U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory
Circular

Subject: Airworthiness Approval of Satellite
Voice (SATVOICE) Equipment Supporting Air
Traffic Service (ATS) Communication

Date: 12/23/14   **AC No:** 20-150B
Initiated By: AIR-130

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1   **PURPOSE.**

This advisory circular (AC) provides guidance on airworthiness approval for designers,
manufacturers, and installers of Satellite Voice (SATVOICE) equipment supporting air
traffic service (ATS).   In this AC, the Federal Aviation Administration (FAA)
recommends one way to gain airworthiness approval for SATVOICE equipment.   This
AC is not mandatory and does not constitute a regulation.   This AC describes an
acceptable means, but not the only means, to gain airworthiness approval for your
SATVOICE equipment.   However, if you use the means described in this AC, you must
follow it in its entirety.

2   **APPLICABILITY.**

This AC affects new applications submitted after its effective date.

3   **CANCELLATION.**

This AC cancels AC 20-150A, *Airworthiness Approval of Satellite Voice Equipment
Supporting Air Traffic Service (ATS) Communication*, dated August 22, 2011.

4   **BACKGROUND.**

Because of frequency congestion and ionospheric/solar conditions in oceanic and remote
flight operations, aircraft operators requested the use of SATVOICE equipment as one of
their two long range communication systems (LRCS).   This revision adds guidance for
obtaining airworthiness approval of SATVOICE equipment intended to be installed as
one of the two required LRCS.   Appendix A to this AC contains a list of acronyms, and
appendix B provides guidance for obtaining related documents.

5   **DESIGN CONSIDERATIONS.**

The following guidance applies to the design approval of satellite voice equipment, including performance standards of the intended function, software, hardware, recording, and audio guidance.   You should use the following documents and guidance during the design stage:

5.1   **Minimum Performance Standards.**

The satellite voice equipment should meet Technical Standard Order (TSO) TSO-C159b, *Next Generation Satellite Systems (NGSS) Equipment*, dated September 29, 2014, or TSO-C132, *Geosynchronous Orbit Aeronautical Mobile Satellite Services Aircraft Earth Station Equipment*, dated March 25, 2004.

5.2   **Software Qualification.**

You should follow the guidance in AC 20-115C, *Airborne Software Assurance*, dated July 19, 2013.

5.3   **Hardware Qualification.**

You should follow the guidance in AC 20-152, *RTCA, Inc., Document RTCA/DO-254, Design Assurance Guidance for Airborne Electronic Hardware*, dated June 30, 2005.

5.4   **Cockpit Voice Recorder (CVR).**

SATVOICE is considered voice communication for the purpose of the operating rules pertaining to CVR.   Means must be provided to record all flightcrew SATVOICE communications in crash survivable memory, if a CVR is required.

5.5   **Audio Management System.**

Means should be provided to interface with the existing audio management system. This interface should afford the flightcrew the ability to promote crew awareness, coordination, and verbal error detection equivalent with current high frequency (HF) communication systems.   Push-to-talk (PTT) operation should be maintained in all aircraft operations, but only to the extent that the flightcrew must actuate a PTT key to be heard by the ground user.

Note: We recommend the audio management system provide full-duplex voice capability via hand, boom, and oxygen mask microphones for both pilots and any additional flight crewmember.

6   **SAFETY ASSESSMENT CONSIDERATIONS.**

The applicant should show the installed system meets the requirements of 14 CFR 25.1309, in accordance with associated AC materials. The safety assessment should consider the intended functions, including the use of the system in the procedural oceanic/remote area environment.

The integration of the LRCS in the overall aircraft architecture should also be considered.   Likelihood of failure or malfunction of the SATVOICE communication system intended for LRCS use in the procedural oceanic/remote area environment supporting ATS communication should be shown to be no more likely than probable (that is, developed commensurate to a minor hazard classification).   Deviation from the requirements of this AC, modification to the operational environment, or use of SATVOICE as a sole means of routine ATS communications may increase the criticality and assessment of the hazard classification.   Some of the safety assessment considerations include:

6.1.1   Derived Safety Requirements.
If the SATVOICE system is intended to be used for one of the two LRCS transceivers, evaluate the operation of the SATVOICE system under a potential load-shed environment.

