the criticality comes from the small actual separation, but over land you have a controller). This would be different in the oceanic regions. Intuitively you have more space in the ocean, and therefore you can do with less monitoring of controllers.
Nico de Gelder, NLR	Q. For ITP, you have to make changes in the ICAO documents. What is your experience with ICAO in getting these changes?
Stéphane	A. I have no experience with ICAO on this. But both on the Australian side and CRISTAL ITP side, there is a good buy-in by the controllers.
Ken Jones, FAA	We worked with ICAO and SASP last year developing the separation standards required for ITP. We nearly have a collision risk model. We may finish the ICAO Doc 4444 amendment by May, probably more likely November; of course that needs to be done before oceanic is implemented.

C. Day2 - Session 3: ASAS Where it is Needed

8 Introduction

Session 3: 14:00 – 17:00: ASAS where it is needed
Chair: Billy Josefsson (LFV) Secretary: Peter Howlett (Thales Air Systems)

This session focused on two themes: use of ASAS to prevent RWY incursions, and long term ASAS strategies.

RWY incursions are a major safety issue, growing larger as a result of the traffic increase. An accident is simply "unacceptable" by all stakeholders. A study (CAST, 2002) found that the runway incursion problem can be reduced by as much as 95 percent with a combination of technologies that greatly enhance pilot situational awareness and provide conflict alerting to air traffic controllers and pilots. The first part of the session looked into different aspects and research results related to the role of ASAS in the prevention of runway incursions.

The session also provided an update on some ongoing research projects and looked into an example of ASAS flight deck implementation.

- RWY incursion facts and comparison US & Europe (Phil Hogge, ASAS TN2)
- EMMA2: Airport surface: runway incursion ATSA-SURF (Michael Roeder, DLR & Antonio Nuzzo, ENAV)
- NUP2+: Safe and efficient airport operations (Lars Lindberg, AVTECH)
- CRISTAL ITP Simulations and trials of ATSAW ITP in N. Atlantic (Johan Martensson, EUROCONTROL HQ)

- *Discussions*
- *Coffee break*

- Merging & Spacing Roadmap by MITRE (Randy Bone, MITRE)
- Equipment hosted in Electronic Flight Bags (EFBs) (Cyro Stone, ACSS)

- *Discussions*
- *Closing remarks*

9 Review of the briefings

9.1 Runway Incursions and ATSA-SURF: Phil Hogge (ASAS TN2)

Brief description:

Accidents occur for many reasons, but those involving collisions between perfectly serviceable aircraft, either in the air or on the airport surface, must be considered as among the ‘most unacceptable’. Currently, the statistics from the 21 reporting European states show that high risk runway incursion incidents are occurring at the rate of over one per week, and that the total number of all runway incursion incidents is running at well over one per day in Europe and around one per day in the USA.

Furthermore, there is a correlation between traffic volume and runway incursions. The SESAR work has shown that the only way of accommodating the expected traffic growth in Europe will be to use existing runways even more intensively. Therefore, unless action is taken, even more incidents can be expected in the future. Since each of the high risk incidents is a potential accident it will only be a matter of time before there is another runway collision accident.

History shows that such accidents generate public and political pressure to mandate suitable safety systems. TCAS was mandated after a series of midair collisions in the USA, and ultimately

mandated worldwide. Similarly, GPWS was mandated after an unacceptable number of CFIT accidents. Both these systems were mandated when they were at a lower level of maturity than ATSAW is now.

There are a number of possible methods of mitigating the risk of runway incursions. Most can only be implemented on the ground, which means that the investment is only effective at the local level. However, money invested in ATSA-SURF could provide a global solution and would also have the benefit of providing a 'platform' on which to build other ASAS applications.

The ASAS community should develop ATSA-SURF as quickly as possible. The first stage should be a 'basic' ATSA-SURF application having a moving map, ownship position and other traffic information to provide supplemental information as an aid to situational awareness. The second stage should be to work on an 'enhanced' ATSA-SURF with suitable alerts and warnings. Such a two stage approach would capitalise on the fact that the basic application is almost mature, it would be relatively easy to certificate, and it would provide an immediate safety benefit.

We need to be ready and, if possible, provide the solution before the inevitable accident occurs.

