



AEROSPACE STANDARD

AS5395™

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Health and Usage Monitoring System Data Interchange Specification

RATIONALE

An open system architecture is a requirement for more affordable, capable vehicle Health and Usage Monitoring System (HUMS). Open systems architecture will provide the operators with the capability to more rapidly field new health and usage monitoring technologies in the field. This document provides a standard definition for the health and usage data that is interchanged between on-board and off-board system. The definition of standard HUMS data items would benefit developers, suppliers, integrators, and maintainers. Standard data items, which represent "fine-grained" HUMS information, would be defined by functional characteristics such as Name, Description, Range, Resolution, and Units. These standard items could provide a foundation for the development and realization of data exchange within a HUMS Open System Architecture.

FOREWORD

At the first RITA HUMS Conference held in Philadelphia, PA in October of 1997, it was agreed that the definition of standard HUMS data items would benefit developers, suppliers, integrators, and maintainers. Standard data items, which represent "fine-grained" HUMS information, would be defined by functional characteristics such as Name, Description, Range, Resolution, and Units. These standard items could provide a foundation for the development and realization of data exchange within a HUMS Open System Architecture.

At present DIS is prioritized with PC-card implementation being first and RITA HUMS Advanced Multipoint Interface Specification (RHAMIS) being next. The Release 6.0 of DIS shall include RHAMIS implementation.

DIS Release 5.1 addresses PC-card implementation. Note that there are RITA HUMS names listed in Section 3 of this document, which might not be used in PC-card implementation. However, it was agreed upon for Draft Release 2.0 to standardize HUMS parameter names and discrete names. Presently unused RITA names shall remain part of the Specification for use with the following RHAMIS implementation. There is a pending SAE number – AS5395, for Data Interchange Specification

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RITA HUMS – DIS MILESTONES

This revision of DIS - Release 5.1 results from meetings held between 1997 and 2002 between RITA principles and vendors.

Below are milestones, which led to DIS Release 5.1

- | | |
|---|-----------------------|
| • Version 1.0 released internal to RITA | March 31, 1997 |
| • Framework released to industry for comments | September 15, 1997 |
| • Industry Conference in Philadelphia | October 29-30, 1997 |
| • Draft Version 1.5 released to industry | November 26, 1997 |
| • Draft Version 2.0 released to industry | February 13, 1998 |
| • Industry conference in Philadelphia | March 11-12, 1998 |
| • BF Goodrich DIS submittal | May 19, 1999 |
| • Smiths Industries DIS submittal | August 30, 1999 |
| • Industry conference in Philadelphia | September 22-23, 1999 |
| • DIS meeting in Las Vegas | January 25, 2000 |
| • DIS meeting in Virginia Beach | May 1, 2000 |
| • Version 3.0 released internal to RITA | May 2000 |
| • Draft Version 4.0 released for comments | August 28, 2000 |
| • Industry conference at Sikorsky | October 23-24, 2000 |
| • Letter of Commitment to Smiths Industries and BF Goodrich | October 2000 |
| • DIS Meeting in Washington DC | May 2001 |
| • DIS Meeting in Arlington, Texas | February 2002 |
| • DIS Meeting in Montreal, Canada | June 2002 |

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INTRODUCTION

Health and Usage Monitoring Systems (HUMS) are becoming more important within the rotorcraft industry. These systems typically include data acquisition, analysis, and information processing to give an indication of the integrity of aircraft components and subsystems. Information gathered in flight is collected and stored for transfer to a ground station for analysis, report generation, and maintenance action indication. The addition of HUMS to rotorcraft can provide benefits such as increased safety, more efficient maintenance, increased rotorcraft lifetime, and reduced cost over the life of the rotorcraft.

Although HUMS provide many positive advantages, existing systems are proprietary solutions (“closed” systems) lacking component interchangeability and interoperability. “Open” systems have been identified as a means to reduce cost and increase capabilities of rotorcraft HUMS by the United States government, rotorcraft manufacturers, and HUMS suppliers. As a result, the Rotorcraft Industry Technology Association (RITA) has proposed open system architecture as a solution to the problem. One aspect of the complete open system architecture is data interchange. This document will provide the requirements for HUMS data interchange within open system architecture.

It is not the intent of this document to specify a HUMS architecture which implements all requirements presented in this document. Instead, the intent is to provide a standard for desired HUMS components, which may be a part of any HUMS architecture. This will provide a consistent, common approach for integration of HUMS components into an architecture, which facilitates interchangeability and interoperability.

One concern is the partitioning of functionality within HUMS. It is possible that one supplier may completely implement a function in the airborne system while another supplier may split the implementation between the airborne system and ground station. This document is designed to accommodate HUMS architectures regardless of the segmentation of functions within a given implementation.

1. SCOPE:

This document establishes the Rotorcraft Industry Technology Association (RITA) Health and Usage Monitoring System Data Interchange Specification. The RITA HUMS Data Interchange Specification will provide information exchange within a rotorcraft HUMS and between a rotorcraft HUMS and external entities.

1.1 Classification:

The RITA HUMS Data Interchange Specification will be used for exchange of information between the following entities.

- a. Between HUMS ground stations and external systems
- b. Between airborne HUMS processors and HUMS ground stations
- c. Between airborne HUMS processors and external airborne systems

The RITA HUMS interfaces covered by this document are shown in Figure 1 and are indicated by thick, bold arrows.

