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Specification No. 11

United Kingdom
Civil Aviation Authority

Issue: 3

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Cockpit Voice Recorder Systems

1 Introduction

1.1 **Implementation** This issue of the Specification will cancel and supersede Issue 2 on 15th March 1984 (see 1.3). The Specification now includes requirements for cockpit voice recorders installed in both aeroplanes and helicopters. The Specification prescribes the minimum performance standards, and the installation and maintenance requirements applicable to such installations. Material differences between the previous issue of the Specification and this Issue 3 are indicated by a marginal line.

1.2 **Applicability** This Specification applies to cockpit voice recorder systems installed in aircraft in accordance with the requirements of the Air Navigation Order 1980 as amended, and subject to the provisions of 1.3. Alternative specifications submitted for approval shall provide for at least an equivalent standard of performance to that stated in this Specification and the particular requirements of the Order.

1.3 **Effectivity**

1.3.1 In respect of aeroplanes for which CAA approval is first sought for a cockpit voice recorder system on or after 15th March 1984, the equipment, its manner of installation and the prescribed maintenance shall comply with this Issue 3 of Specification No.11.

NOTE: It is not intended that cockpit voice recorder systems installed in aeroplanes in compliance with previous issues of this Specification should be re-investigated.

1.3.2 In respect of helicopters, on or after 15th March 1984, the cockpit voice recorder equipment, its manner of installation and prescribed maintenance shall comply with this Issue 3 of Specification No.11.

1.4 ICAO Standards Proposals are being considered by ICAO which are expected to affect significantly the design standards for cockpit voice recorders. The proposals, if adopted, would come into effect in 1987. The proposals include an expansion of the frequency response of recordings. The UK Accident Investigations Branch of the Department of Transport and the CAA strongly support this particular proposal, hence this revision of the Specification includes appropriate Notes to encourage and to provide guidance for an expanded frequency response.

2 Equipment Approval

The following minimum performance standards shall apply to all cockpit voice recorder systems submitted for approval in accordance with this Specification.

2.1 **General** For the purpose of this Specification the equipment to be approved shall be that which is necessary for a cockpit voice recorder system and will include the following items as appropriate to the aircraft:

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Printed copy is available from: TSO, PO Box 29, Norwich NR3 1GN www.tso.co.uk/bookshop
Telephone: 0870 600 5522 e-mail: book.orders@tso.co.uk Fax orders: 0870 600 5533

a) Cockpit equipment, including a control unit, a monitor display, an area microphone and associated preamplifier stages;

b) A crash protected recorder;

c) Audio interface equipment, including microphone/telephone signal summing amplifiers;

d) For helicopters, an interface device suitable for converting a signal representing rotor speed to a format which may be recorded.

2.2 **Recording Channels** The equipment shall be capable of recording simultaneously at least four channels of information.

2.3 **Recording Speed**

2.3.1 The speed at which the recording medium is driven past the recording mechanism shall be compatible with the speed used in commercially available reproduction equipment capable of satisfactorily reproducing aurally the recorded information on the recording medium.

2.3.2 The recording speed shall not vary more than ± 7% from the design speed.

2.4 **Continuity of Recording** When electrical power is applied to the equipment, the equipment shall continuously record without interruption all information applied to each of the four required recording channel inputs.

2.5 **Retention of Recorded Information** The information recorded on each of the four required channels for at least the full 30 minute period immediately preceding removal of electrical power to the equipment shall be retained on the recording medium.

2.6 **Erasure of Record** Facilities shall be provided on the flight deck for erasure of the record on the ground after the aircraft has completed its flight. Means shall be provided to prevent erasure of the recording by the flight crew whilst the aeroplane is capable of moving under its own power or, for helicopters, whilst the rotors are turning for the purpose of flight.

2.7 **Channel Synchronisation** The separate channels required by 3.2.1 of this Specification shall be synchronised so that relative time between those channels can be deduced to within 1 second.

NOTE: In order that commercially available replay equipment can be used to retrieve recordings with precise time correlation between channels, the recording heads of the voice recorder should not be physically staggered.

2.8 **Monitoring** A means of monitoring the voice recorder for proper operation shall be provided and its indication shall be presented on the flight deck. The effectiveness of the monitor for detecting voice recorder failures shall be determined by analysis.

