BERLIN 27 October 2009

RA Downlink Workshop

Airborne Collision Avoidance System (ACAS) Resolution Advisory (RA) Downlink Workshop Report

20 November 2009, Released

DFS Deutsche Flugsicherung

EUROCONTROL

This Report provides a factual account of the presentations and discussions during the 27th October 2009 RA Downlink Workshop. The Report contains a strong stakeholder message that is expected to influence the work programmes of EUROCONTROL and SESAR.

Questions or observations regarding this report can be addressed to safety-nets@eurocontrol.int

The workshop presentations and background information regarding related EUROCONTROL sponsored work can be found on the safety nets web site at www.eurocontrol.int/safety-nets (a copy of the compilation provided to the workshop participants is available on request at the above email address).

Executive Summary

Automatic notification of Airborne Collision Avoidance System (ACAS) Resolution Advisories (RA) to controllers as they occur has been contemplated for many years. In Europe the Überlingen mid-air collision gave additional impetus for a number of organisations to implement what usually is referred to as RA Downlink. With the increasing operational use of Mode S, at least one enabling technology is readily available in a number of States. Furthermore, the functionality to display RAs to the controller exists in commercial ATC systems; some States have already implemented this functionality while others are considering doing so. To avoid proliferation of concepts of use, it is now urgently needed to find common ground for use of RA Downlink in Europe.

Over 60 operational, regulatory and safety experts, representing air navigation service providers, national aviation authorities, research institutes and professional associations from across Europe, USA and Japan gathered for an RA Downlink workshop in Berlin on 27th October 2009.

The workshop was co-chaired by Mr Andreas Krebber of DFS (right) and Mr Martin Griffin of EUROCONTROL (left).

The purpose of the workshop was to find common ground for the use of RA Downlink in Europe, whilst recognising the global nature of ACAS and therefore the need for a worldwide solution.

The workshop reached the following conclusions:

- The ACAS and RA Downlink monitoring activities and offline analyses have provided valuable insight into ACAS behaviour in European airspace and beyond. This insight provides opportunities for general safety improvements in areas such as airspace design, flight manuals and pilot training. These opportunities should be brought to the attention of the appropriate organisations.
- The gained insight should also be used to (1) **now address the open issues related to presenting RAs on CWPs as they occur**, including completion of a generic safety case, development of procedures and clarification of controller responsibilities. Furthermore, there is a need to (2) **create awareness of the open issues**, in particular amongst early adopters of this usage of RA Downlink. Both recommended actions should be pursued by the SPIN Sub-Group in close cooperation with APDSG and in full coordination with SESAR project 4.8.3.

RA Downlink workshop calls for urgent resolution of remaining issues such as:

- **Pilot/controller responsibilities**
- **Legal aspects**
- **Latency**
- **Types of RAs to display**
- **What information to display**
- **Filtering rules**

Participants appreciated and recognised the added value of debating the issues in a truly multidisciplinary and international context and expressed interest in remaining involved in future proceedings.

Glossary

ADS-B	Automatic Dependent Surveillance - Broadcast
ACAS	Airborne Collision Avoidance System
ANS	Air Navigation Services
ANSP	Air Navigation Service Provider
APDSG	ATM Procedures Development Sub-Group
APP	Approach Control
APW	Area Proximity Warning
ATC	Air Traffic Control
ATM	Air Traffic Management
CFL	Cleared Flight Level
CND	Cooperative Network Design
CWP	Controller Working Position
DAP	Downlink Aircraft Parameters
DFS	Deutsche Flugsicherung (Germany)
DSNA	Direction des Services de la Navigation Aérienne (France)
EASA	European Aviation Safety Agency
ENRI	Electronic Navigation Research Institute
EUROCONTROL	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Authority (USA)
FARADS	Feasibility of ACAS II RA Downlink Studies
FIR	Flight Information Region
HMI	Human Machine Interface
ICAO	International Civil Aviation Organisation
IFALPA	International Federation of Air Line Pilots' Associations
IFATCA	International Federation of Air Traffic Controllers Associations
IFR	Instrument Flight Rules
JCAB	Japanese Civil Aviation Bureau
MIT	Massachusetts Institute of Technology
NLR	National Aerospace Laboratory – The Netherlands
PASS	Performance and safety Aspects of Short-term Conflict Alert – full Study
RA	Resolution Advisory
RLP	Řízení Letového Provozu – Air Navigation Services of the Czech Republic
SESAR	Single European Sky ATM Research
SIRE+	Safety Issue Rectification Extension+
SPIN	Safety nets Performance Improvement Network
STCA	Short Term Conflict Alert
TA	Traffic Advisory
TCAS	Traffic alert and Collision Avoidance System (note: for the purpose of this report, TCAS and ACAS should be considered synonymous)
TMA	Terminal Control Area