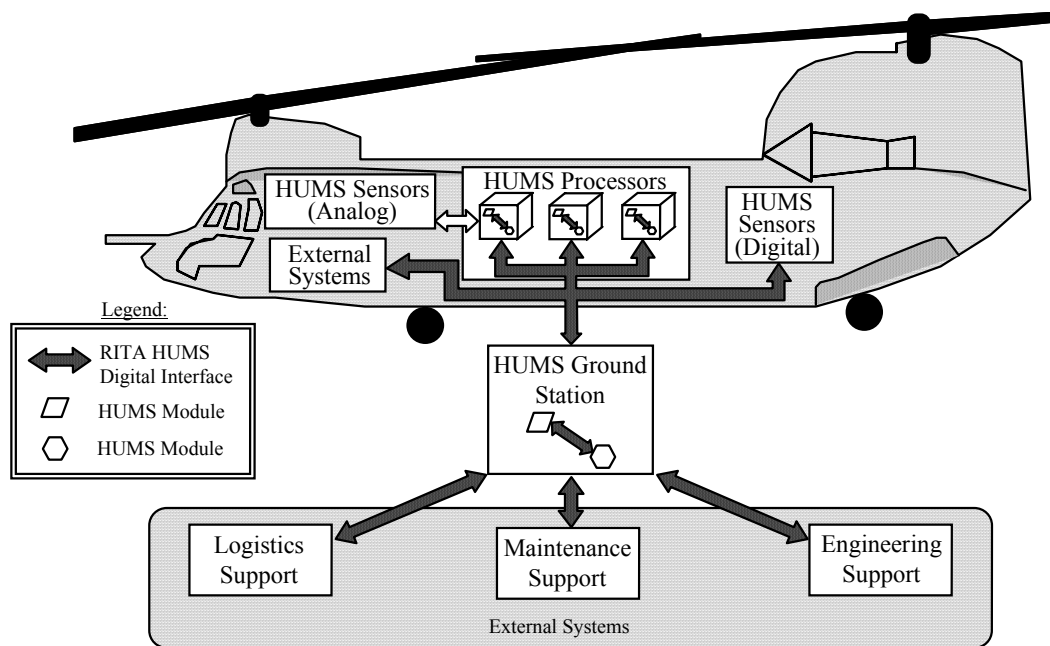


FIGURE 1 - RITA HUMS Interfaces

1.2 Intended Audience:

This document is intended for rotorcraft manufacturers, system integrators, system developers, operators, and HUMS suppliers.

1.3 Document Ownership:

The Rotorcraft Industry Technology Association shall maintain this document.

1.4 Relationship to Other RITA Documents:

Five other documents are also part of the RITA HUMS specification suite. These documents are:

- a. RITA HUMS Accelerometer Interface Specification (AS5391 pending)
- b. RITA HUMS Blade Tracker Interface Specification (AS5392 pending)
- c. RITA HUMS Rotational System Indexing Sensor Interface Specification (AS5393 pending)
- d. RITA HUMS Advanced Multipoint Interface Specification (AS5394)
- e. RITA HUMS Digital Sensors and Airborne HUMS Processors

The Accelerometer and Rotational System Indexing Sensor specifications pertain to the Analog Sensor interface also shown in Figure 1, indicated by the thick, white arrows. The Advanced Multipoint and Blade Tracker specifications fall under the digital interface category. These specifications were agreed to by industry consensus and are evolving as new sensors are developed to these specifications.

1.5 Document Organization:

This document is divided into the following key sections:

- a. Introduction
- b. Applicable Documents
- c. Functional Requirements
- d. Implementation
- e. Appendices

The functional requirements section presents the general concepts required to achieve HUMS data interchange. A model that consists of a transport medium, a transport protocol, and data representation is introduced and used as the foundation for HUMS data interchange.

The implementation section maps the functional requirements to specific transport mediums, protocols, and data representations.

1.5 (Continued):

The object model appendix provides a method to organize or provide a structure to the process of listing individual HUMS parameters. The object model provided is a draft and represents one approach to defining a HUM system. One goal of this specification is to arrive at a HUMS industry consensus on the form of an object model for HUMS.

The candidate open interface system module appendix provides definitions of objects within the model. It describes their functions and inputs and outputs. The details of the inputs and outputs to these objects ensure that the signals and parameters detailed in the functional specification are comprehensive.

1.6 RITA Compliance:

Following are requirements and guidelines for RITA airborne open architecture compliant systems. To be RITA Compliant, the design must meet the requirements. RITA recommends that the designs also adhere to the guidelines.

1.6.1 Airborne Unit Design Requirements: A RITA compliant HUMS airborne unit shall:

- a. Include an ARINC 429 Bus interface that makes all internally used aircraft flight parameters and discretes available externally to allow for growth,
- b. Include a RHAMIS compliant bus interface (RS-485) that makes all HUMS data, being stored for download, available externally to allow for growth applications, and
- c. Comply with RITA HUMS Data Interchange Specification.

1.6.2 Airborne Unit Design Guidelines: RITA recommends that a RITA compliant HUMS airborne unit should include the following:

- a. The provisions for two spare internal cards slots to allow for growth,
- b. Availability of the ARINC 429 and RHAMIS interfaces both externally and to all internal card slots.

