



Advisory Circular

Subject: Audio Alerts and Warnings

Issuing Office: Standards

Activity Area: Qualifying

File No.: 5009-32-4

RDIMS No.: 1622219-V9

AC No.: 500-001

Issue No.: 01

Effective Date: 2007-06-20

TABLE OF CONTENTS

1.0	INTRODUCTION.....	2
1.1	Purpose	2
1.2	Applicability	2
1.3	Description of Changes.....	2
2.0	REFERENCES AND REQUIREMENTS	2
2.1	Reference Documents	2
2.2	Cancelled Documents	2
2.3	Definitions and Abbreviations	2
3.0	BACKGROUND.....	3
4.0	AUDIO ALERTS AND WARNINGS	3
4.1	Types of Warnings	3
4.2	Relevant Standards.....	4
4.3	Ground and Flight Evaluations.....	4
5.0	MUTING OF COCKPIT SPEAKERS.....	4
5.1	General	4
5.2	Conditions Required for Approval of Cockpit Speaker Muting.....	5
6.0	CONTACT OFFICE	6
	APPENDIX A – RECOMMENDED SWITCH LABELLING FOR SPEAKER MUTING.....	7

1.0 INTRODUCTION

This Advisory Circular (AC) is provided for information and guidance purposes. It may describe an example of an acceptable means, but not the only means of demonstrating compliance with pertinent regulations and standards. This AC on its own does not change, create, amend or permit deviations from regulatory requirements nor does it establish minimum standards.

1.1 Purpose

The purpose of this AC is to provide guidance for the demonstration of compliance, assessment and approval to assist in the confirmation of compliance with the applicable requirements of the Airworthiness Manual (AWM) in relation to:

- (a) Cockpit audio alerts and warnings; and
- (b) Switch systems designed to “mute” cockpit speakers thereby “inhibiting” audio alerts to the flight deck under certain conditions.

1.2 Applicability

This document is applicable to all Transport Canada Civil Aviation (TCCA) employees, and to individuals and organizations when they are exercising privileges granted to them under an External Ministerial Delegation of Authority. This information is also available to the aviation industry for information purposes.

1.3 Description of Changes

This document replaces Aircraft Certification Policy Letter (ACPL) 54 Issue 01, dated 1997-03-03 — *Audio Alerts and Warnings*.

2.0 REFERENCES AND REQUIREMENTS

2.1 Reference Documents

It is intended that the following reference materials be used in conjunction with this document:

- (a) Chapter 523 of the Airworthiness Manual (AWM)—*Normal, Utility, Aerobatic and Commuter Category Aeroplanes*;
- (b) Chapter 525 of the AWM—*Transport Category Aeroplanes*;
- (c) Chapter 527 of the AWM—*Normal Category Rotorcraft*;
- (d) Chapter 529 of the AWM—*Transport Category Rotorcraft*;
- (e) Chapter 551 of the AWM—*Aircraft Equipment and Installation*; and
- (f) Transport Canada Publication (TP) 9155—*Master Minimum Equipment List/Minimum Equipment List Policy and Procedures Manual*.

2.2 Cancelled Documents

As of the effective date of this document, the following documents are cancelled:

- (a) Aircraft Certification Policy Letter (ACPL) 54 Issue 1, dated 1997-03-03—*Audio Alerts and Warnings*.

2.3 Definitions and Abbreviations

The following definitions and abbreviations are used in this document:

- (a) **CVR** means Cockpit Voice Recorder.
- (b) **EICAS** means Engine Indicating and Crew Alerting System.
- (c) **HDST** means headset.

- (d) **MMEL** means Master Minimum Equipment List.
- (e) **SPKR** means speaker.
- (f) **TAWS** means Terrain Awareness and Warning System.
- (g) **TCAS** means Traffic alert and Collision Avoidance System.

3.0 BACKGROUND

- (1) In November 1995, the Canadian Transportation Safety Board, now the Transportation Safety Board of Canada, recommended that “the Department of Transport advocate the provision of audio warnings which can be heard by the pilots through whichever audio system they have selected for use”.
- (2) Transport Canada agreed that where audio warnings are provided they should be available through whichever audio system is in use by the pilot. Furthermore, the audio warnings should be assessed for volume levels and intelligibility. Consistent with the above request, Transport Canada developed ACPL No. 54, dated 1997-03-03 to provide guidance regarding the provision of audio alerts and warnings. This AC incorporates the content of ACPL 54 with minor revision to the technical content of that earlier document.
- (3) Transport Canada has also received requests from industry to approve configurations that allow for inhibiting of all audio alerts via the cockpit speaker.