TOPA	TCAS Operational Performance Assessment
VFR	Visual Flight Rules
WAM	Wide Area Multilateration

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CHAPTER 1

Introduction & Summary Results

Describes the purpose and the structure of the Workshop and lists the summary results. A list of Workshop participants is also included.

In this Chapter:

- Purpose of the Workshop
- Proceedings of the Workshop
- Summary of Workshop questionnaire results
- List of participants

Automatic notification of Airborne Collision Avoidance System (ACAS) Resolution Advisories (RA) to controllers as they occur has been contemplated for many years. In Europe the Überlingen mid-air collision gave additional impetus for a number of organisations to implement what usually is referred to as RA Downlink. With the increasing operational use of Mode S, at least one enabling technology is readily available in a number of States. Furthermore, the functionality to display RAs to the controller exists in commercial ATC systems; some States have already implemented this functionality while others are considering doing so. To avoid proliferation of concepts of use, it is now urgently needed to find common ground for use of RA Downlink in Europe.

ATM is an extremely complex socio-technological system. The implications of the introduction of new technologies, like ACAS II, are sometimes counter-intuitive and may only become clear after prolonged operational use. Therefore, significant changes need to be carefully considered from all angles before committing to implementation: how will operations be impacted; are all technical issues known and addressed; what about safety; will roles and responsibilities change; are there legal implications; and many other questions need to be asked and answered.

In May 2006 EUROCONTROL organised a first RA Downlink workshop to report the findings in the FARADS project. That workshop concluded that although RA Downlink seemed technically feasible and operationally useful, insufficient data regarding ACAS behaviour in European airspace was available to draw firm conclusions about the use of RA Downlink in Europe. Since then, EUROCONTROL and other organisations have undertaken monitoring work to fill the gap.

Sufficient progress was made to justify the organisation of a second RA Downlink workshop. Considering the global nature of ACAS it was decided not to limit the scope of the workshop to Europe, but to seek participation from other continents as well. The target audience was comprised of operational, technical, safety, procedures, regulation experts and managers involved in planning or implementing RA Downlink as well as representatives of Stakeholder groups that may be impacted by RA Downlink.

DFS and EUROCONTROL prepared and co-organised this workshop, which took place on 27th October 2009 in Berlin, Germany.

Purpose of the Workshop

ACAS (Airborne Collision Avoidance System) is an airborne safety net that provides the flight crew with a warning of the imminence of a near/mid-air collision by producing a Resolution Advisory (RA) 15-35 seconds in advance.

The transmission of ACAS RA information to controllers is known as 'RA Downlink' and is available via Mode S radar downlink and other emerging technologies. Some States have already implemented RA Downlink and others are actively considering implementation. Technical solutions and concepts of operations vary and in order to avoid a proliferation of concepts there is a need to develop a harmonised approach. Issues still to be resolved include procedures and controller responsibilities, as well as possible safety implications.

"Workshop Objective: Find common ground for the use of RA Downlink in Europe"

Proceedings of the Workshop

The workshop proceeded as follows:

"Welcome & general setting-the-scene" provided the opportunity for Mr Adreas Krebber of DFS, workshop co-chairman, to welcome the participants in Berlin.

Mr Martin Griffin of EUROCONTROL, workshop co-chairman, provided a general introduction to RA Downlink and the purpose of the workshop: trials are happening and implementations are progressing, necessitating agreement on the way forward.