2.9 **Input Circuit Design** The design of the equipment shall be such that the connection of the equipment's input circuits to other aircraft circuits, when accomplished in a manner prescribed by the equipment manufacturer, shall not affect the performance of those aircraft circuits.

2.10 **Audio Frequency Response** When the level of an electrical input signal applied to any of the four required recording channel inputs is held constant and its frequency is varied over the range of at least 350-3000 Hz the level of the signal recorded on the recording medium shall not vary by more than 6dB. The input signal level used shall be within the equipment manufacturer's input level limitations.

NOTE: It is intended, at some future date, to expand this frequency response. Equipment manufacturers are encouraged therefore to achieve a frequency range of 300-6000 Hz with a signal level variation limited to a maximum of 3dB.

2.11 **Distortion**

2.11.1 The combined noise and harmonic distortion of the recorded signal shall not exceed:

a) 10%, when the level of the input signal applied to any of the four required recording channels is equal to the maximum level for which the equipment is designed;

b) 6%, when the level of the input signal is equal to 0.1 of the maximum level for which the equipment is designed.

2.11.2 This standard shall be met at the audio frequency of 1000 Hz.

2.12 **Audio Noise Level - Without Input Signal** With no input signal applied to any of the four required recording channel inputs, the level of the noise recorded on the recording medium shall be at least 35 dB below that level recorded on the recording medium when an input signal at the frequency of maximum response of the channel, and having a level equal to the maximum level for which the equipment is designed, is applied to the same recording channel input.

2.13 **Coupling Between Audio Circuits** When a 1000 Hz input signal, having an amplitude equal to the maximum for which the equipment is designed, is applied to any one of the four required recording channel inputs, the level of the signal recorded on that portion of the recording medium assigned to each of the other recording channels shall be at least 35 dB below the level recorded on the channel to which the input signal is applied.

2.14 **Flutter** When an input, having an amplitude equal to the maximum for which the equipment is designed, is applied to any of the four required recording channel inputs, the level of any flutter frequency between 0.5 and 250 Hz recorded on the recording medium shall not exceed 2% rms of the level of the input signal recorded on that channel.

2.15 **Area Microphone Assembly**

2.15.1 **General Design Features** The mechanical design of the area microphone assembly may be such that all the components of this assembly (such as the preamplifier) need not be located in the same physical unit as the area microphone itself, provided all of the applicable performance standards contained in this Specification are met. The electrical design of this assembly, however, shall be such that the electrical output (without alteration) of the assembly can be applied directly to two of the four required recording channel inputs.

2.15.2 **Frequency Response - Microphone Only** The output level of the microphone shall not vary more than 12 dB (total spread) when exposed to a constant pressure sound source which is varied over the frequency range of 400-3000 Hz. This requirement shall be met over a sound pressure input range of 60 dB-120 dB above 0.00002 N/rn^2 (0.0002 $dyne/cm^2$).

NOTES: 1) It is intended, at some future date, to expand this frequency response. Equipment manufacturers are encouraged therefore to limit the variation to 10 dB over the band 150 Hz to 10 KHz as recommended by RTCA document DO-170[1] "Audio Systems Characteristics and Minimum Performance Standards".

2) Appropriate test procedures for the area microphone are stated in Appendix B of RTCA document DO-170.

Appropriate test procedures for the area microphone are stated in Appendix B of RTCA document DO-170.

1.Obtainable from RTCA, One McPherson Square, 1425K Street, N.W., Suite 500, Washington 20005, USA. The equivalent EUROCAE document, ED18, is available from EUROCAE, 11 Rue Hamelin-75783, Paris, Cedex 16, France.

2.15.3 **Frequency Response - Microphone Preamplifier Only**

a) The output level of the microphone preamplifier shall not vary more than 6 dB (total spread) when the frequency of an input signal is varied over the pass band for which the equipment is designed and its level is held constant.

b) RESERVED.

c) Means shall be provided in the equipment so that the lower cutoff frequency of the microphone preamplifier can be adjusted between 700 and 1000 Hz. This means of adjustment shall not be accessible to the flight crew.

d) RESERVED.

NOTES: 1) It is intended, at some future date, to revise the lower cut-off frequency from 700 Hz to 300 Hz and the upper cut-off frequency from 3000 Hz to 6000 Hz, in order that more information may be obtained from accident recordings. Equipment manufacturers and installers are encouraged therefore to provide equipment meeting this expanded frequency response.

