RTCA, Inc.
1140 Connecticut Avenue, NW, Suite 1020
Washington, DC 20036 USA

Minimum Operational Performance Standards (MOPS) for an Active Traffic Alert and Collision Avoidance System I (Active TCAS I)

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Prepared by: SC-147

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RTCA, Inc.

Telephone: 202-833-9339
Facsimile: 202-833-9434
Internet: www.rtca.org

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FOREWORD

This report was prepared by RTCA Special Committee 147 (SC-147) and approved by the RTCA Technical Management Committee (TMC) on September 12, 1994.

RTCA, Incorporated is a not-for-profit corporation formed to advance the art and science of aviation and aviation electronic systems for the benefit of the public. The organization functions as a Federal Advisory Committee and develops consensus based recommendations on contemporary aviation issues. RTCA's objectives include but are not limited to:

- coalescing aviation system user and provider technical requirements in a manner that helps government and industry meet their mutual objectives and responsibilities;

- analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity and efficiency;

- developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and

- assisting in developing the appropriate technical material upon which positions for the International Civil Aviation Organization and the International Telecommunication Union and other appropriate international organizations can be based.

The organization's recommendations are often used as the basis for government and private sector decisions as well as the foundation for many Federal Aviation Administration Technical Standard Orders.

Since RTCA is not an official agency of the United States Government, its recommendations may not be regarded as statements of official government policy unless so enunciated by the U. S. government organization or agency having statutory jurisdiction over any matters to which the recommendations relate.

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EXECUTIVE SUMMARY

This document provides Minimum Operational Performance Standards (MOPS) for Active Traffic Alert and Collision Avoidance System I (Active TCAS I) on aircraft up to thirty passenger seats as prescribed by the Federal Aviation Administration (FAA) TCAS rules.

Active TCAS I is an air-to-air interrogation device that provides traffic advice to the flight crew by alerting them to the presence of a nearby transponder-equipped aircraft and advising the crew where to look for the aircraft so that it can be visually acquired and avoided if necessary. Unlike TCAS II and TCAS III, Active TCAS I does not provide conflict resolution advisories.

The following summarizes the operational goals to be met by a minimum performance Active TCAS I system for revenue passenger operations:

a. The systems is capable of providing reliable and timely advice to the pilot by using an audible and visual advisory of the proximity of an intruder aircraft.

b. The system will detect and then timely report the range, altitude (if reported) and relative bearing of the proximate aircraft with high reliability.

c. The probability of displaying false targets will be as low as possible.

d. The system should not increase the traffic on the Secondary Surveillance Radar (SSR) radio frequencies in a manner that degrades the ATC system.

Section 1.0 of this document is intended to provide information needed to understand the rationale for the equipment characteristics and requirements stated in the remaining sections.

Section 2.0 contains the minimum performance standards for the equipment. These standards define the required performance under standard operating conditions and stressed physical environments. Section 2.0 also details the recommended bench test procedures necessary to demonstrate compliance with system performance requirements.

Section 3.0 describes the performance required of the installed equipment. Tests for installed equipment are included to ensure that its performance is acceptable when performance cannot be adequately determined through bench testing.

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1.0 Purpose and Scope

1.1 Introduction

This document sets forth minimum operational performance standards for an Active Traffic Alert and Collision Avoidance System (Active TCAS I) to provide the Proximity Warning Indicator (PWI) function on aircraft with up to 30 passenger seats as required by the Federal Aviation Administration's TCAS Rule.

Active TCAS I is an air-to-air interrogation device that provides traffic advice to the flight crew by alerting them to the presence of a nearby transponder-equipped aircraft and advising the crew where to look for the aircraft so that it can be visually acquired and avoided, if necessary. The pilot must be alerted in time to: a) visually look for the intruding aircraft; b) locate it; c) determine if an avoiding maneuver is necessary; and d) accomplish the avoiding maneuver, if necessary (see Appendix A). Unlike Active TCAS II and Active TCAS III, Active TCAS I does not provide conflict resolution advisories.

A significant amount of data demonstrates that a pilot will visually locate an intruder aircraft more rapidly, under normal as well as poor visibility conditions, when intruder range, relative bearing and altitude information are provided.

For the purpose of this document, "own aircraft" refers to the aircraft equipped with Active TCAS I; "other aircraft" refers to another aircraft that the Active TCAS I aircraft is interacting with.

1.2 Useful Range of a PWI-Operational Environment

Three or four nautical miles is a nominal range at which aircraft can reliably be detected in visual flight conditions with normal in-flight visibility. The maximum range that a pilot can visually detect another aircraft varies as a function of relative motion and the contrast of the other aircraft against the background as seen by the pilot. Most near misses and mid-air collisions occur in the airspace below 10,000 feet MSL.

It is expected that there will continue to be a mix of controlled and uncontrolled aircraft using the same airspace and operating in visual meteorological conditions. Thus, a system that can be installed on an aircraft that enhances the pilot's capability of visually locating other aircraft will be operationally useful.

1.3 Need for Cooperative Equipment

It would be best if the system did not require special cooperative equipment to permit an airborne collision avoidance system to perform its function in a suitable manner. However, numerous studies show that some type of cooperative device is necessary to permit the intruding aircraft to be detected in an operationally useful manner. The preferable cooperative device is the ATCRBS or Mode S transponder, with altitude reporting capability, so the pilot of the Active TCAS I equipped aircraft can be told when and where