

System Vicarious Calibration (SVC) of the NASA Plankton, Aerosol, Cloud, Ocean Ecosystem) PACE Observatory Using HyperNav

Statement of Work (SOW)

1. Scope of Work

This contract provides for operation and maintenance of the HyperNav hyperspectral radiometric system to support system vicarious calibration (SVC) of the NASA Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) Ocean Color Instrument (OCI).

2. Background

The HyperNav system was developed under NASA contract 80GSFC22CA050 (ROSES 2019, entitled *A.48 The Plankton, Aerosol, Cloud, Ocean Ecosystem (PACE) Mission System Vicarious Calibration*). The purpose of the contract was to develop, implement, and deploy *in situ* SVC capabilities for the Ocean Color Instrument, the primary instrument on the PACE mission. System vicarious calibration combines satellite sensor data with *in situ* radiometric measurements to determine on-orbit calibration factors, requiring high-accuracy, hyperspectral-resolution measurements with bounded uncertainty.

HyperNav was successfully deployed in 2022 and collected pre-launch SVC measurements. The system has been deployed at four (4) different sites – Hawaii, Mo’orea, Crete, and Puerto Rico – using eight (8) HyperNav radiometric systems and eight (8) floats. These rotational deployments are approximately 60 days in duration. Over the past year, HyperNav completed twenty (20) deployments, collecting over seven hundred fifty (750) radiometric profiles. This data is currently being used by the PACE team to determine the gain coefficients for the PACE OCI sensor.

3. Objective

The objective of this contract is to sustain HyperNav operations and the collection of SVC-quality data in support of the validation of the PACE mission measurements and calibration of PACE OCI sensor products.

4. Technical Requirements

The work to be performed under this SOW includes:

4.1 HyperNav System Deployments. The Contractor shall conduct eight (8) HyperNav system deployments per year across three (3) geographical sites over the period of performance. Deployments shall be distributed as follows: three (3) deployments at the Hawaii site, three (3) deployments at the Mo'orea site, and two (2) deployments at the Puerto Rico site. Each deployment shall have a nominal duration of sixty (60) days. The Contractor shall maintain eight (8) HyperNav radiometric systems and associated float platforms to support rotational deployment operations. Deployments shall be scheduled to optimize clear-sky conditions and maintain at

least one float operational at any given time, with no more than two floats deployed simultaneously.

4.2 Data Processing and Delivery. The Contractor shall operate, maintain, and refine HyperNav data processing streams to generate SVC-qualified radiometric products. The Contractor shall deliver the data to the NASA PACE team at the Ocean Ecology Lab (OEL). The Contractor shall deliver a minimum of one hundred sixty (160) quality-assured in-situ SVC observations for HyperNav over the period of performance.

4.3 Data Analysis and Coordination. The Contractor shall analyze HyperNav data for SVC quality, conduct OCI-HyperNav matchup analyses, and evaluate hyperspectral consistency, radiometric stability, and sensitivity to atmospheric and surface conditions. The Contractor shall coordinate with NASA OEL to review data quality, discuss anomalous profiles, refine matchup selection criteria, and support interpretation of SVC gain estimates. The Contractor shall implement agreed-upon refinements to the processing stream as directed by NASA.

4.4 Sensor Calibration and Maintenance. The Contractor shall perform pre-deployment and post-deployment laboratory calibrations of all HyperNav radiometric systems to ensure measurement accuracy and traceability. The Contractor shall conduct a minimum of nine (9) calibrations of sensors per year to ensure optimal data quality. Calibration procedures shall be documented and shall meet the resolution, accuracy, and uncertainty requirements for PACE OCI system vicarious calibration as specified in the technical literature and as accepted by NASA OEL. The Contractor shall maintain all HyperNav systems, float platforms, and associated equipment in operational condition throughout the period of performance.

4.5 Documentation and Reporting. The Contractor shall document the HyperNav calibration and characterization processes, data processing stream and updates, quality control procedures, and global/site specific matchup analyses. Documentation shall clearly describe processing methods, quality control decisions, and algorithmic updates affecting delivered products. The Contractor shall disseminate results through agency reports and peer-reviewed publications and presentations at professional conferences. The Contractor shall make all source code publicly available through version-controlled repositories (e.g., GitHub) under open-source licenses, with stable releases archived in repositories providing persistent DOIs (e.g., Zenodo). The Contractor shall comply with NASA's Open Science and Data Management Plan requirements.