Key Issues:

- High risk runway incursion incidents are occurring in the 21 European reporting states at the rate of more than one per week, similar rates are experienced in the USA.
- As traffic volume increases the risk of another runway incursion accident increases.
- Both the US NTSB and the Commercial Aviation Safety Team consider that moving map displays and traffic situational awareness in the cockpit would provide significant protection from runway incursions.
- The basic ATSA-SURF application is more mature now than were TCAS and GPWS when they were mandated.
- Adopt a two stage strategy:- (1) develop, certificate and implement a basic ATSA-SURF application as soon as possible; (2) continue to work on an enhanced ATSA-SURF application, incorporating suitable alerts and warnings.

9.2 EMMA2: Airport surface: runway incursion ATSA-SURF (Michael Roeder, DLR & Antonio Nuzzo, ENAV)

Brief description:

The EMMA2 project is based on the first EMMA project that focused on surveillance, monitoring and alerting for the ground controller. EMMA 2 extends this to a shared view between ground system and aircraft.

Key focus of EMMA-2 is on the A-SMGCS system. EMMA 2 looks at Electronic Flight Strips, DMAN/SMAN, TIS-B, CDTI etc.

EMMA2 is developing more advanced services like TIS-B, upload of information to the aircraft, upload of taxi routes and CPDLC services. Integration with SMAN and DMAN is also performed by the EMMA2 test-beds that comprise several aircraft installations, airports and simulators around Europe.

In the cockpit head up displays (HUD) provides guidance and warnings

Key Issues:

In EMMA 2 the Cockpit Display of Traffic Information (CDTI) includes:

Surface Movement Alerts (SMA) providing the flight crew with alerting in case of abnormal surface movement situations e.g. runway incursions, wrong taxiway, crossed stop bar, etc,. with an objective not to create additional alerts on the flight deck.

Traffic Conflict Detection (TCD) providing the flight crew with information on aircraft and/or ground vehicle traffic on the airport surface and potential conflict situations. The main focus is to reduce the potential for conflicts, errors and collision by providing enhanced situational awareness to the flight crew operating on the airport surface especially in all weather conditions using **ADS-B** and **TIS-B** (TCD).

As a general principle EMMA2 proposes that if there is enough time to avoid the conflict by alerting the controller, **only** the controller should receive the alert and take appropriate action. However, the automation support implies a review of the controller and pilot responsibilities when performing low visibility procedures (LVP).

http://www.dlr.de/emma2/

9.3 NUP2+: Safe and efficient airport operations (Lars Lindberg, AVTECH)

Brief description

Trial involved simple replacement of a Com 3 module inside the Rockwell Collins VDL2 digital radio with one capable of the VDL4 digital. This allows the surface movement monitoring to be sent to the aircraft and displayed on the EFB.

NUP2+ is a collaborative project between ANSPs, Airport and Airlines backed up by industry. Main sites are Stockholm Arlanda Airport, Sweden and Vienna Airport, Austria.

Current surface taxi route maps for airports vary in complexity, and sadly we are using the same procedures and formats as 30 years ago when the world's worst aviation accident occurred on the runway surface at Tenerife.

There was an SAS pilot at London who wanted to cross the red lights which indicate a holding position because he thought the ATCO had forgotten to switch them off, but when he asked, the controller said, "why do you ask now, you've already passed three of them!" A shared situational awareness between cockpit and ATC is key for safe and efficient operations. The NUP2+ application provides synchronized traffic situation comprising aircrafts and vehicles for ATC. In cockpit the EFB class II is used to display moving maps with traffic information and warnings.

A conformance check function that checks conformance to clearance and taxiing is integrated in the NUP2+ ATSA SURF application, this function triggers the alarm.

Certification is achieved the remaining task is to get the approval for the operational procedures in cockpit from SAS operations.

Key Issues:

- The need for ATSA SURF is evident and a shared situational awareness is the baseline for safe and efficient operations.
- A general principle within NUP2+ trials and developments is that the pilot or ATCO should be able to correct small mistakes based on the guidance and warnings he / she receives in TWR or cockpit before initiating an alarm to the other party.
- NUP2+ will be operational at Stockholm Arlanda during 2008 including four B737NG SAS aircraft.