6.1.2   User-Modifiable and Option-Selectable Software.
If the system contains software- enabled options that the user can select or is designed for the user to modify without re-evaluation for airworthiness, define the means of compliance (for example, processes, design features, environment, tools, or certification data) per AC 20-115C.

Note. Some ATS facilities may not be capable of providing SATVOICE services as a LRCS.   HF-voice is the only LRCS currently available for Air Traffic Control communications in many areas. Therefore, in areas requiring two operational LRCSs, at least one must be HF-voice when the MEL is applied.   In areas requiring one LRCS, that system must be HF-voice.

7   **PRIORITY, PREEMPTION, AND PRECEDENCE (PPP).**
The priority level column of table 1 below shows the order of precedence in setting up and receiving a SATVOICE call.   We define "preemption" as the immediate and automatic seizure of resources allocated to a lower priority call.   The SATVOICE equipment reallocates the resources to a higher priority call.   Tradeoffs of flight safety requirements versus passenger satisfaction should not be a consideration, except for camp-on calls described below.   Treat PPP as follows:

7.1   SATVOICE calls must be prioritized consistent with table 1.

7.2   For single-channel systems, if the satellite voice channel is in use for a lower priority call and the aircraft receives a higher priority call, the satellite voice equipment or network should clear the channel and accept the higher priority call.   For multi-channel systems, if all available channels are in use, the equipment should preempt the channel supporting the lowest priority call in favor of the higher priority call.   If SATVOICE resources are shared on the aircraft (e.g. for cabin use), the satellite voice equipment must provide the flight crew the means to preempt those resources at any time. The equipment may provide the means for preemption of resources when the flight crew makes a call.

7.3   The SATVOICE equipment may also allow flightcrew members to place their call request at the top of a queue, that is, to "camp-on" while awaiting free resources. Flightcrew procedures should include explicit instructions defining how the flightcrew can use camp-on capability.

7.4   The SATVOICE equipment should configure the cockpit default priority to level 2.

7.5   The flightcrew must have the capability to set the priority level for an individual call.

Table 1. Priorities for SATVOICE Calls

Priority Level	Application Category	SATVOICE
1 *Emergency* (highest) Safety of Flight	Distress and Urgency	Inflight Emergency, Rapid Descent, Urgent Sidestep for Weather
2 *Operational High* (second highest) Safety of Flight	Flight Safety	Altitude Request, ATC Clearance/Instruction
3 *Operational Low* (third highest) Safety of Flight	Regularity of Flight, Meteorological, Administrative	Air Traffic Information Service, AOC, Redispatch, Maintenance
4 *Nonoperational* (lowest) Nonsafety	Public Correspondence	Public Phone Calls

8   **FLIGHT DECK ANNUNCIATION.**

Alerting associated with non-normal conditions (such as failures) of the airborne SATVOICE system must comply with the appropriate part of Title 14 of the Code of Federal Regulations (14 CFR) 25.1322/1302.   For additional guidance, you may review AC 25.1322-1, *Flightcrew Alerting*, and AC 25-11B, *Electronic Flight Displays*.   The criteria that define flightcrew alerting should be consistent with the particular flight deck philosophy associated with the aircraft in question.   The annunciation for the airborne SATVOICE system should comply with the following criteria and should be integrated into the aircraft's existing alerting scheme:

8.1   An aural and visual alert should be provided for each ground-to-air ATS priority 1, 2 or 3 call consistent with §25.1322.   Visual alerts alone may be used for annunciation of priority 4 non-ATS communications.   Applicants should consider the need for an incoming priority 1 call that may require a separate, more attention-getting annunciation than that provided for lower priority incoming calls.

8.2   A means should be provided to alert the flightcrew of detected airborne system failures that render the SATVOICE system inoperative.