1.6.3 RITA Open System Architecture: The proposed RITA Open System Architecture is shown in Figure 2.

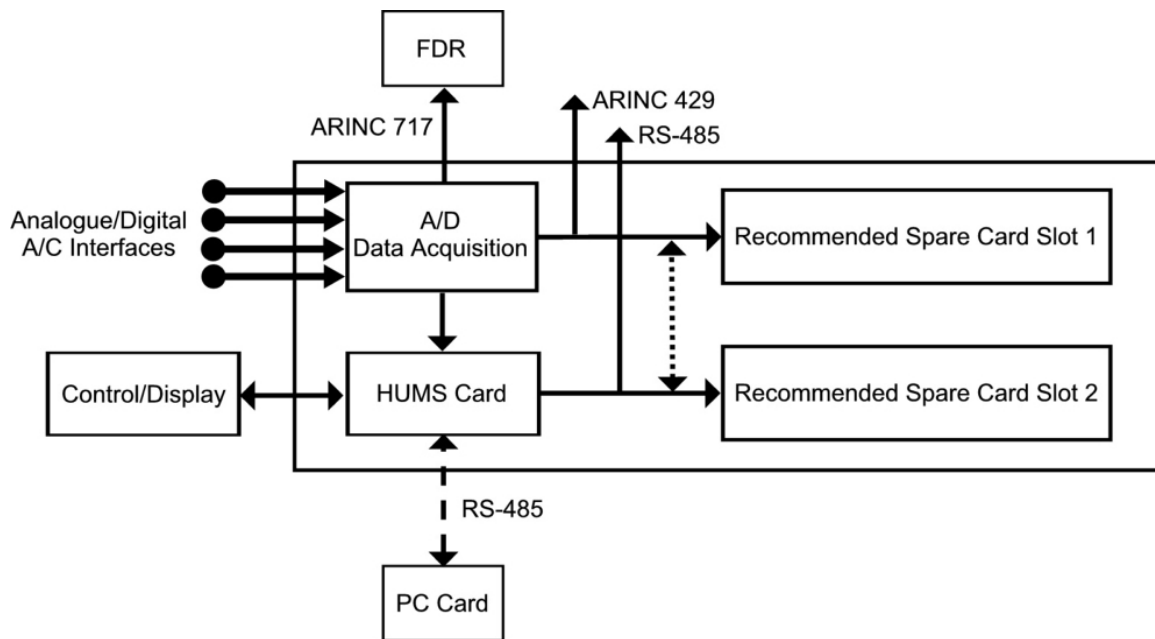


FIGURE 2 - RITA Open System Architecture

2. APPLICABLE DOCUMENTS:

2.1 General:

The documents listed in this section are referenced in Sections 3 through 6 of this document.

2.2 Government Documents:

2.2.1 Specifications, Standards, and Handbooks: The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the Department of Defense Index of Specifications and Standards (DoDISS).

STANDARDS

a. FEDERAL Federal Aviation Regulations

b. DEPARTMENT OF DEFENSE

(1) MIL-STD-961 Department of Defense Standard Practice
for Defense Specifications

(2) MIL-STD-1553 Aircraft Internal Time Division
Command/Response Multiplex Data Bus

2.2.2 Other Government Documents, Drawings, and Publications: The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited.

Army Technical Architecture

Joint Technical Architecture

SD-15 Performance Specification Guide

2.3 Non-Government Publications:

The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents, which are DoD adopted are those listed in the issue of the DoDISS. Unless otherwise specified, the issues of the documents not listed in the DoDISS are the issues of the documents as cited.

a. Aeronautical Radio, Inc.

- | | | |
|-----|-------------|--|
| (1) | ARINC 429P1 | Mark 33 Digital Information Transfer System (DITS)
Part 1 Functional Description, Electrical Interface,
Label Assignments and Word Formats |
| (2) | ARINC 429P2 | Mark 33 Digital Information Transfer System (DITS)
Part 2 Discrete Word Data Standards |
| (3) | ARINC 429P3 | Mark 33 Digital Information Transfer System (DITS)
Part 3 File Data Transfer Techniques |
| (4) | ARINC 573-7 | Mark 2 Aircraft Integrated Data System (AIDS Mark 2) |
| (5) | ARINC 717-9 | Flight Data Acquisition and Recording System |

b. Charles Stark Draper Laboratories, Inc., The

- | | | |
|-----|--------|---|
| (1) | R-2781 | Technology Assessment and Architectural Alternatives
for Integrated Mechanical Diagnostics |
|-----|--------|---|

c. Electronics Industry Association

- | | | |
|-----|---------|---|
| (1) | EIA-485 | Standard for Electrical Characteristic of Generators
and Receivers for Use in Balanced Digital Multipoint
Systems |
|-----|---------|---|

d. European Organization for Civil Aviation Electronics

- | | | |
|-----|-------|---|
| (1) | ED-55 | Minimum Operational Performance Specification for
Flight Data Recorder Systems |
|-----|-------|---|

e. Object Management Group

The Common Object Request Broker: Architecture and
Specification

2.3 (Continued):

f. Rotorcraft Industry Technology Association

- | | | |
|-----|-------------------|--|
| (1) | RITA-HUMS-1.1.1-1 | Health and Usage Monitoring System Accelerometer Interface Specification |
| (2) | RITA-HUMS-1.1.1-2 | Health and Usage Monitoring System Indexing Sensor Interface Specification |
| (3) | RITA-HUMS-1.1.1-3 | Health and Usage Monitoring System Blade Tracker Interface Specification |
| (4) | RITA-HUMS-1.1.1-4 | Health and Usage Monitoring System Advanced Multipoint Interface Specification |
| (5) | PCMCIA/JEIDA | PC Card Standard, Release 8.0 |

2.4 Order of Precedence:

In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. FUNCTIONAL REQUIREMENTS:

3.1 Overview:

Data interchange as it pertains to rotorcraft HUMS presents a number of challenges. How is the information transported between entities? Can the entities communicate with one another? Can the entities understand and interpret the information exchanged?

One solution to these challenges includes the following:

- a. a medium for the transport of the information
- b. a protocol for communication over the medium
- c. a standard representation of the information

This section presents the functional (or logical) requirements for the items presented above.

3.2 Data Interchange File:

The model for data interchange consists of a generic transport medium and two or more entities between which information is exchanged. An entity can be a system external to a HUMS or a component within a HUMS. The model is shown in Figure 3.

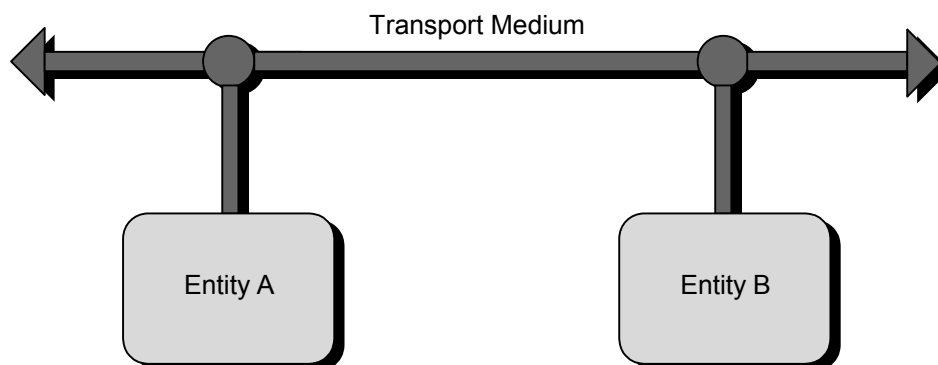


FIGURE 3 - HUMS Data Interchange Model

- 3.2.1 HUMS to External Systems: Figure 4 illustrates how the data interchange model represents the interaction between HUMS and external systems. "External" encompasses ground-based systems, airborne systems, and any hybrid combinations of ground and airborne systems, which do not exist solely for the purpose of HUMS. Examples of external systems include ground-based logistics computers, airborne avionics computers, and aircraft mission management systems.

