SAE INTERNATIONAL

AS7140

COMMON OPEN DATA EXCHANGE (CODEX) FORMAT FOR ROTORCRAFT HEALTH AND USAGE MONITORING SYSTEMS (HUMS)

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Problem

HUMS Analysis Station

Multiple computers to manage the data from a mixed fleet

- Proprietary HUMS systems today
  - Limits 3rd party innovation
  - Tough to manage mixed fleets
  - Less efficient and/or capable
  - Costly

Agenda

- Previous Attempt
- Current Effort
  - Scope & Application
  - Benefits
- Common Concerns
- Way Ahead

Past Work – RITA HUMS Initiative

Timeline

- 1992 - First HUMS fielded
- 1997 - RITA HUMS initiative
- 2006 – RITA Standards published

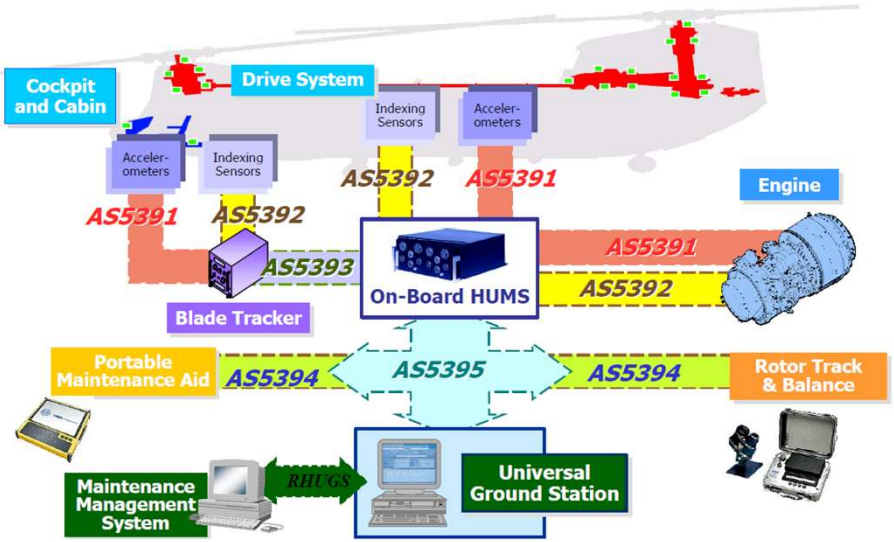
AS5395: Health and Usage Monitoring System Data Interchange Specification

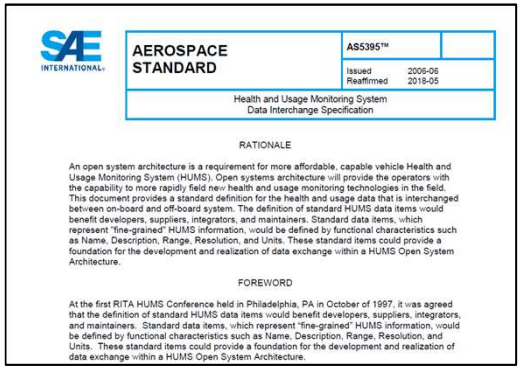
- Developed with US Rotorcraft OEM's, HUMS OEM's
- Demonstrated success, but…

Not in broad use today, likely because:

- Timing – HUMS systems already being fielded
- Rigid structure – little flexibility
- Little user requirement for standardization

RITA HUMS Interfaces





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AEROSPACE STANDARD

AS5395™

Issued 2006-06
Reaffirmed 2018-05

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.

AS7140 – Inception

Inception:

- NOV 2021 - U.S. Army Aviation and Missile Command advocated for a common HUMS rotorcraft standard
- APR 2022 - SAE took up the challenge, created HM-1R
- OCT 2022 – First meeting of HM-1R

Active Participation from:

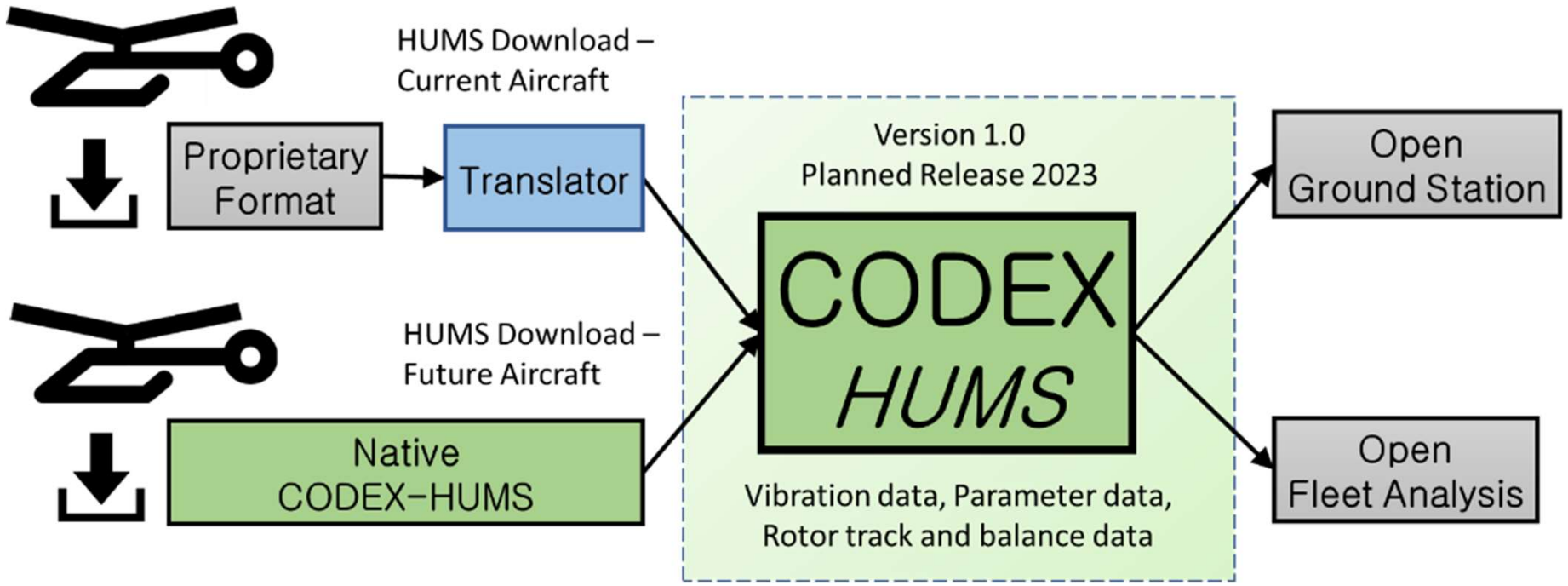
- Most major airframe and engine OEMs
- Most HUMS OEMs
- Many application vendors
- Many Users (U.S. DoD, International governments and civilian operators)

HM-1R In-Person attendees, 9 FEB 2023

AS7140 Rationale

- Provides a more affordable, effective and capable Integrated Vehicle Management System
- Benefits all users (operators, developers, suppliers, integrators and maintainers)
- Meets intent of a Modular Open System Approach

AS7140 – Scope and Application



Note: future versions may potentially accommodate other data (e.g., structural data)

AS7140 – Benefits

- Encourages Innovation
- Allows Flexible Implementation Options
- Facilitates Best Practices
- Ensures Compatibility
- Enables Enterprise Analytics
- Embodies Open Architecture Concepts

RITA AS5395 Concerns Addressed

Timing

- **Still have opportunity to influence Future Vertical Lift (FVL)**
- **Translator will facilitate compatibility with current systems**

File Structure

- **Standard will accommodate different designs and still allow for innovation**

Requirement

- **User initiated the request**
- **Users are involved in writing the standard**

