

**ACAS PROGRAMME
ACASA**

Final Report Summary

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Abstract

The eight WPs of ACASA project have been completed. This final report notes their deliverables and the recommendations from individual WPs.

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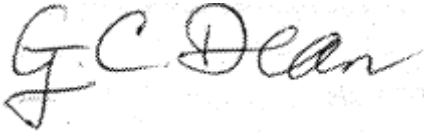


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The following table identifies all management authorities who have successively approved the present issue of this document.

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ACASA

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Version: 1.1

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List of Acronyms

ACAS	Airborne Collision Avoidance System
ACASA	Airborne Collision Avoidance Systems Analysis
ASMT	Automatic Safety Monitoring Tool
ATC	Air Traffic Control
CENA	Centre d'Etudes de la Navigation Aérienne
CPA	Closest Point of Approach
DFS	Deutsche Flugsicherung GmbH
EEC	EUROCONTROL Experimental Centre
FL	Flight Level
HMD	Horizontal Miss Distance
HRA	Horizontal Resolution Advisory
MOPS	Minimum Operational Performance Standards
NM	Nautical Miles
NMAC	Near Mid Air Collision
QinetiQ	The correctly spelt name of a private limited company (formerly DERA)
RA	Resolution Advisory
SARPs	Standards and Recommended Practices
SCRSP	Surveillance and Conflict Resolution Systems Panel
SICASP	SSR Improvements and Collision Avoidance Systems Panel (now succeeded by SCRSP)
Sofréavia	Société Française d'Etudes et Réalisations d'Equipements Aéronautiques
TA	Traffic Advisory
TCAS	Traffic alert and Collision Avoidance System
UK NATS	UK National Air Traffic Services
VMD	Vertical Miss Distance

1. Introduction

1.1 Background and context

1.1.1 The Trans European Network Systems (TENS) of the European Commission, supported a set of studies, in the context of the EUROCONTROL ACAS Programme, to provide information supporting the implementation of an Airborne Collision Avoidance System (ACAS) II in Europe. This study project was called the ACAS Analysis (ACASA) project.

1.2 ACAS Analysis project

1.2.1 The ACASA project, supported by TENS funding, investigated several areas related to ACAS II operational implementation [WP001], including the implications of potential changes to ATM operations and to the airspace environment (specifically relating to the introduction of Reduced Vertical Separation Minima (RVSM) from FL290 to FL420) upon the safety benefit provided by ACAS II in European airspace.

1.2.2 The partners involved in the ACASA project were:

Sofreavia and the Centre d'Etudes de la Navigation Aérienne (CENA) were responsible for work packages (WPs) 3 and 6, and involved with WPs 1, 4, 7 and 8.

Deutsche Flugsicherung (DFS) were responsible for WP 5 and involved with WP 7.

EUROCONTROL Experimental Centre (EEC) were responsible for overall project management, WPs 7 and 8 and were involved with WPs 1, 3 and 6.

QinetiQ were responsible for WPs 1 and 4 and involved with all other WPs.

UK National Air Traffic Services (UK NATS) gave permission to use their data and participated in meetings to be kept abreast of findings.

1.3 Objectives

1.3.1 The aim of the study was to maximise the safety benefit, within reasonable cost, from ACAS II implementation.

1.3.2 To achieve this, a number of smaller objectives were foreseen:

To provide data that will enable the implications of ACAS II performance to be taken into account in airspace and procedure planning.

To provide information to pilots and controllers to minimise operational constraints to ACAS II performance.

To be able to update this information with operationally, technically and statistically valid data.

1.4 Work Breakdown

1.4.1 The following 8 WPs were contracted with the European Commission [WP001]:

WP1: Full system Safety Study

WP3: Study of interaction between ACAS and RVSM

WP4: Estimation of the impact of extending the transponder altitude reporting requirement

WP5: Modelling the electromagnetic environmental effects of ACAS II

WP6: Development of ACAS II training material

WP7: Develop Mode S Monitoring tools to monitor downlinked ACAS II encounter information

WP8: Assess the acceptability of ACAS II horizontal advisories

WP10: Project Management

1.5 Contents of report

- 1.5.1 The eight WPs of the ACASA project have been completed. This final report notes their deliverables and the recommendations from individual WPs.

