N° 1

Issued April 2008

EUROCONTROL VOLUNTARY ATM INCIDENT REPORTING

EVAIR Safety Bulletin

REPORT PERIOD 2007

EUROCONTROL VOLUNTARY ATM INCIDENT REPORTING (EVAIR)

THE SAFETY ANALYSIS FUNCTION EUROCONTROL AND ASSOCIATED REPOSITORY (SAFER)

Against the background of endlessly increasing aircraft movement statistics, the safety issue remains a top priority. It is, and will ever be, the raison d'être of EUROCONTROL. Crucial tools to safeguard safety are mandatory and voluntary reporting systems, embedded in the Safety Management Systems of airlines, airports, ANSPs and other stakeholders.

Since the late 1990's the EUROCONTROL Organisation has identified the need for the measurement of safety levels and trends in Europe, as an essential means to improve aviation safety. This has required the collection and aggregation of safety data from a wide range of stakeholders in order to identify overall safety performance and assess/monitor the implementation of changes to the ATM system.

A Safety Data Reporting and Data Flow Task Force (SAFREP) was set up in 2005 to address the priority areas of safety data reporting, legal, managerial and organisational constraints, and safety data flows for European ATM. The SAFREP Task Force comprised key stakeholders (senior staff from ANSPs and Safety Regulators, European Commission, Airspace Users such as IATA and ERA and controllers' professional associations - IFATCA, EUROCONTROL Agency DAP/SAF and Legal Service, SRC/SRU, PRU/PRC). In answer to SAFREPs Recommendation No. 7 'to bring rationalisation in European ATM safety data collation and analysis.....', the Safety Analysis Function EUROCONTROL and associated Repository (SAFER) concept was developed. This includes the development of a European ATM Safety Data Repository, fed by a system of structured regulatory and voluntary data flows, together with relevant data management processes and procedures, and incorporating a comprehensive safety analysis function.

This Safety Bulletin, the first to be issued, provides:
- an insight into the workings of the **E**UROCONTROL **V**oluntary **A**TM **I**ncident **R**eporting system (EVAIR) - one of the key elements of SAFER, and
- an overview of the statistics accumulated over a fifteen month period from September 2006 to December 2007.

This bulletin will be issued quarterly and will provide the progress made within the reporting arena. This first edition is inevitably lengthier because it provides the background for this initiative. There are immense benefits in sight - with no price to pay. Planes are the fastest means of transportation. We must stay ahead of them to continue improving safety. Future bulletins will include safety information collected through regulatory data flows which runs at a slower pace.

THE MOTIVATION BEHIND VOLUNTARY ATM INCIDENT REPORTING (EVAIR)

The key motivation for establishing the EUROCONTROL Voluntary ATM Incident Reporting system (EVAIR) is to enable all stakeholders to be proactive in fixing identified problems quickly rather than waiting for a year or two (as was the norm in the past). EVAIR is managed by EUROCONTROL, where a team of specialists collect voluntary ATM incident data from airlines, pilots and Air Navigation Service Providers (ANSPs). The data is analysed to spot areas where benefits can be gained by fixing identified problems, and to spot underlying trends that need addressing. A key activity is the ability to act as a communication conduit for and between stakeholders.

EVAIR enables the aviation community to:
- learn, not just from accidents and serious incidents, which are very real traumas for involved operators and providers, but from the low risk bearing incidents
- be provided with feedback within a few days or weeks, which will enable problems to be fixed quickly
- monitor safety improvements and to take corrective actions if necessary.

The inclusion of the Safety data reporting and data sharing and particularly of "SAFER" within the scope of the European Safety Programme for ATM (ESP) was a natural step in improving the areas as identified by the SAFREP Task Force. To that effect the EUROCONTROL Agency voluntary sharing of safety information based on Chief Executive Standing Conference (CESC) policy, was a first step in establishing the: mechanism, processes, principles and criteria for data exchange and speedy identification and resolution of problems.

WHAT MAKES EVAIR WORK?

Without a doubt, front line operators (pilots and air traffic controllers (ATCOs) together with their airlines and air navigation service providers), i.e. those directly exposed to problems and who need to identify and solve them quickly, are at the forefront of the system. It is these stakeholders who provide the first inputs into the voluntary reporting sys-

tem. Reported incidents are sent to EVAIR through the airlines' and ANSPs' safety management systems, and also from airlines associations e.g. IATA, ERA, ELFAA, IACA, who are in full support of this activity. Currently, in the EVAIR Database, reports from airlines make up more than 95% of the overall reports submitted.

In addition to pilots and ATCOs, their companies and associations, the SAFREP TF identified other important stakeholders who can contribute to better incident reporting. These stakeholders are:
- Professional associations e.g. IFALPA and IFATCA
- Regulators
- Accident and Incident Investigation Bodies
- Judicial experts
- Prosecutors
- Politicians
- Media
- Manufacturers
- International organisations
- Airports, etc.

The role of these stakeholders is to encourage, support and enable better reporting, which is currently not at the desired level. A key enabler in encouraging both mandatory and voluntary reporting is the awareness and adoption of a Just Culture - a priority activity for EUROCONTROL.

A QUESTION OF TRUST

One of basic principles of EVAIR and the sharing of safety data between main stakeholders is trust. This trust means that:
- front line operator will not be punished because of reporting and possible omission done

- names of front line operators, airlines, and ANSPs will not be disclosed, and
- analysed data will only be used for the purpose of improving safety, i.e. not for benchmarking etc.

This Safety Bulletin is the first issue and is based on reports provided voluntarily by the airlines and their associations (IATA, ELFAA, ERA, IACA), and also on feedback information received from ANSPs, and in some cases, from Incident Investigation Bodies.

Voluntary participation of ANSPs within EVAIR and Safety Data Sharing at this stage is focused on provision of feedback information on the ATM incidents submitted directly by airlines or forwarded by the EUROCONTROL Agency (European Safety Programme - Activity Field 2 - Incident Reporting and Data sharing) on the airlines' request to the specific ANSP.

At the core of EUROCONTROL's Voluntary ATM Incident Reporting and Safety Data Sharing activities are:
- the data collection and de-identification mechanism
- assistance in mediating between Airspace Users and Air Navigation Service Providers
- provision of the list of safety focal points to the participants of the EVAIR activity
- organisation of ad-hoc meetings and identification of trends of safety concerns to enable quick fixing of identified problems
- monitoring of the application of existing European Safety Action Plans and Safety Action Plans agreed through ad-hoc meetings, and
- support to the development of different projects within EUROCONTROL.

BENEFITS

Participation in EVAIR provides a number of benefits to those who provide the ATM incident reports, such as:
- Quick responses
  - Identification of safety concerns
    - Local
    - Regional
    - Pan-European
  - provision of feedback information
  - problem fixing
- Support to the organisation of Ad-hoc meetings to identify local problems and possible corrective actions
- Quick access to the safety focal points
  - Airlines
  - ANSPs
  - Regulators ...
- Assistance in interfacing between SMSs of Airlines and ANSPs
- Access to the reporting data for
  - Deeper expert analysis and identification of causal factors
  - Planning of future improvements
- Compatibility and complementarities with other safety databases
- Monitoring of implemented Safety Action Plans
- Periodical statistics
- Customised analyses on the request of the participating stakeholder
- ACAS simulations by using different tools EVAIR has at its disposal (Interactive Collision Avoidance Simulator (InCAS), ATM Safety Monitoring Tool (ASMT)
- Sharing of best practice and lessons learned.