4.0 AUDIO ALERTS AND WARNINGS

4.1 Types of Warnings

Audio warning systems are fitted to a wide variety of fixed and rotary wing aircraft and provide an indication of an abnormal system functionality or condition, which may not be immediately obvious. They normally supplement existing warning or caution panels. Audio warnings may be used for, but not necessarily limited to:

- (a) TCAS Alerts;
- (b) Wind Shear;
- (c) Altitude Alerts (both deviation from selected and low altitude);
- (d) TAWS and Ground Proximity Warning Systems Alerts;
- (e) Autopilot Disconnect;
- (f) Stall Warnings;
- (g) Overspeed (Airspeed / Mach No.); and
- (h) Configuration Warnings such as:
 - (i) Landing gear Unsafe / Not down;
 - (ii) Flaps not set for Take-off;
 - (iii) Flap Overspeed;
 - (iv) Fire;
 - (v) Selective Calling (SELCAL);
 - (vi) Engine Failure;
 - (vii) Low Rotor RPM (rotorcraft);
 - (viii) Hydraulic Failures; and
 - (ix) Master Caution / Warning signals.

4.2 Relevant Standards

There are no specific airworthiness requirements that address audio warnings and provide detailed guidance for assessment. The following general sections of the AWM may, however, be used. The “X” in the section numbers shown below refers to Chapters 523, 525, 527, or 529 of the AWM as appropriate to the aircraft type:

- (a) section 52X.1301—*Function and Installation*. Each item of installed equipment must meet the requirements specified under subsections 52X.1301 (a), (b) and (c).
- (b) section 52X.1309—*Equipment, Systems and Installations*. Each item whose functioning is required by the AWM must meet the requirements specified under sections 52X.1309.

4.3 Ground and Flight Evaluations

In demonstrating compliance with the standards listed above, the following guidelines should be used where a ground or flight evaluation, or both, are performed:

- (a) conduct tests throughout the flight envelope in the noisiest configurations to verify that warnings are clearly audible. Example configurations include: high power and high speed; high power with landing gear and lift and drag devices extended; sideslips similar to an engine failure condition (if these cause a change in cockpit noise levels); helicopters in a transition to the hover that generates vibration and noise;
- (b) conduct tests with headsets on and off according to the operation of the aircraft. This assessment will also cater to failure cases and Master Minimum Equipment List (MMEL) dispatch implications. For example: if the aural warnings were only through the headsets, then it would not be appropriate to dispatch with the headsets or intercom system inoperative. Although many modern aircraft provide the alerts through both headsets and cockpit speakers, this was not always the case for older aircraft. Assessments will be performed according to each aircraft. On some aircraft, warnings are provided from dedicated sono-alerts;
- (c) conduct tests while transmitting and receiving air traffic control and other radio signals such as navigation audio. This is to verify that the warnings are audible during these high workload situations, and that they are presented to the crew.
- (d) audio alerts should not be easily confused with one another;
- (e) while aural cues can be an effective attention-getter, they can quickly become counterproductive if not easily cancelled. Pressing the Master Caution / Warning annunciator, for example, should cancel the associated audio warning;
- (f) there is a difference between attention-getting and alarming or startling. Audio levels should not be so high as to prevent effective communication between the crew; and
- (g) it should not be possible for the flight crew to adjust audio alert levels.

5.0 MUTING OF COCKPIT SPEAKERS

5.1 General

- (1) Traditionally, on transport category aeroplanes, all aural alerts have been provided over a cockpit speaker, regardless of whether those same alerts were also provided over the headsets. In some aircraft, passengers seated near the cockpit are able to hear such audio alerts and this can be unnecessarily alarming to them.
- (2) It is recognized that there are a large number of audio alert systems in the cockpit. TCCA has received requests to approve configurations which allow for the inhibiting of such audio alerts and will approve such configurations provided certain conditions are met. The guidance in subsection 5.2 of this AC is consistent with the relief allowed in TP 9155.

- (3) This advisory material is intended to address new installations, or modifications to existing installations on aircraft for which the annunciation of aural alerts via the speaker may have been considered necessary as part of the safety analysis completed during the initial certification of the aircraft, or its installed equipment, and for which the muting of those alerts may not have been considered.
- (4) This advisory material is not intended to address existing approvals. Audio panel selector switches that switch between outputting to the headsets or to the speaker are not addressed in this AC.