2 Deliverables

2.1.1 The ACASA project created the following reports, attached in annex to this summary report:

WP1: Studies on the safety of ACAS II in Europe [WP210D]

WP3: Study of ACAS/RVSM Interaction in European airspace [WP185D]

WP4: Potential benefits of extension of the transponder altitude reporting requirement [WP163D]

WP5: Electromagnetic environmental effects of, and on, ACAS II [WP198D], [WP200D], [WP201D], [WP211D]

WP6: Final report on ACAS II Training Material [WP016D]

WP7: Final report on Mode S Monitoring of ACAS II [WP220D] and the supporting technical reports [WP174D], [WP143D], [WP150D] and [WP060D].

WP8: Final report on a study of the acceptability and efficiency of lateral collision avoidance manoeuvres [WP221D] and the supporting technical reports [WP107D] and [WP166D].

2.1.2 The following project deliverables are also available from the project manager, Mr Garfield Dean, Eurocontrol Experimental Centre, but are not included in this report.

An excel spreadsheet of the Event Tree [WP217D] (used in the full system safety study) and supporting descriptions [WP197D], [WP154D]

The specification of the European Encounter Model [WP186D] also used in the full system safety study.

ACAS II training material [WP010D], [WP011D], [WP012D] and [WP015D].

The final presentations given to the European Commission [WP219D]

2.1.3 In addition, more than 200 working papers were developed for the project. This report, together with the working papers will be published on a CD ROM. From the end of January 2002 they will also be accessible through:

the ACASA web site: http://www.eurocontrol.fr/ba_saf/acas/ACASA_Project.htm

the ACAS Programme web-site:
<http://www.eurocontrol.int/eatmp/projects/acas/ACASAproject.htm>

3 Recommendations

3.1.1 This section restates the recommendations from the individual WP reports. This constitutes the final deliverable from the ACASA project.

3.2 *WP1*

3.2.1 It is proposed that the marked safety benefit of fitting ACAS II to small aircraft be brought to the attention of European decision makers to support Phase 2.

3.2.2 The need to follow the Resolution Advisories (RAs) must be emphasised.

3.3 *WP3*

3.3.1 Aircraft flying in the European RVSM environment should be fitted with ACAS II standard equipment – this demands TCAS II Version 7.0, or higher.

3.3.2 Aircraft flying at 1000' separation in the European RVSM environment should be RVSM MASPS-compliant

3.3.3 Transponders of aircraft flying in the European RVSM environment should report their altitude in 25 feet increments.

3.3.4 Controllers should be provided ACAS/RVSM specific information and training

3.3.5 Pilots should be provided ACAS/RVSM specific information and training

3.3.6 TCAS II Version 7.0 performances in the the European RVSM environment should be carefully monitored.

3.4 *WP7*

3.4.1 States with access to Mode S data should consider automatically monitoring ACAS II RAs which occur in their airspace.

3.4.2 States should monitor their Mode S data for anomalies in ACAS II relevant parameters.

3.5 *WP8*

3.5.1 Before considering any further development of horizontal RAs, then a further study should be made to address in more detail controllers' opinions and reactions to horizontal RAs.

4 References

4.1 WP10

- [WP001] ACASA/WP10/001 – ‘European TEN Study – ACAS Analysis – Work Plan’ Eurocontrol, Version 1.5, 19 June 2000.
- [WP219D] ACASA/WP10/219D – ‘ACASA Final Presentations’ all partners, Version 1.0, 28 November 2001.
- [WP222D] ACASA/WP10/222D – ‘ACASA Final Report’, Eurocontrol, Version 1.1, 1 March 2002.