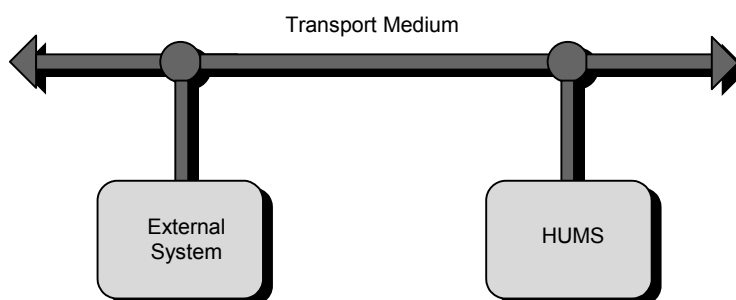


FIGURE 4 - HUMS to External System

- 3.2.2 HUMS Internal Systems: A HUMS can be comprised of any number of HUMS components and transport mediums. Figure 5 illustrates multiple components and multiple transport mediums within a given HUMS. A HUMS module can be created from a logical group of components packaged to provide a specific function.

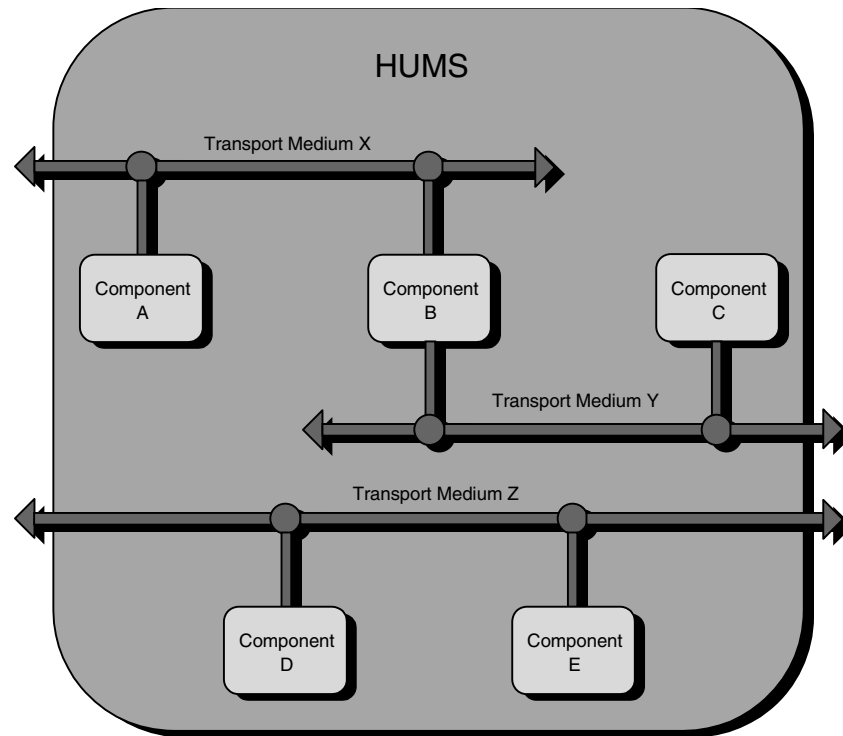


FIGURE 5 - HUMS Components

3.3 Transport Medium:

The information shall be conveyed from one entity to another across a transport medium. The transport medium will be specific to the implementation and therefore defined in Section 20. Examples of transport mediums include wires, fiber optic cable, memory, persistent storage, and the atmosphere.

- 3.3.1 Electrical Characteristics: The electrical characteristics shall be in accordance with the specific implementation as defined in Section 20.
- 3.3.2 Mechanical Characteristics: The mechanical characteristics shall be in accordance with the specific implementation as defined in Section 20.

3.4 Information Representation

The information shall be represented in a standard format during the exchange of information. The standard representation of information shall be data items, data structures, data records, and data files. This will not imply the data be stored in a standard representation, but instead, that the standard representation will be used for exchange of information. The relationship between these data constructs is illustrated in Figure 6. Data items may or may not be a member of a data structure.

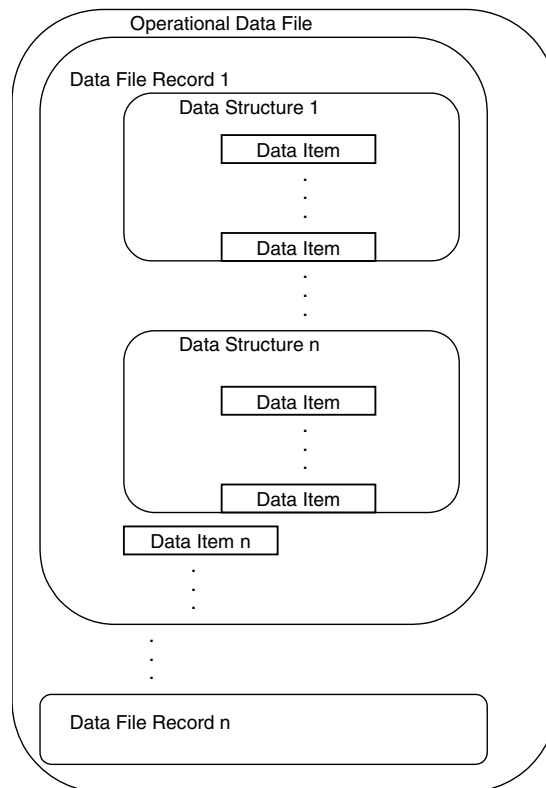


FIGURE 6 - RITA HUMS Information Representation

- 3.4.1 RITA HUMS Operational Data Files: Operational data files contain data records, data structures, and data items. Each operational data file can be downloaded or uploaded (e.g., INIT.DIS) as discussed in Section 4, herein. Currently, there are six (6) downloadable data files. Operational data files shall have the following characteristics:
- File shall be made up of sequential, variable length records.
 - Each file shall reside in the root directory with the exemption of the Index and Initialization files, which are optional.
 - If the file already exists, then system shall add data to it. If the file does not exist, the on-aircraft system shall create a new file and then shall start adding data.
 - The airborne system will use RITA labels to know where to write various records. Low-level will be DOS FAT 12 or higher – card must be formatted (where is optional).

