Request for Information - Telemetry Front End Replacement

I. Scope of Work

This Request for Information (RFI) outlines a requirement for up to ten Pulse Code Modulation (PCM) front-ends. The exact quantity of telemetry front-ends to be procured will depend upon available funding.

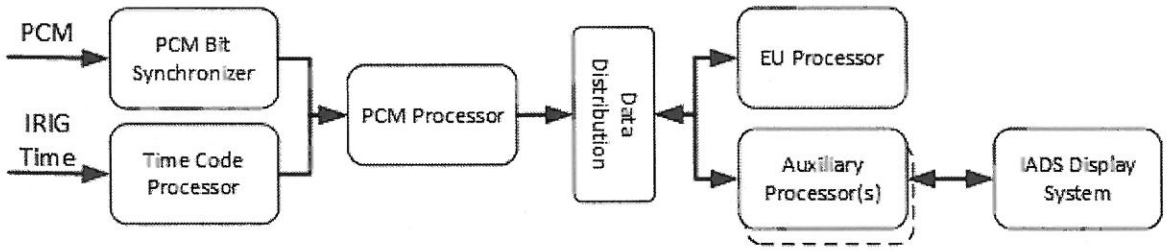
a. Background

The Dryden Aeronautical Test Range (DATR) provides mission control services for the NASA Armstrong Flight Research Center (AFRC) using the Telemetry/Radar Acquisition and Processing System (TRAPS). Telemetry from research aircraft and data from tracking radars are processed and displayed by the TRAPS for researchers in a mission control center.

Telemetry requirements at NASA AFRC have grown to exceed the current throughput of the PCM front-ends used in the TRAPS. The DATR is exploring upgrades to the TRAPS which can scale up telemetry processing capacity. One upgrade to the TRAPS under consideration would migrate PCM telemetry processing, telemetry network processing, engineering units (EU) processing, data archiving and application processing across multiple processors.

b. Objectives

The objective of this RFI is to determine if telemetry front-ends are available that support a decentralized federated architecture as shown in the figure below.



II. Telemetry Front-End Specification

- PCM Bit Synchronizer
  - External bit synchronizer (preferred).
  - Supports input data rates between 1bps to 30Mbps for NRZ-L and RNRZ-L.
  - Provides six inputs (TTL single ended BNC)
  - Supports input impedance 75 Ω
  - Accepts and generates NRZ-L/M/S. RNRZ-L, and BI0-L/M/S.
  - The capability to accept and generate other PCM code types described in chapter 4 of IRIG 106-15 (preferred)
  - Outputs zero degree and 180 degree clock.
  - Supports IRIG standard randomization and derandomization, including forward and reverse direction and shift register code lengths (11,15,17 and 20 bits)

- Time Processor
  - External time processor (preferred).
  - Decode, generate, and translate IRIG A, B, and G time.
  - Optionally provide the capability to generate NTP network time.

- PCM Processor
  - Non-PC FPGA based PCM processor (preferred).
  - Provides a front panel PCM search/lock status display.
  - Provides six PCM inputs (TTL single ended BNC)
  - Supports zero or 180 degree clock input.
  - Supports data rates up to 30 Mbps NRZ-L.
  - Supports NRZ-L/M/S and BI0-L binary codes.
  - Supports normal and inverted code polarity.
  - Supports IRIG standard derandomization, including forward and reverse direction and shift register code lengths (11,15,17 and 20 bits)
  - Performs embedded PCM audio processing (provides both analog and IRIG 106 Ch. 5 audio output).
  - Supports programmable frame synchronization defined in IRIG 106 Ch. 4.
  - Supports frame synchronization word lengths up to 64 bits.
  - Provides the ability to specify the number of synchronization and pattern errors allowed.
  - Supports two subframes per mainframe.
  - Supports asynchronous embedded frames.
  - Supports asynchronous data merge subframes (desired).
  - Supports selectable data alignment (MSB or LSB) per input.
  - Supports up to 512,000 bits per major frame.
  - Supports 256,000 data parameters.
  - Supports individual PCM word lengths from 4 to 64 bits.
  - Supports the IRIG 106-15 chapter 4 definitions for subcommutation, supercommutation, and fragmented words.
  - Supports programmable bit slip of +/-1, +/-2, or +/-3 bits
  - Import IRIG 106-15 Chapter 9 TMATS configuration files.

- Data Distribution Interface
  - Provides a low latency data distribution interface from the PCM processor to external servers.
  - The desire is to drive data to external processors at the highest throughput rate specified for the PCM processor.