JOIN THE SAFETY COMMUNITY

To benefit from participating in EVAIR is simple:
- Provide ATM incidents reports to EUROCONTROL's European Safety Programme, EVAIR Team
- Send feedback information to the originator of the report and send a copy to the EVAIR Team.

On receiving ATM incident reports or feedback information, EUROCONTROL then acts as facilitator in establishing direct operational contact between Airlines and ANSPs in order to quickly fix identified problems. EVAIR is not in favour of getting reports directly from pilots or ATCOs - it is important that they are sent through the SMSs of airlines and ANSPs. It is these organisations who need to know about the problem as they are responsible for taking corrective action.

Currently, the EVAIR team accepts information in any format available, so as to not to give additional workload to the data providers. The basic requirement is that the report has the following essential elements which are defined by ICAO, i.e.
- Date and time of the incident
- Type of aircraft
- Origin-destination from the FPL
- Altitude of the incident
- Geographical location of the incident
- RTF and type of Air Traffic Service
- Estimated horizontal and vertical distance
- Weather impact
- Activation of the automated warning systems, and
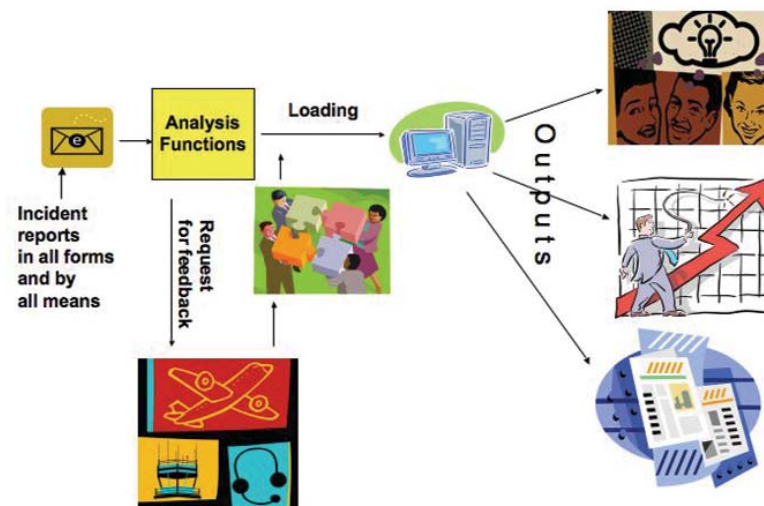- Short description of the incident.

Figure 1: Voluntary Reporting Process Flow - From Report to Action

Figure 1 gives an overview of what happens to a report once it has been received by the EVAIR team.

Reports are analysed by EUROCONTROL ATM safety experts and are entered into the EUROCONTROL TOKAI (Toolkit for ATM Occurrence Investigation) safety database, from where trend analysis can be conducted. To date, analysis has been carried out on reports received in 2007. Graphs in this safety bulletin are based on this data.

Over a fifteen month period (since September 2006 to December 2007), more than 1600 voluntary ATM incident reports have been received by the EVAIR team. That equates to an average of 100 reports per month.

Currently, 25 airlines have been providing voluntary ATM occurrence reports on a regular basis, and a further 24 airlines have confirmed their readiness to join the activity. The 25 airlines providing the occurrence data make up 22.2% of the overall ECAC air traffic.

It should be noted, that the statistics provided by EVAIR are not the results of the official investigations. The statistics represent main trends only and do not interrogate details regarding causal factors. They are based on pilots' reports and the expertise of EUROCONTROL ATM Safety experts carrying out the analysis.

Due to the short period of data collection and therefore relatively lower level of data in the database, no comparison is made between the number of operations and the number of provided incident reports. Neither is there a comparison between the different months or years. However, these comparisons will be included once the amount of data and elapsed time permits.

CONFIDENTIALITY

In dealing with the ATM incident data, EUROCONTROL is fully compliant with ESARR2, ICAO Annex 13 and EC Directive 2003/42.

EUROCONTROL has also developed an Agreement for safety data sharing for stakeholders who would like to formalise the process. The objective of this Agreement is to establish a formal framework for safety data exchange and criteria for the protection mechanism for the relevant safety information collected, stored, and available between EUROCONTROL and Safety Data Providers.

In addition, EUROCONTROL experts working on the EVAIR system are legally obliged to sign a declaration of confidentiality on the non-disclosure of the data.

Currently, 25 airlines have been providing ATM incident reports without the need for an official Confidentiality Agreement, which shows a high level of mutual trust and confidence between EUROCONTROL and those airlines.

DE-IDENTIFICATION

Figure 2 below depicts the process through which EUROCONTROL experts dealing with incident data collection and analysis ensure that the data is fully 'de-identified'. Details contained in the incident report are entered into the database.

In addition, a few control checks are carried out before the end user has sight of any data relating to an incident report. This is to ensure that data is protected from any abuse and any possibility to be used against the reporter or for benchmarking purposes.

NEXT STEPS

In 2008, EVAIR's activity will focus on:
- the consolidation of the mechanism
- the increase of data providers by the inclusion of more airlines and ANSPs
- establishment of the EUROCONTROL Safety Data Repository (SAFER), and
- definition of access control mechanisms that will enable external stakeholders to view data securely.
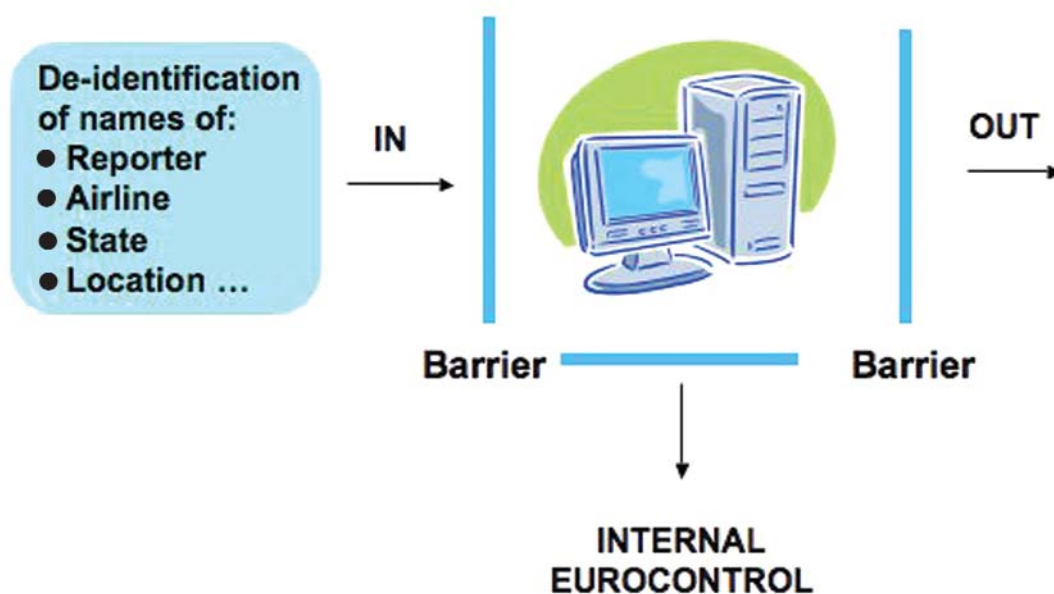

Figure 2: De-Identification Process

The EVAIR team consists of four ATM experts dealing with incident analysis and TOKAI database management.