8.3   There should be a continuous visual annunciation to the crew indicating a call in progress for each SATVOICE channel (for example, via the flight deck audio panel) by means of a readily available indication of call status.   The indication should permit the crew to determine when a call is active on a given channel.

         Note: For air-to-ground calls, the call status indication may indicate an active call at call initiation (rather than connection).   This provides feedback to the flightcrew that the SATVOICE system is in use.

8.4   For each air-to-ground call that cannot be completed, the SATVOICE system should provide for an appropriate annunciation.

8.5   Aural annunciations indicating an incoming call or other purpose during critical flight phases (e.g., takeoff and landing) should be inhibited until after the critical flight phase.

8.6   In cases where the SATVOICE system uses flight deck call camp-on capability, the system should visually indicate to the flightcrew that the requested air-to-ground call has been designated as camp-on until terminated or further acted upon.

8.7   Any destination address on the satellite voice display (such as a Multi-purpose Control and Display Unit (MCDU) should be removed after the call has been completed to avoid flightcrew confusion during subsequent use of the system.

8.8   In the event of satellite signal loss, the SATVOICE system should alert the flightcrew.

8.9   The system should annunciate to the flightcrew if SATVOICE resources are preempted by a higher priority ground-to-air call. .

8.10   The system should provide a continuous visual indication whenever a SATVOICE call is connected.   The system should display the priority for ground-to-air calls.   In addition, the system should display caller identification (ID) information to the flightcrew for incoming calls.

8.11   The system should provide an aural indication when a satellite voice connection has been established .

8.12   The system should provide an indication to the flightcrew in the event of detectable abnormal call terminations or connection failures.

9   **CONTROL CAPABILITY.**

         Control capability for the SATVOICE system should meet the following criteria:

9.1   Each flightcrew member should have adequate accessibility to SATVOICE controls and be able to easily initiate/answer a call while performing other flight deck duties.

9.2   A means should be provided for the flightcrew to terminate a connected call (that is, by manual action).   Applicants should consider providing the flight crew with the possibility to terminate the call by pressing a single direct access button.

9.3   The use of speed dialing (that is, SATVOICE number database), instead of the 6-digit short code or PSTN number, should be used wherever possible. The option to manually dial a SATVOICE number should be available to the crew.

9.4   After SATVOICE system initialization, the flightcrew should not have to unlock or reactivate by other means (such as inserting a credit card or reentering a security code) the SATVOICE resources for the duration of the flight.

9.5   A means should be provided to allow the flightcrew to place an individual call on hold so communication on other radio channels is possible without terminating the SATVOICE call.   A means to allow call hold function capability should be provided via the audio control panel (ACP), or use of a MCDU or control display unit (CDU).   When the crew places a SATVOICE call on hold, the risk of inadvertently clearing the call should be minimized.

9.6   A means for the flightcrew to display the SATVOICE system configuration (that is, an operational software version/part number or database version/part number) should be provided.

10   **VOICE CALL ROUTING.**
         The SATVOICE equipment must verify the priority level when a ground-to-air voice call is received.   Calls must be routed by priority level as follows:

10.1   To the flight deck, if they are SATVOICE calls of priority levels 1 through 3.

10.2   To the passenger cabin, if they are SATVOICE calls of priority level 4.

11   **TEST AND EVALUATION.**

11.1   Evaluate the general arrangement and operation of controls, displays, circuit breakers, annunciators, alerts, and any placards of the SATVOICE system.   Evaluation should verify that operational procedures minimize the requirement for the flightcrew to back out of multiple branches of the menu structure to initiate/answer a call in accordance with the guidance of this AC.

         Note: For example, if the pilot were editing the flight plan on the MCDU, it is not acceptable to have to back out to the main MENU page to select the SATCOM pages to answer a SATVOICE call.

11.2   Evaluate any self-test features and failure mode displays and annunciators.   The criteria that define flightcrew alerting should be consistent with the particular flight deck philosophy associated with the aircraft in question.

