Docket No. SA-530

Exhibit No. 8 - C

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Technical Standard Order C194
Helicopter Terrain Awareness and Warning System (HTAWS)

(5 Pages)

Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, D.C.

TSO-C194

Effective
Date: 12/17/08

Technical Standard Order

Subject: Helicopter Terrain Awareness and Warning System (HTAWS)

1. **PURPOSE.** This technical standard order (TSO) is for manufacturers applying for a TSO authorization (TSOA) or letter of design approval (LODA). In it, we (the Federal Aviation Administration) tell you what minimum performance standards (MPS) your helicopter terrain awareness and warning system (HTAWS) must first meet for approval and identification with the applicable TSO marking.

2. **APPLICABILITY.** This TSO affects new applications submitted after its effective date. Major changes to HTAWS approved under this TSO will require a new authorization. See Title 14 of the Code of Federal Regulations (14 CFR) § 21.611(b).

3. **REQUIREMENTS.** New models of HTAWS identified and manufactured on or after the effective date of this TSO must meet the MPS qualification and documentation requirements in RTCA, Inc. document RTCA/DO-309, *Minimum Operational Performance Standards (MOPS) for Helicopter Terrain Awareness and Warning System (HTAWS) Airborne Equipment*, dated March 13, 2008.

a. Functionality. This TSO's standards apply to equipment intended to provide terrain and obstacle aural and visual alerts to reduce the risk of controlled flight into terrain (CFIT) helicopter accidents.

b. Failure Condition Classification. Failure of the function defined in paragraph **3a** of this TSO is a major failure condition. Develop the system to, at least, the design assurance level equal to this failure condition classification. False sensor inputs (erroneous altitude, terrain data, airport, etc.) to the HTAWS computer need not be considered for compliance to these failure condition classifications.

c. Functional Qualification. Demonstrate the required performance under the test conditions in RTCA/DO-309, Section 2.

d. Environmental Qualification. Test the equipment according to RTCA/DO-160F, *Environmental Conditions and Test Procedures for Airborne Equipment,* dated December 6, 2007.

e. Software Qualification. If the article includes a digital computer, develop the software according to RTCA/DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*, dated December 1, 1992.

f. Electronic Hardware Qualification. If the article includes a complex custom micro-coded component, develop the component to the guidance in FAA Advisory Circular (AC) 20-152, *RTCA, Inc. Document RTCA/DO-254, Design Assurance Guidance for Airborne Electronic Hardware.* The hardware design assurance level should be consistent with the failure condition classification in paragraph **3b** of this TSO.

g. Deviations. We have provisions for using alternate or equivalent means of compliance to the criteria in the MPS of this TSO. If you invoke these provisions, you must show that your equipment maintains an equivalent level of safety. Apply for a deviation under 14 CFR § 21.609 before submitting your data package.

4. MARKING.

a. Mark at least one major component permanently and legibly with all the information in 14 CFR § 21.607(d). Use serial number in place of optional date of manufacture as stated in 14 CFR § 21.607(d)(3).

b. Also, mark the following permanently and legibly, with at least the manufacturer's name, subassembly part number, and the TSO number:

(1) Each component that is easily removable (without hand tools),

(2) Each interchangeable element, and

(3) Each subassembly of the article that you determined may be interchangeable.

c. If the component includes a digital computer, then the part number must include hardware and software identification. Or, you can use a separate part number for hardware and software. Either way, you must include a means to show the modification status.

NOTE: Similar software versions, approved to different software levels, must be differentiated by part number.

d. Identify deviations granted to the article by marking "Deviation. See installation/instruction manual (IM)" after the TSO number. You can abbreviate the marking to "(Dev. See IM)."

e. When applicable, identify the equipment as an incomplete system or state that the article performs functions beyond those described in paragraph **3a** of this TSO.