2) Where available, the 300 Hz setting should be used unless, for the particular aircraft, a noise level with an unacceptably high energy content in the low frequency spectrum has to be attenuated.

2.15.4 **Harmonic Distortion - Microphone Preamplifier Only** When a signal of 1000 Hz or less within the pass band for which the equipment is designed is applied to the input terminals of the preamplifier and with the gain adjusted to produce maximum rated voltage on the output terminals with an input level equivalent to that produced by the microphone(s), for which the preamplifier is designed, exposed to a sound pressure of up to 120 dB above 0.00002N/m^2(0.0002 dyne/cm^2), the total harmonic distortion shall not exceed 10%.

2.15.5 **Harmonic Distortion - Microphone Only** When the cockpit-mounted area microphone is exposed to a sound pressure source within the range of 60 dB-120 dB above 0.00002 N/m^2 (0.0002 dyne/cm^2), at a frequency of 500 Hz, the total harmonic distortion of the output of the microphone shall not exceed 10%.

2.15.6 **Insulation Resistance** The resistance between any exposed conducting material of the cockpit-mounted microphone assembly of the equipment (non-electrical circuit) and the electrical circuit of this assembly shall be at least 10 megohms when measured with an applied voltage of at least 500 volts dc.

2.16 **Identification** The crash protected recorder shall be provided with means to facilitate its identification in conditions following a crash including crash and fire. This may be achieved by the recorder being coloured fluorescent orange or international orange and carrying the following warning in relief in black letters at least one inch (2.5 cms) high:-

Flight recorder	-	do not open
Enregistreur de vol	-	ne pas ouvrir

In addition reflective tape shall be attached to the external surfaces of the recorder to facilitate its recognition for the purpose of location in poor visibility including sea water immersion conditions.

NOTE: Where the methods of this paragraph 2.16 are not appropriate, alternative means should be discussed with the Civil Aviation Authority.

2.17 **Crash Protection Requirements** The warning required in paragraph 2.16 shall remain legible and the output level and distortion characteristics of a 1000 Hz signal previously recorded on each channel shall not have changed by more than 2 dB when the recording medium is played back after the voice recorder has been subjected to the tests of a) and the recording medium to the test of b).

a) Impact shock and fire (in this order).

b) Sea water immersion.

2.18 **Test Procedures**

2.18.1 **Impact Shock** The recorder shall be subjected to an impact shock having a peak acceleration of at least 100 'g' and a time duration of at least 11 milliseconds. The force shall be applied in the direction of the longest diagonal line that can be drawn through the recorder under tests.

NOTE: It is recommended that the voice recorder be subjected to the shock test applicable to flight data recorders. This test involves half sine wave shocks applied to each of the three axes in the most critical direction, and having a peak acceleration of 1000 'g' for at least 5 milliseconds.

2.18.2 **Fire**

a) At least 50% of the outside surface of the recorder shall be subjected to flame of not less than 1100°C for a minimum of 30 minutes.

b) At the start of the fire tests the recorder shall be at its normal maximum internal working temperature and shall be allowed to cool naturally after the test.

2.18.3 **Sea Water Immersion** The recording medium shall be immersed in sea water for 48 hours.

2.19 **Environmental Standards**

2.19.1 The cockpit voice recorder system shall be designed in accordance with BCAR Sections D, G, J and R and JAR-25 as appropriate and subjected to type approval tests in accordance with the requirements of:

a) the relevant parts of British Standard BS 3GlOO Parts 1, 2 and 3[1], or

b) TSO C.84[2], or

c) RTCA/EUROCAE document D0 160A/ED14A[3], or

d) other approved specifications

and shall show compliance with the requirements of this paragraph 2 of this Specification throughout the environmental ranges appropriate to the location of its various elements in the aircraft.

2.19.2 The Applicant for equipment approval shall produce a Declaration of Design and Performance which provides the information required by BCAR Section A, Chapter A3-3. The CAA will, if satisfied, approve the equipment in relation to this DDP.

1. Obtainable from British Standards Institution, 2 Park Street, London, W1Y 4AA.
2. Obtainable from FAA, Office of Airworthiness (AWS-100), 800 Independence Ave. S.W. Washington D.C. 20591. U.S.A.
3. Obtainable from EUROCAE, 11 Rue Hamelin - 75783, Paris, Cedex 16, France.

2.20 **Replay Facility** The Applicant shall confirm that replay equipment will be available which is capable of:

a) replaying any combination of the four channels together and

b) transcribing 4 channel voice recording on to a standard 6.35 mm (0.25 in) magnetic tape in the correct relative order.