"RA Downlink, people either love it or hate it"

"RA Downlink demystified" was the title under which nine presentations were delivered about ACAS and/or RA Downlink monitoring, studies and operational experience. The presentations triggered questions, clarifications and debate that provided focus for the following themes.

"RA Downlink: Organisational positions and points of view" provided an opportunity for four organisations to present their views about the topic of the workshop. These presentations further focussed the debate on issues that need to be resolved before wide-spread implementation can take place.

"Key elements of future-proof RA Downlink" commenced with a final presentation in which the position of the SPIN Sub-Group was outlined. The subsequent discussions provided further insight into the required next steps.

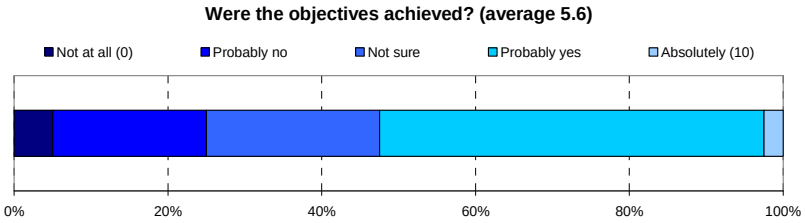
The co-chairmen then summarised the discussions as follows:

- The ACAS and RA Downlink monitoring activities and offline analyses have provided valuable insight into ACAS behaviour in European airspace and beyond. This insight provides opportunities for general safety improvements in areas such as airspace design, flight manuals and pilot training. These opportunities should be brought to the attention of the appropriate organisations.
- The gained insight should also be used to (1) **now address the open issues related to presenting RAs on CWPs as they occur**, including completion of a generic safety case, development of procedures and clarification of controller responsibilities. Furthermore, there is a need to (2) **create awareness of the open issues**, in particular amongst early adopters of this usage of RA Downlink. Both recommended actions should be pursued by the SPIN Sub-Group in close cooperation with APDSG and in full coordination with SESAR project 4.8.3.

Summary of Workshop questionnaire results

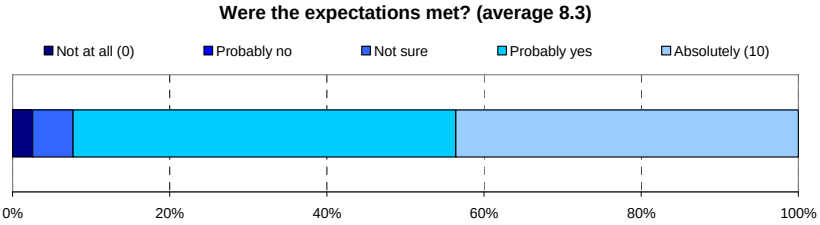
At the end of the workshop a short Questionnaire was filled in by the participants. The Questionnaire contained multiple choice questions with possible answers ranging from *"Not at all"* to *"Absolutely"*. The responses are captured in the following 100% stacked bar charts to visualise the percentage of answers for each possibility. Furthermore the calculated average on a scale of 0 to 10 is shown for each question.

The first question of each Questionnaire aimed to assess the degree of consensus on whether or not the objective of the workshop, find common ground for the use of RA Downlink in Europe, was achieved.



The responses illustrate that, although there is a tendency towards "probably yes", there are open issues that still need to be addressed. Some respondents indicated that their hesitation is at a detailed level rather than at a general way forward level.

The second question aimed to assess the depth, relevance, timeliness and overall usefulness of the workshop.



The results are positive as illustrated in the above graph.

