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Specification No. 18

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Civil Aviation Authority

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Flight Data Recorder for Helicopter Accidents Investigation

Contents

1 Introduction

1.1 Schedule 4, Scale SS of the United Kingdom Air Navigation Order 1989, as amended, reference (a) requires that certain categories of helicopter be equipped with a flight data recorder system of a type approved by the Civil Aviation Authority for the pl4rppaes of accident investigation.

1.2 Flight data recorder systems installed in helicopter in compliance with the Order shall comply with this Specification pr such other specification as the CAA may approve. Alternative specifications shall provide at least an equivalent standard of performance and crash survivability and shall comply with the particular reqi4ements of the Order.

1.3 Where reference is made in this Specification p cockpit voice recorder system, it shall be understood to mean a system approved by CM n accordance with either CM Specification No. 3.1 (reference (b)) or EUROCAE Minimum Operational Performance Requirement ED-56 (reference (c)). Combined recorders shall take account also of the recording duration requirements defined in paragraph 1.5(d)(i) of this Specification.

1.4 This Specification No. 18 is based on, and must be used in conjunction with, EUROCAE Minimum Operational Performance Specification (MOPS) ED-55 (reference (d)).

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1.5 For the purposes of this Specification, a flight data recorder system may comprise the following equipment:

a) transducers and sensors which provide data for the flight recording function,

b) data acquisition and processing equipment which provide the interface between input sensors, transducers, helicopter systems and the crash protected recorder.

c) recording equipment comprising, either

i) a non-deployable, crash protected, flight data recorder (separate from the cockpit voice recorder) capable of preserving the information recorded during at least the last 8 hours of its operation, or

ii) a combination of a non-deployable, crash protected recorder capable of preserving the information recorded during at least the last 30 minutes of its operation (e.g. the cockpit voice recorder with data on one track) together with an 8 hour duration deployable flight data recorder capable of preserving the recording under conditions of its deployment and subsequent landing, or

d) as an option to the systems defined in paragraph 1.5(c), a combined cockpit voice recorder/flight data recorder which meets the following requirements:

i) the cockpit voice recorder shall be capable of recording and retaining at least the last hour of cockpit voice recording information on not less than three separate channels.

ii) the data recorded during at least the last five hours of the operation of the combined cockpit voice recorder/flight data recorder or the maximum duration of the flight, whichever is the greater, shall be retained and shall be crash protected data. Additional data, which may be unprotected, shall also be retained and shall relate to either the period immediately preceding that for which protected data is required to be retained or such other period or periods as the CM may permit pursuant to Article 40 of the Air Navigation Order (see paragraph 3.4.3 of this Specification). Procedures will need to be established by the helicopter operator for the removal and retention of unprotected flight data at appropriate intervals in accordance with arrangements approved by the CM.

NOTE 1: Unprotected data may be obtained from a maintenance data recorder associated with the combined cockpit voice recorder/flight data recorder system.

NOTE 2: The design of the voice recorder erase feature will need to ensure that, when used, the flight data record is not affected.

e) ancillary equipment including, where relevant, underwater locating beacons, radio beacons, crash sensors, deployment mechanisms and batteries dedicated to the flight recorder system.

NOTE 1: Requirements for Underwater Locating Beacons are given in CM Specification No. 12 (reference (e)).

NOTE 2: Requirements for Deployable Radio Beacons are given in CM Specification No. 16 (reference (f)).

2 Applicability

2.1 This Specification prescribes the minimum performance standards, equipment approval criteria, installation and maintenance requirements applicable to flight data recording systems installed in helicopters in accordance with the provisions of Schedule 4, Scale SS of the Air Navigation Order 1989, as amended.

3 Requirements

3.1 General

Reference must be made to EUROCAE MOPS ED-55 which gives details of the Operational Requirements to be met together with Equipment and Installation standards and associated guidance material.

3.2 Equipment Approval

3.2.1 The crash protected recorder or the deployable recorder, as the case may be, must be of a type approved by CM. Application for approval will need to be made by the equipment manufacturer using either the Accessory Procedure (13K products) or the Appliance Registration Procedure (non UK products).

