

## **CMAF Contract Representative Task Order**

**Title:** Mellifluous Lidar System mechanical design effort

**Period of Performance:** 9 month period, beginning January 2014

### **Task Background**

Goddard Space Flight Center (GSFC) has developed a prototype lidar remote sensing instrument. This instrument, the Mellifluous Lidar System, or MLS, is a proof-of-concept scanning lidar instrument to be used for studies of atmospheric clouds. It is necessary to take the prototype instrument, which is in breadboard form, and repackage it into a form factor suitable for high-altitude aircraft.

The MLS instrument work is to be done in-house at GSFC under the management of the Sciences and Exploration Directorate (SED, or Code 600). The MLS will be used on the NASA ER-2 high-altitude aircraft.

The MLS instrument is a laser-based scanning remote sensor designed to measure profiles of clouds. The aspects of the instrument to be repackaged include a laser, a 9-inch diameter telescope/receiver, and receiving optics and detectors. The primary instrument subsystems (lasers, telescope, and detectors) already exist. This RTO addresses the work needed to design an appropriate mechanical enclosure(s), fabricate or procure parts, assemble the instrument in the enclosure(s), and perform functional fit check with the aircraft.

The MLS will be housed in a wing pod on the ER-2 aircraft. As such, the volume limitation is 52" long by 26" wide by 30" tall. Instrument weight and balance are also significant factors in the design. The aircraft provides a 16-inch diameter window for nadir viewing. Proposed designs will have to be approved by the aircraft Lead Engineer, with final suitability for flight determined by visual inspection by the aircraft Lead Engineer and a functional fit check with the aircraft.

The Principal Investigator (PI), Instrument Manager (IM), and Systems Engineer (SE) will be GSFC civil servants. The contractor will work closely with the PI, IM, and SE but will not assume those roles.

### **Special Considerations**

1. Information on the NASA ER-2 aircraft can be found in the Experimenter Handbook, on-line at: [www.nasa.gov/sites/default/files/189893main\\_ER-2\\_handbook\\_02.pdf](http://www.nasa.gov/sites/default/files/189893main_ER-2_handbook_02.pdf)
2. Experience with NASA aircraft and associated safety protocols is a key element in assessing contractor capability. Prior experience working with NASA aircraft shall be specifically stated.

3. Experience with NASA aircraft environments is a key element in assessing contractor capability. Structural loads, thermal/pressure environment, and mass/volume restrictions are important design considerations. Prior experience working with NASA aircraft shall be specifically stated.
4. It is assumed that design and analysis work shall be performed off-site at the contractor's facility. The assembly of the instrument shall be done on-site in a NASA laboratory facility. The aircraft functional fit check shall be performed at the NASA Dryden Flight Research Center Aircraft Operations Facility (DAOF) in Palmdale, California (contractor should assume 5 days on-site for the fit check).

### **Task Description**

Working with the GSFC PI, IM, and SE, the contractor shall perform the following in support of the MLS development:

1. Requirements and interface definition
  - develop and maintain ICD(s) for instrument subassembly interfaces, to include laser interfaces, opto-mechanical interfaces, and electrical connector interfaces.
  - develop and maintain ICD for instrument-aircraft mechanical interface
2. Support system integration
  - provide on-site support for subsystem and system-level assembly
  - provide on-site support for aircraft fit-check (at DFRC)
3. Mechanical design and fabrication
  - provide mechanical design for all mechanical components needed to re-package and assemble the instrument. These components include, but are not limited to, instrument enclosure(s), sealed boxes/enclosures that may be required internal to the instrument, mechanical interfaces for subsystem mounting, mechanical mounting of individual components (e.g., lenses, mirrors, etc.), and mechanical mounting of instrument to aircraft frame.
  - provide detailed drawings of each component and assembly level drawings for groups of components.
  - provide fabrication and/or procurement of mechanical components, to include proper documentation of certified materials and fasteners.
4. Structural analysis
  - provide structural analysis of overall instrument package to ensure ER-2 structural safety requirements at met. The structural analysis will be reviewed by the aircraft Lead Engineer and permission to fly the instrument is contingent upon approval of the structural analysis package.

5. Thermal design
  - provide thermal design/analysis for the instrument and environment (e.g., internal to the ER-2 wing pod). This should include analysis of thermal loads to allow proper design of thermal interfaces and controls, definition of any required heater circuits (including identification of specific components), and definition of any required blanketing.
6. development of Ground Support Equipment (GSE)
  - develop concepts for appropriate GSE to permit assembly and handling of the MLS instrument
  - fabricate and/or procure GSE to permit assembly and handling of payload
7. Support and participate in design reviews as follows:
  - instrument Preliminary Design Review (PDR, at GSFC, 1 day, April 15, 2014)

### **Deliverables**

Task Item	Description	Schedule	Delivery Method
1	ICD for instrument-aircraft interface	9 months from task start	hardcopy and electronic copy
1	ICD(s) for instrument subassembly interfaces	9 months from task start	hardcopy and electronic copy of each ICD
3	detailed drawings of each component and assembly level drawings for groups of components	9 months from task start	hardcopy and electronic copy of drawing packages
3	components and fabricated parts as required for the instrument enclosure(s)	as required throughout to meet completion date of 9 months after task start	all parts shall be packaged for safe transport to GSFC
4	structural analysis package	5 months from task start	hardcopy and electronic copy
5	thermal analysis and design package	5 months from task start	hardcopy and electronic copy
6	fabrication and/or procurement of parts for GSE handling equipment	8 months from task start	all parts shall be packaged for safe transport to GSFC
7	instrument Preliminary Design Review	3.5 months from task start	slide package to permit PDR-level evaluation of designs