Ms Dragica Stankovic
ATM Safety Expert
Leader of Activity Field 2
dragica.stankovic@eurocontrol.int
Tel: +32 2 729 50 34
Fax: +32 2 729 90 82

Serghei Fedoseev
Serghei.fedoseev@eurocontrol.int

Serghei Gheorghita
Serghei.gheorghita@eurocontrol.int

Tim Baldwin
Tim.baldwin@eurocontrol.int

STATISTICS FROM THE EUROCONTROL VOLUNTARY ATM INCIDENT REPORTING SYSTEM (EVAIR)

Analysis of voluntarily provided ATM incident reports enables us to identify trends for the number of incidents per phase of flight, and subsequently to identify main contributors to ATM incidents.

Figure 3 shows that 64% of the ATM occurrences fall within the APP/TWR, and 36% of them within the Area Control.

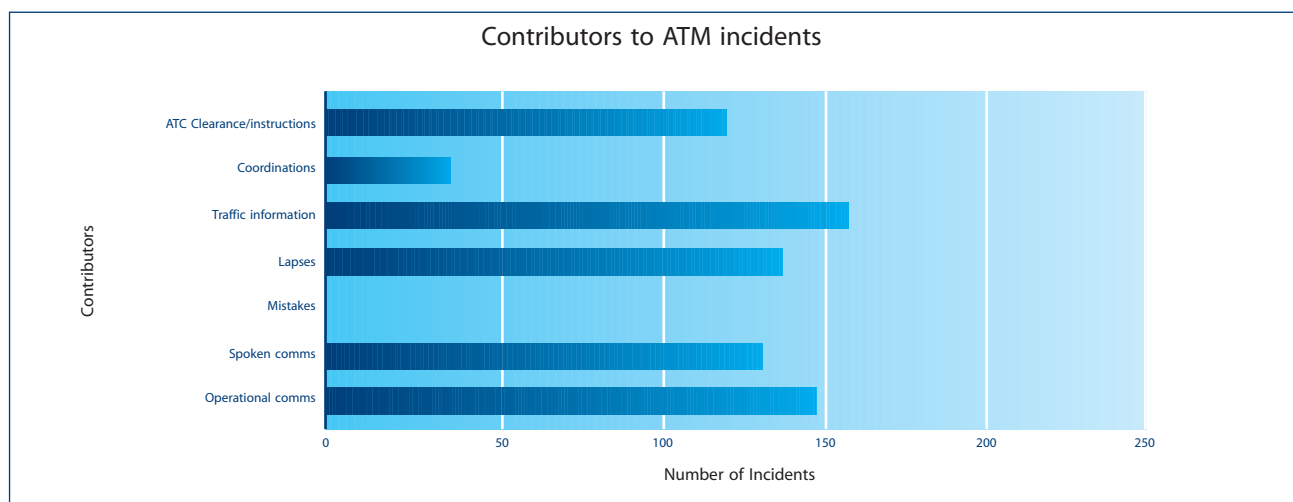The most frequent incidents related to APP/TWR are Level Bust, and Runway and Taxiway Incursions.

Phase of Flight

En-route 36%
Landing 1%
Standing 1%
Take-off 10%
Taxiing 14%
Approach 38%
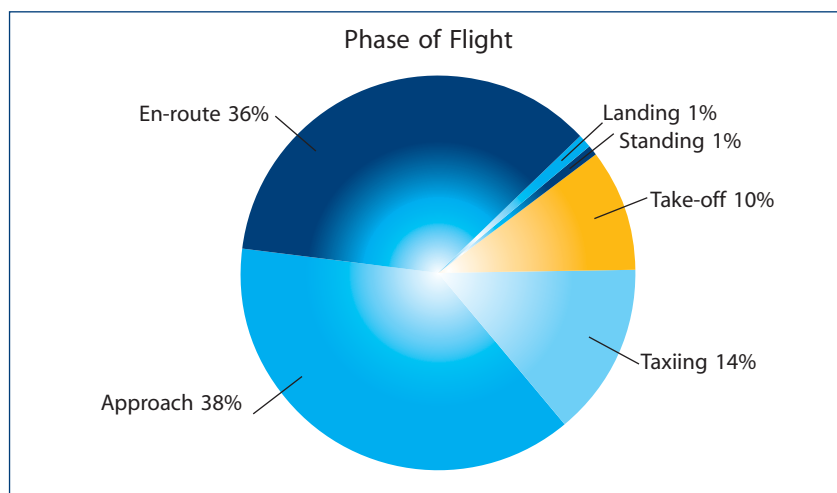
Figure 3: Phase of Flight

Contributors to ATM incidents

Contributors:
- ATC Clearance/instructions
- Coordinations
- Traffic information
- Lapses
- Mistakes
- Spoken comms
- Operational comms

Number of Incidents

Figure 4: Contributors to ATM Incidents

As can be seen in Figure 4, the top contributors to ATM incidents are:
- Mistakes as part of an air traffic controller's action, decision or judgment which produced an unwanted or unintentional result
- Traffic Information, referring to the applicable separation that has not been established
- Incorrect operational communication (pilot/controller and controller/controller communications).
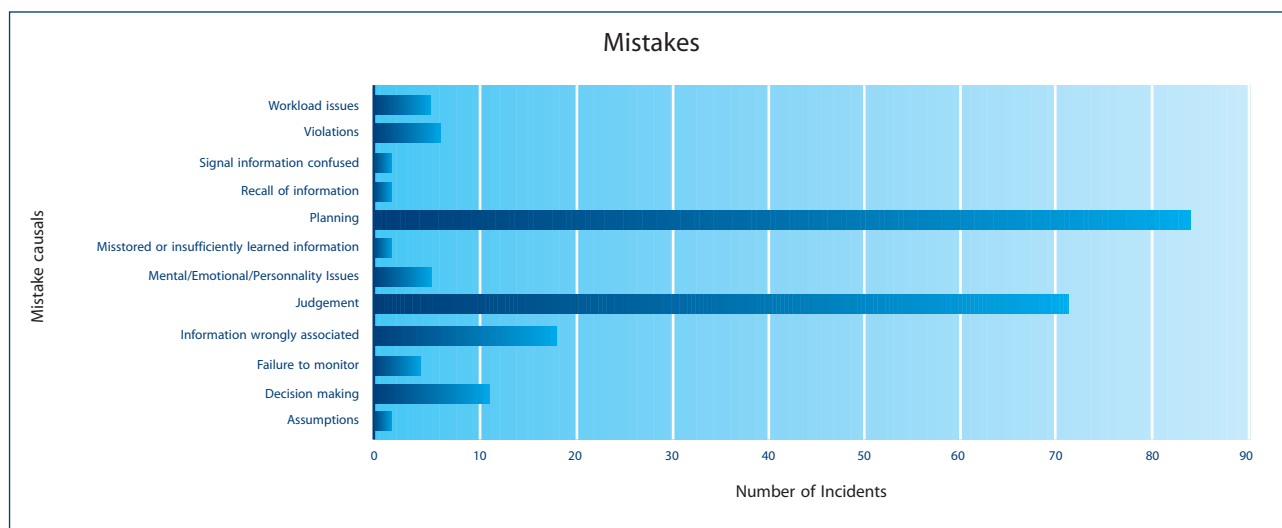
TOP CAUSAL FACTORS

Figure 5: Top Causal Factors - Mistakes

Mistakes represent the psychological part of an air traffic controller's action, decision or judgment that produced an unwanted or unintentional result. Bad planning and Judgment are the most common mistakes made.