9.4 CRISTAL ITP Simulations and trials of ATSAW ITP in N. Atlantic (Johan Martensson, EUROCONTROL HQ)

Brief description

The main aim for the ATSA-ITP procedure is to improve flight economy and flight safety. This is achieved by increasing the opportunities for flight level changes by using a new longitudinal separation standard during climb and descend and by increased pilot awareness of climb and

descend opportunities. Currently only ~12% of aircraft actually carry out requests for climbs en-route.

Simulations of ATSA ITP manoeuvres included the use of Airbus aircraft simulator, NATS and ISAVIA ground system simulators, and NATS traffic simulation tool (NATSIM). NATSIM is a simulation tool capable of simulating real traffic samples as well as modifying them to take into account traffic growth, airborne capabilities, and flight crew behaviour etc.

Flight trials of the ITP procedure were successful and included an Airbus A340 test aircraft performing ITP manoeuvres with reference to an SAS aircraft in a procedural environment, however under Reykjavik, Iceland, radar control. ITP will be helpful if the current procedures do not allow climb or descent.

The trials are promising in terms of technical feasibility as prototypes and current technical equipment support the ITP procedure sufficiently. Detailed performance analysis is ongoing as well as complimentary business case work.

The operational acceptability is also quite mature; the procedures were appreciated, well understood and correctly applied by pilots and ATCOS. The airborne prototype HMI was found "easy to use" and the current controller HMI is acceptable to support ITP. There is a basic agreement within CRISTAL ITP on phraseology, both by controllers and flight crew. Trials pointed at a strong preference for using CPDLC (free text is acceptable and pre-formatted messages preferred). The amount of training needed for ATCOS and pilot was found to be small.

Results from trials are direct input to ATSA-ITP standard activity.

Key Issues:

- The ITP trials was successful and actually the world's first flight trial of the ATSA-ITP procedure.
- CRISTAL ITP successfully achieved clarification of how the ITP procedure can be applied in the NAT airspace.
- CRISTAL ITP provided important input to the ATSA-ITP standard.
- Technical Feasibility for airborne systems was OK.
- CRISTAL ITP created Operational Acceptance by controllers and flight crew.
- Benefit analysis result consolidation is ongoing and results are expected shortly.

Identified areas for further attention are: Use of third party Aircraft Identification over voice; ITP clearance over voice is time consuming; Operational use of existing conflict probe function in relation to the new separation minima: Examine if there is an argument for ITP specific controller HMI functions.

9.5 Issues from chaired discussions

Mete Celiktin, EUROCONTROL HQ	Q (To Johan Martensson): Context on implementation is important within SESAR. There is also a clearance request monitoring function that allows controllers to put clearance requests into the flight planning system, and it calculates the cruise level info by when it is possible to clear the cruise level limitations. A benefit investigation on this function is being done by NATS and NavCanada. What is the status of the CRISTAL ITP benefit analysis and have the CRISTAL ITP project compared the ITP benefits to this clearance request monitoring function benefits?
Johan Martensson, EUROCONTROL HQ	A. The CRISTAL ITP benefit consolidation is still ongoing. We have positive initial results, and we are doing comparison to other functions/application benefits. We have not compared ITP results with this particular function. We will look into what data we have available for this function and if we have data to compare with ITP benefits, then we will try do that.
Bob Hilb, UPS	Q (To Lars): I was hoping to hear how we could accelerate decisions?
Lars Lindberg,	A. We are in a position to accelerate and the key to this is the business case. We need to