The operational data files are shown in Table 1.

TABLE 1 - Operational Data Files

FILE	DESCRIPTION	AIRBORNE	GROUND
LOGBOOK.DIS	Alert File (Exceedance and Caution)	Write/extend	Read
RTB.DIS	RTB File	Write/extend	Read
FLIGHT.DIS	Flight Data File	Write/extend	Read
HUMSData.DIS	HUMS Data File	Write/extend	Read
INIT.DIS	Initialization File	Read	Write
INDEX.DIS	Index File	Write	Read

There is a detailed listing of the data structure and/or data items that belongs to each record associated to a data file. This information is presented in 3.4.2.

- 3.4.1.1 Logbook Data File: This file shall contain the following records:
- Exceedance
 - Vibration-related alerts
 - Aircraft Equipment Failure
 - Usage Aircraft Equipment (aircraft, engine, APU)
 - Power Assurance

3.4.1.1 (Continued):

The duration for Exceedance and Vibration Alerts are expected to be much shorter than other duration (e.g.; Rotor, APU) therefore there shall be only one start/stop record for exceedance and one start/stop record for vibration alert. For other duration in the logbook file, there shall be two records for start/stop.

3.4.1.2 RTB Data File: This file shall contain the record RTBCIXXX which is the RTB condition indicator records. This record incorporates several data items some of which are associated to data structures. The definition of the record is found in 3.4.2.2. The RTB Data file is used to download all RTB HUMS data.

3.4.1.3 Flight Data File: There is a single flight data record, FLIGHTDR, within this file. The FLIGHTDR record definition is found in 3.4.2.3.

3.4.1.4 HUMS Data File: This is the vibration measurement data and logging file. This file shall contain the balance of the HUMS data (other than alert and usage data) such as vibration measurement initiation/completion logging and data logging. There are two types of records associated to this file. HUMSXXXX record contains public data, while PHUMSXXXX record contains private data which is unique to the operator/system. The definition of the records is found in 3.4.2.4.

3.4.1.5 Index Data File: This file is optional and may be used by the on-aircraft HUMS to keep track of where EOF records are in each file. The index file enables the on-aircraft system to quickly identify where in the file to begin writing new records. This feature is intended to make the process of finding the EOF more efficient. There is a single record, INITXXXX, associated with this file. The definition of the record is found in 3.4.2.5.

3.4.1.6 Initialization Data File: This file is optional and can be used to upload parameters to the on board system such as gross weight or number of passengers. There is a single record, INDXFILE, associated to this file as defined in 3.4.2.6.

3.4.2 RITA HUMS Data Records: All data records belong to an Operational File as illustrated in Table 2. The data record naming convention is as follows:

The RHUMSDSN represents ASCII character string for a particular data record. The data record and their corresponding record names are listed in Table 2. All HUMS Data Record Names shall be no more or less than eight (8) characters in length. RHUMSDSN names shall be padded (XXXX) to ensure the eight character representation. Multiple records shall use be represented by X to XXXX and shall be right justified starting at 1. For example, VIBA0001 represents the first record of a Vibration Alert.

TABLE 2 - RITA HUMS Data Record Names (RHUMSDSN)

RHUMSDSN	EXTENDED NAME	DESCRIPTION	DATA FILE
APUSTPXX	APU Stop	---	LOGBOOK.DIS
APUSTRXX	APU Start	---	LOGBOOK.DIS
ELSTPXXX	External Load Cycle Stop	---	LOGBOOK.DIS
ELSTRXXX	External Load Cycle Start	---	LOGBOOK.DIS
ENGSTPXX	Engine Stop	XX refers to engine number	LOGBOOK.DIS
ENGSTRXX	Engine Start	XX refers to engine number	LOGBOOK.DIS
EVNTXXXX	Event	---	LOGBOOK.DIS
EXCDXXXX	Exceedance	---	LOGBOOK.DIS
FLIGHTDR	Flight Data Record	---	FLIGHT.DIS
HEFAILYX	HUMS Equipment Failure	BIT Detected Failure	LOGBOOK.DIS
HRECSEX	HUMS Recording Session	Can be written into each file	LOGBOOK.DIS
HUMSXXXX	HUMS Data Record	---	HUMSData.DIS
INDXFILE	Index File	Optional	INDEX.DIS
INITFILE	Initialization File	Optional	INIT.DIS
LDTIMXXX	Landing Time	---	LOGBOOK.DIS
PHUMSXXX	Proprietary HUMS Data Record	---	HUMSData.DIS
POWASRXX	Power Assurance	---	LOGBOOK.DIS
PROPXXXX	Proprietary Data Record	---	LOGBOOK.DIS
RBKSTPXX	Rotor Brake Stop	XX refers to rotor number	LOGBOOK.DIS
RBKSTRXX	Rotor Brake Start	XX refers to rotor number	LOGBOOK.DIS
RTBCIXXX	RTB Condition Indicator Record	---	RTB.DIS
RTSTPXXX	Rotor Stop	XX refers to rotor number	LOGBOOK.DIS
RTSTRXXX	Rotor Start	XX refers to rotor number	LOGBOOK.DIS
SEFSTPXX	Single Engine Flight Stop	XX refers to engine number	LOGBOOK.DIS
SEFSTRXX	Single Engine Flight Start	XX refers to engine number	LOGBOOK.DIS
TOTIMXXX	Takeoff Time	---	LOGBOOK.DIS
VIBAXXXX	Vibration Alert	---	LOGBOOK.DIS