According to other available data, training is one of the areas that could help in mitigating the high number of these types of occurrences.
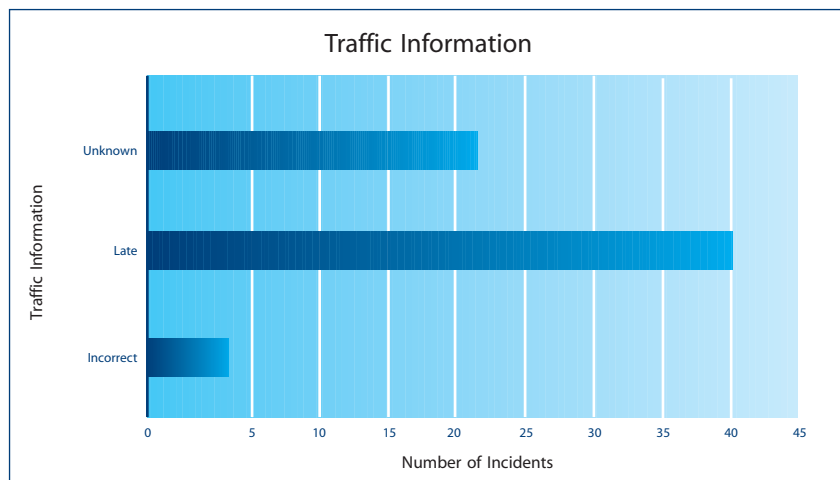

Figure 6: Top Causal Factors - Traffic Information

Traffic Information refers to the applicable separation that was not established. Late reaction or provision of information is the most common cause.

Timely Traffic Information could reduce the high number of occurrences of this type. A potential solution could be to emphasise this issue during ATCO training.

Operational Communication
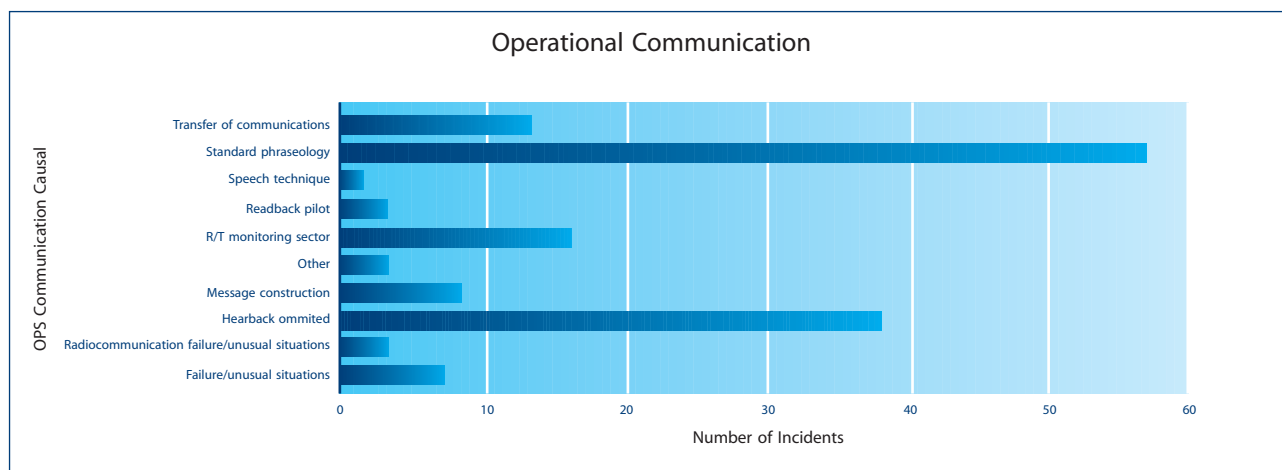
Figure 7: Top Causal Factors - Operational Communication

Operational Communication refers to pilot/controller (Air/Ground) and controller/controller (Ground/Ground) communication.

Standard phraseology and hearback/read-back as part of the same actions are the highest ranking issues within Operational Communications, and relate to both pilots and controllers.
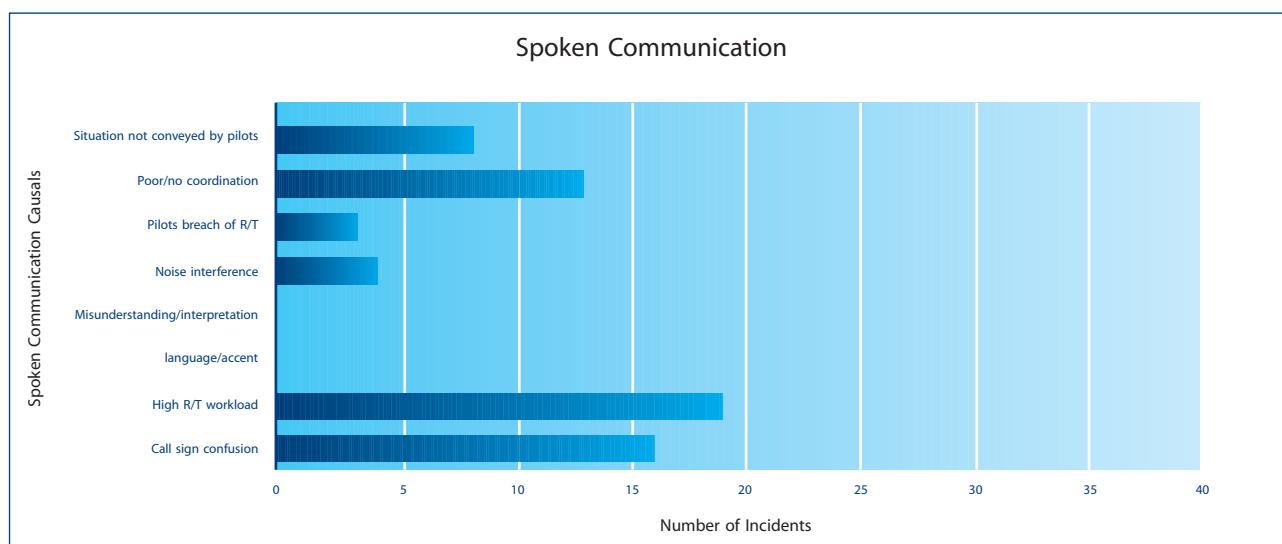

Spoken Communication

Figure 8: Top Causal Factors - Spoken Communication

Spoken Communication refers to human/human communication. The topics included in Figure 8 are those top causal factors that make the situation unclear or uneasy to understand as described or as information was given.

Misunderstanding, Language/Accent and Call Sign Confusion problems are the top ranking issues.

