

Civil use of Night Vision Goggles within the National Airspace System

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ABSTRACT

When properly employed, Night Vision Goggles (NVGs) improve a pilot's ability to see during periods of darkness. The resultant enhancement in situational awareness achieved when using NVGs, increases flight safety during night VFR operations. FAA is constrained with a lack of requisite regulatory and guidance infrastructure to adequately facilitate the civil request for use of NVGs within the National Airspace System (NAS). RTCA Special Committee-196 (SC-196), Night Vision Goggle (NVG) Appliances & Equipment, is formed and tasked to develop: operational concept and operational requirements for NVG implementation into the NAS, minimum operational performance standards for NVGs, and training guidelines and considerations for NVG operations. This paper provides a historical perspective on use of NVGs within the NAS, the status of SC-196 work in progress, FAA integration of SC-196 committee products and the harmonization effort between EUROCAEs NVG committee and SC-196.

Keywords: NVG, NVIS, ANVIS, compatible aircraft lighting, panoramic night vision goggle, PNVG.

1. INTRODUCTION

A mature and mission-critical military technology, image intensification based night vision is receiving increased attention as a suitable aid to night flight operations within civil aviation. This is directly attributable to the influx of NVG experienced military aviators entering civil aviation. The significant improvement in design, function and performance of the aviation NVG, also contributes to an increased acceptance within civil aviation. Looming on the aviation horizon, are next generation aviation NVG systems, which include wider fields of view and integrate flight data symbology. An example of advanced aviation NVG systems is the Panoramic Night Vision Goggle (PNVG).

Many public-use operators, largely aerial law enforcement, routinely perform night flight operations with NVGs in both urban and rural scenarios. Use of NVGs has afforded these operators the latitude of extending daytime operations into hours of darkness, providing increased protection to the communities they serve. Operating with NVGs has formed a symbiotic relationship between better utilization of tax-payer funded resources and improved relations with the public at large. An example of this is the aerial application of insecticide and herbicide in Lee County, Florida. NVGs enable this operation to be conducted at night taking advantage of reduced surface winds, which yield better spray patterns and minimize exposure to Lee County citizens. When operating within the scope of their public-use charter, public-use operators are exempted from many of the Federal Aviation Regulations as they apply to aircraft type certification, pilot certification and aircraft operation.

In certain instances, FAA has amended operational specifications, permitting select commercial operator's within the Emergency Medical Services (EMS) sector, limited flight use with NVGs. Supplemental Type Certificates (STC) have been granted for interior lighting modifications, which optimize performance of the NVG. Additionally, the NVG is certified for operation utilizing the STC mechanism. The applicant's operator's specification (OPSPEC) is amended to include initial and recurrent training and NVG flight operational parameters. Current Federal Aviation Regulations (FARs) do not address NVG flight. An internal FAA memorandum designated NVG's as "appliances"¹, requiring certification prior to use under Title 14, CFR, Chp.1, Part 135. Additionally, NVG manufacturers requested certification for their NVG appliance.

The integration of NVG flight into the NAS is both challenging and daunting for resource-constrained FAA. Title 14, CFR, Chp.1 Parts (hereafter referenced as FAR Part) 1, 23, 27, 29, 43, 61, 91, 121, 133, 135, 137, 141, 142, 145 are affected. FAA functional disciplines required to support the integration include standards, operations, certification, safety, and manufacturing. The process for certifying the 135 applicant described above, is both time consuming and costly. A more efficient method to standardize the process will include publication of Advisory Circulars (ACs) and modification to the FARs.

RTCA, a private, not-for-profit Washington D. C. based organization, joins industry, operator and regulator to develop consensus-based standards documents for aviation technical concepts. Typically, a committee is formed, often at the request of FAA, to address an emerging technology with aviation application. These committees are chartered and supported by RTCA, with the Program Management Committee (PMC) providing final approval for the document. In July 1999, FAA requested RTCA form a committee for NVGs.

2. RTCA SPECIAL COMMITTEE – 196

2.1 Structure

Following the FAA petition, RTCAs governing body approved the formation of SC-196. Co-chairpersons were selected and terms of reference were established². The initial plenary meeting³ for SC-196 was conducted December 9 – 10, 1999, in Washington, D. C. Subsequent to this meeting, six additional plenary meetings and multiple working group off-site meetings are concluded. All plenary meetings are announced in the *Federal Register*, and are open to any interested party.

SC-196 constitutes members from government, industry, and operator. Membership is illustrated in Table 1.