11.3   Evaluate the SATVOICE system installation for satisfactory identification, accessibility, and visibility.   Credit may be allowed from previous installation verification.

11.4   Purposely insert input errors to verify the system is robust.

11.5   Evaluate the SATVOICE and other aircraft systems for mutual noninterference, which may be associated with radio frequency emissions.   Determine the digital computer clock frequencies associated with the aircraft earth station (AES) design.   If applicable, evaluate existing navigation and communications receivers at these discrete frequencies and their associated harmonics to confirm noninterference.   Intermodulation products have also caused interference and may need to be evaluated.

11.6   Evaluate the integration of the SATVOICE system with other systems.   Evaluate other systems as necessary to show the SATVOICE system does not interfere with their operation.

Note: Attention should be given to other "L" band equipment, particularly the global positioning system (GPS) equipment.   Intermodulation effects are possible between multiple channel SATCOM installations and GPS.

11.7   Determine whether the SATCOM voice system can be used within acceptable workload and with a minimal reliance on flightcrew memory.

11.8   Evaluate the SATVOICE communication equipment performance during maneuvering flight.

12   **AIRPLANE FLIGHT MANUAL (SUPPLEMENT) WORDING.**

The airplane flight manual (AFM) or airplane flight manual supplement (AFMS) must include the procedure for how to place a priority 1 (distress or urgency) call, both with and without preemption, and should provide a description of other normal and non-normal procedures for system operation, and what actions are expected by the flightcrew for each case.

12.1   **Operating Limitations.**

Systems installed in accordance with this AC should not warrant any new operating limitations.

12.2   **Operating Procedures.**

The AFM or AFM supplement should identify the criteria used in the airworthiness assessment. For example,   "The Federal Aviation Administration has evaluated the SATCOM voice equipment in accordance with AC 20-150B and found that it meets the criteria of that AC for a required LRCS.   Compliance with AC 20-150B does not constitute operational approval."

If you have any suggestions for improvements or changes, you may use the template provided at the end of this AC.

David W. Hempe,
Manager, Design, Manufacturing, &
   Airworthiness Division
Aircraft Certification Service

Appendix A. Acronyms

AC   Advisory Circular

AES   Aircraft Earth Station (Airborne SATVOICE Equipment)

AFM   Airplane Flight Manual

AFMS   Airplane Flight Manual Supplement

AMS(R)S   Aeronautical Mobile Satellite (Route) Service

AMSS   Aeronautical Mobile Satellite Service

AOC   Airline Operational Control

ATC   Air Traffic Control

ATS   Air Traffic Services

FAA   Federal Aviation Administration

GPS   Global Positioning System

HF   High Frequency

ID   Identification

LRCS   Long Range Communication System

MCDU   Multi-purpose Control and Display Unit

MEL   Minimum Equipment List

MOPS   Minimum Operational Performance Standards

NGSS   Next Generation Satellite System

PPP   Priority, Preemption, and Precedence

PTT   Push-to-Talk

RCP   Required Communication Performance

RSP   Required Surveillance Performance

SATCOM   Satellite Communication

SATVOICE   Satellite Voice

TSO   Technical Standard Order

Appendix B. Related Documents

The following information may help you determine the airworthiness of your satellite equipment:

B.1   TITLE 14 OF THE CODE OF FEDERAL REGULATIONS (14 CFR).

You can get copies of 14 CFR parts 21, 23, 25, 27, 29, 43, 91, 121, and 135 from the Superintendent of Documents, Government Printing Office, P.O. Box 371954, Pittsburgh, PA, 15250-7954. Telephone 202-512-1800; fax 202-512-2250. You can also get copies from the Government Printing Office website at http://bookstore.gpo.gov/catalog/laws-regulations/code-federal-regulations-cfrs-print/cfr-title-14-aeronautics-space.

B.2   FAA ADVISORY CIRCULARS (AC).