As a contribution to the improvement of safety, EUROCONTROL has initiated a project to deconflict callsign similarities. The plan is to place this function in CFMU.
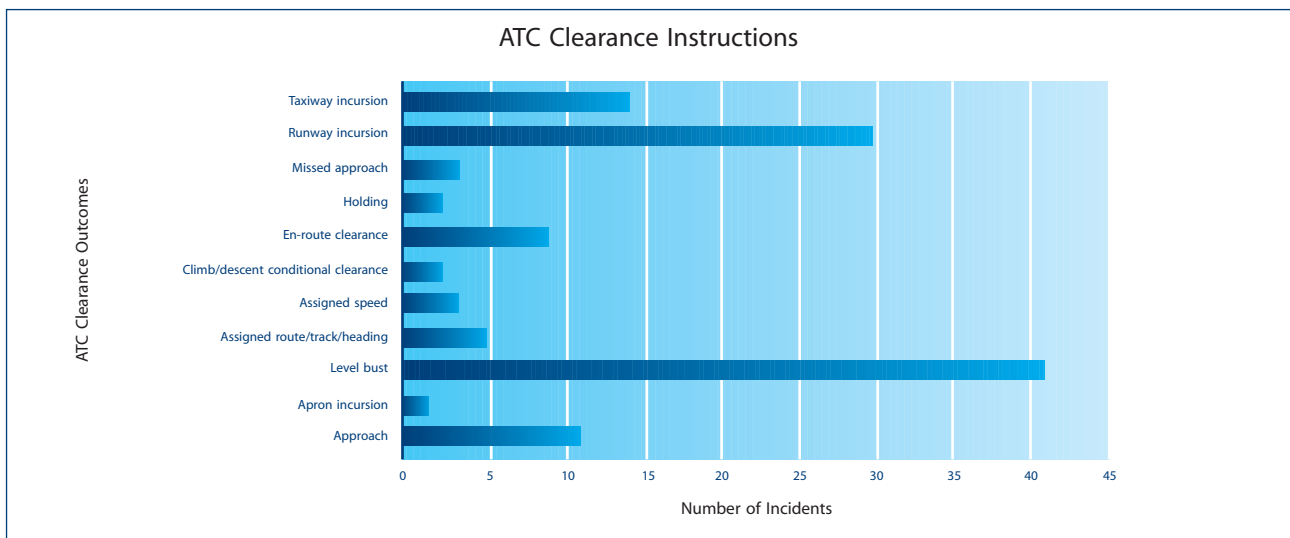
ATC Clearance Instructions

Figure 9: Top Causal Factors - ATC Clearance Instructions

ATC Clearance/Instructions are related to incorrect aircraft reactions, which could be the consequence of pilot or controller mistakes. Level Bust and Runway Incursions are the most frequent consequences of the incorrect ATM Clearance Instructions. However, combined Runway and Taxiway Incursions shows that ATC Clearance Instructions problems are much higher on the ground than in the air.

EUROCONTROL has developed European Action Plans for:

- The Prevention of Level Busts, and
- The Prevention of Runway Incursions

Stakeholders are urged to implement the appropriate actions to minimise such occurrences.

ACAS REPORTING

ACAS is the Airborne Collision Avoidance System intended to improve air safety by acting as a 'last-resort' method of preventing mid-air collisions or near collisions, between aircraft. ACAS is the generic term for Airborne Collision Avoidance Systems, of which TCAS II is the only example. Reports on ACAS incidents are a part of the EUROCONTROL ATM Safety Database.

ACAS data has been collected through manual (airlines' and ANSPs' reports) and automated reporting via the ATM Safety Monitoring Tool (ASMT) developed by EUROCONTROL. As ACAS incidents are part of the mandatory reporting requirement, it was decided to dedicate a separate section to the ACAS ATM analysis within this EVAIR Safety Bulletin. The statistics below are derived from manual reporting provided by volunteering airlines and from data collected automatically from one Mode-S radar station and provided by the relevant volunteering ANSP. ACAS statistics produced as part of the EVAIR activity are not intended to replace the existing ACAS Bulletin, which is issued by the Mode-S programme. On the contrary, EVAIR's collection of ACAS incident reports and production of statistics support the work of the Mode-S programme by providing data that could help in identifying technical problems related to the work of ACAS.

MANUAL ACAS REPORTING

ACAS reports constitute 23.5% of the overall incidents within the EVAIR database - i.e. those collected manually. ACAS incidents account for a high percentage of the total number of the ATM incidents. This is due to the reporting of ACAS incidents being mandatory - i.e. pilots and controllers are obliged to report ACAS incidents.

The most common occurrence of ACAS is when an aircraft deviates from ATC clearance to avoid the risk of collision with another aircraft, i.e. when the pilot is taking avoiding action. The total number of incidents in the database where avoiding action was reported accounts for nearly 11% of incidents. However, it should be noted that, when comparing incidents involving avoiding action only within ACAS reports, this figure increases to 64%.
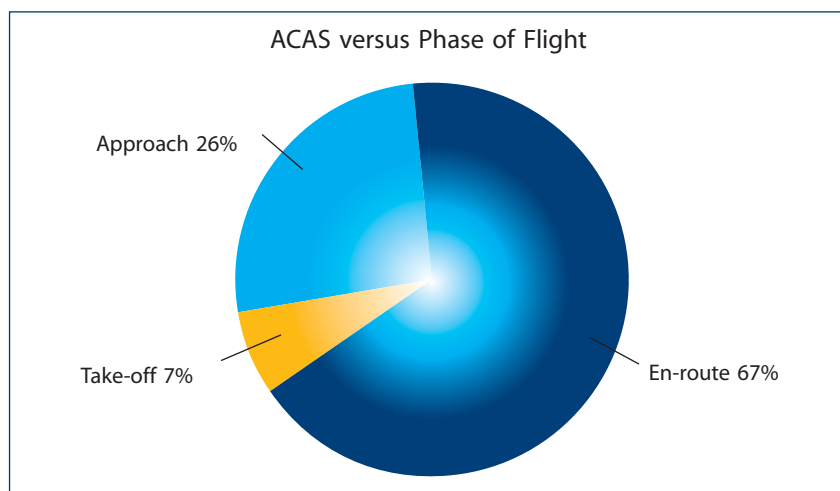
Figure 10: ACAS Versus Phase of Flight

Using data received via the manual reporting process, the most affected phase with ACAS activations is En-route with 67%, while Approach accounts for 26% of ACAS occurrences.

We would normally expect more ACAS incidents within the APP phase. However, the figures shown could be due to a limited amount of data. This trend will be monitored.
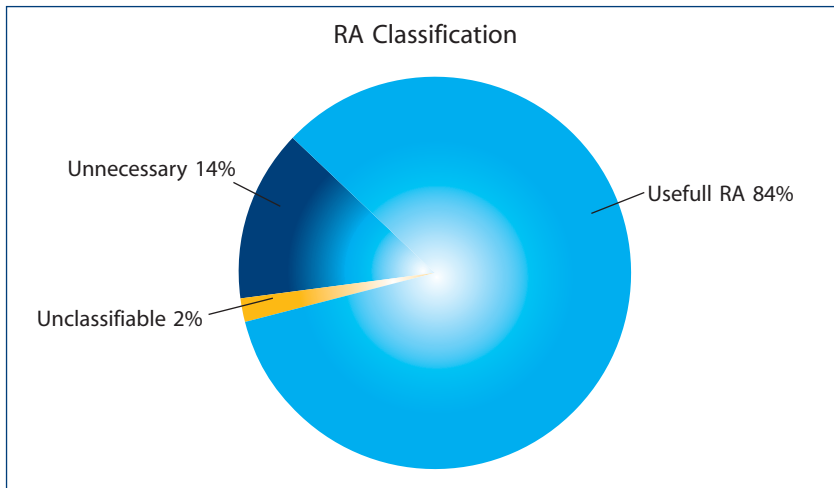
RA Classification