AVTECH	convince the bean counters. There's a good book by Geoffrey Moore: Bridging the chasm, between the inventors and the implementers of this world – otherwise we don't succeed. The business case is not ASAS alone or 4D alone, it's a combination. RNP and navigation is underestimated, but SAS is ready to introduce the first RNP procedures in Europe to be trialled. [EUROCONTROL's CTA (controlled time of arrival) ATM System Integration Studies], Cassis, will bridge some of this gap until we can get into place RNP operations. The VLJ's and Southwest operations are where we'll get most of the nice figures out to convince the bean counters.
Christian Denke, ECA	Q. Is there a definite distinction between EMMA2 and NUP2+? In EMMA2, you have a very restrictive policy regarding uplink of information to the cockpit. Why do you restrict the information to the controller only? In NUP2, you would provide these to the flight crew as well.
Michael Roeder, DLR	A. Yes. EMMA 2 is about today's operations and techniques. Not many aircraft are able to receive. NUP2+ looks further out. How many aircraft in NUP2+? EMMA 2 is using real aircraft data, not test aircraft.
Lars	A. I strongly disagree. Since 2002, we've done demos with the virtual towers and etc in NUP2+. It's an operational system in Arlanda. We have the data from this trial. We have the OSEDs, the infrastructure is available. We'll be flying RNP etc; we have AMAN, DMAN; CASIS will be flying with MD80s; we have an area where we can do things, but also on the other side.
Dragos	A. Personally I don't see big discrepancies. Q. (To Lars) You showed similar displays for the tower and the A/C. What happens in multiple A/C and tower environments where airport databases may not always be as similar? How would you go about harmonising these databases?
Lars	A. Databases are a big burden on things. In some trials we faced accuracy or integrity issues. For example we ran into problems because the FMS Database missed one digit of resolution.
Ken Jones, FAA	Q. (To Johan): What distance and closure rates did you have in the trial flights, and did you get any comments on the HMIs (air or ground) that were different from the simulations?
Johan	A. The ITP procedure allows you to have 15nm [separation]. We used that for simulations but we used ~30nm for the trials. There was no closing speed (Mach) in the scenario. Regarding the Airborne HMI, Philippe Pellerin from Airbus who was one of the pilots in the test aircraft and also is in the audience, is in a much better position to answer.
Philippe Pellerin, Airbus	A. There are some differences linked to wind but otherwise the same as the simulation. I was involved in designing the HMI so I have to say it is very good! We had to use free text for the CPDLC.
John Brown, Boeing	Q. (To Johan): During the development of the ITP description, there were many queries about whether the Air Traffic Controller could use his systems to ensure that the proper conditions were met to initiate an ITP clearance (i.e. a sanity check). Did they test this in the trials?
Johan	A. During the trials we had radar coverage over Iceland so comparison between radar and the FDPS system was possible. We found discrepancies especially during manoeuvres e.g. when one A/C was orbiting. The general agreement was that controllers are not in a position to assess whether the aircraft reported, ADS-B derived, distance is OK or not.
Frédéric Legrand, DSNA	Q. (To Johan): In the CRISTAL ITP simulation, concerning your phraseology during experiments, how did you identify the aircraft?
Johan	A. We used the spelled ICAO callsign for identification.

9.6 Merging & Spacing (M&S) Roadmap by MITRE Randy Bone, (MITRE)

Brief description:

Randy presented some of the M&S activities undertaken by MITRE. This includes steps that are already implemented as well as future steps.

Implementation is in six phases

Detailed application descriptions and preliminary hazard assessments have been developed for initial phases and preliminary concepts for later phases are being developed

Phase 4 definition is the current focus

Phase I and 2 implement 2 main functions:

- ABESS (Airline Based En-route Sequencing ands Spacing) provides Strategic arrival spacing at merge fix and prepares traffic for FDMS.
- FDMS (Flight Deck based Merging & Spacing) provides fine-tuned arrival and landing spacing.

Key Issues:

- Four Human In the Loop simulations have been conducted
- A slight pilot workload increase was observed but was considered acceptable. All other evaluation results were positive.
- M&S implementation by UPS:
  - 5 x 757 A/C equipped
  - Cospace derived algorithm
  - Considering the number of aircraft equipped and the availability of trained controllers and pilots, M&S procedures are currently conducted about once a week on average.
- Phase 3 adds ATC scheduling en-route metering
- We will eventually be moving from spacing applications to separation applications.

9.7 SafeRoute - equipment hosted in EFBs - Cyro Stone (ACSS)

Brief description

SafeRoute is a solution designed for easy retrofit installation. It is currently used operationally by UPS for their Louisville hub operations. It is already certified on the B757 and STC/TSO certification on the B767 is pending.

The main goals of SafeRoute are to allow Operational Efficiencies to be gained e.g. fuel savings, capacity gains, and to improve safety particularly on the airport surface. SafeRoute uses existing aircraft equipment as much as possible and is designed for easy installation and quick return on investment.

Key Issues:

SafeRoute is a Software Package that can be hosted on an ACSS TCAS Shipset:

- DO-260A TCAS 3000 Surveillance Processor
- DO-260A Mode-S Transponder

The CDTI function can be hosted in:

- EFIS / ND
- Class II / III EFB

In EFB-based installations where the CDTI is not within the primary field of view, a small ADS-B Guidance Display (AGD) is proposed that provides the necessary information to conduct M&S procedures.