Other Concerns Addressed

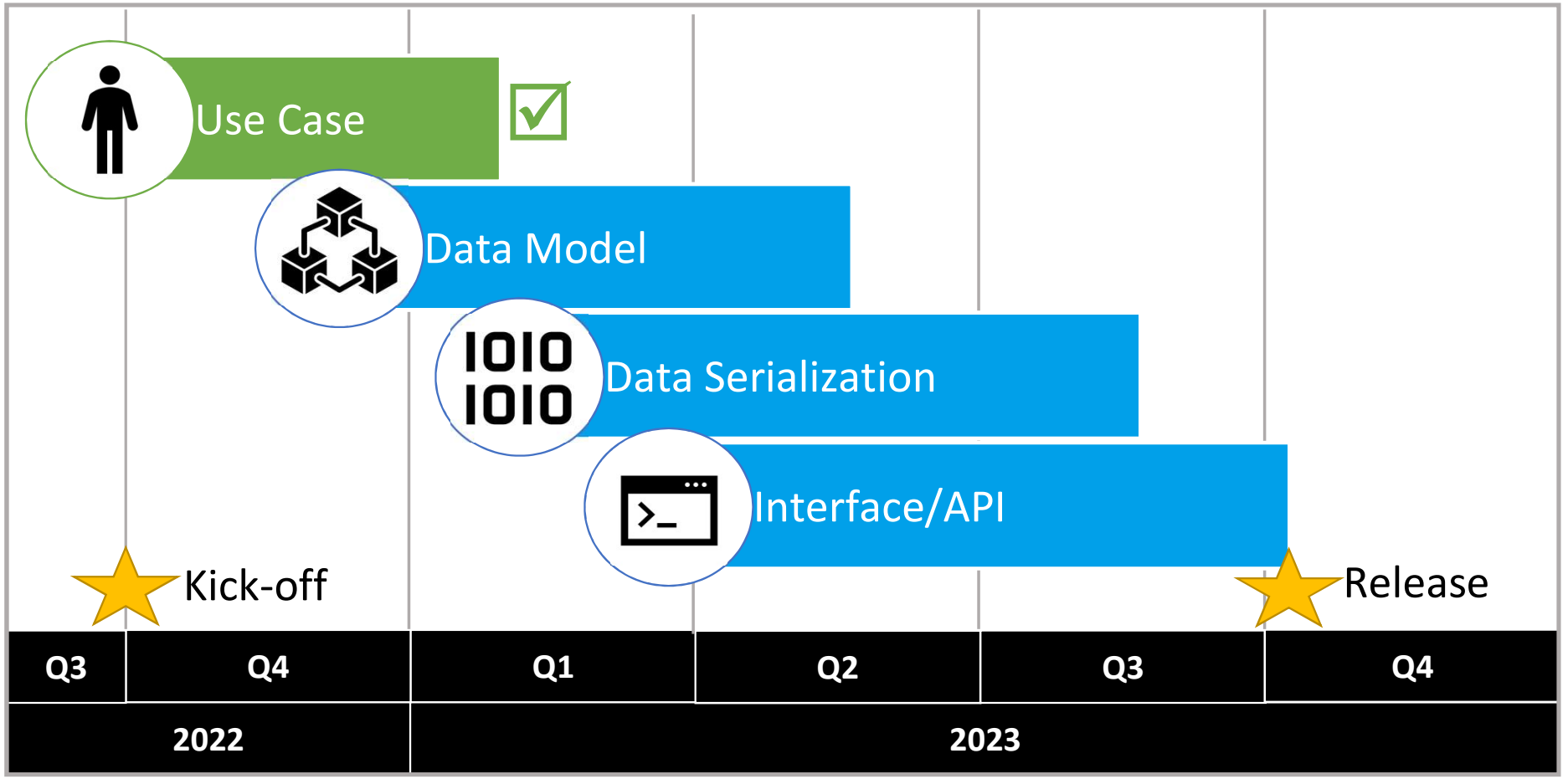
Protection of Proprietary Data

- **Standard enables protection of data**

Data Size:

- **Subcommittee is focused on size and compressibility**
- **Format will enable prioritization for data transmission**

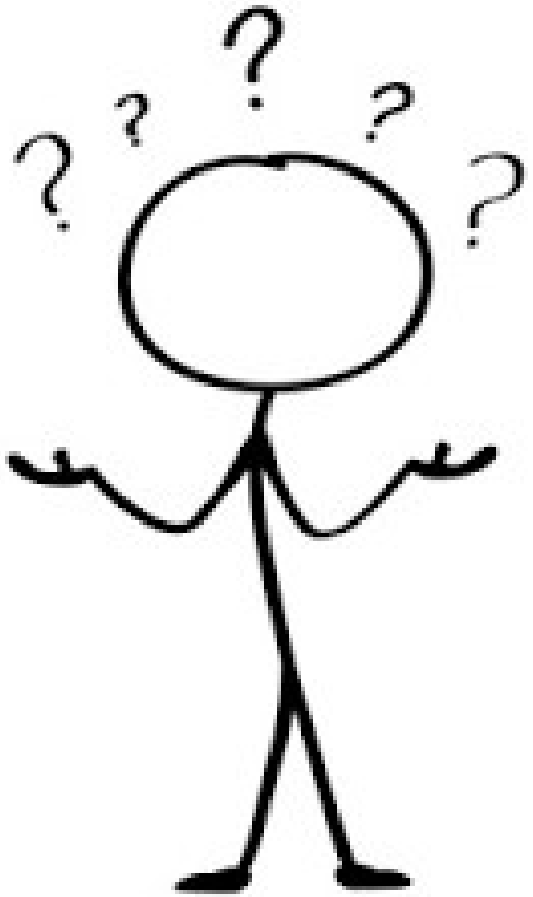
Way Ahead


Use Case
Data Model
Data Serialization
Interface/API
Kick-off
Release
Q3
Q4
Q1
Q2
Q3
Q4
2022
2023

How to Contribute

- **Join the committee:** This industry-led committee already includes participation from the majority of rotorcraft OEMs, HUMS vendors, as well as many civil and military operators - but there is still room for you. Contact the committee chair to request more information: Brian Tucker (btucker4@bellflight.com)
- **Get the word out:** We need people who see the benefits of the open approach to advocate for its adoption through incorporation in new designs and inclusion in future requirements.
- **Plan for the open HUMS ecosystem of the future**: while the CODEX-HUMS format is the key to the open future of HUMS data, it is only the beginning. We see a world where we standardize interactions with data.

Questions



Backup Slides

The following slides are intended to help answer specific questions or be incorporated into the main presentation depending the audience

Use Cases Developed

- Quick Turn Maintenance
- Predictive Maintenance
- On Board Monitoring (in flight)
- Remaining Useful Life
- Rotor Track and Balance
- Flight Data Monitoring
- Drivetrain Diagnostics

Data Schema Placeholder

- Will develop slide once schema finalized

Data Serialization Placeholder

- Will fill out slide once serialization format is determined

API Interface Placeholder

- Will fill out slide once API Interface is determined