List of participants

Alkalay Isa	skyguide
Alshakhs Mohammed	Jazeera Airways
Arino Thierry	Egis Avia
Aveneau Christian	DSNA
Bakker Ben	EUROCONTROL CND
Bencsik János	Hungarocontrol
Cizek Vladimir	RLP
Cressent Florence	DSNA
de Lang Noud	EUROCONTROL Maastricht UAC
De Oliveira Costa Sylvestre	DSNA
Dean Garfield	EUROCONTROL CND
Denke Christian	European Cockpit Association
Domogala Philippe	IFATCA
Drozdowski Stan	EUROCONTROL CND
Fischer Harald	DFS Deutsche Flugsicherung GmbH
Giordano Grazia	EUROCONTROL CND
Graf Carl	EADS Deutschland GmbH
Graner Yvonne	DFS Deutsche Flugsicherung GmbH
Griffin Martin	EUROCONTROL CND
Guimarães Rui	NAV Portugal
Guttman Robert	Austro Control
Heinzl Bodo	LR23 ASt Langen
Herbert Geraint	UK Air Accidents Investigation Branch
Howell Rod	QinetiQ Ltd
Janssen Micha	EUROCONTROL Maastricht UAC
Korab Milan	RLP

Krebber Andreas	DFS Deutsche Flugsicherung GmbH
Law John	EUROCONTROL CND
Loscos Jean-Marc	DSNA
Marquard Steffen	DFS Deutsche Flugsicherung GmbH
McFarlane Nick	Helios
Morscheck Hans-Jürgen	DFS Deutsche Flugsicherung GmbH
Oleinikova Vera	ORO NAVIGACIJA
Olson Wesley	MIT Lincoln Laboratory
Olszta Jessica	MIT Lincoln Laboratory
Pasic Dijana	EUROCONTROL CND
Pierce Ron	JDF Consultancy LLP
Pratt William	QinetiQ Ltd
Rafailovic Bosko	SMATSA
Raynaud Béatrice	Egis Avia
Roberti Fabrizio	Techno Sky Srl
Rosgen Louis	VERACITY ENGINEERING
Rozzi Simone	Middlesex University
Santos Carlos	NAV Portugal
Save Luca	Deep Blue srl
Seychell Anthony Francis	EUROCONTROL CND
Shaw Chris	EUROCONTROL CND
Shepherd Jean-Philippe	skyguide
Shigeru Ozeki	ENRI
Soukup Milan	RLP
Starke Wolfgang	VC - Vereinigung Cockpit
Stuhlsatz Volker	EUROCONTROL Maastricht UAC
Suchy Neal	FAA
Terenzi Michela	Deep Blue srl
Tucker Kevin	Helios
Ularescu Razvan	EUROCONTROL ASRO
Urbanik Igor	LPS SR š.p.
van Es Gerard	NLR
Volkmar Horst-Ulrich	Federal Ministery of Transport, Building and UA, Germany
Wheeler Stephen	UK CAA
Wivell Peter	UK Air Accidents Investigation Branch
Yamaguchi Shigehiko	Japan Civil Aviation Bureau

CHAPTER 2

RA Downlink demystified

Provides a summary of the nine presentations that were delivered and discussed about ACAS and/or RA Downlink monitoring, studies and operational experience.

In this Chapter:

- Summaries of the presentations with key points of the discussions

ACAS overview & previous RA downlink studies

Mr Garfield Dean of EUROCONTROL started his presentation with a short overview of ACAS, noting in particular that ACAS is not aware of ATC clearances or separation minima. ACAS interacts with ATC by sometimes causing deviations from clearances.

ACAS is able to handle multi-aircraft encounters. Although ACAS rarely causes a domino effect, two such cases were observed in Swiss airspace in recent years, in one case involving four aircraft.

"Deviations from ATC clearances due to RAs are typically 500 feet and usually less than 1000 feet; however, in exceptional cases they can be more"

The most common RA is the "Adjust Vertical Speed Adjust" RA that is typically caused by a high vertical rate just before the (safe) level off at the CFL. Such RAs are usually uneventful; they often involve just one aircraft (RAs in level aircraft are delayed) and do not have to be reported to ATC as they do not cause a deviation from the clearance. However, in exceptional cases they can trigger an erroneous pilot response leading to a level bust and even the above-mentioned domino effect.