ADS-B IN TSO STC certification has already been secured for initial ASAS applications.

- M&S (Merging & Spacing)
- CDAs (Continuous Descent Arrivals)
- CAVS (CDTI Assisted Visual Separation)
- SAMM I (Surface Area Movement Management)

ITP (In-Trail Procedures) will be supported in the near future. Its certification is foreseen in July 2009.

With previous retro-fit implementations, it took 12 years for the technology to be fully implemented across the worldwide fleets. Airlines are now looking for a Return On Investment that pays back in 12 to 15 months.

Next steps: Hosting of the CDTI function on Class-II EFBs will be offered in the future which will significantly reduce the equipment cost.

9.8 Issues from chaired discussions

Cyro Stone, ACSS	NPRM required GPRS accuracy equivalent to WAAS (Wide Area Augmentation System). These are not necessary for present applications. They will be needed for alerts and future applications. The MMR's that GPS currently has today are good for the applications we've certified.
Nico de Gelder, NLR	Q. Do you anticipate transition issues with respect to retrofits for flight deck merging and spacing, especially for the implementation of RTA functions in on-board systems?
Randy Bone, MITRE	A. We use the schedule time, and input into the same FMS that uses speeds and others.
Nico	Q. Same RTA functionality as in the FMS is duplicated in other on-board systems?
Randy	A. Yes.
Bob Hilb, UPS	A. No other FMS has the ability to do what we want to do. You duplicated the 737 FMS, but the FMS RTA function tries to optimise the individual A/C, while we need to optimise the entire system, globally. We hope the [trajectory] models can be harmonized [for everyone] otherwise it won't work. The Langley trajectory models could be used in high density airspaces to achieve this.
Lars Lindberg, AVTECH	A. In the trials we were not only using the Smiths/GE FMS but also the Thales FMS on the Airbus. The Thales FMS on the Airbus doesn't have the same capability as the Boeing. Looking at Louisville, the ACSS technology – there is a significant optimisation with the top of descent. But the TOD (top of descent) can differ between aircraft by as much as 60 Nm. We need to make sure the requirements are there for forward fit and push requirements for vendors and OEMs.
Jean-Marc Loscos, DSNA	Q. When we first started discussing ASAS applications, we intended to display only the aircraft of interest to the flight crews. We even considered some cases where only the target aircraft

	would be displayed and we could remove all the other aircraft from the display. Has our thinking changed and do we now want the flight crews to see all aircraft?
Cyro	A. We were not asked that question during the trials or from the feedback. (To clarify,) we were not asked to remove the other traffic in the trials.
John Brown, Boeing	Q. Do you see a need in future for a dual thread – redundant architecture for the equipment?
Cyro	A. On the aircraft we are already using redundant inputs for the GPS information.

10 Concluding remarks: Phil Hogge (ASAS-TN2)

Phil Hogge (ASAS-TN2) started his summary of the Seminar by showing the lists of all the ASAS applications that have been included in the SESAR and NextGen roadmaps. These proved that the ASAS community had been very successful in achieving the objectives identified in previous workshops.

During the five years that the ASAS Thematic Network has been in existence we have moved from tentatively talking about Situational Awareness and Spacing to the point where we are actively working on Airborne Separation. Everyone who has been involved should be congratulated for all the hard work that has gone on behind the scenes to achieve this.

The Thematic Network is a unique forum. It is open to all stakeholders; it has well over 100 members; it has met every six months for five years; it has facilitated global cooperation on global interoperability; it has contributed to a better understanding of stakeholder needs; and it has developed a widespread consensus on what ASAS is and how it can be used.

In moving forward, the ASAS community will need to continue working with SESAR and NextGen to promote the harmonised deployment of ASAS in a Trajectory Managed environment. ASAS and Trajectory Management are symbiotic.

It will also be necessary to find ways of incentivizing airlines and ANSPs to start local ASAS implementations. The CASCADE process of pioneer airlines is a good example, and it must be possible to identify financial and environmental benefits from the use of ITP in oceanic regions and remote airspace, and from Spacing and Merging in TMAs. Furthermore there is an urgent need to enhance safety on the airport surface through the use of ATSA-SURF.