5. APPLICATION DATA REQUIREMENTS. As a TSO manufacturer-applicant, you must give the FAA aircraft certification office (ACO) manager responsible for your facilities a statement of conformance, as specified 14 CFR § 21.605(a)(1) and one copy each of the following technical data to support your design and production approval. (Under 14 CFR § 21.617(a)(2), LODA applicants submit the same data through their civil aviation authority:)

a. Operating instructions and equipment limitations sufficient to describe the equipment's operational capability. Describe any deviations in detail. If needed, identify equipment by part number, version, revision, and criticality level of software/hardware, classification for use, and environmental categories.

b. Installation procedures and limitations sufficient to ensure that the HTAWS, when installed according to the installation procedures, still meets this TSO's requirements. Limitations must identify any unique aspects of the installation. Finally, the limitations must include a note with the following statement:

> The conditions and tests for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only according to 14 CFR part 43 or the applicable airworthiness requirements.

c. Schematic drawings of the installation procedures.

d. Wiring diagrams of the installation procedures.

e. List of components, by part number, that make up the HTAWS complying with the standards prescribed under this TSO. Include vendor part number cross-references, when applicable.

f. A component maintenance manual (CMM), covering periodic maintenance, calibration, and repair, for the continued airworthiness of installed HTAWS. Include recommended inspection intervals and service life.

g. Material and process specifications list.

h. The quality control system (QCS) description required by 14 CFR §§ 21.143 and 21.605(a)(3), including functional test specifications. The QCS should ensure that you will detect any change to the equipment that could adversely affect compliance with the TSO MPS, and reject the item accordingly. (Not required for LODA applicants.)

i. Manufacturer's TSO qualification test report.

j. Nameplate drawing with the information required by paragraph **4** of this TSO.

k. List of all drawings and processes (including revision level) that define the article's design. For a minor change, follow the directions in 14 CFR § 21.611(a). Show any revisions to the drawing list only on our request.

l. An environmental qualifications form as described in RTCA/DO-160F, Appendix A, for each component developed under this TSO.

m. If the article includes a digital computer: a plan for software aspects of certification (PSAC), software configuration index, and software accomplishment summary. We recommend that you submit the PSAC early in the software development process. Early submittal allows us to quickly resolve issues, such as partitioning and determining software levels.

n. If the article includes a complex custom micro-coded component: a plan for hardware aspects of certification (PHAC); hardware verification plan; top-level drawing; and hardware accomplishment summary. We recommend that you submit the PHAC early in the hardware development process. Early submittal allows us to quickly resolve issues.

6. MANUFACTURER DATA REQUIREMENTS. Besides the data given directly to us, have the following technical data available for review by the responsible ACO or civil aviation authority:

a. Functional qualification specifications for qualifying each production article to ensure compliance with this TSO.

b. Equipment calibration procedures.

c. Corrective maintenance procedures within 12 months after TSOA or LODA.

d. Schematic drawings.

e. Wiring diagrams.

f. Material and process specifications.

g. The results of the environmental qualification tests conducted per RTCA/DO-160F.

h. If the article includes a digital computer, the appropriate documentation defined in RTCA/DO-178B, including all data supporting the applicable objectives in RTCA/DO-178B, Annex A, Process Objectives and Outputs by Software Level.

i. If the article includes a complex micro-coded component, the appropriate hardware life cycle data in combination with design assurance level, as defined RTCA/DO-254, Appendix A, Table A-l.

7. FURNISHED DATA REQUIREMENTS. If furnishing one or more articles manufactured under this TSO to one entity (such as an operator or repair station), provide the following:

a. One copy of the data in paragraphs **5a** through **5f,** and **5l** of this TSO. Add any other data needed for the proper installation, certification, use, or for continued airworthiness, of the HTAWS.

b. If the article performs functions beyond those described in paragraph **3a** of this TSO, send one copy of the data in paragraphs **5l** through **5n**.

8. HOW TO GET REFERENCED DOCUMENTS.

a. Order RTCA documents from RTCA Inc., 1828 L Street NW, Suite 805, Washington, D.C. 20036. Telephone (202) 833-9339, fax (202) 833-9434. You can also order copies online at www.rtca.org.

b. Order copies of 14 CFR part 21, Subpart O and parts 27 and 29, from the Superintendent of Documents, Government Printing Office, P.O. Box 979050, St. Louis, MO 63197. For general information telephone (202) 512-1800, fax (202) 512-2250. You can also order copies online at www.access.gpo.gov. Select "Access," then "Online Bookstore." Select "Aviation," then "Code of Federal Regulations."

c. You can find a current list of technical standard orders and advisory circulars on the FAA Internet website Regulatory and Guidance Library at http://rgl.faa.gov. You will also find the TSO Index of Articles at the same site.

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