Organization	Government	Industry	Operator	Comment
Federal Aviation Administration	X			Standards, Safety, Operations, Manufacturing, Certification
Transport Canada	X			Certification, Operations
Civil Aviation Authority	X			United Kingdom, Australia
Joint Aviation Authority	X			Multiple European Member Nations
Airborne Law Enforcement Association			X	International Public-Use Aerial Law Enforcement Association
US Army	X		X	PM-NV/RSTA Fort Belvoir, Night Vision Devices Branch Ft. Rucker
US Air Force	X		X	Air Force Research Lab WPAFB & Mesa, HQ USAF Pentagon, Air Force Flight Standards
US Navy	X		X	Naval Air Systems Command, Naval Air Warfare Center
Bell, Eurocopter, Agusta, Sikorsky, Boeing		X		Aircraft Manufacturers
Multiple Aircraft Lighting OEMs		X		NVG Compatible Aircraft Lighting
Multiple NVG Manufacturer's		X		Domestic and Foreign
Multiple Federal Agencies			X	Customs, Border Patrol, DOE
Multiple Flight Training Vendors		X		Currently providing public-use, part 91 and part 135 training
Serviceability OEM		X		Continued Airworthiness
Head-Up Display OEM		X		
Existing NVG Operators			X	Public-use, Part 135, Foreign
Special Interest Groups		X	X	HAI, AOPA, ATA

Table 1. SC-196 Membership by Organization and Category

Working groups were established and chairpersons were identified prior to the first plenary meeting to best facilitate the development of committee products. Each committee member is assigned to a working group. Assignments are determined by the member's area of expertise and area of interest. In many instances, a committee member supports multiple working groups.

Consensus within the respective working group is the goal as products are developed. In instances where consensus is not achieved, or where full-committee resolution is required, the working group chairperson(s) presents the issue to the plenary for discussion and resolution.

Completed working group documents are reviewed by an editorial committee. Following edit, the document is submitted to RTCA for general ballot within the committee. Each member receives a copy of the document and is requested to submit their concurrence, concurrence with comment or non-concurrence. Following balloting closure, a review group is convened to resolve each concur with comment and non-concurrence. Disposition is presented to the committee during a plenary session. All concur with comment and non-concurrence issues and the disposition are presented to the committee. The committee approves final disposition. Final draft documents, including any concur with comment and/or non-concurs, are submitted to RTCA for approval. RTCAs' PMC reviews the submission and either approves the document for publication or returns the document to the committee for further action⁴.

SC-196 formed five working groups to develop three deliverable products. Organization of the working groups is illustrated in Table 2.

Working Group	Product	Chairperson(s)	Comment
#1 Operational Concept	Operational Concept and Operational Requirements for NVG Implementation into the National Airspace System (NAS)	Karl Poulsen (Rocky Mountain Helicopters) Bill Wallace (FAA)	
#2 NVGs	Minimum Operational Performance Standards (MOPS) for NVGs	Roy Holmes (ITT) Cliff Connors (Northrop-Grumman/Litton)	Sec.1 Introduction Sec.2 NVG Performance Sec.4 Installation
#3 NVIS Lighting	Minimum Operational Performance Standards (MOPS) for NVGs	Jim Garrett (Executive Technical Services) Jim Hurley (Hoffman Eng.)	Sec.1 Introduction Sec.3 NVIS Lighting Sec.4 Installation
#4 Continued Airworthiness	Minimum Operational Performance Standards (MOPS) for NVGs	Randy Stewart (DOE)	Sec.1 Introduction Sec.5 Continued Airworthiness
#5 Training	Training Guidelines and Other Considerations for NVG Operators	Dave Peltz (Advanced Flight Training Systems) Keith Gladstone (CAE)	

Table 2. SC-196 Working Group Organization and Product

2.2 Products

SC-196 product output is in the form of RTCA approved documents. RTCA publishes and maintains finished products. These products are for sale and available to government and industry. Often, these documents are the basis for government policy decisions.

2.2.1 Operational concept and operational requirements for NVG implementation into the NAS

This document establishes the basis for remaining SC-196 documents. It defines intended operational applications and addresses requisite operational requirements. Scope and breadth include rotorcraft and fixed wing applications from general aviation through commercial operations. This document is complete, published and available from RTCA as DO-268. DO-268 is titled, *Concept of Operations (CONOPS) for NVG Civil Operations*⁵.

2.2.2 Minimum operational performance standards for NVGs

The holistic integration of NVG, internal aircraft lighting, aircraft windshield, other viewing panels and external lighting comprise the Night Vision Imaging System (NVIS). This document establishes minimum performance standards and continued airworthiness certification standards for NVIS hardware. It outlines recommended practices for the testing, installation and evaluation of NVIS. With an eye to the future, this work in progress includes enough breadth of scope to allow for the integration of advanced night vision imaging technologies. SC-196 has titled this document, *Minimum Operational Performance Standards (MOPS) for Integrated Night Vision Imaging System Equipment*.

2.2.3 Training guidelines and other considerations for NVG operations

Consideration is given to training needs for both NVIS operations and the serviceability of NVIS hardware. This document integrates existing FAA NVG operational training programs for Part 135 Operators, relevant DOD NVG operational training programs and relevant other existing NVG operational training programs. When used with the CONOPS and MOPS, this document aids operators, trainers, modifiers and repair stations in the establishment of their training process and training programs.