4.2 WP1

- [WP210D] ACASA/WP1/210D – ‘Studies on the safety of ACAS II in Europe’, QinetiQ, Version 1.2, 18 January 2002.
- [WP186D] ACASA/WP1/186D – ‘European Encounter Model. Specifications and Probability tables’, CENA/Sofreavia & QinetiQ, 20 July 2001
- [WP217D] ACASA/WP1/217D – ‘Excel Spreadsheet of the Event Tree’, QinetiQ, Version 4.0 24 December 2001.
- [WP197D] ACASA/WP1.6/197D – ‘Notes on the event tree for the ACAS collision risk ratio’, QinetiQ, Version 2.3, 12 September 2001-12-31
- [WP154D] ACASA/WP1.6/154D – ‘Fault Tree’, QinetiQ, Version 1.0, 2 February 2001

4.3 WP3

- [WP185D] ACASA/WP3/185D – ‘Study of interaction between RVSM and ACAS within the European RVSM airspace’. CENA/Sofreavia, Version 1.1, 4 September 2001

4.4 WP4

- [WP163D] ACASA/WP4/163D – ‘Potential benefits of extension of altitude reporting requirement’. QinetiQ, Version 1.1, 27 August 2001

4.5 WP5

- [WP201D] ACASA/WP5/201D – ‘Executive Summary - Electromagnetic environmental effects of and on ACAS’, DFS, Version 1.0, 15 November 2001
- [WP198D] ACASA/WP5.1/198D – ‘WP5.1 - Electromagnetic environmental effects of and on ACAS’, DFS, Version 1.0, 10 September 2001
- [WP200D] ACASA/WP5.1/200D – ‘WP5.2 Report - The electromagnetic environmental effects of ACAS II. (SIEM Modelling Results)’, QinetiQ, Version 1.0, September 2001
- [WP211D] ACASA/WP5.1/211D – ‘WP5 extension - Electromagnetic environmental effects of and on ACAS’, DFS, Version 1.0, 15 November 2001.

4.6 WP6

- [WP16D] ACASA/WP6/16D – ‘Final report on ACAS Training Material’, CENA/ Sofreavia, Version 1.0, 29 January 1999.
- [WP15D] ACASA/WP6/15D – ‘ACAS Brochure’, CENA/ Sofreavia, Version 1.0, 29 January 1999.
- [WP12D] ACASA/WP6/12D – ‘Description of RITA events (slides)’ CENA/ Sofreavia, Version 1.0, 29 January 1999.
- [WP11D] ACASA/WP6/11D – ‘Introduction to RITA (slides)’ CENA/ Sofreavia, Version 1.0, 29 January 1999.
- [WP10D] ACASA/WP6/10D – ‘ACAS and Air Traffic Control (Slides)’ CENA/ Sofreavia, Version 1.0, 29 January 1999.

4.7 WP7

- [WP220D] ACASA/WP7/220D – ‘Mode S Monitoring of ACAS’, Eurocontrol Experimental Centre, Version 1.0, 31 December 2001
- [WP 174D] ACASA/WP7.1/174D – ‘Automatic Safety Monitoring Tool WP7.1 ASMT Mode S Monitoring Tool Final Report’, Eurocontrol Experimental Centre, Version 1.0, 1 August 2001
- [WP143D] ACASA/WP7.3/143D – ‘WP – 7.3 Mode S Monitoring for ACASA – Final Report’, QinetiQ, Version 1.0, 21 November 2001
- [WP150D] ACASA/WP7.4/150D – ‘Parallel Monitoring of ACAS related 1030 and 1090 signals’, DFS, Version 1.2f, 22 November 2001
- [WP060D] ACASA/WP7.5/060D – ‘Results for the Mode S ACAS events analysis’, CENA/Sofreavia, Version 1.0, 31 August 1999.

4.8 WP8

- [WP221D] ACASA/WP8/221D – ‘Study of the acceptability and efficiency of lateral collision avoidance manoeuvres’ Eurocontrol Experimental Centre, Version 1.0, 31 December 2001
- [WP107D] ACASA/WP8.1/107D – ‘Acceptability of ACAS horizontal advisories’, CENA/Sofreavia, Version 2.0, 20 June 2001
- [WP166D] ACASA/WP8.3/166D – ‘Acceptability of ACAS Horizontal Advisories: The view of pilots and controllers’, QinetiQ, Version 1.0, 29 March 2001.

**4.9 All references at 4.2,4.3, 4.4, 4.5, 4.6, 4.7, and 4.8 are merged in the:
ACASA Final Report, Edition 1.0, 1 March 2002**