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Civil Operators' Training Guidelines for Integrated Night Vision Imaging System Equipment

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FOREWORD

This report was prepared by Special Committee 159 (SC-159) and approved by the RTCA Program Management Committee (PMC) on July 29, 2004.

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- 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.

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EXECUTIVE SUMMARY

The hours of darkness add to a pilot's workload by decreasing those visual cues commonly used during daylight operations. The decreased ability of a pilot to see and avoid obstructions at night has been a subject of discussion since aviators first attempted to operate at night. Technology advancements in the late 1960s and early 1970s provided military aviators some limited ability to see at night and therein changed the scope of military night operations. Continuing technological improvements have advanced the capability and reliability of night vision imaging systems to the point that they are receiving increasing scrutiny, are generally accepted by the public, and are viewed by many as a tool for night flight.

Simply stated, night vision imaging systems are an aid to night VFR flight. Currently, such systems consist of a set of night vision goggles and normally a complimentary array of cockpit lighting modifications. The specifications of these two sub-system elements are interdependent and, as technology advances, the characteristics associated with each element are expected to evolve. The complete description and performance standards of the night vision goggles and cockpit lighting modifications appropriate to civil aviation are contained in RTCA/DO-275 "*Minimum Operational Performance Standards for Integrated Night Vision Imaging System Equipment"*.

An increasing interest on the part of civil operators to conduct night operations has brought a corresponding increased level of interest in employing night vision imaging systems. However, the night vision imaging systems do have performance limitations. Therefore, it is incumbent on the operator to employ proper training methods and operational procedures to minimize these limitations to ensure safe operations. This document presents training guidance that has been generated from lessons learned by agencies that have many years of experience in the training and operational application of night vision imaging systems. By tapping this experience base it is hoped that civil aircrew, through appropriate ground and flight training, will learn how to properly use night vision imaging systems, thus enhancing the effectiveness of night operations while mitigating the potential for mishaps relating to the use of these systems. A description of the underlying operational concepts is contained in RTCA/DO-268 "*CONCEPT OF OPERATIONS, Night Vision Imaging System for Civil Operators"*. In turn, operators employing night vision imaging systems should have the guidance and support of their regulatory agency in order to safely train and operate with these systems.

The role of the regulatory agencies in this matter is to develop the technical standard orders for the hardware as well as the advisory material and inspector handbook materials for the operations and training aspect. In addition, those agencies charged with providing flight weather information should modify their products to include the night vision imaging systems flight data elements not currently provided.

An FAA study (DOT/FAA/RD-94/21, 1994) best summarized the need for night vision imaging systems by stating, "When properly used, NVGs can increase safety, enhance situational awareness, and reduce pilot workload and stress that are typically associated with night operations."

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1 INTRODUCTION

The desired integration of aviation night vision imaging system (NVIS) technology into civil aviation requires the successful interface of numerous disciplines. Presently, three documents will be used to fully and completely describe the various elements of a successful NVIS program. The complete discussion of these NVIS disciplines is distributed across the Concept of Operations (RTCA/DO-268) and the Minimum Operations Performance Standards (MOPS) (RTCA/DO-275) for the NVIS Equipment, and this document, the Training Guidelines. There is crossover from document to document and the Training Guidelines contain some areas more specific than others when there is no associated document more appropriate to the information. Items such as the operational concepts and hardware specifications are specifically provided for in the Concept of Operations and MOPS and therefore, are treated superficially by the Training Guidelines.

1.1 Purpose

The purpose of this document is to describe the optimum training to support the implementation of aviation NVIS technology into the national airspace system (NAS) by civil aviation operators. This paper discusses the training types, pilot training, other required personnel training, and training support equipment. As with all training, there is a burden on the operator to continuously update the training to accommodate the expansion of knowledge and improvements in technology.

This document is not restricted with respect to aircraft category. However, the examples provided are designed predominately for helicopters since initial interest in civil aviation NVIS stems from the rotorcraft community.