3.4.2.1 Logbook Data Records:

3.4.2.1.1 Exceedance – EXCDXXXX:

TABLE 3 - Exceedance Data Record

RITA HUMS DATA ITEM / STRUCTURE NAME	DESCRIPTION
SESNO	Session number
SYSTM	System time of exceedance for (a) start or (b) stop depending on Completion Indicator
MCAGEC	Aircraft Manufacture Cage Code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) (a) start or (b) stop
COMPIND	Completion Indicator – indicates (a) if the values in the fields Max/Min and Duration are valid and also (b) start or stop
MXMNVE	Max (or Min) Value of parameter that triggered the exceedance condition
DURAVIBE	Duration of Exceedance
TXTEXCD	Optional text string (40 bytes) – if not used or unknown, fill with space characters
NARRAYEL	Number or array elements
ARRAYDAT	Array of elements
CRC32	Results of CRC-32 algorithm

TABLE 4 - Exceedance Parameters

RITA HUMS DATA ITEM STRUCTURE NAME	FIELD – DESCRIPTION
XXXXXXXXX	8-Character RITA HUMS name
PARVALUE	Parameter value
INTFCD	Data validity code

3.4.2.1.2 Vibration Alert – VIBAXXX:

TABLE 5 - Vibration Alert Data Record

RITA HUMS DATA ITEM / STRUCTURE NAME	DESCRIPTION
SESNO	Session number
SYSTIM	System time of vibration for (a) start or (b) stop depending on Completion Indicator
MCAGEC	Aircraft Manufacture Cage Code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) (a) start or (b) stop
COMPIND	Completion Indicator – indicates (a) if the values in the fields Max/Min and Duration are valid and also (b) start or stop
MXVAL	Max value of parameter that triggered the vibration alert condition
DURAVIBE	Duration of vibration alert
TXTVIBA	Optional text string (40 bytes) – if not used or unknown, fill with space characters
NARRAYEL	Number or array elements
ARRAYDAT	Array of vibration alert related parameters (see Table 6)
CRC32	Results of CRC-32 algorithm

TABLE 6 - Vibration Alert Parameters

RITA HUMS DATA ITEM STRUCTURE NAME	FIELD – DESCRIPTION
XXXXXXXX	8-Character RITA HUMS name
PARVALUE	Parameter value
INTFCD	Data validity code

3.4.2.1.3 HUMS Equipment Failure – HELAILYX: HELFAILYX Record is a BIT detect failure, where Y = S (Startup BIT), I (Initiated BIT), P (Periodic BIT).

TABLE 7 - HUMS Equipment Failure Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTIM	System time of failure (a) start or (b) stop
MCAGEC	Aircraft Manufacture Cage Code
ACSERN	Aircraft Serial Number
ACMODL	Aircraft Model Number
UTC	Date and time of day (UTC) of failure (a) start or (b) stop
NARRAYEL	Number of array elements
HEFAILUR 1	HUMS equipment failure data structure
.	.
HEFAILUR NARRAYEL	.
CRC32	Results of CRC-32 algorithm

3.4.2.1.4 ROTOR START – RTSTRXXX: XXX refers to rotor number in the record name.

TABLE 8 - Rotor Start Data Record

RITA HUMS DATA ITEM STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTIM	System time of rotor start
MCAGEC	Aircraft Manufacture Cage Code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of rotor start
CNOSTR	Cumulative number of rotor starts – if not used or unknown set to FFFF _H – Optional
CRC32	Results of CRC-32 Algorithm

3.4.2.1.5 Rotor Stop – RTSTPXXX: XXX refers to rotor number in the record name.

TABLE 9 - Rotor Stop Data Record

RITA HUMS DATA ITEM / STRUCTURE NAME	DESCRIPTION
SESNO	Session number
SYSTM	System time of vibration for (a) start or (b) stop depending on Completion Indicator
MCAGEC	Aircraft Manufacture Cage Code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of rotor stop
ROTDURA	Duration of last rotor turning – if not used or unknown set to FFFF _H – optional
CUMDURA	Cumulative number of rotor turning time (hours) – if not used or unknown set to FFFF _H – optional
CRC32	Results of CRC-32 algorithm

3.4.2.1.6 Rotor Brake Start – RBKSTRXX: XX refers to rotor number in the record name.

TABLE 10 - Rotor Brake Start Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time of rotor brake start
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) or rotor brake start
CBKAPPS	Cumulative number of brake applications
CRC32	Results of CRC-32 algorithm

3.4.2.1.7 Rotor Brake Stop – RBKSTPXX: XX refers to rotor number in the record name.

TABLE 11 - Rotor Brake Stop Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time of rotor brake start
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of rotor brake stop
SPARE	Not used set to FFFF _H – left for record consistency
SPARE	Not used set to FFFF _H – left for record consistency
CRC32	Results of CRC-32 algorithm

3.4.2.1.8 Take Off Time – TOTIMXXX:

TABLE 12 - Take Off Time Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time of take off
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of take off
CUMTO	Cumulative numbers of take-offs
CRC32	Results of CRC-32 algorithm

3.4.2.1.9 Landing Time – LDTIMXXX:

TABLE 13 - Landing Time Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTIM	System time of landing
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of landing
FLTDURA	Duration of flight – if not known set to FFFF _H – should take precedence if provided
CFTDURA	Cumulative flight time (hours)
CRC32	Results of CRC-32 algorithm

3.4.2.1.10 External Load Start – ELSTRXXX:

TABLE 14 - External Load Start Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTIM	System time of external load
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of external load start
CELCYC	Cumulative number of external load cycles
CRC32	Results of CRC-32 algorithm