5.2 Conditions Required for Approval of Cockpit Speaker Muting

- (1) A switching system may be installed in the cockpit that allows the flight crew to mute all audio to the cockpit speaker. Such a switching system would affect all communication and navigation radios, and any other alerts provided through the aircraft audio system. This may include, but is not limited to, TCAS, TAWS, Overspeed, Stall warnings, Configuration warnings and other warnings, cautions and audio outputs.
- (2) The installed switching system shall meet the following conditions and limitations:
 - (a) There must be appropriate indication to the flight crew regarding audio selection. The indication must be within the normal field of view of both pilots and be satisfactorily visible under all anticipated lighting conditions. A momentary-to-toggle (bi-stable), electrically resettable circuit, controlled by a momentary contact Push Button Annunciator type of switch is recommended. On aircraft equipped with an EICAS, or a similar system that displays messages to the crew, an EICAS message may be displayed, but is not required if using a Push Button Annunciator;
 - (b) The switching system shall not allow for muting of audio to the pilots' headsets;
 - (c) A limitation must be included in the Aircraft Flight Manual or Aircraft Flight Manual Supplement requiring both flight crew members to use headsets when audio is not provided to the cockpit speakers. A placard may be appropriate to meet this requirement;
 - (d) Aural alerts and warnings to the headset need to be provided via an unmuted and unswitched input source with a set volume level that is not adjustable by the flight crew and that is adequate for all anticipated operating conditions;
 - (e) During "power up", or following an interruption of power, the system must default to provide audio output to both the speaker and the headphones;
 - (f) If either pilot selects the microphone select switch to the oxygen mask position, the system shall revert to providing audio output to both the speaker and the headphones;
 - (g) It shall not be possible to mute the speaker output of any audio alerts unless the speaker output of all communication and navigation radios are also muted;
 - (h) If a CVR is installed, the CVR shall record all audio heard through the headsets, including any aural alerts. With cockpit speakers muted, the CVR system shall be shown to continue to comply with the CVR "*Installation and Installed Performance*" Standards of paragraph 551.101(d)(1) of the AWM using the prescribed test procedures. It may be acceptable to repeat the CVR certification "read back test" on the ground for the certification of this switching system though considerations must be made of any alerts that are muted or attenuated on the ground. It may be necessary to simulate a "weight off wheels condition" to effectively conduct this CVR test on the ground; and
 - (i) The switch should be labelled as shown in *Appendix "A"* of this document, subject to a consistent approach with the cockpit design philosophy. The colour white is recommended for switch labelling, however cyan may be acceptable. The colour green is not recommended and amber is not acceptable.

6.0 CONTACT OFFICE

For more information please contact:
Policy Standards Coordinator (AARTC)

Phone: 613-990-8234
Facsimile: 613-952-3298
E-mail: CAIRS_NCR@tc.gc.ca

Suggestions for amendment to this document are invited and should be submitted via the Transport Canada Civil Aviation Issues Reporting System (CAIRS) at the following Internet address:

<http://www.tc.gc.ca/CivilAviation/QualityAssurance/QA/cairs.htm>

or by e-mail at: CAIRS_NCR@tc.gc.ca

Original signed by Brian Whitehead for

D.B. Sherritt
Director, Standards
Civil Aviation

APPENDIX A – RECOMMENDED SWITCH LABELLING FOR SPEAKER MUTING

System State and Associated Labels			
Switch Label	Top of Switch – Speaker “On”	Bottom of Switch – Speaker “Off”	Notes
Recommended Labelling:			
None	“SPKR & HDST”	“HDST ONLY”	Not necessarily consistent with “dark cockpit” design philosophy, but may be appropriate regardless.
			<div style="border: 1px solid black; padding: 5px; width: fit-content;"> SPKR & HDST <hr style="width: 50%; margin: 0 auto;"/> HDST ONLY </div>
“SPEAKER MUTE” or “SPEAKER”	Blank	“MUTED”	May be appropriate for aircraft with “dark cockpit” design philosophy.
			<div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> SPEAKER <hr style="width: 50%; margin: 0 auto;"/> MUTED </div>
Acceptable Labelling:			
“COCKPIT SPEAKER” or “SPEAKER”	“ON”	“OFF” or “MUTED” or “MUTE”	
			<div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> SPEAKER <hr style="width: 50%; margin: 0 auto;"/> ON <hr style="width: 50%; margin: 0 auto;"/> OFF </div>
“SPEAKER INHIBIT”	Blank	“ON”	May be appropriate for aircraft with “dark cockpit” design philosophy.
			<div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> SPEAKER INHIBIT <hr style="width: 50%; margin: 0 auto;"/> ON </div>
Not Recommended:			
Any of the Above.	“NORMAL”	“MUTED”	Normal in some aircraft for some operations may be always to mute speaker output, so use of the word “Normal” could be confusing.
			<div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> SPEAKER <hr style="width: 50%; margin: 0 auto;"/> NORMAL <hr style="width: 50%; margin: 0 auto;"/> MUTED </div>
Unacceptable:			
“SPEAKER INHIBIT”	“OFF”	“ON”	
			<div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> SPEAKER INHIBIT <hr style="width: 50%; margin: 0 auto;"/> NORMAL <hr style="width: 50%; margin: 0 auto;"/> MUTED </div>