- Engineering Unit (EU) Data Processor
  - External processor (desired)
  - 64 bit Linux operating system distribution based on Red Hat Enterprise Linux (RHEL) (desired)

- Supports single and double precision data.
- Supports arithmetic, bit manipulation, Boolean, conditional, event change, exponential, format conversion, interpolation tables, modular, logarithmic, polynomials, trigonometric algorithms for EU processing.
- Supports user definable functions.
- Provide the ability to configure data alignment (MSB or LSB) for a measurement.
- Software decommutation capability is highly desired.
- Capability to support EU processing rates higher then 2Msps.
- Provide connectivity to the Data Distribution interface.
- Capability to time stamp data parameters with 1ms accuracy.

- Auxiliary Data Processor(s)
  - External processor (desired)
  - 64 bit Linux operating system distribution based on Red Hat Enterprise Linux (RHEL) (desired)
  - Provides the capability to create and execute researcher defined special purpose applications. These applications calculate derived parameters using input data received in the telemetry.
  - Application processors should be scalable. Additional computers can be added to process additional special purpose applications.
  - Provide the ability for an operator to ability to configure, launch, terminate, and receive status from these special purpose applications.
  - Provide a compatible interface to the Symvionics Interactive Analysis and Display System (IADS).
  - Provide connectivity to the Data Distribution Interface.
  - Provide the ability to archive raw, EU to disk, and output of special purpose algorithms to disk (preferred).

III. Technical Point of Contact

Send responses/proposals by email to afrc-rfess-procurement@mail.nasa.gov

IV. Specific Task Requirements

- Please provided the following information in the information response.
- Specifications, brochures and test data demonstrating the proposed telemetry front-end supports the requirements in section II.
- Cost per unit.
- Delivery time after receipt of order.
- Number of fielded units and known failure rates.

V. Period of Performance

N/A

VI. Deliverables

a. Telemetry Front-Ends:

The Contractor shall deliver six telemetry front-ends.

b. Telemetry Front-End Software Baseline:

The Contractor shall establish a NASA DATR software baseline that includes the telemetry front-end source code/firmware, executables and configuration information. The NASA DATR software baseline shall be delivered electronically with each system delivery. A version description document shall be provided with each new software delivery.

c. Testing:

The Contractor shall perform a formal ATP with the Government at the manufacturer's facility. The Contractor shall provide the acceptance test procedure documentation electronically ten business days prior to each system ATP for review by the Government. Any failure encountered during the ATP shall be documented so as to identify the cause and the effect of the failure. The ATP is required on all procured front-end equipment sets.

d. Quality Control and Tracking:

The Contractor shall use commercial standards for manufacturing, quality control, and testing. A tracking document should be maintained for each telemetry front-end by serial number to provide a documented history of the unit. This history should document the manufacturing and test history of the telemetry front-end.

e. Maintainability:

The telemetry front-end shall be configured so that repairs or upgrades do not keep the unit out-of-service for more than 24 hours. A modular design should allow for quick sub-component replacement.

f. Unusual or Unexpected Front-End Behavior:

If the behavior affects the normal operation of a telemetry front-end, then the Contractor shall provide a correction within 10 business days. If the correction cannot be provided within

the specified time limit, then documented progress of efforts to provide a correction must be provided within 10 business days and thereafter every 10 business days until the correction is provided. If a correction cannot be provided, then alternative equipment of equal or better value shall be offered as a replacement subject to customer approval.

If the behavior does not affect the normal operation of the telemetry front-end, then the Contractor shall provide a correction within 30 business days. If the correction cannot be provided within the specified time limit, then documented progress of efforts to provide a correction must be provided within 10 business days and thereafter every 10 business days until the correction is provided.

g. Training:

The Contractor shall provide training on-site at NASA AFRC. Training will be scheduled in cooperation with the customer to accommodate mission requirements at NASA AFRC. Training shall consist of Operations and Maintenance, System Architecture and Design, and Software Architecture and Design.

h. Documentation:

The contractor shall provide system documentation. The system documentation shall consist of the following:

- System Operations and Maintenance
- System Architecture and Design
- Software Architecture and Design

i. Post-Delivery Support:

The Contractor shall propose post-delivery support. The Government estimates this support will include both phone and email technical support and on-site support. The Government's estimate for on-site support is at least 1 month (4 individual trips – 4 days each) to support DATR TRAPS integration efforts.

VII. Acceptance Criteria

N/A

VIII. Government-Furnished Property (GFP)

N/A

IX. Special Considerations

The specification herein is not limited and may change in the future.

X. Security Requirements

The Contractor shall protect the confidentiality, integrity and availability of NASA Electronic Information and IT resources and protect NASA Electronic Information from unauthorized disclosure. NASA will help the Contractor complete a NASA IT Security Management Plan should that be required. This plan shall describe the processes and procedures that will be followed to ensure appropriate security of NASA DATR resources that might be used in this procurement.

The existing DATR security plan will be used as the required IT Security plan for this procurement.

The Contractor shall identify the processes they use to mitigate the risk of malware being resident on deliverables to the DATR