This document does not discriminate between for-hire and not-for-hire operations, as the minimum training is the same for both. Examples are provided for Part 91 and 135 training programs as the regulatory environment differs for the various types of operations.

The focus of the paper is the safe and efficient implementation of NVIS during the various phases of flight. The goal of implementing NVIS into the NAS is to improve an operator's situational awareness during night visual flight rule (VFR) operations without compromising safety.

1.2 Background

In 1971, the US Army adopted night vision devices for use in aviation. By the late 1980's many military trained night vision goggle (NVG) helicopter pilots were in the civil industry. The demand for night vision technology was spreading to the civil sector.

In 1989, Rocky Mountain Helicopters, a Part 135 air ambulance operator, informed the FAA of their intention to start employing NVGs in their single pilot operations.

In 1990, the Federal Aviation Administration (FAA) stated that Night Vision Enhancement Devices (NVEDs) are considered an appliance and that if an applicant wanted approval for operation with an NVED, a minimum operational performance standard (MOPS) would need to be developed and accepted by the FAA.

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In 1994, the FAA released a study, Night Vision Goggles in Emergency Medical Service (EMS) Helicopters. The report stated "NVGs are a viable tool during the enroute and terminal operations during certain EMS scenarios. When properly used, NVGs can increase safety, enhance situational awareness, and reduce pilot workload and stress that are typically associated with night operations."

In 1996, Rocky Mountain Helicopters again approached the FAA with a plan to utilize NVGs. The FAA coordinated with the US Army to review training, operational, and goggle standards. The FAA determined that the critical issues to be resolved were pilot training, NVG certification standards and approval, and aircraft lighting. In order to expedite the program, the first several operator approvals were completed through the Supplemental Type Certificate (STC) process.

On February 5, 1999 in Asheville, NC, Rocky Mountain Helicopters (14 CFR 135 Air Carrier) conducted the first FAA approved civil night vision flight.

In the fall of 1999, the FAA requested RTCA, Inc develop recommended standards for use of night vision goggles in civil aviation.

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2 TERMINOLOGY

2.1 Night Vision Goggles

A NVG is a binocular appliance that amplifies ambient light and is worn by an operator. The NVG enhances the operator's ability to maintain visual surface reference at night.

2.1.1 Type

Type refers to the design of the NVG with regards to the manner in which the image is relayed to the operator. A Type 1 NVG is one in which the image is viewed directly in-line with the image intensification process. A Type 1 NVG is also referred to as "direct view" goggle. A Type 2 NVG is one in which the image intensifier is not in-line with the image viewed by the operator. In this design, the image may be reflected several times before being projected onto a combiner in front of the operator's eyes. A Type 2 NVG is also referred to as an "indirect view" goggle.

2.1.2 Class

Class is a term used to describe the filter present on the NVG objective lens. The filter restricts the transmission of light below a determined frequency. This allows the cockpit lighting to be designed and installed in a manner that does not adversely affect NVG performance. Class B NVGs have been defined as the minimum acceptable for civil operations. (See RTCA/DO-275)

2.1.2.1 Class A

Class A or "minus blue" NVGs incorporate a filter, which generally imposes a 625 nanometer cutoff. Thus, the use of colors in the cockpit (e.g., color displays, color warning lights, etc.) may be limited. The blue green region of the light spectrum is allowed through the filter.

2.1.2.2 Class B

Class B NVGs incorporate a filter that generally imposes a 665 nanometer cutoff. Thus, the cockpit lighting design may incorporate more colors since the filter eliminates some yellows and oranges from entering the intensification process.

2.1.2.3 Modified Class B

Modified Class B NVGs incorporate a variation of a Class B filter but also incorporates a notch filter in the green spectrum that allows a small percentage of light into the image intensification process. Therefore, a Modified Class B NVG allows operators to view fixed heads-up display (HUD) symbology through the NVG without the HUD energy adversely affecting NVG performance.

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