The presentation then recalled the main findings of the FARADS project, i.e.:

- The technical study showed that RA Downlink is technically feasible, and that Mode S was, in 2006, considered the best solution. In 2009 an update of this study indicated that the ACAS Monitor (presented by DFS – see Chapter 3) met most criteria considered in this study.
- The latency study found that controllers will be aware of RAs within 10 seconds in 95% of the cases when using Mode S. This figure takes all delays into account, including technical and human elements.
- The operational acceptability was studied through real-time experiments and that identified net operational and safety benefits although these could not be quantified.
- Further investigations were considered necessary, including RA monitoring, a review of ICAO procedures and an economic assessment.

RA monitoring via Mode S in the European Core Area

Mr Jean-Marc Loscos of DSNA presented recent RA monitoring activities using the French Mode S radars. Two monitoring projects were performed:

- The PASS project that collected and analysed a data set of 880 RA encounters collected during a seven months period in the entire coverage area of the radars (i.e. well beyond the borders of France).
- The SIRE+ project that focussed on the Paris TMA and collected and analysed another data set of 56 RA encounters during a three month period.

Both projects confirmed that the vast majority of RAs occur in only one of the aircraft involved in the encounters. This is either because the other aircraft are not ACAS-equipped, or because of the geometry of the encounters.

The monitoring work also revealed a number of technical issues, such as empty RA messages and errors or inconsistencies in RA messages. Such messages can and must be filtered out when RA Downlink information is displayed on CWPs. Most of the anomalies are related to technical issues with specific transponders and these issues were flagged up to the appropriate authorities.

"Extrapolation shows that about 18 RA encounters occur in Europe during an average day"

The monitoring work in Paris TMA also revealed a number of hot spots where RAs occur. These are being addressed through airspace redesign.

The two projects showed that pilot compliance with RAs decreases in lower airspace. More generally, valuable insights into the frequency, duration and nature of RAs was obtained that can now be used to complement the FARADS findings.

DSNA intends to continue RA monitoring in order to assess TCAS performance, and will consider RA Downlink display on CWP in the context of SESAR project 4.8.3 that is led by DSNA.

ACAS monitoring in the USA

Mr Wesley Olson of MIT Lincoln Laboratory (for FAA) presented initial monitoring results in the FAA's TCAS Operational Performance Assessment Program (TOPA). TOPA is still in the roll-out phase but has already started to produce periodic and focussed reports.

Initial TOPA results are generally consistent with European findings with some notable exceptions:

- The frequency of RA encounters is significantly higher in the USA. This is in part explained by the higher traffic density and in part by the following points.
- The vast majority of RA encounters occur in uncontrolled airspace and reflect interactions between TCAS-equipped aircraft and VFR traffic or non-equipped business jets.
- Many of such interactions are caused by VFR traffic legally flying at 500 feet between IFR flight levels.

FAA currently has no plans for RA Downlink display on CWP because many RAs do not require changes in flight path; pilot non-

compliance with climb/descent RAs has the potential to cause confusion; and because the role of ATC in interactions between IFR and VFR traffic is unclear.

Monitoring of safety nets operational performance in Europe (PASS project)

Mr Thierry Arino of Egis Avia presented the overall scope of the PASS project, stating that the purpose of this project is to move a step closer to achieving a performance-oriented definition for ground-based safety nets. In particular, quantified performance requirements for STCA would be an important element of a consistent overall concept for ground-based and airborne safety nets.

In addition to the benefits of RA monitoring, as presented earlier by Mr Jean-Marc Loscos, collecting and analysing safety nets related occurrences brought an understanding of the current situation regarding adequacy of STCA alerts, adequacy of TCAS alerts and compatibility of STCA and TCAS alerts.

