

## JUSTIFICATION FOR OTHER THAN FULL AND OPEN COMPETITION (JOFOC)

1. This document is a justification for other than full and open competition prepared by the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center (NASA's GSFC):

NASA's GSFC proposes to enter into a contract with Hamamatsu Corporation, a Large Business. This document justifies the determination for using other than full and open competition.

2. The nature and/or description of the action being approved:

This justification provides the rationale for contracting by other than full and open competition for NASA's acquisition of a Multi-Pixel Photon Multiplier (PMT) from Hamamatsu Corporation.

The ICESat-2 Project is baselining a micropulse laser transmitter which will lay down a multiple ground-spot pattern to collect data on the topography of ice sheets and the thickness characteristics of sea ice. The Advanced Topographic Laser Altimeter System (ATLAS) instrument is designed to operate in micropulse, photon counting mode. This micropulse laser will put an extremely high number of photons in the air at one time, which in turn, requires a Detector with high sensitivity, low noise, high speed, and low time jitter to capture the returning photons from the ground. In addition, the detector or combination of detectors (array) must survive for a minimum of 5 years.

The PMT is a key component in the Advanced Topographic Laser Altimeter System (ATLAS) instrument receiver technology. It converts the photon into electrical pulse with high gain and time precision, thus enabling the precise measurement of the optical pulse traveling time. The travel time then provides the elevation of the ground. The overtime elevation changes over time indicate the changes of the ice sheet. This PMT is an off shelf photon counting detector from Hamamatsu. It has been fully qualified in Alpha Magnetic Spectrometer (AMS-02) mission in large quantity (640). The AMS-02 experiment is a state-of-the-art particle physics detector being constructed, tested and operated by an international team composed of 56 institutes from 16 countries and organized under United States Department of Energy (DOE) sponsorship. Over 640 Hamamatsu PMT detectors are used in the instrument. The PMT has gone through all of the qualification, radiation, vibration and shock, temperature and vacuum testing. In addition, the lifetime test data from Hamamatsu has shown better than 5 years lifetime in ATLAS operating conditions.

3. Description of the supplies or services required, including an estimated value:

The PMT is an off-the-shelf photon counting detector from Hamamatsu. The detector is for subsystem engineering development in the areas of Mechanical design, Electrical design, Lifetime verification, Reliability testing.

The cost estimate for the PMT detector is approximately \$2200 per device. 100 detectors are needed, for a total estimated value of \$220,000.00.

4. Statutory authority permitting other than full and open competition:

The statutory authority for this JOFOC is 10 U.S.C. 2304(c)(1), only one responsible source. The Government intends to award using FAR Part 13 and Subpart 13.5 – “Test Program For Certain Commercial Items”.

5. A demonstration that the proposed contractor’s unique qualifications or the nature of the acquisition requires use of the authority cited:

ICESAT-2 detector has very high performance requirements. It requires:

1. Detection Wavelength: 300-650 nm
2. 16 (4x4) arrayed detector with active area of 4 mm x 4 mm per pixel.
3. Quantum Efficiency at 532nm: 20%
4. Current gain  $2.5 \times 10^6$
5. Worst case dark count 10,000/s at 25C
6. Continuous operation
  - a. No dead time
  - b. No detector reset
7. Time Jitter 330 ps (FWHM)
8. Time response
  - a. Rise time 830 ps
9. Afterpulsing < 1%
10. No cryogenic cooling
11. Heritage of space flight
12. Lifetime: > 5 years with average 2.25MCPS continuous background count rate

Hamamatsu is the leading vendor for photon counting PMT. It has provided flight detectors for AMS-01 & -02, PAMELA, and GLAST missions. The detector meets all of the performance requirements and has been successfully integrated into the instruments. The PMT has gone through all of the flight qualification, radiation, vibration and shock, temperature and vacuum testing. In addition, the lifetime test data from Hamamatsu has shown better than 5 years lifetime in ATLAS operating condition. In conclusion, Hamamatsu is the only vendor that can deliver a photon counting detector that meets all of the requirements and qualifications for ICESAT-2 mission.

6. Description of the efforts made to ensure that offers are solicited from as many potential sources as practicable, including whether a notice was or will be publicized as required by Federal Acquisition Regulation (FAR) 5.202:

A notice was publicized on the Federal Business Opportunities website ([www.fbo.gov](http://www.fbo.gov)). Notice identification number - Request for Information (RFI): NNG10333578L, Technology Readiness Level 6 Detectors (TRL6). All business types and sizes were solicited to respond.

7. Description of the market research conducted, and the results or a statement of the reasons market research was not conducted:

Market research was conducted and resulted in the determination that no sources other than Hamamatsu can build a PMT that meets the ICESAT-2 ATLAS instrument's requirements.

The determination that no other sources meet the necessary specifications for the required detectors was based on the responses received from the RFI (NNG10333578L). Two vendors, Sydor Instruments, LLC and Ball Aerospace and Technologies Corp., submitted responses to the RFI. Both vendors provided a table that does address the TRL-6 maturity level, however both vendors did not have a clear path of an existing detector to TRL-6, including lifetime demonstration, while meeting the performance specification by February 2011.

The detector team has been continuously supported and monitored the detector technology process through SBIR, conferences, and symposiums. In the past year, the team has tested and evaluated multiple detectors from various vendors. The vendors include: Voxel, Princeton Lightwave, Epitaxial Technologies, Apeak, AMD. The results were also summarized and published. Based on the tests and evaluations of the above mentioned vendors, none of the vendor's detectors can meet the specification for the ICESAT-2 detector.

8. Other facts supporting the use of other than full and open competition:

The Hamamatsu PMT has gone through all of the flight qualification, radiation, vibration and shock, temperature and vacuum testing. In addition, the lifetime test data from Hamamatsu has shown better than 5 years lifetime in ATLAS operating condition. In conclusion, Hamamatsu is the only vendor that can deliver a photon counting detector that meets all of the requirements and qualifications for ICESAT-2 mission.

9. Sources, if any, that expressed an interest, in writing, in the acquisition: This is a draft copy of the JOFOC that is being submitted for the synopsis approval. Once the

synopsis closes, the JOFOC will be updated to reflect any sources other than the proposed source that expressed an interest in this acquisition.

10. The actions the Agency may take to remove or overcome any barriers to competition before any subsequent acquisition for the supplies or services required: The Agency posted RFI NNG10333578L on the Federal Business Opportunities (FBO) website in order to remove or overcome any barriers to competition. The Agency will also post a Sole Source Synopsis for Hamamatsu Corporation on the FBO website for the 100 detectors in order to remove or overcome any barriers to competition.

JOFOC Signature Page for (add short descriptive title of requirement, e.g., "contract extension for NNG---")

Technical Officer:

I certify that the facts presented in this justification are accurate and complete.

Jeonjung Yang

Signature

5/28/2010

Date

Contracting Officer:

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

Ch. A. Reid

Signature

6/2/2010

Date