DEPARTMENT OF THE NAVY
NAVAL POSTGRADUATE SCHOOL
1 UNIVERSITY CIRCLE
MONTEREY, CA 93943-

IN REPLY REFER TO

JUSTIFICATION FOR OTHER THAN FULL AND OPEN COMPETITION

Upon the basis of the following justification, I as Contracting Officer hereby approve use of the other than Full and Open competition for the proposed contractual action pursuant to the authority of 10 USC 2304(c)(1), only one responsible source and no other supplier or servicing activity will satisfy agency requirements, as implemented by FAR 6.302-3.

1. Contracting Activity

Naval Postgraduate School
Department of Contracting and Logistics
1 University Circle
Monterey, CA 93943

2. Description of the Action Being Approved

This justification covers the procurement of technical reports for the study technical readiness and design concepts for Small Imaging Satellites for Sparse Aperture Systems. This justification for other than full and open competition will be posted at the Government wide Point of Entry.

3. Description of Supplies/Services

Development of the capability to form optical sparse apertures is a crucial enabling technology for small satellites. This capability would open up numerous new potential applications for the use of small satellite constellations and could potentially offer substantial savings over the current need to launch extremely large satellites to have large apertures on-orbit.

NPS has undertaken a study on sparse aperture systems which enables small satellites to form a large aperture in space for high resolution space imaging. One of the challenges for realizing a sparse aperture system in space is in the wavefront control and formation flying capabilities of the current small satellites and technical advancements necessary to achieve the required specifications of sparse aperture system.

To address these challenges, NPS is evaluating the most promising approaches to sparse aperture synthesis using small satellites, to include an assessment of the technological readiness of the needed small satellite wavefront control and formation flying technologies, the expected performance characteristics and limitations, and to formulate notional design concepts for testing small satellite platform for sparse aperture synthesis on-orbit.

4. Statutory Authority Permitting Sole Source

FAR 6.302 -- Circumstances Permitting Other Than Full and Open Competition.

5. Rational Justifying Use of Cited Statutory Authority

6.302-1 -- Only One Responsible Source and No Other Supplies or Services Will Satisfy Agency Requirements.

As the small satellite platform will require stringent attitude control and payload capabilities, selection of the small satellite bus is very important. As a basis for this study, NPS is investigating a small satellite platform that has a launch mass of 80-180kg with the payload mass capabilities of 30-70 Kg. Reconfigurable satellite bus platform such as BCP 50

and BCP 100 by Ball Aerospace are used as study bases that can provide comparable industry capability. This study is expected to provide a notional concept that can be implemented in the near future with a reasonable cost and schedule, which can serve as future path for on-orbit demonstration sparse aperture system using small satellites.

The required tasks are to evaluate technical readiness of small imaging satellite for sparse apertures and to develop notional sparse aperture design based on Ball Aerospace BCP 50 and BCP 80 satellite bus. Ball Aerospace is determined as a sole source based on sole knowledge and experience with BCP 50 and BCP 80 satellite bus along with the unique capability in wavefront control and formation flying for imaging satellites.

6. Description of Efforts Made to Solicit Offers from as Many Offerors as Practicable

Due to Ball Engineering's unique experience and study of small satellites BCP 50 and BCP 100, there are no other companies that could be solicited to fulfill the requirement.

7. Determination of Fair and Reasonable Cost

Costs will be determined fair and reasonable at time of award by the Contracting Officer and based on previous contracts and similar contracting efforts.

8. Market Research

NPS hosted three workshops from 2011-2013 with wide attendance from private industry and DoD with sessions directly related to or involving sparse aperture systems. The workshops informed NPS of the contractors performing research and development in the specific area of Small Imaging Satellites for Sparse Aperture Systems

These workshops led to NPS personnel subject matter expertise in the area of sparse aperture systems and an understanding that wavefront control, formation flying, and small imaging satellites were specific sub-areas of expertise required for study of small imaging satellite sparse aperture systems. These workshops identified current and relevant with private sector capabilities and the identification of Ball Aerospace and their unique expertise in the fields of wavefront control, formation flying, and small imaging satellites.

9. Other Facts Supporting Use of Other than Full and Open Competition

As identified in the market research phase, three of the critical enabling technologies for a small imaging satellite sparse aperture system are wavefront control, formation flying, and small imaging satellites. Ball Aerospace has unique expertise and experience with each of these three technologies. Below are summaries of Ball's unique experience in these areas that no other vendors can provide:

Small Imaging Satellites

- Ball Configurable Platform 100 (BCP 100). Launch mass $\leq$ 180kg. Payload mass 70 kg. Two BCP 100 spacecraft have flown.

- Ball Configurable Platform 50 (BCP 50). Launch mass $\leq$ 80kg. Payload mass 30 kg.

- The tasks of (Task 3.2) Notional Design Concepts for Small Imaging Satellites for Sparse Aperture Systems will require knowledge of the design and development of small satellites. Ball has already developed small satellite buses (BCP 100, BCP 50) that fit within the range of expected bus size and performance. The results from Ball for Task 3.2 will provide high credibility in the design, cost, and schedule for the system. Ball has unique capability in the area of small satellite design and development.

Wavefront Control

- James Webb Space Telescope (JWST): JWST is a first of its kind architecture utilizing active wavefront control of a segmented aperture. Ball architected the telescope and wavefront sensing and control techniques. Wavefront sensing and control is a critical technology for a sparse aperture telescope. Ball built the mirror segments, fine steering mirror, and mechanisms necessary to bring the telescope segments into alignment. The ability to sense and control the phase of the mirrors is a critical technology in a sparse aperture telescope architecture.

- Ball built hardware demonstrations of the JWST primary mirror. Ball developed test facilities like the Ball's WFS&C Testbed on JWST to demonstrate phase control and alignment of the mirror. This is a similar task to aligning a sparse aperture telescope.

Formation Flying

- Remote Mirror Experiment (RME): Demonstrated ability to engineer and execute a highly distributed, real-time, precision control loop across ground and space assets. Precision sensing and control of distributed systems is required for sparse aperture telescopes.

- Starlight Mission: Ball Aerospace was chosen as the spacecraft provider and top level system integrator for the JPL Starlight mission. The free-flying design maintained position to within several cm. Ball Aerospace's design work and simulation demonstrated that constellation control to the levels required by an interferometry mission is supported. In addition, Ball Aerospace has worked for several years on the TPF mission and participated in Interferometer Architecture, Design, and Formation Flying Technology Development Teams, in an SE&I role.

- Grace Follow On: Ball has experience in the GRACE mission using formation flying (although in a trailing orbit) which is one of only two operational formation flying missions (the other being MMS flying in a loose formation)

10. Actions to Remove Barriers to Future Competition

Sparse Aperture Small Satellite Imaging Systems are currently a unique and advanced technology with requirements determined through research. There are currently no plans to remove barriers for future competition. NPS will continue to keep current industry knowledge and seek competitive vendors for similar and future requirements for small satellite imaging systems.

I CERTIFY THAT STATEMENTS CHECKED, AND INFORMATION PROVIDED ABOVE, ARE COMPLETE AND CORRECT TO THE BEST OF MY KNOWLEDGE. I UNDERSTAND THAT THE PROCESSING OF THIS SOLE SOURCE JUSTIFICATION PRECLUDES THE USE OF FULL AND