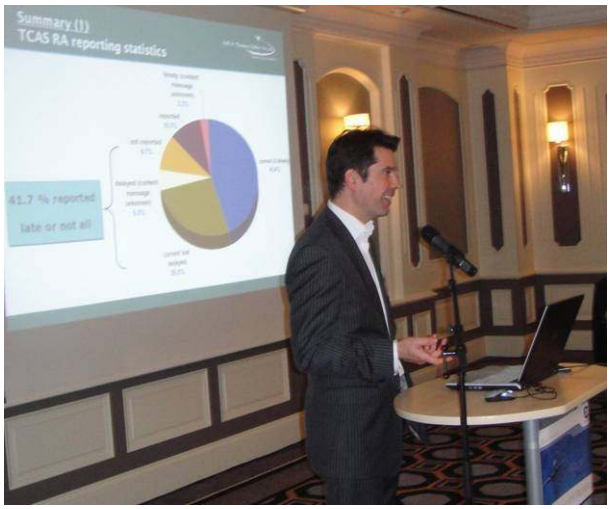
The current situation is now being modelled and analysed in two phases, ending in 2010, to propose not only a first set of STCA performance requirements but also to provide a modelling foundation for further research in the SESAR context.

An analysis of pilots' TCAS RA reports to ATC was performed. About 50% of "Climb/Descend" RAs are reported, whilst reporting of other RAs is about 20%. Preliminary findings also show that the lack of report by crews receiving a coordinated "Climb/Descend" RA is often associated to a pilot report by the threat aircraft.

Finally lack of report is sometimes associated to pilots not following the RA, while short duration RAs in general are often not reported.

Statistics about quality and content of TCAS RA reports to ATC by pilots

Mr Gerard van Es of NLR presented another analysis of pilots' TCAS RA reports to ATC that was performed using a larger data set than PASS, covering a longer time span. Although RA reporting rules had changed during the period of the analysis, no significant changes were seen in the actual reporting of RAs.



It was noted that:

- A significant number of operators still use outdated flight manuals. This typically happens when there is a legal requirement for using unmodified aircraft manufacturer supplied manuals.
- The TCAS RA reporting procedures have changed several times during recent years. Irrespective of the previous point, adherence to procedures often lags behind their entry into force. Procedures need to be stable in order to be effective.

In particular the lack of compliance with ICAO procedures was found to be an area of concern that requires action.

ACAS RA Downlink in Australia

Airservices Australia had submitted a short presentation but were not able to attend the workshop; Mr Stanislaw Drozdowski, Chairman of the SPIN Sub-Group, summarised the presentation, highlighting that Airservices Australia has mature plans to implement the display of RA Downlink on the CWP. The actual implementation is delayed for reasons that are unrelated to the subject.

The implementation plans foresee the display of "RA" without further (climb/descend) information. No changes to existing ATC procedures are intended.

Airservices Australia is also considering future improvements related to timeliness and reliability of the function based on ADS-B.

RA downlink studies in Japan

Mr Shigeru Ozeki of ENRI began his presentation with highlighting that the near midair collision between a B747 and a DC10 over Yaizu in January 2001 had triggered, amongst other things, studies into RA Downlink display on CWP. Different options had been considered and a Mode S-based solution has been in operational use since 2003.

The effectiveness of the current solution is reduced by the low update rate and therefore long latency. Also, too many nuisance RA downlinks disturb the controllers. Therefore the RA downlink alert is displayed in the same colour of the whole track label in order to reduce its visual impact and the supervisor has the possibility to switch the function off.

RA monitoring work had been performed as part of the studies. That work had provided valuable insight into ACAS behaviour over Japan: several hot spots were identified. Future work will aim to automate RA monitoring. New surveillance technologies such as WAM and ADS-B are being considered to address current issues.

RA downlink practical experience in the Czech Republic

Mr Milan Soukup of RLP informed the workshop that the implementation of RA Downlink display on the CWP was motivated by the availability of Mode S technology in the Prague FIR since the end of 2008. An operational evaluation started in May 2009 and is still ongoing. During the evaluation period the display of RAs is for information only and controllers should not issue instructions in the opposite direction as indicated (arrows indicate the upward or downward sense of RAs).

About one RA is observed per day, not all of which are in the Prague FIR. This frequency and also the observed types of RA correlate well with the RA monitoring results in other areas.

So far no negative feedback has been received from controllers. The display of RAs has facilitated provision of traffic information and verification of clearances issued.

RA Downlink Presentation in Budapest FIR

Mr János Bencsik of Hungarocontrol presented the experience with RA Downlink display on CWP in Budapest FIR. Before commencing the operational use, monitoring had been conducted using a test system as part of an implementation plan for using most of the Mode S DAPs.