Finally, ICAO needs to take note of the importance of ASAS in the SESAR and NextGen programmes and start work now to identify the appropriate international standards.

Turning to the immediate future of the ASAS-TN, Phil informed delegates that there will be another workshop to be held towards the end of 2008, and that ways will be found to link up with the FAA on a joint ASAS Forum.

Having listened with growing optimism to the presentations during the Seminar he felt that we had at last reached ‘Critical Mass’. It is now necessary to build on this and to continue the joint work.

11 ASAS-TN2 Conclusions and Recommendations

1. The ASAS Thematic Network is fulfilling its objective to accelerate the introduction of ASAS/ADS-B operations and has already seen many of its previous recommendations successfully achieved. For example :-

   - The extensive sharing of information between delegates and organisations is stimulating the development of ASAS applications, is furthering understanding, is helping to find opportunities for implementation, and is aiding global harmonisation.
   - This global activity has significantly advanced the maturity of the ASAS applications.
   - Both the SESAR and NextGen Master Plans include the development and implementation of ASAS.
   - There are four ADS-B/ASAS applications in operational use :-
     - ADS-B NRA in Australia
     - M&S, CAVS and ATSA-SURF in the USA

     The first European applications are expected soon
   - Both Airbus and Boeing now explicitly include ASAS functionality in their plans.

2. However progress towards implementing ADS-B and initial ASAS applications is more advanced in the USA than in Europe. For example:-

   - There are currently only a very small number of ASAS projects in Europe compared with the USA.
   - European outcomes such as the ASPA-M&S algorithms have been implemented in the USA but not in Europe.
   - European ADS-B implementation plans are more fragmented than those in the USA, Canada and Australia.

3. Outside Europe important developments are taking place to advance the implementation and understanding of ADS-B and ASAS. Within Europe action needs to be strengthened to ensure that future developments and implementations advance in step. It is therefore recommended that:-

   - both EUROCONTROL and the FAA actively build on the commonalities in the SESAR and NextGen roadmaps. Therefore the EUROCONTROL/FAA R&D Action Plan 23 (Future Uses of ADS-B and ASAS) should be strongly supported.
   - noting that considerable development work is required to enable future ASAS applications, and that this work needs to be defined in consultation with the ASAS community, the SESAR JU work programme must give appropriate emphasis to ASAS research in delivering the SESAR Target Concept.
   - the fragmentation of the European ADS-B implementation plans be addressed at Single Sky Committee level.

4. Given that the SESAR and NextGen plans include ASAS, the members of the ASAS Thematic Network are concerned that ICAO is not working with sufficient urgency on the procedures and standards for the use of ASAS. It is therefore recommended:-

   - That the SESAR JU and NextGen agree an early joint approach to ICAO on the use of ASAS in order that ICAO gives ASAS the necessary emphasis.
   - That there is a pressing need for ICAO to start work on identifying appropriate international standards, for example:-
     - PANS-OPS
     - PANS-ATM
     - High level standards for ADS-B
   - The work deriving requirements in support of early ADS-B and ASAS applications, done by the RFG, a Joint Sub-Group of RTCA SC-186 and EUROCAE Working Group 51 (ADS-B), should be considered by ICAO at the earliest opportunity.

5. Strong near-term business drivers for ASAS include:-

- ITP applications in Oceanic areas which have the potential to increase payload, to reduce fuel burn, and to reduce environmental emissions.
- ATSA-SURF application, on the airport surface, can increase safety by reducing the risk of runway incursions and can increase the efficiency of airport operations.
- ASPA-M&S application in the TMA (particularly when enabling CDAs) has been shown to reduce fuel burn, to reduce noise and environmental emissions, and increase airport throughput.

6. Given the fact that there are some strong potential business drivers, but that it is difficult to find ways of starting suitable widespread implementations, there is a need to encourage both airlines and ANSPs to start trials and to coordinate local deployments which will lead to a harmonised system. It is therefore recommended that:-

- CASCADE Programme and its CRISTAL activities, which are already having a positive impact on early deployment, should be continued, but strengthened through a cohesive European implementation plan.
- Incentives be identified to encourage pioneer stakeholders.
- EUROCONTROL should continue ASAS-TN type work and link it with the planned FAA ASAS communication activity.

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