3.2.2 With the exception of the equipment defined in 3.2.1, CM approval of other items of equipment used in the flight data recorder system e.g. the data acquisition unit, may be obtained by the installer using the Component Procedure, or by the equipment manufacturer using either the Accessory Procedure or the Appliance Registration Procedure whichever is applicable.

3.2.3 Flight data recording equipment will be eligible for approval in accordance with this Specification provided that compliance is shown with the equipment standards stated in EUROCAE MOPS ED-55.

NOTE 1: A recorder using magnetic tape medium, previously approved by CM, or a recorder which is a derivative model of a recorder previously approved by CM, in accordance with the equipment standards stated in CM Specification No. 10, Issue 1 (reference (g)), will be acceptable for installation in helicopters provided that compliance is shown with recording capacity and duration requirements for the particular installation.

NOTE 2: Equipment approval procedures are defined in British Civil Airworthiness Requirements Section A, Issue 1, Chapter A4-8 (Reference (h)), and Section B, Chapter B4-8 (Reference (i)).

3.3 Installation Approval

3.3.1 In showing compliance with BCAR Section G, BCAR 29 or JAR 29, whichever is applicable to the helicopter concerned, account must be taken of the operational and installation requirements of EUROCAE MOPS ED-55 and its associated guidance material.

NOTE: The selection of the equipment and their locations in the helicopter will need to take into consideration the expected vibration levels. The environmental qualification of the equipment must be adequate for the locations selected to ensure acceptable system reliability and performance.

3.3.2 A reference document, applicable to the equipment and its installation in each helicopter to be approved, shall be compiled and submitted to the CM. The document shall provide details of the conversion data and logic required for translation of the data held in memory to parameters expressed in engineering units.

3.4 Information to be Recorded

3.4.1 Helicopters over 7000 kg MTWA

Where compliance with Scales SS(ii) or SS(iii) of Schedule 4 of the Order is required, the parameters defined in Annex 1, Table A1-2 of EUROCAE MOPS ED-55, shall be recorded. Where spare recording capacity exists and where it can be accomplished with reasonable practicability, the additional recommended parameters of Table A1-5, where relevant, should be recorded.

3.4.2 **Helicopters over 2730 kg and up to and including 7000 kg MTWA**

Where compliance with Scales SS(i) or SS(iii) of Schedule 4 of the Order is required, the parameters defined in Annex 1, Table A1-4 of EUROCAE MOPS ED-55, shall be recorded. Where spare recording capacity exists and where it can be accomplished with reasonable practicability, the remainder of the parameters of Table A1-2 and the additional recommended parameters of Table A1-5, where relevant, should be recorded.

3.4.3 **Additional data**

The additional data to be recorded in compliance with paragraph I.5(d)(ii) of this Specification shall include, as a minimum, the following:

i) A record of a period of at least 10 seconds of continuous data at minimum collective pitch on the ground for datum calibration purposes.

ii) A record of a period of continuous data starting 20 seconds before until 90 seconds after the initial rise in rotor speed from the most recent rotor start.

iii) A record of a period of continuous data starting 20 seconds before until 90 seconds after lift-off of the flight (i.e. the first take-off after rotor start).

NOTE 1: In accordance with paragraph 2.5.2 of EUROCAE MOPS ED-55, the CM may require supplementary parameters to be recorded for any novel or unique design or operational characteristic of the helicopter.

NOTE 2: The foregoing referenced parameter Tables are reproduced in Appendix 1 to this Specification.

3.5 **Maintenance and Calibration**

3.5.1 The maintenance tasks required to ensure the serviceability and continued airworthiness of the flight recorder system shall be established.

3.5.2 An analysis shall be performed to identify those sensors or transducers where either the serviceability or the accuracy could be degraded and remain undetected. The maintenance tasks to be performed shall take account of this analysis by requiring functional and calibration checks at suitable intervals.

3.5.3 Calibration data of flight recorder sensors and transducers shall be retained by the helicopter operator or, by arrangement, its maintenance organisation.

Appendix 1

Parameter Tables

A1.1 Recording Format

A1.1.1 It is important that reference is made to EUROCAE MOPS ED-55 which gives guidance on parameter processing and recording formats.

A1.1.2 Tables A1.2, A1.4 and A1.5 of EUROCAE MOPS ED-55 give details of the parameters to be recorded as required by paragraph 3.4 of this Specification.