Figure 11: RA Classification

In Figure 11, pilots' reports show that the largest number of RAs are regarded as Useful, indicating that the activated RA, as a last safety net resort, helped in solving the traffic conflict in a safe manner.
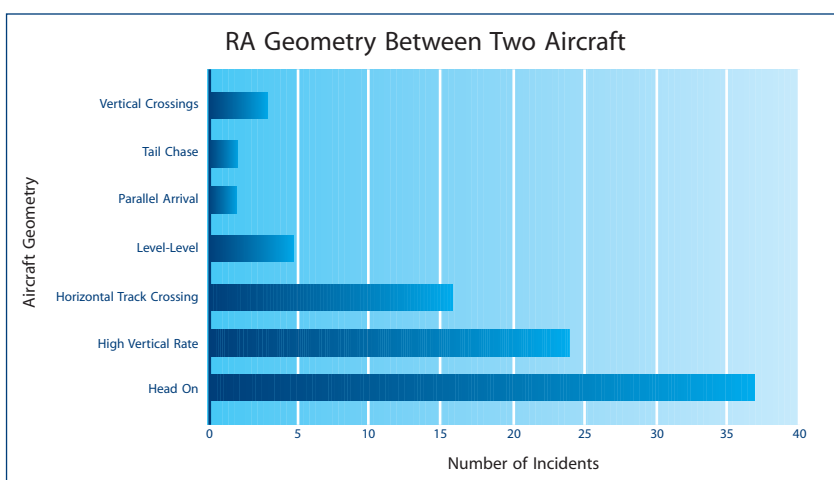
According to the Harmonisation for European Incident Definition Initiative for ATM (HEIDI) taxonomy, Resolution Advisories (RAs) have been classified as:

- Useful RA - The TCAS II system generated an advisory in accordance with its technical specification in a situation where there was, or would have been, a risk of collision between the aircraft.

- Unnecessary RA - The TCAS II system generated an advisory in accordance with its technical specification in a situation where there was not, or would have not been, a risk of collision between the aircraft.
- Unclassifiable RA - The TCAS II system generated an advisory that cannot be classified because of insufficient data.

RA Geometry Between Two Aircraft

Figure 12: Resolution Advisory Geometry Between Two Aircraft

A 'Head On' situation is the most frequent position between two aircraft when a RA is activated. Head On situations account for 46% of the overall ACAS reports. Head On and High Vertical Rate Speed Situations account for 76% of the overall ACAS reports.

This data could be used when considering airspace design.

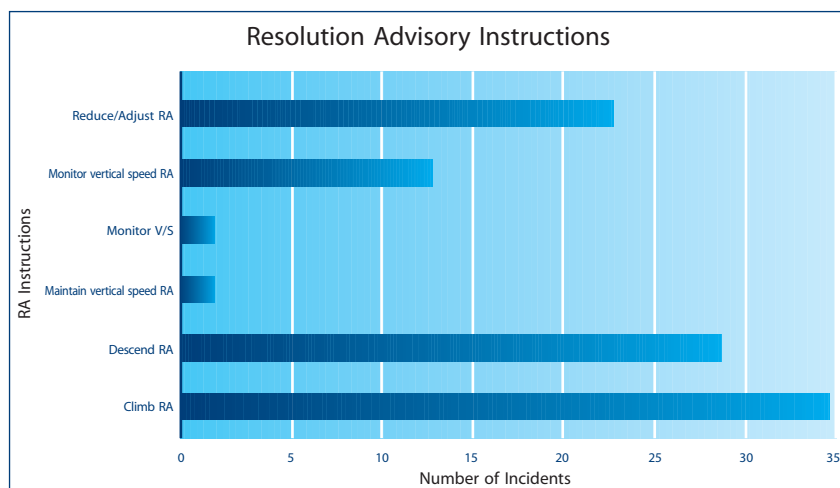## Resolution Advisory Instructions

Figure 13: Resolution Advisory Instructions

Climb and Descend are the most frequent TCAS RA instructions of the manually reported ACAS incidents. However, Reduce/Adjust RA, which is related to the speed of the aircraft, also accounts for a high number of incidents. Figure 13 shows that some of the RAs could be triggered by too high a rate of climb or descent and not, as could be understood, by the wrong ATC Instructions.
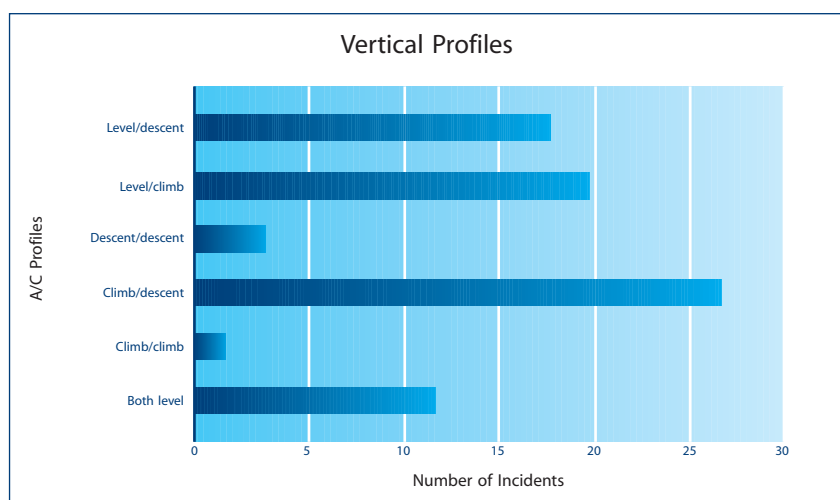
Vertical Profiles

Figure 14: Vertical Positions

Vertical Profiles are related to the vertical positions between two aircraft when a RA was activated. Climb/Descent are the most frequent positions between two aircraft when a RA is activated, accounting for 33% of the overall ACAS reports.
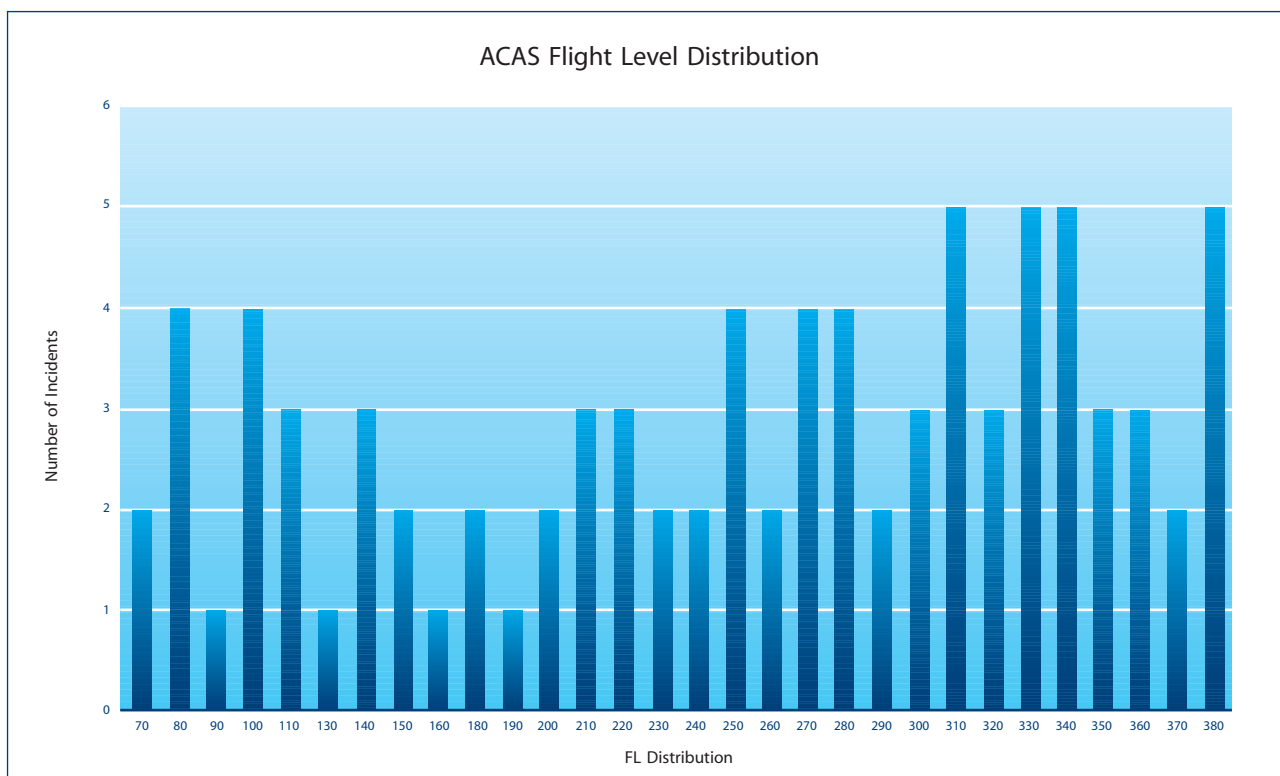
ACAS Flight Level Distribution

