

**OUTLINE REQUIREMENTS FOR AN AVIONICS  
BAY ENVIRONMENT DATA LOGGER**

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## **OUTLINE REQUIREMENTS FOR AN AVIONICS BAY ENVIRONMENT DATA LOGGER**

### **0 EXECUTIVE SUMMARY**

This document outlines the basic requirements for a data logging system that could be used to investigate key parameters of the real environment experienced by avionic equipment.

The background is that the operating environment specified for airborne electronic equipment is a major driver in both the technical design solution and in the final cost.

It is important not to mandate unrealistically high levels for environmental parameters, but to take a more pragmatic approach of using field data. Unfortunately there does not appear to be a great deal of such data available.

Therefore as some current air systems will be in-service for 30-40 years and their avionic systems subject to a number of upgrades addressing obsolescence and added capability, it would be cost effective if the real environment was correctly specified, when addressing these upgrades

<b>Table of contents</b>	<b>Page no.</b>	
<b>0</b>	<b>Executive summary</b>	<b>1</b>
<b>1</b>	<b>Introduction</b>	<b>3</b>
<b>2</b>	<b>Scope</b>	<b>3</b>
<b>3</b>	<b>Environmental parameters to be investigated</b>	<b>3</b>
<b>4</b>	<b>Aims</b>	<b>4</b>
<b>5</b>	<b>Data logger system requirements</b>	<b>4</b>
5.1	Physical	4
5.2	Performance	4
5.2.1	Vibration	4
5.2.2	Temperature	5
5.2.3	Pressure	5
5.2.4	Humidity	5
5.2.5	Acceleration	5
5.3	Environment	5
5.4	Reliability and Maintainability	5

## **1 INTRODUCTION**

The operating environment for airborne electronic equipment is a major driver in both the technical design solution and in the final cost. Designing to meet the incorrectly specified environment can lead to either under or over design resulting in failures in service or unnecessarily heavy and costly Line Replaceable Items (LRIs).

Earlier environmental specifications tended to mandate unrealistically high levels that had been enveloped/evolved from a range of requirements. Later specifications take the a more pragmatic approach of encouraging the use of field data. However nearly all currently in service air platforms used the earlier approach when addressing environmental specifications.

Therefore, as some of these platforms will be in service for 30-40 years and their electronic systems subject to a number of upgrades, either to address obsolescence or add capability, it would be cost effective if the real environment was correctly specified when addressing these upgrades. Unfortunately there does not appear to be a great deal of such data available, which suggests that measurements may be timely.

To investigate the real environment a data logging system is required, and this document outlines the requirements for such a system.

## **2 SCOPE**

This document outlines the requirements of a simple data logger and, where relevant, its associated sensors in terms of:

- Environmental parameters to be investigated
- Aims of the logger and sensors
- Physical requirements of the logger and sensors
- Performance requirements
- Environmental requirements
- Reliability and maintainability.

The data logger is intended for use in military fast jets and helicopters, since avionics in commercial/transport aircraft are considered to be well defined.

## **3 ENVIRONMENTAL PARAMETERS TO BE INVESTIGATED**

The following five parameters have most impact on the design, cost and performance of avionic systems, and it is intended that the data logger and its sensors should be able to record these:

Vibration, which has great implications for the physical integrity of components, line replaceable units and their connectors

Temperatures, both high and low, which have numerous potential effects on electronic components and materials

Pressure, which can cause leaks and arcing

Humidity, which can cause physical and chemical deterioration of materials

Acceleration, for its effects on integrity of construction

#### **4 AIMS**

The aim is for the data logging system to be self-contained, including most, if not all sensors, so that the only connection to the trials aircraft may be for a possible external source of power, if required. It should be designed to be small, lightweight, easily attached and removed, and capable of being sited where crew and vehicle safety cannot be compromised. It will be used mainly to record data according to predetermined thresholds. It is not intended to record any flight data.

### **5 DATA LOGGER SYSTEM REQUIREMENTS**

#### **5.1 Physical**

It is not intended to define any particular dimensions, but the logging system should be small enough to fit into available areas in fast jets and helicopters in squadron service, either in avionics bays or elsewhere. The data storage medium should be carried internally; data may be downloaded either via connectors to the logger and by removal of the storage medium for later analysis. Such removal should be quick and easy. A removable internal power supply should be incorporated. Its removal should be quick and easy and it should be capable of being recharged using a commercial charger.

#### **5.2 Performance**

The data logging system should be capable of recording any parameter that meet a threshold and continue to record it until it falls below the threshold. The means of setting thresholds should be self-contained and be able to be pre-set. Means of calibration should be self-contained.

The logging system should be capable of recording all parameters continuously for 5 hours, and any two parameters for 20 hours. Pressure and acceleration should be recorded continuously. The data recorded should include a clock signal set at UTC.

The data recorded on the storage medium should be capable of interpretation on a commercial PC.

#### 5.2.1 Vibration

3 axes, 2kHz bandwidth.

Measurement of vibration at, say 15,000 samples/s is by far the most onerous in terms of data storage required for the logger, and it would be an advantage if the recorder provided digital signal processing capability to reduce the data and provide quick answers in place of large quantities of raw data. This could provide peak level, its frequency and duration, and minimum level, its frequency and duration.

#### 5.2.2 Temperature

-60 to +100°C

10 samples/s

#### 5.2.3 Pressure

Air pressure for altitude between ground and 20,000m. 10 hPa to 1080hPa.

10 samples/s

#### 5.2.4 Humidity

Ideally to 99% RH, and condensation would be very useful. This parameter is of particular importance, and care needs to be taken over selection of sensors, since they are notoriously unreliable and take time to recover from condensation.

10 samples/s

#### 5.2.5 Acceleration

3 axes, range +/-200g

100 samples/s

### **5.3 Environment**

The data logging system will be required to operate and function correctly in any orientation during its service life in squadron aircraft. In order to do this it will need to meet the applicable environmental conditions laid out in ASSC/210/2/57.

### **5.4 Reliability and Maintainability**

The principal objective is to provide high availability of the data logger equipment & to ensure a high probability of it to complete its mission.

This requires the, Mean Time Between Failures (MTBF) to be maximised, Mean Time To Repair (MTTR), Maintenance At Vehicle (MAV) & Maintenance Off Vehicle (MOV) to be minimised. All requirements should ideally comply with DEF STAN 00-40.

The supplier should provide quantified predictions of the MTBF, MTTR, MAV & MOV activities required & the through life costs associated with the particular design.

The service life shall be 15 years.

The shelf life shall be 5 years. The design will include suitable packaging.

Where possible Components Off The Shelf (COTS) shall be used in the construction of the equipment to achieve lowest cost of ownership.