A1.1.3 Table A1.8 of EUROCAE MOPS ED-55 provides an example of a preferred data frame structure based on the use of 12 bit words recorded in a 4 second frame at the rate of 64 words per second. Similarly, Table A1.9 provides a preferred format where the recording rate is 128 words per second. Discrete parameters may be included in discrete words or, where resolution requirements allow, in the least significant bits of variable parameters.

A1.1.4 Table Al.10 of EUROCAE MOPS ED-55 gives details of the accuracy limits required for the pressure altitude parameter.

A1.1.5 The foregoing referenced tables are reproduced in this Appendix.

A1.1 Parameter Characteristics

Parameter characteristics are discussed in Annex 1 of EUROCAE MOPS ED-55.

EUROCAE MOPS ED-55 TABLE A1.2 - Parameters to be Recorded - Large Helicopters

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
1a or 1b	Time Relative Time Count	24 hours 0 to 4095	4 4	± 0.125% per hour ± 0.125% per hour	1 second	a) UTC time preferred where available. b) Counter increments every 4 seconds of system operation.
2	Pressure Altitude	-1000 ft to maximum certificated altitude of aircraft + 5000 ft	1	± 100 ft to ± 700 ft See Table A1.10	5 ft	See paragraph A1.5.1 of ED-55
3	Indicated Airspeed	As the installed measuring system	1	± 3%	1 kt	See paragraph A1.5.1 of ED-55
4	Heading	360 degrees	1	± 2 degrees	0.5 degrees	
5	Normal Acceleration	-3 'g' to +6'g'	0.125	± 1% of Maximum range excluding a datum error of ± 5%	0.004'g'	The resolution may be rounded from 0.004 to 0.01'g' subject to compliance with paragraph A1.5.2 of ED-55.
6	Pitch Attitude	± 75 degrees	0.5	± 2 degrees	0.5 degrees	
7	RollAttitude	± 180 degrees	0.5	± 2 degrees	0.5 degrees	
8	Manual Radio Transmission Keying	Discrete(s)	1	-	-	Preferably each crew member but one discrete acceptable for all transmissions provided the system meets 4.2.1 of ED-55

TABLE A1.2 (continued) - Parameters to be Recorded - Large Helicopters

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
9	Power on each engine	Full range		± 2%	0.2% of full range	Sufficient parameters e.g. Power Turbine Speed and engine torque should be recorded to enable engine power to be determined. A margin for possible overspeed should be provided.
9a	Free Power Turbine Speed (NF)	0-130%				
9b	Engine Torque	Full range				
9c	Cockpit Power Control Position	Full range or each discrete position	Each control each second	± 2% or sufficient to determine any gated position	2% of full range	Parameter 9c is required for helicopters with non-mechanically linked cockpit - engine controls, otherwise recommended.
10a	Main rotor speed	50 to 130%	0.5	± 2%	0.3% of full range	
10b	Rotor brake	Discrete	1			Where available.

TABLE A1.2 (continued) - Parameters to be Recorded - Large Helicopters

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
11	Primary Flight Controls - Pilot input and / or * control output position	Full range		± 3% unless higher accuracy is uniquely required	0.5% of operating range	*For helicopters that can demonstrate the capability of deriving either the control movement (one from the other) for all modes of operation and flight regimes, the 'or; applies. For helicopters with non-mechanical control systems the 'and' applies. See paragraph A1.5.3 of ED-55.
11a	collective pitch		0.5			
11b	longitudinal cyclic pitch		0.5			
11c	lateral cyclic pitch		0.5			
11d	tail rotor pedal		0.5			
11e	controllable stabilator		0.5			
11f	hydraulic selection	Discrete(s)	1			
12	Hydraulics low pressure	Discrete(s)	1	-	-	Each essential system should be recorded.
13	Outside air Temperature	-50° to +90°C or available sensor range	2	± 2 degrees	0.3 degree	