Figure 15: ACAS Flight Level Distribution

Within the upper airspace, the majority of incidents occur at flight levels (FL) FL310, 330, 340 and 380, while in the lower airspace, FLs280, 270, 250, 220 and 210 are the most affected. In the approach phase, these are FLs100 and 80.

NOTE: The low number of occurrences per flight level is due to a lack of information for some of the incidents - we do not have the Cleared or Actual FL data.
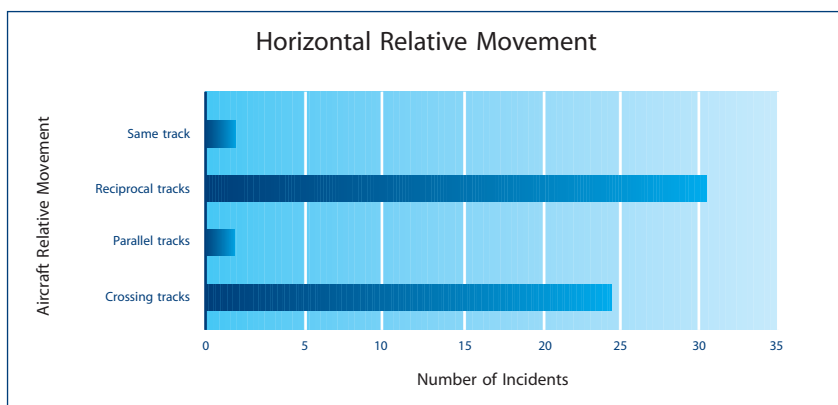
Figure 16: Horizontal Relative Movement

Horizontal Relative Movements are positions between two aircraft within their horizontal profile. Figure 16 shows that the reciprocal (opposite) tracks are the most frequent situations when a RA is triggered, accounting for 37% of the overall ACAS reports.

This data could be used when considering airspace design.

GENERAL CONCLUSIONS

- In a number of areas, it is thought that improvements in training could reduce the number of incidents occurring.
- Airspace design plays a part in mitigating against incidents.
- The statistics developed are based on a limited amount of data and reflect the true number of incidents only. It is anticipated that future reports will provide comparative figures between the number of incidents vs the number of operations.
- The quality of the data will improve over time with more active participation by all stakeholders.

AUTOMATIC COLLECTION AND ANALYSIS OF ACAS RESOLUTION ADVISORIES (RA)

The Automatic Collection of ACAS Resolution Advisories is being trialed within the EVAIR system. The data is collected from a single Mode-S radar station and is collected by a tool called the ATM Safety Monitoring Tool (ASMT). Statistics provided by this tool give an overview of ACAS RAs detected by monitoring RA downlink messages with the ASMT Tool. The period covered is the last quarter of 2007.

A total of 354 downlink messages were assessed as real RAs.

The largest number of RAs can be seen in the lower Flight Levels which can be assumed to involve a large number in uncontrolled airspace flying visual flight rules.
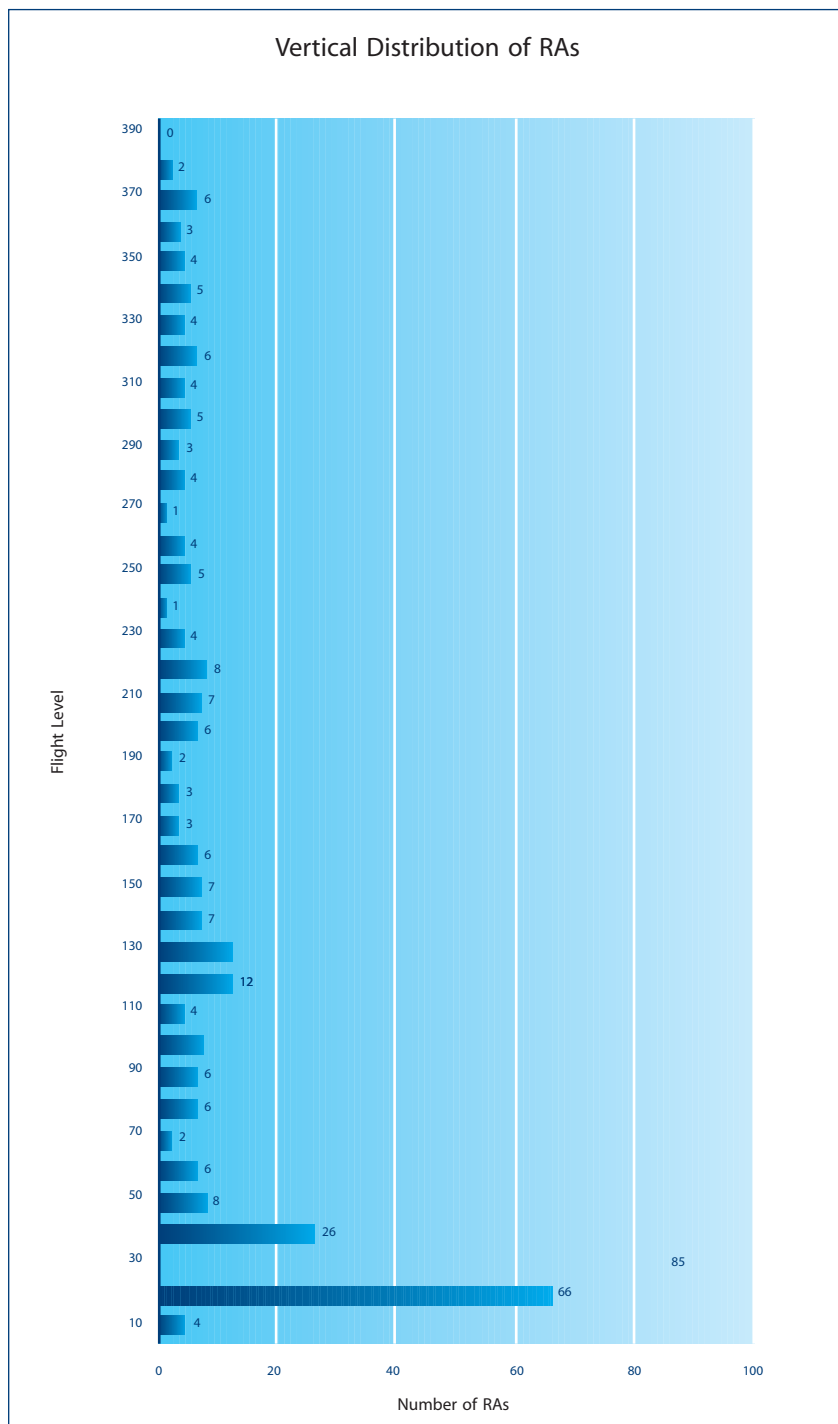

