

November 12, 2013

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TO: 12/Science and Flight Projects Contracting Branch, Office of Procurement

FROM: 468/Laser Remote Sensing Branch/Engineering Directorate

SUBJECT: Justification for Other Than Full and Open Competition (JOFOC) for "Science, Technology, Design, Development, Test and Evaluation in Support of Active Lidar Remote Sensing of Carbon Dioxide (CO₂) Concept Development."

1. Recommendation

I recommend that NASA Langley Research Center (LaRC) negotiate only with ITT Industries Space Systems Division (hereafter referred to as ITT- soon to be novated to Exelis, Inc.) for a contract to obtain services that are necessary in support of instrument concept development for active lidar remote sensing measurement of CO₂.

2. Nature and Description of the Action being Approved:

NASA LaRC proposes to award a sole source, performance-based contract to ITT for support of measurement capability and concept development. The scope of work will include research, technology, design, development, test and evaluation support of an instrument based on a multifunctional fiber laser, to remotely measure atmospheric content of CO₂ and other ancillary measurements.

Background:

LaRC, as part of its Atmospheric Sciences program and using its lidar core competency, has pioneered the use of laser remote sensing to provide measurements of the Earth's atmosphere from space and airborne platforms. Increasing atmospheric CO₂ and its effect on the Earth system has become an important topic for policy makers and has led to recommendations that NASA develop a capability to remotely monitor atmospheric CO₂ from space using lidar remote sensing. The following discussion provides a background on LaRC's response to these recommendations and describes activities undertaken by LaRC to investigate and assess the feasibility of a mission with the goal of significantly enhancing the understanding of the role of CO₂ in the global carbon cycle in response to emerging NASA requirements.

In 2004, the National Research Council (NRC) of the U.S. National Academies received requests from the NASA Office of Earth Science, National Oceanic and Atmospheric

Administration (NOAA), National Environmental Satellite Data and Information Service (NESDIS), and the U.S. Geological Survey (USGS) Geography Division, to conduct a decadal survey to generate consensus recommendations from the Earth and environmental science and applications communities regarding a systems approach to space-based and ancillary observations that encompasses the research programs of NASA; the related operational programs of NOAA; and associated programs such as Landsat, a joint initiative of USGS and NASA.

On January 27, 2005, the NRC issued a Request For Information (RFI) from the Earth science community on mission concepts to support its recommendations for space observations for the next decade. In response to the RFI, LaRC submitted a white paper describing a mission concept that had been under development since 2003 to monitor atmospheric CO₂. The mission concept was called the Active Carbon and Climate Laser International Mission (ACCLAIM) and was intended to position LaRC to implement the next laser remote sensing mission beyond Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO), an Earth Systems Science Pathfinder (ESSP) mission currently on orbit. The ACCLAIM mission concept was based on the CALIPSO programmatic model and addressed NASA needs by significantly enhancing the understanding of the role of CO₂ in the global carbon cycle by providing day/night, all-latitude, and all-season CO₂ column integral measurements using laser remote sensing.

In 2005, NASA announced its intention to release an Announcement of Opportunity (AO) for an ESSP mission. The ESSP Program is a component of NASA's Science Mission Directorate that addresses unique, specific, highly-focused mission requirements in Earth System research. The ESSP program provides periodic "Windows of Opportunity" to accommodate new scientific priorities and infuse new scientific participation into the Earth Science Division. ESSP is also home to NASA's Earth Venture (EV) class of missions designed to meet complementary mission needs such as demonstration of the value and accuracy of a measurement technique as either a precursor or follow-on to a space mission. On August 24, 2005, NASA LaRC issued a partnering synopsis (SS-NNL05ESSP) for a teaming opportunity for the ESSP Program in anticipation of the next NASA Science Mission Directorate AO. The objective of the partnering synopsis was to team LaRC's core competencies in atmospheric sciences, laser/lidar remote sensing, and passive remote sensing with other government agencies, industry, and academia. Selected partners would assist NASA LaRC mission teams to develop competitive proposals in response to upcoming AOs. The partnering synopsis covered all areas of the mission life-cycle from definition, through design, development, integration and test, launch, operations, science data analysis and distribution. The seven mission elements included: (1) Science Instrumentation, consisting of 6 types of instrumentation, (2) Mission Management, (3) Spacecraft and Launch Options, (4) Mission Operations, (5) Payload Operations, (6) Science data processing facilities, and/or (7) Education and Public Outreach. Instrument requirements to support ACCLAIM mission concepts were included in the partnering synopsis. On November 4, 2005, the NASA LaRC Science Directorate selected ITT as a partner under element (1) "Science Instrumentation". A major consideration in the selection of ITT was the existence of its proprietary measurement technology called a Multi-function Fiber Laser Lidar (MFLL) with a demonstrated capability of measuring atmospheric CO₂.