Although we do not refer to all of the following ACs, they all relate to this AC (for example, both AC 20-140 and AC 120-70 provide guidance for data communication). You may access all ACs on the FAA website at www.faa.gov/regulations_policies/advisory_circulars/.

B.2.1   AC 20-115C, *Airborne Software Assurance*.

B.2.2   AC 20-152, *RTCA, Inc., Document RTCA/DO-254, Design Assurance Guidance for Airborne Electronic Hardware*.

B.2.3   AC 20-174, *Development of Civil Aircraft and Systems.*

B.2.4   AC 21-16G, *RTCA Document DO-160 versions D, E, F, and G, Environmental Conditions and Test Procedures for Airborne Equipment.*

B.2.5   AC 23.1309-1E, *System Safety Analysis and Assessment for Part 23 Airplanes*.

B.2.6   AC 23.1311-1C, *Installation of Electronic Display in Part 23 Airplanes*.

B.2.7   AC 25-11B, *Electronic Flight Displays*.

B.2.8   AC 25.1309-1A, *System Design and Analysis*.

B.2.9   AC 25.1322-1, *Flightcrew Alerting*.

B.3   FAA TECHNICAL STANDARD ORDER (TSO).

You can get copies of TSO-C159b, *Next Generation Satellite Systems (NGSS) Equipment*, dated September 29, 2014, and TSO-C132, *Geosynchronous Orbit Aeronautical Mobile Satellite Services Aircraft Earth Station Equipment*, dated March 25, 2004, from the Regulatory and Guidance Library (RGL) website at www.airweb.faa.gov/rgl. On the website, select "Technical Standard Orders (TSO) and Index," then select "Current."

B.4   **RTCA DOCUMENTS.**

You can get copies of the following documents from RTCA, Inc., 1828 L Street NW., Suite 805, Washington, DC, 20036-4008. Telephone (202) 833-9339, fax (202) 833-9434, website www.rtca.org.

B.4.1   RTCA/DO-160G, *Environmental Conditions and Test Procedures for Airborne Equipment*, dated December 8, 2010.

B.4.2   RTCA/DO-178C, *Software Considerations in Airborne Systems and Equipment Certification*, dated December 13, 2011.

B.4.3   RTCA/DO-210D (Change 1 and 2), *Minimum Operational Performance Standards (MOPS) for Geosynchronous Orbit Aeronautical Mobile Satellite Services (AMSS) Avionics*, dated April 19, 2000.

B.4.4   RTCA/DO-262B, *Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems (NGSS),* dated June 17, 2014.

B.4.5   RTCA/DO-343, *Minimum Aviation System Performance Standard for AMS(R)S Data and Voice Communications Supporting Required Communication Performance (RCP) and Required Surveillance Performance (RSP) in Procedural Airspace,* dated August 21, 2013.

B.5   **INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO).**

You can get copies of Annex 10, Aeronautical Telecommunication, and ICAO Satellite Voice Operations Manual (Doc [SVOM], Version 0.3, October 21, 2014 from ICAO External Relations and Public Information Office, 999 University Street, Montreal, Quebec H3C 5H7, Canada. Telephone (514) 954-8022, fax (514) 954-6769, website www.icao.int.

Appendix C. Advisory Circular Feedback Information

If you have comments or recommendations for improving this advisory circular (AC), or suggestions for new items or subjects to be added, or if you find an error, you may let us know by using this page as a template and 1) emailing it to 9-AWA-AVS-AIR500-Coord@faa.gov or 2) faxing it to the attention of the AIR Directives Management Officer at 202-267-3983.

Subject: (insert AC number and title)   Date: (insert date)

Comment/Recommendation/Error: (Please fill out all that apply)

An error has been noted:

Paragraph _____

Page _____

Type of error (check all that apply): Editorial:----- Procedural-----

Conceptual____

Description/Comments:_____
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Recommend paragraph _____ on page _____ be changed as follows:
(attach separate sheets if necessary)

_____

In a future change to this advisory circular, please include coverage on the following subject:
(briefly describe what you want added attaching separate sheets if necessary)

_____

Name: _____