Figure 17: Vertical Distribution of Resolution Advisories

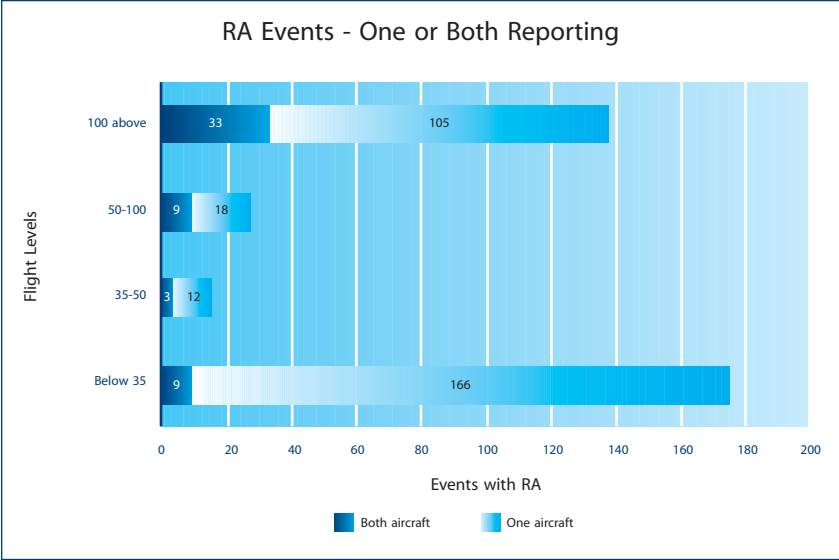Figure 18 shows that TCAS provides advisories to one aircraft even when both are equipped.

RA Events - One or Both Reporting

Flight Levels	
100 above	33 / 105
50-100	9 / 18
35-50	3 / 12
Below 35	9 / 166

Events with RA

Legend: Both aircraft / One aircraft

Figure 18: Resolution Advisory Events - One or Both Aircraft Reporting

Vertical rates are calculated by the ASMT and are shown as a high rate, above 1500 ft per minute or below 1500 ft per minute or level.
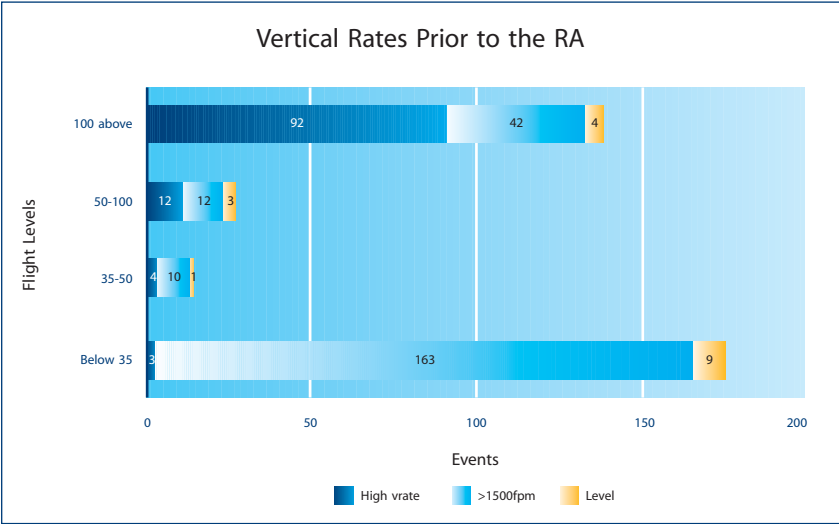
Vertical Rates Prior to the RA

Flight Levels	
100 above	92 / 42 / 4
50-100	12 / 12 / 3
35-50	4 / 10 / 1
Below 35	3 / 163 / 9

Events

Legend: High vrate / >1500fpm / Level

Figure 19: Vertical Rates Prior to the Resolution Advisory
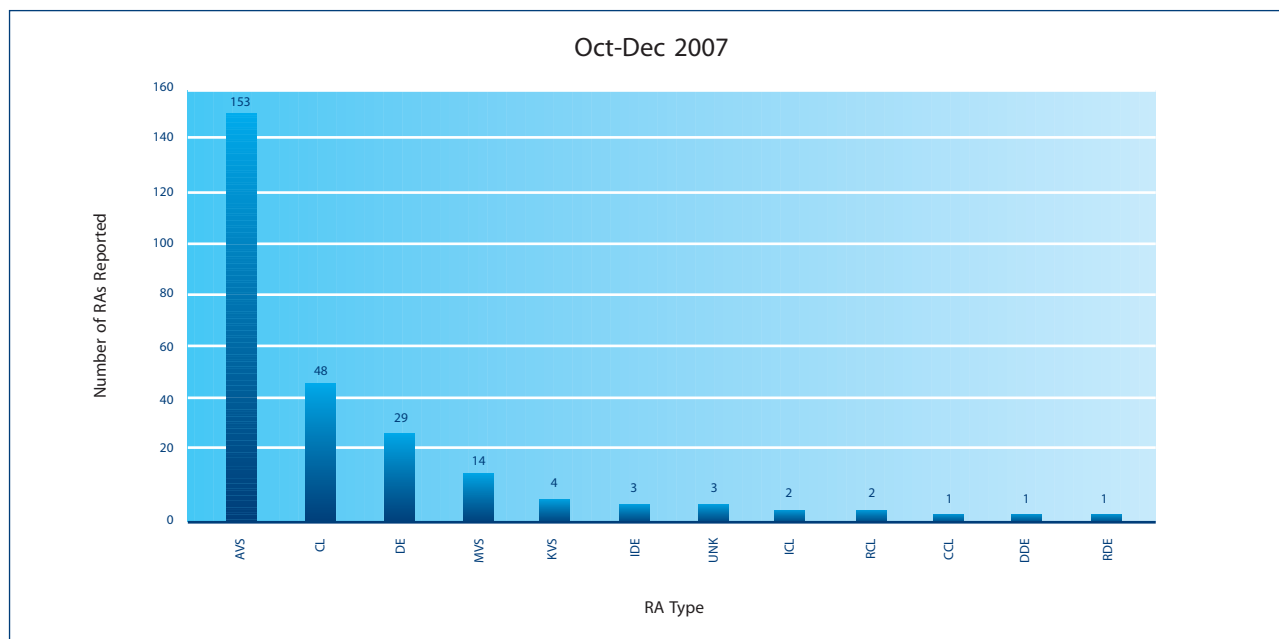
TYPE OF RA REPORTED

Figure 20: Type of RA Reported

Figure 20 shows a count of all RAs reported by downlink. The largest number of RAs are "Adjust Vertical Speed", which could be due to the high vertical rate of climb or descent.

The table below shows the breakdown of RA by type below FL160.

RA	MEANING	TOTAL	%
AVS	Adjust Vertical Speed	153	58.62%
CL	Climb	48	18.39%
DE	Descend	29	11.11%
MVS	Monitor Vertical Speed	14	5.36%
KVS	Keep (Maintain) Vertical Speed	4	1.53%
IDE	Increase Descent	3	1.15%
UNK	Unknown	3	1.15%
ICL	Increase Climb	2	0.77%
RCL	Reversal Climb	2	0.77%
CCL	Crossing Climb	1	0.38%
DDE	Don't Descend	1	0.38%
RDE	Reversal Climb	1	0.38%
GRAND TOTAL		**261**	

Cover: Photos courtesy of EUROCONTROL Maastricht