5. Deliverables

The Contractor shall provide the following deliverables:

Table 1: Deliverables

Deliverable Reference #	Deliverable	Format of Deliverable	Recipient	Due Date / Frequency
5.1	Progress Report	Report	NASA OBB program	Annual
5.2	SVC Measurements	Data	PACE Project	Daily
5.3	Final Scientific and Technical Report	Report	NASA OBB / STI Program	End of Contract
5.4	Commercial IT Authorization Report (CITAR) DRD	Report (CITAR Template)	COR / NASA OCIO	Monthly (if purchases occur)
5.5	Capital Planning and Investment Control (CPIC) Cost Reporting DRD	Report (CPIC Template)	COR / NASA OCIO Investment Manager	Annually
5.6	Security Requirements for Unclassified IT Resources DRD / C-SCRM Plan	Plan (NIST SP 800-161)	COR / NASA OCIO	Within 30 days of award (or per DRD instructions)

6. Travel

The Contractor shall perform the scheduled travel identified in Table 1 as necessary to accomplish the requirements of this SOW. The quantities, destinations, timing, and estimated amounts in Table 2 are planning estimates and performance assumptions. Unless otherwise stated in the contract, all scheduled travel is included in the firm-fixed price. The Contractor shall obtain the Contracting Officer's written approval before undertaking material travel that is outside the destinations, purposes, or frequency identified in Table 2. Such approval does not, by itself, change the contract price, period of performance, or other contract terms. Any change to the contract price or requirements shall be made only by the Contracting Officer through an executed contract modification. The Contractor shall manage travel costs within the firm-fixed price. The Government will not separately reimburse travel costs or pay additional amounts solely because actual travel costs exceed the estimates in Table 2.

Table 2: Scheduled Travel

<u>Name of Travel/Event</u>	<u># of Travelers</u>	<u>Destination</u>	<u># of Days/Nights</u>	<u>Frequency</u>
NASA PACE meeting	1	Washington, DC (or determined location)	3/2	1x year
HyperNav deployment - Hawaii	1	Hawaii	3/2	3x year
HyperNav deployment – Mo’orea	2	Mo’orea	7/6	2x year
HyperNav deployment – Puerto Rico	1	Puerto Rico	5/4	1x year
Ocean Optics or alike conference	2	TBD	5/4	1x year

7. Place of Performance

The place of performance shall be the Contractor’s facility and at the HyperNav deployment sites.

8. Information Technology, Security, and Records Management Requirements

8.1 IT Purchase Authorization

- a. The Contractor shall ensure all IT products and services direct charged to the contract are approved through the OCIO's Commercial IT Request (CITR) Application. This includes, but is not limited to, FITARA, Supply Chain Risk Management (SCRM), IPv6, and 508 compliance. No purchases of commercial IT products or services shall be made prior to coordination and approval by the OCIO. The Contractor shall report purchases monthly utilizing DRD IT-02, Commercial IT Authorization Report (CITAR).
- b. This contract shall only be used to purchase software, software maintenance, hardware, or hardware maintenance necessary for the performance of this contract. NASA shall own the license(s) or subscriptions for any software or applications purchased. All hardware shall be titled to NASA.

8.2 Section 508 Conformance

The contractor shall ensure that all products, platforms, services, and communications delivered as part of this work statement that are Information and Communication Technology (ICT) or contain ICT, conform to the Revised Section 508 of the Rehabilitation Act Standards, 36 C.F.R. § 1194.1 & Apps. A, C & D. The Standards may be found at <https://www.access-board.gov/ict/>.

8.3 Records Management

- a. The Contractor shall maintain all records created for Government use or created in the course of performing the contract and/or delivered to, or under the legal control of the Government and must be managed in accordance with Federal law, including but not limited to, the Federal Records Act (44 U.S.C. chs. 21, 29, 31, 33), NARA regulations at 36 CFR Chapter XII Subchapter B, as well as NASA records policies (NPD 1440.6, NASA Records Management Program, and NPR 1441.1, NASA Records Management Program Requirements).
- b. The Contractor shall ensure that NASA-owned/Contractor-held records are segregated from contractor-owned records and from non-record materials and report holdings of NASA records.
- c. The Contractor shall immediately notify the Contracting Officer and NASA Records Officer upon discovery of any inadvertent or unauthorized removal, defacing, alteration, or destruction of Federal records. Destruction of Federal Records is EXPRESSLY PROHIBITED unless in accordance with records retention schedules or as directed by the Contracting Officer.
- d. All Contractor employees assigned to this contract who create, work with, or otherwise handle Federal Records are required to complete mandatory NASA-provided records management training. The Contractor shall ensure that training has been completed according to agency policies, including initial training and any required annual or refresher training.
- e. The Contractor shall incorporate the substance of this clause, its terms and requirements including this paragraph, in all subcontracts under this contract, and require written subcontractor acknowledgment of same.

9. Milestone Payment Schedule

9.1 Payment Structure

Payment under this Firm-Fixed-Price contract shall be made upon completion and Government acceptance of the milestones specified in Table 3.