TABLE A1.2 (continued) - Parameters to be Recorded - Large Helicopters

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
14	AFCS mode and engagement status	A suitable combination of discretes	1	-	-	Discretes should show which systems are engaged and which primary modes are controlling the flight path of the helicopter.
15	Stability augmentation system engagement	Discrete	1	-	-	
16	Main gearbox oil pressure	As installed	1	As installed	$6.895\ kN/M^2$ (1 psi)	
17	Main gearbox oil temperature	As installed	2	As installed	1 degree	
18	Yaw rate	± 400 degrees/second	0.25	± 1%	2 degrees per second	An equivalent yaw acceleration is an acceptable alternative
19	Indicated sling load force	0 to 200% of maximum certified load	0.5	± 3% of maximum certified load	0.5% of maximum certified load	With reasonable practicability is sling load indicator is installed
20	Longitudinal Acceleration (body axis)	± 1'g'	0.25	± 1.5% of maximum range excluding a datum error of ± 5%	0.004'g'	See comment for parameter 5.
21	Later Acceleration	± 1'g'	0.25	± 1.5% of maximum range excluding a datum error of ± 5%	0.004'g'	See comment for parameter 5.

TABLE A1.2 (continued) - Parameters to be Recorded - Large Helicopters

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
22	Radio Altitude	-20 ft to +2500 ft	1	As installed. ± 2 ft or ± 3% whichever is greater below 500 ft and ± 5% above 500 ft recommended	1 ft below 500 ft, 1 ft + 0.5% of full range above 500 ft.	
23	Vertical beam deviation		1	As installed. ± 3% recommended.	0.3% of total range	See paragraph A1.5.4 of ED-55
23a	ILS Glide Path	± 0.22 DDM or available sensor range as installed.				
23b	MLS Elevation	+0.9 to +30 degrees				
24	Horizontal beam deviation		1	As installed. ± 3% recommended.	0.3% of total range	See paragraph A1.5.4 of ED-55
24a	ILS Localiser					
24b	MLS Azimuth	± 0.22 DDM or available sensor range as installed. ± 62 degrees				
25	Marker beacon passage	Discrete	1	-	-	One discrete is acceptable for all markers

TABLE A1.2 (continued) - Parameters to be Recorded - Large Helicopters

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
26	Warnings	Discretes	1	-	-	A discrete must berecorded for the master warning, gearbox low oil pressure and SAS failure. Other 'red' warnings should be recorded where the warning condition cannot be determined from other parameters or from the cockpit voice recorder.
27	Reserved					This parameter serial number is used by ICAO for Navigation receiver frequency selection which is included in the recommended list of Table A1.5.
28	Reserved					This parameter serial number is used by ICAO for DME Distance which is included in the recommended list of Table A1.5.

TABLE A1.2 (continued) - Parameters to be Recorded - Large Helicopters

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
29	Reserved					This parameter serial number is used by ICAO for Navigation Data which is included in the recommended list of Table A1.5.
30	Landing gear or gear selector position	Discrete(s)	4	-	-	Where installed

EUROCAE MOPS ED-55 TABLE A1.4 - Parameters to be Recorded - Small Helicopters

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
1	Relative Time Count	0 to 4095	4	± 0.125% per hour	One second	Counter increments every 4 seconds of system operation
2	Pressure Altitude	-1000 ft to 20,000 ft	1	± 100 to ± 700 ft See table A1.10	25 ft	
3	Indicated Airspeed	As the installed measuring system	1	± 5% or ± 10kt whichever is greater	1 kt	
4	Heading	360 degrees	1	± 5 degrees	1 degree	
5a	Normal Acceleration	-3'g' to +6'g'	0.125	± 0.2'g' in addition to a maximum offset of ± 0.3'g'	0.01'g'	The resolution may be rounded from 0.01'g' to 0.05'g' subject to compliance with paragraph A1.5.2 of ED-55
6	Pitch Attitude	100% of usable range	0.5	± 2 degrees	0.8 degree	
7	Roll Attitude	± 60 degrees or 100% of usable range from installed system if greater	0.5	± 2 degrees	0.8 degree	
8	Manual Radio Transmission keying	Discrete(s)	1	-	-	Preferably each crewmember but one discrete acceptable for all transmissions.