3.4.2.1.11 External Load Stop – ELSTPXXX:

TABLE 15 - External Load Stop Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time of external load stop
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of external load stop
SPARE	Not used set to FFFF _H – left for record consistency
SPARE	Not used set to FFFF _H – left for record consistency
CRC32	Results of CRC-32 algorithm

3.4.2.1.12 APU Start – APUSTRXX:

TABLE 16 - APU Start Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time of APU start
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of APU start
CAPUSTR	Cumulative numbers of APU starts
CRC32	Results of CRC-32 algorithm

3.4.2.1.13 APU Stop – APUSTPXX:

TABLE 17 - APU Stop Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTIM	System time of APU stop
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of APU stop
APUDURA	APU operating hours – in not used set to FFFF _H
CUMAPU	Cumulative APU operating hours
CRC32	Results of CRC-32 algorithm

3.4.2.1.14 Engine Start – ENGSTRXX: XX refers to engine number in the record name.

TABLE 18 - Engine Start Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTIM	System time of engine start
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of engine start
CENGSTR	Cumulative numbers of engine starts- if not used or unknown set to FFFF _H - Optional
CRC32	Results of CRC-32 algorithm

3.4.2.1.15 Engine Stop – ENGSTPXX: XX refers to engine number in the record name.

TABLE 19 - Engine Stop Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time of engine stop
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of engine stop
ENGDURA	Engine operating hours – if not known set to FFFF _H
CUMENG	Cumulative engine operating hours
CRC32	Results of CRC-32 algorithm

3.4.2.1.16 Single Engine Flight Start – SEFSTRXX: XX refers to engine number in the record name.

TABLE 20 - Single Engine Flight Start Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time of single engine flight start
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of single engine flight start
CSEFSTR	Cumulative number of single engine flight starts
CRC32	Results of CRC-32 algorithm

3.4.2.1.17 Single Engine Flight Stop – SEFSTPXX: XX refers to engine number in the record name.

TABLE 21 - Single Engine Flight Stop Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time of flight stop
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of single engine flight stop
ESFDURA	Duration of single engine flight (hours) – if not known set to FFFF _H
CSFENG	Cumulative single engine flight hours
CRC32	Results of CRC-32 algorithm

3.4.2.1.18 HUMS Recording Session – HRECSESX: This record, HUMS recording session, can be written to each data file – Logbook, RTB, Flight, and HUMSData.

TABLE 22 - HUMS Recording Session Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time of recording session start
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of recording session start
CONTIND	Continuation Indicator
NARRAYEL	Number of elements to follow
ARRAYDAT	Array of version data (see Table 23)
CRC32	Results of CRC-32 algorithm

TABLE 23 - Version Data

RITA HUMS DATA ITEM OR STRUCTURE NAME	DESCRIPTION
VERTYPE	Version Type
VERNUM	Version Number
HUMSPN	Manufacturer PN

3.4.2.1.19 Proprietary Data Record – PROPXXXX: XXXX refers to the proprietary data record number.

TABLE 24 - Proprietary Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) that event was detected
VCAGEC	Vendor cage code
DBLOCSZ	Data block size
PDBLOC	Proprietary data
CRC32	Results of CRC-32 algorithm

3.4.2.1.20 Power Assurance – POWASRXX:

TABLE 25 - Power Assurance Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time of power assurance test
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) of Power Assurance Check Test
PACTPF	PAC Test pass or fail
NARRAYEL	Number of power assurance parameters recorded
PAP 1	First power assurance parameter
PAP NARRAYEL	Last power assurance parameter
CRC32	Results of CRC-32 algorithm

3.4.2.1.21 Events – EVNTXXXX:

TABLE 26 - Event Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTIM	System time of Event for (a) start or (b) stop depending on Completion Indicator
MCAGEC	Aircraft manufacture cage code
ACSERN	Aircraft serial number
ACMODL	Aircraft model number
UTC	Date and time of day (UTC) (a) start or (b) stop
COMPIND	Completion Indicator – indicates (a) if the values in the fields Max/Min and Duration are valid and also (a) start or (b) stop
MXMNVE	Max (or Min) value of parameter that triggered the event condition
DURAVIBE	Duration of event
TXTEVNT	Optional text string (40 bytes) – if not used or unknown, fill with space characters
NARRAYEL	Number of array elements
ARRAYDAT	Array of event related parameters (See Table 27)
CRC32	Results of CRC-32 algorithm

TABLE 27 - Event Parameters

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
XXXXXXXX	8-Character RITA HUMS name
PARVALUE	Parameter value
INTFCD	Data Validity Code

3.4.2.2 Rotor Track and Balance (RT&B) Records: This file shall contain RT&B data records.

3.4.2.2.1 RTB Condition Indicator Records – RTBCIXXX:

TABLE 28 - RTB Condition Indicator Records

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time
MCAGEC	Aircraft Manufacture Cage Code
ACSERN	Aircraft Serial Number
ACMODL	Aircraft Model Number
UTC	UTC day and time of day that the RTB acquisition was detected
ACQDESID	Acquisition Description ID
FLTRGID	Flight Regime ID
NUMHAR	Number of Harmonic Array elements
NUMTRCI	Number of Track Item Array Elements
HUMBLCI	Number of Blade CI data item Array Elements
AHARCI	Array of Harmonic Data (See Table 29)
ATRCLAG	Array of Track/Lag Data (See Table 30)
AMBLCU	Array of Blade Data (See Table 31)
ALOCTXT	Text describing Accelerometers location
CRC32	Results of CRC-32 algorithm

3.4.2.2.2 RTB Harmonic Indicator Data:

TABLE 29 - RTB Harmonic Indicator Data

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
ALOCID	Accelerometer Location ID for Condition Indicator
HARMCIID	Harmonic ID – harmonic for Condition Indicator
AMPRTBH	Amplitude – RTB Harmonic Amplitude
PHRTBH	Phase – RTB Harmonic Phase