Table 3: Milestone Payment Schedule

Milestone ID	Milestone Description	Success Criteria (Trigger for Payment)	SOW Ref.	Frequency / Timeline	Payment Amount (% of Total FFP)
M-1.01 to M-1.12	Monthly Operations & Data Delivery Routine maintenance, data processing streams, matchup analyses, and daily delivery of SVC data to the PACE OEL.	Verification by NASA OEL of continuous daily data stream delivery and monthly matchup analyses for the preceding month.	4.2, 4.3, 5	Monthly (<i>12 payments per year</i>)	30% total (<i>2.5% per month</i>)
D-2.01 to D-2.03	Hawaii Deployments Execution of 60-day rotational deployments in Hawaii.	Successful deployment of the float, establishment of data stream, and completion of the 60-day deployment cycle.	4.1	3x per year	12% total (<i>4% per deployment</i>)
D-3.01 to D-3.03	Mo'orea Deployments Execution of 60-day rotational deployments in Mo'orea.	Successful deployment of the float, establishment of data stream, and completion of the 60-day deployment cycle.	4.1	3x per year	15% total (<i>5% per deployment</i>)
D-4.01 to D-4.02	Puerto Rico Deployments Execution of 60-day rotational deployments in Puerto Rico.	Successful deployment of the float, establishment of data stream, and completion of the 60-day deployment cycle.	4.1	2x per year	8% total (<i>4% per deployment</i>)
C-5.01 to C-5.09	Sensor Calibrations Pre-deployment and post-deployment	Submission and NASA acceptance of calibration documentation	4.4	9x per year	18% total (<i>2% per calibration</i>)

Milestone ID	Milestone Description	Success Criteria (Trigger for Payment)	SOW Ref.	Frequency / Timeline	Payment Amount (% of Total FFP)
	laboratory calibrations of radiometric systems.	detailing resolution, accuracy, and uncertainty limits.			
R-6.01	Annual Program Reviews & Travel Participation in the NASA PACE meeting and Ocean Optics (or similar) conference.	Completion of travel/attendance and submission of any associated meeting presentation materials or summaries.	6	Annually (<i>Usually Q3 or Q4</i>)	7% total
R-7.01	Annual Reporting & Open Science Compliance Delivery of the annual progress report and publication of source code.	NASA acceptance of the Annual Progress Report sent to the agency directly, and submission of data from the HyperNav system into the designated repository (e.g., OB.DAAC).	4.5, 5	Annually (<i>Month 12</i>)	10% total
TOTAL					100%

9.2 Milestone Acceptance Process

(a) **Submission of Invoice.** The Contractor shall submit an invoice for each milestone upon completion of the work and satisfaction of the acceptance criteria specified in Table 3.

(b) **Government Review Period.** The Government shall have thirty (30) calendar days from receipt of the Contractor's invoice and supporting documentation to review the milestone completion and either:

- Accept the milestone and authorize payment; or
- Reject the milestone with written explanation of deficiencies.

(c) **Deficiency Correction.** If a milestone is rejected, the Contractor shall correct the deficiencies and resubmit within fifteen (15) calendar days. The Government shall have an additional fifteen (15) calendar days to review the resubmission.

(d) **Supporting Documentation.** Each invoice shall include sufficient documentation to demonstrate completion of the acceptance criteria, including but not limited to:

- Deployment reports with dates, locations, and status report of data transmission.
- Calibration dates and specifications of results.
- Meeting attendance and summary of presentation materials.
- Any other relevant information regarding Monthly Operations & Data Delivery.

9.4 Cumulative Data Requirements

Notwithstanding the monthly payment structure, the Contractor remains obligated to deliver a minimum of one hundred sixty (160) quality-assured in-situ SVC observations over the period of performance as specified in Section 4.2. Failure to meet this cumulative requirement may result in withholding of final milestone payment R-02 until the deficiency is corrected.

9.5 Payment Terms

Payment shall be made in accordance with the Prompt Payment Act. The Government shall make payment within thirty (30) days after:

- Receipt of a proper invoice; and
- Acceptance of the milestone deliverable(s).

9.6 Force Majeure

(a) **Definition.** For purposes of this contract, "Force Majeure" means an event or condition beyond the reasonable control of the Contractor that prevents or delays performance of contractual obligations, including but not limited to: acts of God, fires, floods, epidemics, pandemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather including storms, acts of war or terrorism, civil disturbances, or acts of government in its sovereign capacity.

(b) **Notice Requirement.** If the Contractor is prevented from performing any obligation under this contract by Force Majeure, the Contractor shall:

- Notify the Contracting Officer in writing within five (5) business days of the occurrence or anticipated occurrence of the Force Majeure event;
- Describe the nature of the Force Majeure event and its expected duration;
- Explain the specific contractual obligations affected; and
- Propose mitigation measures or alternative performance methods.

(c) **Effect on Performance.** Upon receipt and verification of a Force Majeure notice, the Contracting Officer may, at the Government's sole discretion:

- Extend the time for performance of affected milestones without penalty;
- Modify the contract to accommodate alternative performance methods; or
- Terminate the contract for the convenience of the Government in accordance with FAR 52.249-2.

(d) **Limitations.** Force Majeure shall not excuse the Contractor from performance if:

- The event was caused by the Contractor's negligence or willful misconduct;
- The event was reasonably foreseeable and the Contractor failed to take reasonable precautions;
- The Contractor fails to use reasonable efforts to mitigate the effects of the Force Majeure event; or
- The event affects only the Contractor's economic circumstances (e.g., increased costs, market conditions, supplier pricing).

(e) **No Additional Compensation.** The Contractor shall not be entitled to additional compensation or price adjustment solely due to a Force Majeure event. Any contract modification shall be limited to schedule adjustments or scope modifications as determined appropriate by the Contracting Officer.