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Minimum Operational Performance Standards for Airborne Thunderstorm Detection Equipment

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F O R E W O R D

This document was prepared by Special Committee 154 of the Radio Technical Commission for Aeronautics. It was approved by RTCA on May 16, 1986.

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1.0 PURPOSE AND SCOPE

1.1 Introduction

This document contains minimum operational performance standards for non-radar airborne thunderstorm detection equipment. These standards specify system characteristics that should be useful to designers, manufacturers, installers and users of the equipment.

Compliance with these standards is recommended as one means of assuring that the equipment will perform its intended function(s) satisfactorily under all conditions normally encountered in routine aeronautical operations. Any regulatory application of this document is the sole responsibility of the appropriate governmental agencies.

Section 1.0 of this document provides information needed to understand the rationale for equipment characteristics and requirements stated in the remaining sections. It describes typical equipment applications and operational goals as envisioned by Special Committee 154. Definitions and assumptions essential to proper understanding of this document are also provided in this section.

Section 2.0 contains the minimum performance standards for the equipment. These standards specify the required performance under standard and environmental conditions. Also included are recommended bench test procedures necessary to demonstrate equipment compliance with the stated minimum requirements.

Section 3.0 describes the performance required of the installed equipment. Tests for the installed equipment are included when performance cannot be adequately determined through bench testing.

Section 4.0 describes the operational performance characteristics for equipment installations and defines conditions that will assure the equipment is used properly in the expected operational environment.

This document considers an equipment configuration consisting of, but not limited to: A receiver/processor, control panel, display, antenna(s) and interconnecting cables. Operational performance standards for functions or components that refer to equipment capabilities that exceed the stated minimum requirements are identified as optional features.

The word "equipment" as used in this document includes all components and units necessary for the system to properly perform its intended function(s). For example, the "equipment" may include an antenna, a receiver unit, a display, mounting trays, etc. In the case of this example, all of the foregoing components and units comprise the "equipment." It should not be inferred from this

example that each equipment design will necessarily include all of the foregoing components or units. This will depend on the specific design chosen by the manufacturer.

If the equipment implementation includes a computer software package, the guidelines contained in RTCA/DO-178A, "Software Considerations in Airborne Systems and Equipment Certification," should be considered.

1.2 System Overview

Thunderstorms, by definition, contain electrical discharges and strong electrical fields. Statistically, these electrical discharges are usually present when the convective cell contains turbulence, visible precipitation and wind shear. Investigation has shown that electrical fields and discharges are detectable by airborne equipment for long periods of time during the life of the thunderstorm cell. The electrical gradient begins to build up early in the cell's life cycle and remains detectable through much of the cell's dissipation.

Airborne thunderstorm detection equipment provides the flight crew with range and bearing information to sferics or electrical discharge activity associated with thunderstorms, in order to identify areas likely to be associated with turbulence.

The equipment detects electromagnetic and/or electrostatic signals emanating from atmospheric electrical discharges; processes them in the receiver/processor; and displays them, by range and azimuth from the aircraft, on an indicator.

1.3 Operational Applications

It is envisioned that airborne thunderstorm detection equipment will be used in either a stand-alone installation, i.e. with no other weather avoidance equipment onboard the aircraft, or in conjunction with airborne weather radar or other devices. In either case, the equipment should assist the flight crew in assessing the location and severity of thunderstorm activity and selecting an avoidance flight path suitable to the flight characteristics of their aircraft.

1.4 Operational Goals

The severe weather associated with thunderstorm activity constitutes one of the most potentially dangerous environments to flight; therefore detection and knowledge of thunderstorm location would be of value to the pilot. Government-sponsored as well as industry research has revealed the extent and composition of the electrical fields in thunderstorms with sufficient accuracy to permit detecting statistically acceptable baseline data. Investigation has shown that where detectable electric fields and discharges exist, they exist in, or in close proximity to,