National Aeronautics and
Space Administration

Langley Research Center
100 NASA Road
Hampton, VA 23681-2199

March 11, 2009

Reply to Attn of: 126

TO: 126/Teresa M. Hass, Research and Projects Contracting Branch, OP

FROM: 468/Dr. M. Nurul Abedin, Remote Sensing Flight Systems Branch, SED

SUBJECT: Justification for Other Than Full and Open Competition (JOFOC) for Far-Infrared Extended Blocked Impurity Band (FIREBIB) Detector Development to Extend the Wavelength into the far-IR to at least 50 μm (goal 100 μm)

1. Recommendation

It is recommended that NASA Langley Research Center (NASA LaRC) negotiate only with DRS Sensors & Targeting System (hereinafter referred to as DRS) for the development of Far-Infrared Extended Blocked Impurity Band (FIREBIB) detector.

2. Nature of the Action

The nature of the action being approved is the Justification for Other Than Full and Open Competition to develop the FIREBIB Detector from 10 to at least 50 μm on a sole source basis from DRS.

3. Description of the Supplies or Services

In 2006, NASA Langley, in partnership with DRS, under NASA LaRC Contract NNL06AA25C, began a program to develop and demonstrate prototype Blocked Impurity Band (BIB) detectors capable of providing the sensitivity of liquid helium (4 K) cooled detectors while operating at temperatures near 10 K as accessible by the new cryocoolers. This project, called the Far-Infrared Detector Technology Advancement Partnership (FIDTAP) and implemented by NASA as an Advanced Technology Initiative (ATIQRS-06-3001), successfully demonstrated both wavelength extension (to 50 μm) and sensitivity (D* exceeding 10^{10}cm sqrt. Hz /W) in a detector with high bandwidth and radiation resistance compared with 4 K sensors, plus excellent space heritage.

The advancement of the far infrared BIB detector is very important for the NASA CLARREO mission, which requires a detector at Technology Readiness Level (TRL) 6. Previously, DRS was able to extend the wavelength range to 50-um with detectivity around 10^{10} cm.rtHz/W. However, this detector is not mature enough to support the CLARREO mission. Therefore, DRS shall continue their detector development effort to demonstrate their performances within this FIREBIB project. In 2008, NASA LaRC partnered again with DRS on the

FIREBIB proposal selected under the NASA Research Announcement (NRA) NNH08ZDA001N, Research Opportunities in Space and Earth Science (ROSES-2008), Program Element A.21, Advanced Component Technology (ACT). FIREBIB will further develop the FIDTAP work from Technology Readiness Level (TRL) 3 to TRL 5, and demonstrate an advanced class of detectors possibly applicable to the CLARREO mission and other future NASA space science missions. Procurement of this additional detector development effort with DRS is an integral step to developing the FIREBIB detector from 10 to 50 μm wavelength range. A critical requirement of the CLARREO mission is low noise and high sensitivity far-IR detectors that are responsive to 50 μm (200 cm^{-1}). Preliminary science requirements indicate that the far-IR detectors should have a specific detectivity (D*) of about 10^{10} cm Hz /W, which is beyond the capability of traditional thermal detectors such as thermopile or pyroelectric detectors that have typical specific detectivities (D*) on the order of 10^{8} cm Hz /W. Available off-the-shelf pyroelectric and bolometric detectors are not sufficiently sensitive for CLARREO objectives. DRS shall design, develop, integrate, and test the far infrared blocked impurity band detector. The effort to be procured under this JOFOC will reduce the technical risk of this detector development work for CLARREO and other future NASA space science missions.

DRS shall be responsible to continue the development demonstrated in the FIDTAP project and increase its capabilities to meet the requirements of the FIREBIB project. DRS shall adapt a detector design and light-trapping detector packaging from the previous FIDTAP detector program to achieve the following target performance levels from 10 to 50 μm (with 100 μm goal): (i) Unity gain; (ii) Bandwidth > 100 kHz suitable for the CLARREO Fourier transform spectrometer instruments; (iii) Quantum Efficiency (QE) > 99.9% in a trap detector configuration; (iv) Specific Detectivity > 1e+10 cm sqrt (Hz) /W (goal > 1e+11 cm sqrt (Hz)/W); (v) QE stability against temperature and radiation effects; (vi) Nominal Detector Area (trap acceptance area) of 200 x 200 μm^2.

The deliverables will consist of 12 detectors and a final report detailing the detector design and performance characteristics. The total estimated cost for this FIREBIB detector developmental effort is $900,000.

4. Statutory Authority

Authority for the Justification for Other Than Full and Open Competition is provided by FAR 6.302-1 (a)(2)(iii)(A). DRS is the only known responsible source and no other supplies or services will satisfy agency requirements as this effort is a follow on for the continued provision of highly specialized equipment, including major components thereof, when it is likely that award to any other source would result in substantial duplication of cost to the Government that is not expected to be recovered through competition, 10 U.S.C. 2304(c) (1).

5. Contractor's Unique Qualifications

DRS is a premier developer of Focal Plane Arrays (FPAs) and Detector technologies for remote sensing, reconnaissance, surveillance and targeting systems. DRS FPA capabilities heritage is based on the FPA businesses that were originated at Rockwell International,

Boeing and Texas Instruments and later acquired by DRS. They have a portfolio of detector technologies including: vanadium oxide bolometers, silicon pin diodes, mercury cadmium telluride, silicon blocked impurity band, visible light photon counters, and avalanche photodiodes. They design and develop their own readout integrated circuits for their FPAs.