TABLE A1.4 (continued) - Parameters to be Recorded - Small Helicopters

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
9	Power on each engine	Full range	Each engine each second	± 5%	1% of full range	Sufficient parameters e.g. Power Turbine Speed and Engine Torque should be recorded to enable engine power to be determined. A margin for possible overspeed should be provided. Data may be obtained from cockpit indicators used for aircraft certification.
9a	Power Turbine Speed	Maximum range				
9b	Engine Torque	Maximum range				
9c	Cockpit Power control position	Full range or each discrete position	Each control each second	± 2% or sufficient to determine any gated position	2% of full range	Parameter 9c is required with non-mechanically linked cockpit-engine controls, otherwise recommended.
10a	Main Rotor Speed	Maximum range	1	± 5%	1% of full range	
10b	Rotor brake	Discrete	1	-	-	Where available

TABLE A1.4 (continued) - Parameters to be Recorded - Small Helicopters

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
11	Primary Flight Controls - Pilot input and/or* control output position	Full range		± 3%	1% of full range	*For helicopters that can demonstrate the capability of deriving either the control input or the output control movement (one from the other) for all modes of operation and flight regimes, the 'or' applies. For helicopters with non-mechanical control systems it is recommended that the 'and' should apply. See Paragraph A1.5.3 of ED-55.
11a	Collective Pitch		0.5			
11b	Longitudinal Cyclic Pitch		0.5			
11c	Lateral Cyclic Pitch		0.5			
11d	Tail Rotor Pedal		0.5			
11e	Controllable Stabilator		0.5			
11f	Hydraulic selection	Discrete(s)	1			

TABLE A1.4 (continued) - Parameters to be Recorded - Small Helicopters

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
12	Warnings	Discrete(s)	1	-	-	A discrete must be recorded for the master warning, low hydraulic pressure (each system), SAS fault status and gearbox low oil pressure. Other 'red' warnings should be recorded where the warning condition cannot be determined from other parameters or the cockpit voice recorder.
13	Outside Air Temperature	Available range from installed system	2	± 2 degrees	0.3 degrees	
14	Autopilot engagement status	Discrete(s)	1			Where practicable, discrete should show which primary modes are controlling the flight path of the helicopter.
15	Stability Augmentation System engagement	Discrete	1			

EUROCAE MOPS ED-55 TABLE A1.5 - Additional Recommended Parameters to be Considered

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
1	Navigation Data	As installed		Data should be obtained from the most accurate system as installed.		Where capacity permits, latitude / longitude resolution should be 0.0002 degrees.
1a	Drift Angle		4		0.1 degree	
1b	Wind Speed		4		1 knot	
1c	Wind Direction		4		1 degree	
1d	Latitude / Longitude		4		0.002 degrees	
2	Metered brake pressure / brake pedal position	As installed	1	As installed		To determine braking effort applied by pilots or by autobrakes
3	Additional Engine Parameters	As installed	Each Engine Each second	As installed		The preferred priority is EPR/N1. Indicated vibration level, N2, EGT, TLA, fuel flow and fuel cut off lever position.
4	TCAS	Discrete(s)				The recording of at least the Resolution Advisory is strongly recommended.
4a	Traffic Advisory		1			
4b	Resolution Advisory		1			
4c	Sensitivity level (Crew selected)		4			
5	Windshear Warning	Discrete	1			

TABLE A1.5 (cotinued) - Additional Recommended Parameters to be Considered

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
6 6a 6b	Selected barometric setting Pilot First Officer	As installed	64	As installed	1 mb	Where practicable, a sampling interval of 4 seconds is recommended.
7 7a 7b	Selected Altitude Manual Automatic	As installed	1	As installed	100 ft	Where capacity is limited a sampling interval of 64 seconds is permissible.
8	Selected Speed	As installed	1	As installed	1 kt	Where capacity is limited a sampling interval of 64 seconds is permissible.
8a	Manual					
8b	Automatic					
9	Selected Mach	As installed	1	As installed	0.01	Where capacity is limited a sampling interval of 64 seconds is permissible.
9a	Manual					
9b	Automatic					
10	Selected Vertical Speed	As installed	1	As installed	100 ft/min	Where capacity is limited a sampling interval of 64 seconds is permissible.
10a	Manual					
10b	Automatic					
11	Selected Heading	360 degrees	1	As installed	1 degree	Where capacity is limited a sampling interval of 64 seconds is permissible.