The adopted solution for the display of RAs, as well as the experience gained so far, are very similar to those in Prague FIR. There are two notable differences:

- The number of observed RAs is somewhat lower, which is explained by Hungary being further from the European Core Area.
- RA sense reversals are shown by two arrows and "Adjust Vertical Speed Adjust" by "–".

Displaying the sense of RAs is seen as the real benefit of the function because it allows the controller to avoid issuing contradictory instructions.

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CHAPTER 3

Organisational positions and points of view

Provides the views of four organisations about the topic of the workshop.

In this Chapter:

- Summaries of the presentations with key points of the discussions

AMOR – A DFS approach to provide RA information to ATC and Safety Management

Mr Steffen Marquard of DFS explained that DFS had determined the requirement for RA Downlink display on the CWP to be a latency of no more than two seconds. This requirement had triggered a number of R&D projects of which the current one is AMOR.

By not relying on rotating antenna (adding half the rotation rate to the average latency), but instead using omni-directional antenna and passive receivers capturing RA-Broadcast and RA coordination messages this requirement has been shown to be achievable.

Proof of concept has taken place in the Frankfurt area and now six stations are being deployed to cover the complete German airspace above 10,000 feet. An additional mobile station will enable monitoring work in specific lower airspace volumes.

Initially the objective is to develop a comprehensive database of ACAS events that will enable analyses that support airspace and procedure planning, as well as internal and external incident investigations.

Early results in the Frankfurt area show up to three ACAS events per day. Also here predominantly “Adjust Vertical Speed Adjust” RAs are observed, as well as a number of transponder-related anomalies that are flagged up to the appropriate organisations.

Investigation of possible “on-line” display on CWP is also ongoing, including filter development and elimination of false alerts. However, such usage is not expected to happen in the next few years.

Use of RA Downlink information – The NATS perspective

NATS had submitted a presentation about their off-line use of RA downlink data and their considerations regarding display of RA Downlink information to controllers but had been unable to attend the workshop.

The summary of the NATS presentation was briefly examined, noting that NATS had made effective use of RA Downlink data off-line. No clear operational requirement to display RA Downlink to controllers existed but numerous considerations would have to be addressed in SESAR sub work package 4.8 first.

European Cockpit Association point of view

Captain Christian Denke of the European Cockpit Association, referring to the previous RA Downlink Workshop that took place in May 2006 and by recalling the sequence of events during the last minutes before the Überlingen midair collision, reminded the workshop that RA Downlink should not be a matter of years but rather a matter of seconds.

He also recalled from the ACAS & STCA interaction/ interoperability workshop of March 2007 that RAs are stressful situations for pilots and that pilots may report late or inaccurately to ATC.

IFALPA, of which the European Cockpit Association is a member, continues to support the concept that display of "RA status" at controller stations may enhance the awareness of ground ATC personnel that aircraft under their control may deviate from cleared flight profiles in response to an ACAS command.

RA broadcast receivers should be implemented at such ATC ground stations, where SSR Mode S with the associated data link capability is not available or not operationally used.

It is understood that there may be significant human factors considerations involved with the implementation of such technology. The implications of these considerations should be thoroughly investigated and taken into account prior to implementation.

"RA Downlink" may considerably reduce the time of unawareness" on the ground while an RA is in progress and thus contributes to a more robust operation

In view of the need to reduce the delay between the occurrence of an RA and its ensuing notification communications, IFALPA calls for an increase of the report rate to a technically feasible value in the order of not less than one report per second. It should be noted that these reports will be transmitted only during rare periods when RAs are occurring.

The dangers of RA downlink

Mr Philippe Domogala of IFATCA recalled that ever since 2004 as a Federation IFATCA is opposed to RA Downlink. However, IFATCA also recognises that RA Downlink might, in some cases, be beneficial (e.g. increased situational awareness) and that there is a strong pressure on States to implement on States. So, in case of implementation the following criteria must be met:

1. Clear and unambiguous legal responsibilities for controllers.
2. No delay in downlink (e.g. due to antenna rotation).
3. Displayed at the appropriate controller position(s).
4. Must be fully compatible with ground safety nets (STCA, APW, etc...)
5. Nuisance and false alerts must be kept to an absolute minimum.