DRS is the inventor of the extrinsically doped Blocked Impurity Band (BIB) detector technology. The original BIB detector technology was based on arsenide (As) doping which resulted in detectors with 28- μm cutoff. Since that time, DRS has demonstrated detectors with Antimonide (Sb) and Gallium (Ga) dopants. Detectors with Sb dopant result in longer spectral response to 40 μm. Detectors with Ga dopant result in shorter spectral response to 18 μm but offer higher operating temperature up to 30K.

In the last several years, DRS has demonstrated another BIB detector variant with its extended wavelength detectors. This DRS innovation has resulted in doubling the spectral response range of As doped detectors from 28 μm to in excess of 50 μm, as demonstrated in the FIDTAP project. Through this new innovation DRS believes it is possible to develop and demonstrate silicon (Si) BIB detectors with response characteristics out to 100 μm. While the FIDTAP program demonstrated As doped detectors operating in excess of 50 μm in wavelength (TRL level 3 to 5), the detectors need to be further developed to a higher maturity level (TRL level 6), to perform for the FIREBIB project. FIREBIB detectors must operate in the 10 to 50 μm spectral range with high sensitivity. Therefore, the continued development of this technology will meet our needs for FIREBIB program. DRS is uniquely positioned to continue the development of the extended wavelength BIB detector technology that it innovated several years ago.

Under NASA LaRC Contract NNL06AA25C, DRS developed and demonstrated these prototype Blocked Impurity Band (BIB) detectors in support of the FIDTAP program. The contract period of performance for NNL06AA25C was June 2006 through December 2008.

NASA awarded contract NNL06AA25C as a cost share contract in the amount of $200,000 with DRS in kind contribution in the amount of $200,000, the total FIDTAP project value was $400,000. To award the FIREBIB effort to another source would result in a substantial duplication of costs to the Government that are not expected to be recovered through competition.

Based on the market research conducted in January 2006 for previous NASA Contract NNL06AA25C, DRS is the only known source that can meet our requirements for this follow on detector technology development.

6. Efforts Made to Solicit Offers

A Sources Sought Synopsis (LCT-Longwave-Infared-Detector) describing the FIDTAP requirement was advertised via NASA's Acquisition Internet Service (NAIS) and FedBizOpps on January 20, 2006, soliciting information for the FIDTAP program. DRS was the only respondent and the technical end user determined them to be the sole source to provide the detector. A sole source synopsis was posted for the Longwave Infared Detector Development (LDF-Longwave-Infared-Detector) was also posted on NAIS and FedBizOpps

on March 6, 2006, announcing NASA's intention to negotiate with DRS on a sole source basis for the FIDTAP effort.

This FIREBIB effort is a follow-on procurement to the FIDTAP detector procurement.

Following approval of this JOFOC, a synopsis of our requirement will also be published via NAIS and FedBizOpps announcing the Government's intention to negotiate with DRS on a sole-source basis for the FIREBIB detector.

7. Determination of the Contracting Officer

A thorough review of the proposal will be conducted to ensure the resultant negotiated price is fair and reasonable.

8. Description of the Market Research

Market research was performed for the FIDTAP detector procurement, NASA Contract NNL06AA25C, and as noted in paragraph 6 above, sources-sought synopsis soliciting information about potential sources was issued and only DRS submitted a response to the request. The Contracting Officer for new Business at NASA LaRC and the FIREBIB project lead discussed the need for a partnering synopsis; however, based upon prior experience and responses, did not believe that alternative sources would be identified through the partnering synopsis process. Therefore, a partnering synopsis was not issued. A FEDBIZOPPS sole source synopsis will be released after the approval of this justification.

9. Any Other Facts Supporting the Use of Other Than Full and Open Competition

NASA LaRC has issued a Teaming Opportunity Synopsis for the past several years for partners to propose development of longwave infrared detectors that meet the requirements described in item 3 above. DRS has consistenly responded and been the only partner that has adequately addressed our requirements.

10. Listing of Sources

As indicated in item 6, 8 and 9 above, DRS was the only source to submit a response regarding a far infrared detector development that was responsive to our requirements.

11. Subsequent Competitive Acquisitions

None.

12. Certifications

Technical Certification

I certify that to the best of my knowledge and belief, the data furnished above is complete and accurate.

Nurul Abedin — 3/11/09

Dr. M. Nurul Abedin — Date

Contracting Officer Certification

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

Teresa M. Hass — 3/11/09

Teresa M. Hass — Date
Contracting Officer

Susan E. McClain — 3/11/09

Susan E. McClain — Date
Assistant Head, Research and Projects Contracting Branch

Concurrence (if greater than $500K):

Michael I. Mark — 16 Mar 09

Michael I. Mark — Date
Office of Chief Counsel

Virginia C. Wycoff — 3/18/2009

Virginia C. Wycoff — Date
Procurement Officer

Approval:

Stephen G. Jurczyk — 3/24/09

Stephen G. Jurczyk — Date
Competition Advocate

LaRC Memorandum to Teresa M. Hass, Dr. M. Nurul Abedin, dated March 11, 2009

cc:
106/OD
134/OP
141/OCC
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468/RSFSB
126/T. M. Hass
126/S. M. McClain
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468/M. N. Abedin

126/TMHass:bt 3/4/09 (48496)