TABLE A1.5 (cotinued) - Additional Recommended Parameters to be Considered

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
12 12a 12b	Selected Flight Path Course / DSTRK Path Angle	 360 degrees As installed	1	As installed	 1 degree 0.1 degrees	Where capacity is limited a sampling interval of 64 seconds is permissible.
13	Selected Decision Height	0-500 ft	64	as installed	1 ft	
14 14a 14b	EFIS Display Format Pilot First Office	Discrete(s)	4	-	-	Discretes should show the display system status e.g. off, normal, fail, composite, sector, plan, rose, nav aids, wxr, range, copy.
15	Multi-function / Engine / Alerts Display format	Discrete(s)	4	-	-	Discretes should show the display system status e.g. off, normal, fail and the identity of display pages for emergency procedures, checklists and procedures need not be recorded.
16	DME 1 and 2 Distance	0-200NM	4	As installed	1NM	A sampling interval of 64 seconds is acceptable where other navigation parameters are recorded.

TABLE A1.5 (cotinued) - Additional Recommended Parameters to be Considered

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
17	AC Electrical Bus Status	Discrete(s)	4			
18	DC Electrical Bus Status	Discrete(s)	4			
19	Engine Bleed Valve Position	Discrete(s)	4			
20	APU Bleed Valve Position	Discrete(s)	4			
21	Computer Failure	Discrete(s)	4			Critical Flight and Engine Control Systems
22	Engine Thrust Command	As installed	2	As installed	2% of full range	
23	Engine Thrust Target	As installed	4	As installed	2% of full range	
24	Computed Centre of Gravity	As installed	64	As installed	1% of full range	
25	Fuel Quantity in CG Trim Tank	As installed	64	As installed	1% of maximum quantity	
26	Head up Display in use	Discrete(s)	64			
27	Para Visual Display on	Discrete(s)	1			

TABLE A1.5 (cotinued) - Additional Recommended Parameters to be Considered

Serial No	Parameter	Range	Sampling Interval in seconds	Accuracy Limits (Sensor Input compared to FDR read out)	Minimum Resolution in read out	Remarks
28	Navigation Receiver Frequency Selection	Sufficient to determine selected frequency	4	As installed	-	An offset value or channel counter would be acceptable. The frequency to be recorded should be that associated with the information displayed to the pilot.
29	Helicopter Health and Usage Monitor System (HUMS)	As installed	-	As installed	-	Principal HUMS parameters as available including Main and Tail Rotor vibration.
30	Event Marker	Discrete	1	-	-	From cockpit switch.

EUROCAE MOPS ED-55 TABLE A1.8 - SAMPLE DATA FRAME STRUCTURE FOR HELICOPTERS BASED ON WORD RATE OF 64 PER SECOND

SF	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER
1	1	/	9	/	17	/	25	/	33	Lat. Lng. Msp	41	Drift Ang	49	/	57	P1 Baroset
2		Synch		Magnetic		Cyclic		Main Gear		P1 EFIS		Wind Ang		Cyclic		Mfd Disp
3		Words		Heading		Lat. Pos.		Oil Pres.		Sel DH		Wind Spd		Lat. Pos.		P2 Baroset
4		/		/		/		/		P2 EFIS		Spare		/		Mfd Disp
1	2	/	10	/	18	/	26	/	34	/	42	/	50	/	58	/
2		Altitude		Indicated		Tail Rtr		Radio		Altitude		Ground		Tail Rtr		Pressure
3		Rate (FAA)		Airspeed		Pedal Pos.		Altitude		Rate (FAA)		Speed		Pedal Pos.		Altitude
4		/		/		/		/		/		/		/		/
1	3	/	11	/	19	/	27	/	35	/	43	/	51	/	59	/
2		Main Rotor		Eng. No. 1		Eng. No. 2		Eng. No. 1		Main Rtr.		Eng. No. 2		Eng. No. 1		Eng. No. 2
3		Speed		Torque		NG Speed		NF Speed		Speed		Torque		NG Speed		NF Speed
4		/		/		/		/		/		/		/		/
1	4	/	12	/	20	/	28	/	36	/	44	/	52	/	60	/
2		Normal		Normal		Normal		Normal		Normal		Normal		Normal		Normal
3		Accel'n		Accel'n		Accel'n		Accel'n		Accel'n		Accel'n		Accel'n		Accel'n
4		/		/		/		/		/		/		/		/
1	5	/	13	/	21	/	29	/	37	/	45	/	53	/	61	/
2		Long		Pitch		Long		Sling load		Long		Pitch		Long		Sling load
3		Accel'n		Attitude		Accel'n		Force		Accel'n		Attitude		Accel'n		Force
4		/		/		/		/		/		/		/		/
1	6	/	14	/	22	/	30	OAT	38	/	46	/	54	/	62	/
2		Lateral		Roll		Lateral		Gear Temp		Lateral		Roll		Lateral		Vertical
3		Accel'n		Attitude		Accel'n		OAT		Accel'n		Attitude		Accel'n		Deviation
4		/		/		/		Gear Temp		/		/		/		/
1	7	/	15	/	23	/	31	Lat'd LSP	39	/	47	/	55	/	63	/
2		Yaw		Coll'tive		Yaw		NAV 1 Frq		Yaw		Coll'tive		Yaw		Lateral
3		Rate		Pitch		Rate		Time LSP		Rate		Position		Rate		Deviation
4		/		/		/		NAV 2 Frq		/		/		/		/
1	8	/	16	/	24	/	32	Longt LSP	40	/	48	/	56	/	64	Sel Alt
2		Discretes		Cyclic		Discretes		DME 1 Dis		Discretes		Cyclic		Discretes		Sel Speed
3		Word No. 1		Long Pos		Word No. 2		Time MSP		Word No. 3		Long Pos		Word No. 4		Sel Hdg
4		/		/		/		DME 2 Dis		/		/		/		Sel crse