NOTE: For helicopters, the CAA will need to be satisfied with the means of retrieval of data (e.g. rotor speed) from the channel assigned to recording non-aural data.

2.21 **Sonar Location Beacon** Provision shall be made for the attachment to the voice recorder of an underwater sonar location beacon. It is strongly recommended that the method of attachment is such that the beacon will not become separated from the crash protected part of the recorder when subjected to the impact shock specified in 2.18.1.

NOTE: The requirements for sonar location beacons are stated in CAA Specification No.12 - "Underwater Sonar Location Device Approval Installation and Maintenance".

3 Installation

3.1 General

3.1.1 The cockpit voice recorder shall be of an approved type and shall be installed in accordance with the requirements of BCAR, Sections D, G, J and R and JAR-25 as appropriate.

3.1.2 The cockpit voice recorder shall be so installed that under normal working conditions the environmental and operating conditions shall be within the limits to which the equipment has been declared.

3.2 Information to be Recorded

3.2.1 Each cockpit voice recorder shall have a minimum of four channels and shall be installed with inputs as follows:

a) for the first channel, from each microphone and headset used at the first pilot station,

b) for the second channel, from each microphone and headset used at the second pilot station, or if this station is not required, from each microphone on the flight deck that is used with the passenger address system if its signals are not recorded on another channel,

c) for the third channel, from the cockpit mounted area microphone,

d)

i) In respect of installations in aeroplanes, for the fourth channel, from each microphone and headset used at the third crew member station, or if this station is not required, from each microphone on the flight deck that is used with the passenger address system if its signals are not recorded on another channel.

ii) In respect of installations in helicopters, for the fourth channel, from a source which provides a signal and reference timebase from which main rotor speed can be deduced. The characteristics of the source and of the recording format shall be such that rotor speeds, within the range of at least 80% of Minimum Rotor Rotational Speed to 110% of Maximum Rotor Rotational Speed (See BCAR Section G, G8-2,5.6), can be deduced to an accuracy of ±2% of the normal rotor rotational speed. Where rotor speed is periodically sampled, the maximum interval between samples shall not exceed one second.

NOTES: 1) For cockpit voice recorders complying with ARINC Characteristic No. 557[1], the recorder input channels are listed below. However, the Characteristic does not define the relationship between the input channels and the tracks on the recording tape. Since the edge of the recording tape has a higher risk of damage than the middle, the first pilot's and area microphone channels should be recorded on the middle tracks. With the assumption that track 1 is located closest to the base of the recording head, the tracks should be allocated to a given channel as shown in the list. Appendix A to this Specification illustrates the preferred recording configuration.

a) First pilot - ARINC Channel 3 (Track 2)

b) Second pilot/PA - ARINC Channel 2(Track 4)

c) Area Microphone - ARINC Channel 4(Track 3)

d) Third crew member or PA/DATA - ARINC Channel 1(Track 1)

2) For helicopters with two or more main rotors it is acceptable to record the speed of only one rotor.

1.Obtainable from Aeronautical Radio Inc. 2551 Riva Rd, Annapolis, Maryland 21401, USA

3.2.2 The cockpit area microphone shall be located and mounted in a position to pick up general cockpit sounds, flight crew speech, and for helicopters, transmission gearbox sounds. The preamplifiers and filters shall be so adjusted, and if necessary supplemented, that the intelligibility of recorded speech and general sounds is as high as practicable when recorded under cockpit noise conditions and played back.

NOTE: In certain cases, e.g. helicopters with two or more main rotors with widely separated transmission gearboxes, it may be necessary to install additional area microphones in order to obtain adequate recordings of cockpit and transmission sounds. In such cases, passenger address broadcasts need not be recorded. Instead, signals from additional area microphones may be substituted.

3.2.3 All sounds received by the microphones listed in 3.2.1 a), b) and, where applicable, d), shall be recorded irrespective of the position of the RT/IC selector switch; the wiring shall be such that sidetone is produced only when R/T or I/C is selected.

NOTE: This paragraph does not apply to hand held microphones incorporating an ON/OFF switch. For such microphones, the sounds received need only be recorded when the switch is selected ON.

3.3 **Quality of Recording** The quality of the recording on each channel shall be as high as practicable and, for each installation, shall be established by aural play-back and, where applicable, data retrieval of in-flight recorded information.