3.4.2.2.3 RTB Track Indicator Data:

TABLE 30 - RTB Track Indicator Data

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
TRALOCID	Tracker Location ID. Tracker for the condition indicator
ROTORID	Rotor ID. Rotor for the condition indicator
VALIDREV	Valid Number of Revs in the average
TOTREVS	Total number of Revs in the acquisition
LTURNOFF	Light Turned Off. Non-Zero = Tracker light turned off
TKMEAN	Mean Track Value
LLMEAN	Mean Lag Value
TSPREAD	Track Spread Value
LSPREAD	Lag Spread Value

3.4.2.2.4 RTB Blade Indicator Data:

TABLE 31 - RTB Blade Indicator Data

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
ROTORID	Rotor ID. Rotor for the condition indicator
BLADEID	Blade ID. Blade for the condition indicator
TKREL	Track Value
TKDEV	Track Standard Deviation Value
LLREL	Lead/Lag Value
LLDEV	Lead/Lag Standard Deviation

3.4.2.3 Flight Data File: This file shall contain flight data records.

3.4.2.3.1 Flight Data Record – FLIGHTDR:

TABLE 32 - Flight Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time
ACSERN	Aircraft Serial Number
ACMODL	Aircraft Model Number
UTC	UTC day and time of day
TXTFLGTD	Text field describing flight data record
NARRAYEL	Number of Flight Array Elements
ARRAYDAT	Array of Flight Data (HUMS Standard Elements) (See Table 33)
CRC32	Results of CRC-32 algorithm

3.4.2.3.2 Flight Data Parameters Value:

TABLE 33 - Flight Data Parameters' Value

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
XXXXXXXX	8-Character RITA HUMS name
PARVALUE	Parameter value
INTFCD	Data Validity Code

3.4.2.4 HUMS Data File:

3.4.2.4.1 HUMS Data Record – HUMSXXXX:

TABLE 34 HUMS Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time
MCAGEC	Aircraft Manufacture Cage Code
ACSERN	Aircraft Serial Number
ACMODL	Aircraft Model Number
UTC	UTC day and time of day
TXTHUMSD	ASCII character string describing HUMS Data Record
NARRAYEL	Number of HUMS Array Elements
ARRAYDAT	Array of HUMS Data

3.4.2.4.2 HUMS Data Parameters Value:

TABLE 35 - HUMS Data Parameter's Value

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
XXXXXXXX	8-Character RITA HUMS name
PARVALUE	Parameter value
INTFCD	Data Validity Code

3.4.2.4.3 Proprietary HUMS Data Record – PHUMSXXXX:

TABLE 36 - Proprietary HUMS Data Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time
MCAGEC	Aircraft Manufacture Cage Code
ACSERN	Aircraft Serial Number
ACMODL	Aircraft Model Number
UTC	Date and time of day (UTC) that event was detected
VCAGEC	Vendor Cage Code
DBLOCSZ	Data block size
PDBLOC	Proprietary data
CRC32	Results of CRC-32 algorithm

3.4.2.5 Index File:

3.4.2.5.1 Index Record – INDXFILE:

TABLE 37 - Index Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
SESNO	Session number
SYSTM	System time
MCAGEC	Aircraft Manufacture Cage Code
ACSERN	Aircraft Serial Number
ACMODL	Aircraft Model Number
UTC	UTC day and time of day
PNUMLB	Pass number in Logbook file =0 if not wrapping; =1 if wrapping and this is first time pass
OFFSLB	Offset into Logbook file
PNUMRTB	Pass number in RTB data file =0 if not wrapping; =1 if wrapping and this is first time pass
OFFSRTB	Offset into RTB file
PNUMFGT	Pass number in Flight data file =0 if not wrapping; =1 if wrapping and this is first time pass
OFFSFGT	Offset into Flight file
PNUMHUMS	Pass number in HUMS data file =0 if not wrapping; =1 if wrapping and this is first time pass
OFFSHUMS	Offset into HUMSData file
CRC32	Results of CRC-32 algorithm

3.4.2.6 Initialization File:

3.4.2.6.1 Initialization Record – INITFILE:

TABLE 38 - Initialization Record

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
INITFILE	RITA HUMS Data Structure Name
MCAGEC	Aircraft Manufacture Cage Code
ACSERN	Aircraft Serial Number
ACMODL	Aircraft Model Number
UTC	UTC day and time of day when initialization file was written
HUMSMPN	Manufacturer's part number
NARRAYEL	Number of HUMS Array Elements
ARRAYDAT	Array of HUMS Parameters (See Table 39)
CRC32	Results of CRC-32 algorithm

TABLE 39 - HUMS Initialization Parameters

RITA HUMS DATA ITEM OR STRUCTURE NAME	FIELD – DESCRIPTION
XXXXXXXX	8-Character RITA HUMS name
PARVALUE	Parameter value

- 3.4.3 Data Structures: A data structure shall consist of data elements grouped together to provide a logical relationship of information. Data Structures are used when a well-defined relationship between separate data elements must be maintained in the data transfer process in order to preserve the integrity of the data. An example of a Data Structure is a polar variable in which the magnitude and phase are stored together to identify a unique data point. Data packets/parameters as information elements, shall be grouped into records/data blocks. Each record/data block shall be self-contained and shall be routed into operational data files described in 3.4.1.
- 3.4.3.1 Data Structure Characteristics: The RITA HUMS data structures shall be described using the following characteristics:

a. RITA HUMS Structure Name

b. Description

c. Fields
- 3.4.3.1.1 RITA HUMS Structure Name: The RITA HUMS Structure Name shall represent a unique identifier for data structure. This identifier shall consist of at least one but no more than eight 'case insensitive' alphanumeric characters (A through Z, 0 through 9), the first of which shall be an alphabetic (A through Z) character. The identifier shall terminate with a numeric character only when indicating similar parameters for multiple components such as engines, hydraulic systems, etc. Otherwise, the identifier shall terminate with an alphanumeric character.
- 3.4.3.1.2 Description: The Description shall convey information about the unique identifier in textual form.
- 3.4.3.1.3 Data Structure Fields: Data structures shall contain one or more data elements called fields, where a field may be individual data items or other data structures.