SF: Sub-FrameWD: Word

EUROCAE MOPS ED-55 TABLE A1.9 - SAMPLE DATA FRAME STRUCTURE FOR HELICOPTERS BASED ON WORD RATE OF 128 PER SECOND

SF	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER	WD	PARAMETER
1	1	Sync	17	Eng 1	33	Eng 1	49	/	65	/	81	Sup'fram 1	97	Sup'fram 2	113	Pres Alt C
2		Sync		Oil 2		Oil 2		Spare		Reserved		Spare		Nav 1 frq		Frame Count
3		Sync		Temp 2		Press 1		/		(Sync)		Time MSP		Lat Lng MSP		Pres Alt C
4		Sync		/ 2		/ 2		/		/		EFIS Mode		Nav 2 Frq		MFD Mode
	2	Time LSP	18	Heading	34	Main Gear Oil Press	50	Radio Altitude	66		82	Drift Angle	98	Latitude LSP	114	Pressure Alt-Fine
	3	Altitude Rate	19	Indicated Airspeed	35	Main Gear Oil Temp	51	Lateral Deviation	67	Altitude Rate	83	Ground Speed	99	Long'tude LSP	115	Outside Air Temp
	4	Yaw Rate	20	Sling Load Force	36	Yaw Rate	52	Vertical Deviation	68	Yaw Rate	84	Sling Load Force	100	Yaw Rate	116	
	5	Normal Accel'n	21	Normal Accel'n	37	Normal Accel'n	53	Normal Accel'n	69	Normal Accel'n	85	Normal Accel'n	101	Normal Accel'n	117	Normal Accel'n
	6	Long Accel'n	22	Pitch Attitude	38	Long Accel'n	54		70	Long Accel'n	86	Pitch Attitude	102	Long Accel'n	118	
	7	Lateral Accel'n	23	Roll Attitude	39	Lateral Accel'n	55		71	Lateral Accel'n	87	Roll Attitude	103	Lateral Accel'n	119	
	8	Main Rotor Speed	24	Engine 1 NG	40	Engine 1 NF	56		72	Main Rotor Speed	88	Engine 2 NG	104	Engine 2 NF	120	
	9	Main Rotor Vibration	25	Engine 1 Torque	41	Collective Pitch	57		73	Tail Rotor Vibration	89	Engine 2 Torque	105	Collective Pitch	121	
	10	Wind Angle	26	Engine 1 PLA	42	Cyclic Long Pos'n	58		74	DME 1 Distance	90	Engine 2 PLA	106	Cyclic Long Pos'n	122	
	11	Wind Speed	27	Engine 1 Fuel Flow	43	Cyclic Lat Pos'n	59		75	DME 2 Distance	91	Engine 2 Fuel Flow	107	Cyclic Lat Pos'n	123	
	12		28	Engine 1 EGT	44	Tail Rotor Pedal	60		76		92	Engine 2 EGT	108	Tail Rotor Pedal	124	
	13		29	Engine 1 Ind Vib	45	Stabilator Position	61		77		93	Engine 2 Ind Vib	109	Stabilator Position	125	
	14	Discretes 1	30	Discretes2	46	Discretes 3	62	Discretes 4	78	Discretes 5	94	Discretes 6	110	Discretes 7	126	Discretes 8
	15	Discretes 9	31	Discretes 10	47	Discretes 11	63	Discretes 12	79	Discretes 13	95	Discretes 14	111	Discretes 15	127	Discretes 16
	16	Baroset Pilot	32	Altitude Select	48	Speed Select	64	Heading Select	80	Baroset Co Pilot	96	Course Select	112	DH Select	128	