NOTE: See Appendix B for guidance on flight testing and analysis.

3.4 **Electrical Supply** Each cockpit voice recorder shall be so installed that it receives its electrical power from the bus bar that provides the maximum reliability for the operation of the cockpit voice recorder without jeopardising supplies to essential or emergency services.

NOTE: For helicopters, where the voice recorder relies on AC electrical power, the voltage and frequency of the AC supply will need to be independent of main rotor speed unless the cockpit voice recorder is designed to function normally for voltage and frequency fluctuations arising from rotor speed variations within the range of 50% to 130% of normal operating speed.

3.5 **Operation**

3.5.1 Electrical power shall be automatically applied to the cockpit voice recorder system prior to the aeroplane starting to move under its own power and shall not be removed until the end of the flight when the aeroplane is no longer capable of moving under its own power, or for a helicopter, prior to the time the rotors first turn for the purpose of flight until after the rotors are next stopped.

NOTE: Where practical, the recorder should be operating from the start of the check list before engine start until the end of the check list at the termination of the flight.

3.5.2 Where the recorder is electrically powered such that it might continue to operate after a crash or ditching, then an automatic means shall be provided to simultaneously stop the recorder and prevent each erase feature from functioning, within 10 minutes after impact.

NOTE: An acceptable means of compliance would be to install a device which would interrupt the electrical supply to the recorder when the inertial force on the aeroplane exceeds 3 'g' forwards or, for helicopters, 3 'g' along the axis 45 degrees below the horizontal forward axis. In addition, for helicopters equipped in compliance with the Air Navigation Order for flights over water, a device should be installed so as to interrupt the electrical supply to the recorder following an enforced ditching.

3.6 **Accessibility of Controls** Controls which are not intended to be adjusted by the flight crew shall not be readily accessible.

3.7 **Protection of Aircraft Circuits** Precautions shall be taken to ensure that the connection of the voice recorder to the aircraft circuits will not, either in normal operation or in fault conditions, significantly affect those circuits.

3.8 **Location**

3.8.1 Insofar as it is practicable the recorder shall be installed in a position to minimise the probability of damage from crash impact and subsequent fire. For aeroplanes, a position as far to the rear as possible, consistent with reasonable maintenance access, will normally be required. For helicopters, a position shall be agreed with the CAA.

NOTE: Where a sonar location beacon is required to be attached to the recorder, a position for the recorder should be chosen such that beacon transmissions are not attenuated to an unusable level by sound absorbent structure, e.g. composite honeycomb materials. If such a position is not possible then, in addition to the beacon on the recorder; a second beacon will need to be attached elsewhere to the aircraft.

3.8.2 The recorder shall remain attached to the local structure under normal, longitudinal and transverse accelerations of 15 'g'.

3.9 **Integrity of Flight Data Recorder** Where the voice recorder is installed adjacent to the flight data recorder, it shall be demonstrated that erasure of the voice record does not affect the information stored by the flight data recorder.

4 Maintenance

Operators will not be required to have immediate access to replay equipment but shall make provision in their Maintenance Schedules for periodic maintenance checks. These checks will include replay and/or suitable ground checks at periods to be agreed with the CAA. Overhaul periods shall, where appropriate, be specified in the Maintenance Schedule.