2.3 Milestones

RTCA tasked SC-196 to develop committee products with required due dates. As SC-196 evolved and matured, it became apparent these dates were aggressive and would not be met. Relevant factors impeding the committee include the magnitude of the task and the increasingly important requirement to harmonize with EUROCAE. Table 3 defines SC-196 work in progress.

Product	Original Milestone	Estimated Completion	Status
Operational Requirements for NVG Implementation into the National Airspace System (NAS)	May, 2000	Completed	Published. RTCA DO-268.
Minimum Operational Performance Standards (MOPS) for NVGs	September, 2000	September, 2001	Working groups finalizing draft. Edit in May, 2001.
Training Guidelines and Other Considerations for NVG Operations	July, 2001	December, 2001	Draft outline.

Table 3. SC-196 Committee Products

3. FAA INTEGRATION OF SC-196 PRODUCTS

3.1 Concept of Operations (CONOPS) for NVG civil operations

FAA and industry intend to reference this document as the Terms of Reference or premise for amendments to FAR Part 1, 61, and 91 rulemaking. Currently, no civil regulatory document references NVGs. The CONOPS promotes and publicizes the need for standardized NVG operations rulemaking activity. Having achieved government and industry consensus during SC-196 development of this document, it is intended that requirements identified in the CONOPS be integrated into relevant FARs.

3.2 Minimum Operational Performance Standards (MOPS) for integrated night vision imaging system equipment

Upon completion of the MOPS, two FAA documents will be developed. The first is a Technical Standard Order (TSO) which will enable NVG manufacturers to certify their product as a stand-alone entity. Upon award of Technical Standard Order Authorization, the manufacturer can manufacture the NVGs using the approved design specification without repeating the certification process. The TSO will be developed through reference to the NVG equipment performance requirements and test procedures from the MOPS document.

The second document will be an amendment to Advisory Circulars for FAR Part 27 (Normal Category Rotorcraft) and 29 (Transport Category Rotorcraft). This amendment is intended during the next revision cycle. These AC's provide the reader with the interpretation of FAR Parts 27 and 29, respectively. They also provide an acceptable means to comply with these FARs. FAR Parts 27 and 29 address how an applicant receives certification for a new or amended design to their rotorcraft using a new or supplemental type certificate. The FAA intends to revise these AC's to include information concerning compliance with these FARs with respect to NVG modification. This information will reference the appropriate sections of the MOPS concerning the standards and test procedures for the NVGs and NVIS lighting, the installation and evaluation of the NVIS, and the continued airworthiness of the NVIS.

It is intended for the Small Airplane Certification AC for FAR Part 23, to be amended using a similar process to the one described above. A schedule has not been established for this activity.

3.3 Training guidelines and other considerations for NVG operations

With the development of FARs for NVG operations and AC material for NVG aircraft certification, it is necessary to provide information to operators, training schools, and private individuals the means for the safe employment of NVGs. FAA intends to provide advisory material or guidance to the public regarding this matter. Upon publication of the RTCA Training

document, FAA intends to reference this document in the form of a handbook, or in multiple advisory documents. FAA will encourage operators and those seeking an NVG operating certificate or endorsement to reference the RTCA Training Guidelines.

4. SC-196 & EUROCAE HARMONIZATION

The European Organization for Civil Aviation Equipment (EUROCAE), an organization similar to RTCA, develops minimum performance standards for airborne electronic equipment. EUROCAE documents are referenced in the Joint Technical Standard Orders, and other regulatory documents developed by the Joint Aviation Authorities (JAA). EUROCAEs membership includes all of the primary European aviation administrations and the primary aircraft and equipment manufacturers. These entities actively participate in the various EUROCAE working groups responsible for development of these documents. EUROCAE Working Group 57 was developed to analyze the issues of civil NVG use and prepare MOPS for Airborne NVGs⁶.

Many members of WG 57 are also members of SC-196, and vice versa. This ensures that these parallel efforts produce documents, which are standardized and achieve harmonization. This is significant, in that it enables European and US manufactured products, conforming to these standards, to be sold into each others market without having to conform to significant differently rules of compliance. This principle also applies to flight or operating rules, and aircraft modification requirements. Following these practices within RTCA and EUROCAE, ensures that future FARs, JARs, TSOs, ACs, and other guidance material are harmonized, and affords industry and government the best means for integration of NVGs. A lack of harmonization, results in different standards, and creates undue burden for manufacturers, operators, and regulatory agencies alike.

5. CONCLUSION

NVGs are a useful tool, aiding night flight operations. RTCA SC-196 and EUROCAE WG-57 efforts enable the integration of NVGs into regulatory and advisory materials. Without a cooperative effort of both regulatory agencies and industry and their embracing the work of RTCA SC-196, the timely integration of NVGs into civil aviation will languish.

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