All sub-frames per word allocated to same parameter unless different parameter shown for individual sub-frames.SF: Sub-FrameWD: Word

EUROCAE MOPS ED-55 TABLE A1.9 - SAMPLE DATA FRAME STRUCTURE FOR HELICOPTERS BASED ON WORD RATE OF 128 PER SECOND

Standard	Equivalent Pressure Mercury		Tolerance, Feet Plus or Minus	
Altitude				
(Feet)	MM	IN. HG	Room Temperature	Low Temperature
-1,000	787.9	31.02	100	150
-500	773.8	30.47	100	-----
0	760.0	29.92	100	150
500	746.4	29.39	100	-----
1,000	732.9	28.86	100	-----
1,500	719.7	28.33	100	-----
2,000	706.6	27.82	100	-----
3,000	681.1	26.81	125	-----
4,000	656.3	25.84	150	210
6,000	609.0	23.98	150	250
8,000	564.4	22.22	150	-----
10,000	522.6	20.58	150	-----
12,000	483.3	19.03	180	350
14,000	446.4	17.57	210	-----
16,000	411.8	16.21	240	-----
18,000	379.4	14.94	270	450
20,000	349.1	13.75	300	-----
22,000	320.8	12.63	335	-----
25,000	281.9	11.10	375	560
30,000	225.6	8.88	450	600
35,000	178.7	7.04	525	730
40,000	140.7	5.54	600	800
50,000	87.3	3.44	700	-----

Extract From FAA TSO C51a

Appendix 2

Reference Documents

a) UK Air Navigation Order 1989.

b) CAA Specification No. 11, Issue 3, August 1983: Cockpit Voice Recorder Systems.

c) EUROCAE Document ED-56, 1998: Minimum Operational Performance Requirement for Cockpit Voice Recorder Systems.

d) EUROCAE Document ED-55, May 1990: Minimum Operational Performance Specification for Flight Data Recorder System.

e) CAA Specification No. 12, Issue 1, May 1974: Underwater Locating Devices.

f) CAA Specification No. 16, Issue 1, November 1985: Automatically Deployable Emergency Locator Transmitters for Helicopters

g) CAA Specification No. 10, Issue 1, May 1974: Flight Data Recorder Systems.

h) British Civil Airworthiness Requirements, Section A, Issue 1 (CAP 553), Chapter A4-8, Design Approval of Aircraft Components, Equipment and Accessories.

i) British Civil Airworthiness Requirements, Section B, Issue 1 (CAP 554), Chapter B4-8, Design Approval of Aircraft Components, Equipment and Accessories.

j) ICAO Annex 6, Part III: International Operations - Helicopters.

k) FAA Docket No. 25530, July 11, 1988: Cockpit Voice Recorders and Flight Recorders; Final Rule.

l) FAA Technical Standard Order, TSO C51a: Aircraft Flight Recorder.

NOTE 1: ICAO and CAA documents are obtainable from the Civil Aviation Authority, Printing and Publication Services, Greville House, 37 Gratton Road, Cheltenham, GL50 2BN, England.

NOTE 2: EUROCAE documents are obtainable from EUROCAE, 11 Rue Hamelin, 75783 Paris Cedex 16, France.

NOTE 3: FAA documents are obtainable from FAA Office of Airworthiness, Aircraft Engineering Division, (AIR-100), 800 Independence Avenue, S.W., Washington DC, 20591 USA.