Appendix No. A

Cockpit Voice Recorder

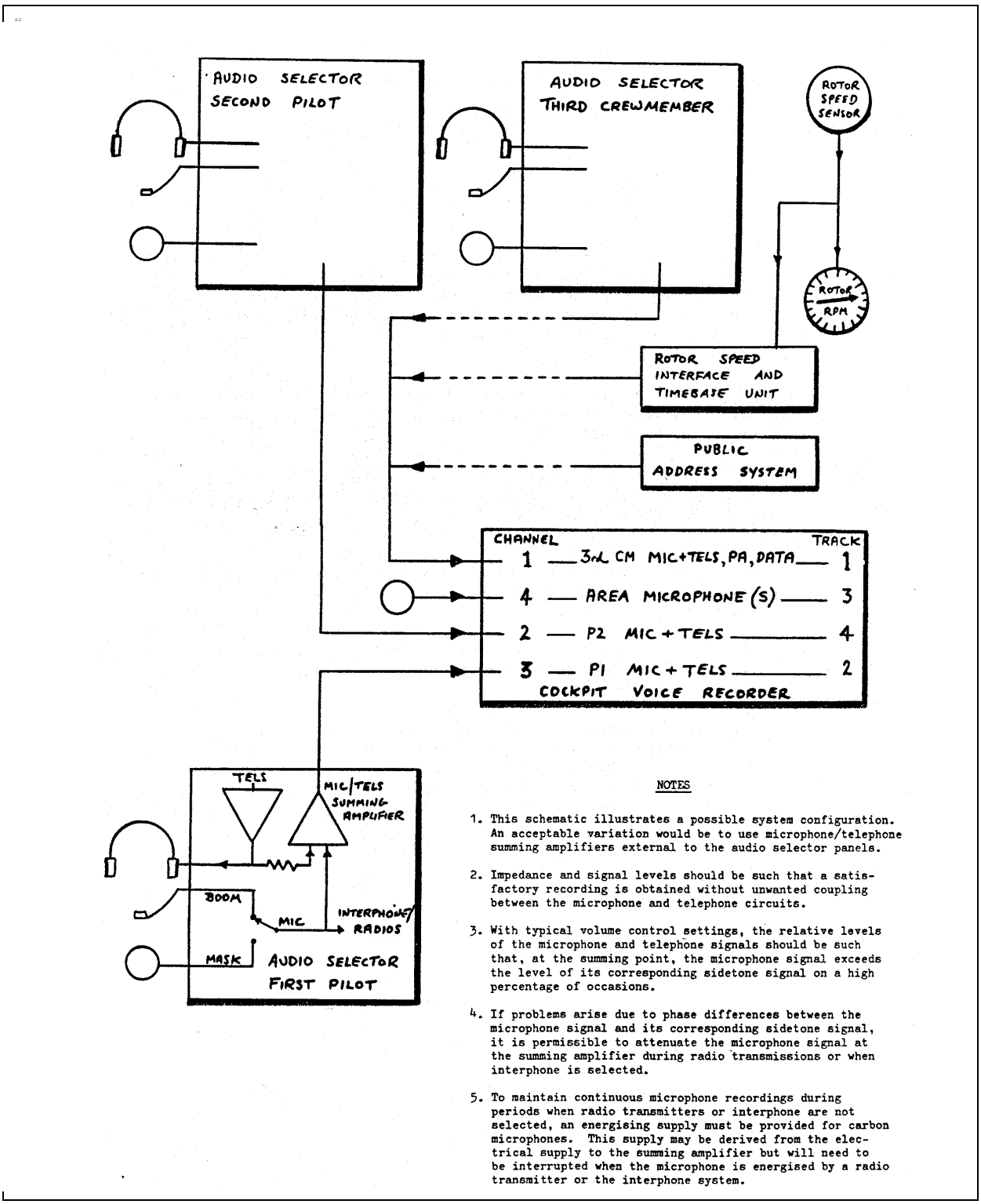

Figure 1 Cockpit Voice Recorder

Appendix No. B

Cockpit Voice Recorder

Flight Test

1 General

1.1 Paragraph 3.3 of the Specification requires each newly installed recorder to be flight tested and the recording, so obtained, to be analysed. The test and analysis must demonstrate adequate recording quality during all normal regimes of flight including taxying, take-off, cruise, approach and landing. For helicopters, hover and auto-rotation should be included.

1.2 Since the duration of the recording is limited to 30 minutes, the CVR circuit breaker should be tripped between each test phase and at the end of the landing run.

1.3 If time permits, systems which generate sounds on the flight deck and which might not otherwise be used during the test flight, should be operated with appropriate announcements.

1.4 This appendix provides guidance for flight testing both aeroplanes and helicopters. It may need to be adapted to suit the particular installation being tested.

1.5 The replay and analysis must be performed by a replay centre acceptable to the CAA. The replay centre must ensure the privacy of the recordings.

1.6 Recordings offered for analysis may be released to the operator's engineering organisation, a replay centre, the CAA, the Accident Investigation Branch of the Department of Transport and, if appropriate, other Airworthiness Authorities. The agreement of the flight crew concerned is assumed unless instructions, in writing, are given by the flight crew stating any restrictions to be applied.

2 Procedure

IMPORTANT To enable proper analysis of the recording, it is essential that adequate commentary on the flight is provided, e.g. crew actions altitudes and speed. Each test should be clearly announced and the crew member identified, e.g. "Co-pilot testing oxygen mask microphone with interphone off".