In its Decadal Survey "Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond," dated January 27, 2007, the NRC recommended that NASA implement the ASCENDS (Active Sensing of CO₂ over Nights, Days, and Seasons) mission to produce global atmospheric column CO₂ measurements without seasonal, latitudinal, or diurnal bias using simultaneous laser remote sensing of CO₂ and O₂. The goal of the ASCENDS mission is to enhance understanding of the role of CO₂ in the global carbon cycle. Thereafter, the previously proposed ACCLAIM mission was retitled ASCENDS in order to more clearly align with the direction from the NRC and NASA Headquarters. The three science objectives are: (1) quantify global spatial distributions of atmospheric CO₂ on scales of weather models in the 2010-2020 era and beyond; (2) quantify current global spatial distribution of terrestrial and oceanic sources and sinks of CO₂ on 1° x 1° grids at weekly resolution; and (3) provide a scientific basis for future projections of CO₂ sources and sinks through data-driven enhancements of Earth system process modeling. The NRC recommendation that NASA implement the ASCENDS mission was based in large part on NASA LaRC's RFI submission for ACCLAIM.

Since 2005, NASA and ITT have worked collaboratively to define, document, and develop ASCENDS key components and subsystems, as described in paragraph 5 below. We are currently expecting an Announcement of Opportunity to be released in FY2015 for the ASCENDS mission. The proposed contract will allow the Government and ITT to refine the measurement technique and understand potential science and engineering trades, increase component TRL, reduce associated risks, and validate expectations for the ASCENDS mission that justify readiness for selection and implementation.

3. Description of the Required Services

The required services in this follow-on contract will continue to include research, technology, design, development, test and evaluation support of an instrument based on a multifunctional fiber laser, to remotely measure atmospheric content of CO₂ and other ancillary measurements in meeting the objectives of the ASCENDS mission concept development. The specific requirements will be defined in Task Orders. The scope of work to be performed under the contract includes the following:

- Development, improvement, maintenance, and implementation of algorithms for retrieval of CO₂ mixing ratio, including required ancillary measurements, and diagnostic algorithms for validation and maintenance of analytical models
- Development of numerical models for ASCENDS-related measurements
- Analysis and interpretation of data from satellite, aircraft, balloon, and ground-based instruments for understanding and validation of ASCENDS models and algorithms.
- Mission, Payload, and Instrument Operations support for ASCENDS airborne and ground systems not provided by the Government
- Logistical support and ground facilities for personnel and equipment while conducting ASCENDS field missions and experiments
- Engineering and Technology Development support in the development of ASCENDS sensors and instruments to meet mission needs and objectives

- Instrument/Sensor Design to translate research objectives and scientific requirements into viable ASCENDS instrument concepts for ground, aircraft, and space flight research applications
- Instrument/Sensor Development for analytical studies, concept development, design verification, assembly, modification, and development of ASCENDS instrumentation systems.
- Instrument/Sensor Calibration and Testing for calibration, integration, testing, and qualification of ASCENDS-related research instruments
- Instrument support for selected ESSP EV proposals which are complementary to the ASCENDS mission requirements and provide opportunities to demonstrate the viability of the MFL CO₂ measurement technique.

A cost-plus-fixed-fee, Indefinite Delivery Indefinite Quantity (IDIQ), task order contract is proposed for this requirement. The period of performance will be for five years. The guaranteed minimum will be \$10,000 and the maximum contract value will be \$7,000,000 over the five-year period of performance.

4. Statutory Authority

As authorized by 10 U.S.C. 2304 (c)(1), and implemented by Federal Acquisition Regulation (FAR) 6.302-1(a)(2)(ii) and (iii), full and open competition need not be provided for when the supplies and services are deemed to be available only from the original source in the case of follow-on contract of highly specialized equipment and highly specialized services. Award to any other source would result in substantial duplication of cost to the Government that is not expected to be recovered through competition and unacceptable delays in fulfilling the agency's requirements. The agency selected ITT based on its science instrumentation and unique capability of measuring CO₂. Since the initial selection, NASA has invested more than seven years and \$3.6M to further develop and extend the capabilities of the ITT system instrumentation to be able to meet the objectives of the ASCENDS program. The agency cannot meet its project milestones with any other source or recoup its investment of time and money through competition. These milestones include demonstrating the capability of this technique to provide validated CO₂ data in multiple field campaigns and to publish the modeling and analysis results in refereed science journals in preparation for responding to the ASCENDS AO.

The award of a contract to ITT is also supported by FAR 6.302-1(a)(2) when it is necessary to award a contract to a particular source when only one source is able to meet the agency's minimum needs. ITT's Multifunctional Fiber Laser Lidar (MFL) was selected by NASA as the only instrument capable of meeting the key measurement requirements for the ACCLAIM/ASCENDS mission concept as defined by the NRC. ITT has a unique capability to provide the supplies and research services by virtue of its proprietary instrumentation and knowledge.