This IFATCA policy was clarified using the example of small transporter vans in Germany, able to drive up to 180 km/h: for different reasons drivers, employers and manufacturers love it, but the Federation Drivers Union is against it for safety reasons.

Because of the safety implications IFATCA considers that there is a need for Regulator involvement and asked for the position of EASA on RA Downlink.

IFATCA also asked whether the investigations as called for in the IFALPA policy (see previous presentation) were actually conducted and the results taken into account by States that are implementing RA Downlink.

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CHAPTER 4

Key elements of future-proof RA Downlink

Provides a summary of the closing presentation, recurring discussion themes during the workshop, wrap-up discussions and closing remarks.

In this Chapter:

- Closing presentation
- Discussions
- Workshop conclusions

Position of SPIN SG

Mr Stanislaw Drozdowski, Chairman of the SPIN Sub-Group, reminded the workshop that the SPIN Sub-Group is a unique forum with multi-disciplinary safety net expertise from a wide representation of ANSPs and industry.

RA Downlink is already available in commercial systems and diverging operational practices are already emerging. In order to avoid proliferation of concepts there is an urgent need for harmonisation.

The work that needs to be done now includes:

- Establishment a harmonised concept of operation;
- Development of a detailed safety case; and
- Development of procedures, including incorporation in ICAO documentation.

Guidance material will also need to be developed. The SPIN Sub-Group has a proven track record in all of these areas and should be considered as the right forum to move things forward.

Discussions

Discussions during the day often referred to the planned SESAR work on safety nets. This work will be performed in three projects that are part of Work Package 4 (En Route Operations). Safety nets are addressed in Sub Work Package 4.8 (Air and Ground Safety Nets) that addresses, by delegation from Work Package 5, also TMA Operations. The three projects are:

- Project 4.8.1: Evolution of Ground-Based Safety Nets
- Project 4.8.2: Evolution of Airborne Safety Nets
- Project 4.8.3: Ground-Airborne Safety Nets Compatibility

These projects are currently in the initiation phase and are expected to start their work early next year.

It was noted that many of the issues discussed during the day, in particular those related to technology-related aspects, would require further R&D that would naturally fit in SESAR. Other aspects are more closely related to current operations and would therefore benefit from being addressed by existing working arrangements

such as the SPIN Sub-Group. There is a need for a coordinated approach which also takes full account of related activities in other parts of the world.

Questions and discussions showed that there are still many misconceptions about ACAS operations. But also experts are still learning from monitoring activities. Irrespective of RA Downlink, widespread and continued monitoring, as also recommended in ICAO documentation, is clearly a valuable safety assurance means.

Different opinions were expressed regarding the usefulness and possible implications of presenting RA sense information to the controller. It did not become clear if these opinions are based on R&D results or expert judgement.

Workshop conclusions

Workshop conclusions were formulated by the co-chairmen at the end of the day, starting with the observation that it had been an informative and constructive day during which convergence of opinions could be observed.

The co-chairmen then summarised the discussions as follows:

- The ACAS and RA Downlink monitoring activities and offline analyses have provided valuable insight into ACAS behaviour in European airspace and beyond. This insight provides opportunities for general safety improvements in areas such as airspace design, flight manuals and pilot training. These opportunities should be brought to the attention of the appropriate organisations; and
- The gained insight should also be used to (1) **now address the open issues related to presenting RAs on CWPs as they occur**, including completion of the safety case, development of procedures and clarification of controller responsibilities. Furthermore, there is a need to (2) **create awareness of the open issues**, in particular amongst early adopters of this usage of RA Downlink. Both recommended actions should be pursued by the SPIN Sub-Group in close cooperation with APDSG and in full coordination with SESAR project 4.8.3.

The secretary of the SPIN Sub-Group was tasked to initiate appropriate follow-up action.

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