2.1 Prior to Engine Start

2.1.1 Check that the CVR is operating. If the CVR cannot operate due to system interlocks, then include these procedures after engine start.

2.1.2 Press the ERASE button.

2.1.3 Press the CVR TEST button.

2.1.4 Select BOOM microphone and interphone 'ON' at all positions.

2.1.5 Call out aircraft type, registration, date, time and crew complement.

2.2 Engine Start

2.2.1 (Helicopters only) During rotor spin-up, call out RPM at 50%, 80% and 100%.

2.2.2 Perform the procedures of 2.1 if not already done except, for helicopters, do not operate the ERASE.

2.2.3 Make a test announcement from each crew member's position in turn using the boom microphones with interphone selected 'ON' followed by a second announcement with the interphone 'OFF'.

2.2.4 Repeat 2.2.3 using the oxygen mask microphone.

2.2.5 (Aeroplanes only) Announce and test the stall warning stick shaker.

2.2.6 (Helicopters only) Close the flight deck windows.

2.3 **Take-off**

2.3.1 With headsets worn and boom microphones available for use, record a normal take-off and initial climb.

2.3.2 Announce landing gear and flap selections and other actions.

2.4 **Cruise**

2.4.1 With interphone OFF, announce and activate aural warnings.

2.4.2 (Aeroplanes only) Accelerate to, and announce V_{MO}. Continue until the overspeed warning sounds. Reduce speed as required.

2.4.3 Perform a test transmission from each pilot's station using VHF and boom microphones.

2.4.4 Perform a test transmission from each pilot's station using VHF, a hand-held microphone and the flight deck loudspeakers.

2.4.5 Perform a test transmission from each pilot's station using HF (if fitted) and boom microphones.

2.4.6 Perform a test transmission using the Marine radio if fitted.

2.4.7 Perform test broadcasts from the flight deck and the cabin using the passenger address system.

2.4.8 (Helicopters only). Call out rotor RPM

2.4.9 Announce and open the flight deck-cabin door. Announce and close the door after 30 seconds.

2.4.10 Where permitted, announce and open the flight deck windows. Announce and close the windows after 30 seconds.

2.5 **Helicopter Auto-Rotation and Hover**

2.5.1 At a safe altitude, perform an auto-rotation descent with power recovery.

2.5.2 Announce and hover for approximately one minute.

2.6 **Landing**

2.6.1 Record final approach and landing including ILS and Marker audio identification. Announce landing gear and flap selection and other actions.

2.6.2 At end of landing run call out the time. (Note 30 minutes tape limitations).

2.6.3 Select BOOM microphone and interphone 'ON' at all positions and announce "End of Test".

2.6.4 DO NOT ERASE

2.6.5 PULL CVR CIRCUIT BREAKER.

3 Replay and Analysis

3.1 The CVR with the tape recording should be sent to a replay centre acceptable to the CAA. A copy of the test schedule used during the flight should accompany the tape recording.

NOTE: Where a CVR is installed in a type of aircraft for the first time, or where the installation is a prototype design, the CAA will require the replay and analysis of the prototype recording to be performed using 4-channel reproduction equipment capable of replaying any combination of the four channels together. An acceptable replay service for this purpose is provided by the Accident Investigation Branch of the Department of Transport, Building T49, Royal Aircraft Establishment, Farnborough, Hampshire, Telephone (0252) 24461.

3.2 The replay centre should establish that recordings of adequate quality have been made on all channels for the test conditions stated in 2. In addition to subjective listening tests, proper signal recording level should be confirmed.

3.3 The replay centre should furnish a report to the Applicant together with a copy to the CAA, Avionics/Electrical Installation Section Brabazon House, Redhill, Surrey, RH1 1SQ. The report should identify the aircraft and test flight concerned and should confirm that all input channels were identified for the various test conditions. Details of any other observations made from the recording should be included. For helicopters, correlation between rotor speed announcements by the crew and recorded rotor speed data should be established and recorded. In all cases, the position of the area microphone in the particular aircraft should be stated in the report.

4 Disposal of Recording

4.1 The original recording need not be copied unless specific instructions have been given by the Applicant.

4.2 For the first aircraft of a particular type, the original tape should be forwarded to the Accidents Investigation Branch at Farnborough for retention by the Branch for use as a reference tape for the type.

4.3 In all other cases, the tape should be returned to the Applicant.