5. Nature of Acquisition Requiring Use of Authority

NASA LaRC, as part of its Atmospheric Science research program, is pursuing the development of an instrument and other ancillary measurements to support Earth System

Science proposal and concept development efforts for ASCENDS. The key measurement requirements for ASCENDS as defined by the NRC include:

- Full seasonal sampling to high latitudes, day-night sampling, and some ability to resolve (or weight) the altitude distribution of the CO₂-column measurement, particularly across the middle to lower troposphere, using laser absorption spectroscopy,
- CO₂ mixing ratio measured to a precision of 0.5 percent of background (slightly less than 2 ppm) at 100-km horizontal length scale over land and at 200-km scale over open oceans, and
- CO₂ measurements near 1.57 μm (preferred because of their relative insensitivity to temperature errors, relative freedom from interfering water-vapor bands, good weighting functions for column measurements across the lower troposphere, and the high technology readiness of lasers).

The ITT MFLL is the only instrument meeting all of the NRC requirements that has been successfully demonstrated in an airborne field experiment, a necessary step in the development on a space-borne instrument. ITT has invested several millions of dollars in its proprietary technology to develop, improve, and enhance this technology and its ability to measure atmospheric trace gases, in particular CO₂. NASA LaRC has invested over \$3.6M in the program development efforts over more than seven years. ITT and LaRC have collaboratively tested the ability of the MFLL to make measurements of atmospheric CO₂ through a systematic series of twelve airborne flight and ground test campaigns that allowed for evolution and optimization of several key components and subsystems of the MFLL to enable TRL advancement. These advancements include development of improved detectors, modulation algorithms and data retrieval methods as well as enhanced ability to measure above low reflectivity surfaces (water and snow) and through thin cirrus clouds.

The results of these experiments have been presented at numerous science forums over the last seven years, such as the NASA Carbon Cycle and Ecosystems Workshop, the International Laser Radar Conference, the American Geophysical Union (AGU), the International Carbon Dioxide Conference (ICDC), the International Workshop on Greenhouse Gas Measurement (IWGGMS), and the NASA ASCENDS Mission Workshop. ITT's recognition in the industry as being uniquely qualified in the area of CO₂ measurements is demonstrated in their participation in these national and international forums and periodic surveys of the literature.

6. Potential Sources and Market Research Conducted

Although other potential sources were identified through the issuance of the competitive partnering synopsis in 2005, ITT was selected as the science instrumentation partner for LaRC based on its unique qualifications, its proprietary instrument, and demonstrated capability of making remote CO₂ measurements meeting the agency's requirements. No other provider could produce the data from a fiber-based CO₂ lidar of value to support LaRC's proposal development efforts. Based on the additional cost and schedule that would be required to duplicate ITT's proprietary capability to adequately perform this contract, efforts to solicit more than one source for this procurement are not contemplated.

In order to test the market to confirm that ITT remained the only firm capable of meeting NASA's requirements, in April 2011 a sources sought synopsis was released on NASA Acquisition Internet Service (NAIS) and FedbizOpps soliciting information about potential sources for Intensity-Modulated Continuous-Wave Lidar (IM-CW) For Remote Sensing of CO₂ and O₂ from Space. NASA sought information from entities which had (1) successfully demonstrated the ability to measure CO₂ and O₂ with an IM-CW lidar in laboratory or field tests; (2) used technology to make the measurement that had a clear path to being scaled and developed within a spaceflight mission; and (3) could fully demonstrate engineering feasibility to do so within three years. ITT was the only responsive submission received. Their response demonstrated full capability. One other company responded, which only addressed a small part of the requirements set forth in the solicitation.

Following approval of this JOFOC, a synopsis of NASA's requirements will be published via the NAIS and FedBizOpps announcing the Government's intention to negotiate only with ITT.

7. Determination by the Contracting Officer of Fair and Reasonable Costs

With assistance of the NASA requiring organization, the Contracting Officer will conduct a thorough review of the proposal to ensure that the anticipated cost to the Government will be fair and reasonable. In addition, historical data under prior contracts awarded to ITT will be used for cost comparisons where applicable. After the contract is awarded, the cost of individual task orders will be negotiated between NASA and ITT to ensure the costs are ultimately determined fair and reasonable by the Contracting Officer pursuant to FAR 15.4.

Technical Certification

I certify that to the best of my knowledge and belief, the data presented in this justification is accurate and complete.

Byron Meadows,
Langley ASCENDS Project Manager

Date

Contracting Officer Certification

I hereby determine that the anticipated cost to the Government will be fair and reasonable and certify that this justification is accurate and complete to the best of my knowledge and belief.

Karen C. Dempster
Contracting Officer

Date

Concurrence:

Rosemary C. Froehlich,
Head, Science and Flight Projects
Contracting Branch, OP

Date

Office of Chief Counsel

Date

David H. Jones
Acting Procurement Officer

Date

Approval:

Stephen G. Jurczyk
Competition Advocate

Date