**ORDER FOR SUPPLIES OR SERVICES**

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Delivery Order/Call No.</th>
<th>Date of Order/Call</th>
<th>Item No.</th>
<th>Schedule of Supplies/Services</th>
<th>Quantity Ordered/Accepted</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Amount Accepted</th>
</tr>
</thead>
</table>

**Acceptance**

- The contractor hereby accepts the offer represented by the numbered purchase order as it may previously have been or is now modified, subject to all of the terms and conditions specified on this number purchase order.

**Signing**

- Larry Kohlenstein, CFO

**Accounting and Appropriation Data/Local Use**

- Mail to:
  - JHU-APL
  - 3701 North Point Drive
  - Laurel, MD 20706

**Payment**

- By number:
  - 1101
  - 2001

**Signature**

- Signature of Authorized Government Representative

- Date

**Date of Receipt**

- Received at:
  - Date received

**Telephone Number**

- [ ] Partial

**E-Mail Address**

- [ ] Final

**I certify this account is correct and proper for payment.**

- [ ] Complete

**Signature and Title of Certifying Officer**

- [ ] Partial

**Ship to**

- [ ] Final

**Signer's Initials**

- [ ] Correct

**Account Number**

- [ ] Final

**Voucher Number**

- [ ] Correct
Section B - Supplies or Services and Prices

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>SUPPLIES/SERVICES</th>
<th>ESTIMATED COST</th>
<th>FIXED FEE</th>
<th>TOTAL EST. COST PLUS FIXED FEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001</td>
<td>Research &amp; Development</td>
<td></td>
<td></td>
<td>$2,240,858.00</td>
</tr>
<tr>
<td></td>
<td>The Contractor shall furnish the necessary personnel, materials, facilities and other services as may be required to perform Contract Line Item Number (CLIN) 0001, 0003, in accordance with the Statement of Work, Attachment 1 hereto, and as specified in the Contractor's proposal entitled, &quot;Station-Keeping Buoy,&quot; dated December 20, 2004, copies of which are in possession of both parties.</td>
<td></td>
<td></td>
<td>$2,240,858.00</td>
</tr>
</tbody>
</table>

ACRN AA

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<tr>
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<tr>
<td>0003</td>
<td>R&amp;D Technical, Business Status &amp; Final</td>
<td>$0.00</td>
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<tr>
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<td>CPFF</td>
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<td>NSP</td>
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<tr>
<td>ITEM NO</td>
<td>SUPPLIES/SERVICES</td>
<td>ESTIMATED COST</td>
<td>FIXED FEE</td>
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<td><strong>OPTION 1</strong> - The Contractor shall furnish the necessary personnel, materials, facilities and other services as may be required to perform Contract Line Item Number (CLIN) 0001, 0003, in accordance with the Statement of Work, Attachment 1 hereto, and as specified in the Contractor's proposal entitled, &quot;Station-Keeping Buoy,&quot; dated December 20, 2004, copies of which are in possession of both parties.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0005</td>
<td>R&amp;D Technical, Business Status &amp; Final</td>
<td>$0.00</td>
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</tr>
<tr>
<td></td>
<td><strong>OPTION 1</strong></td>
<td></td>
<td></td>
<td>NSP</td>
</tr>
</tbody>
</table>
SECTION D Packaging and Marking

CLAUSES INCORPORATED BY FULL TEXT

D-1 Packaging and Marking

All items shall be preserved, packaged, packed and marked in accordance with best commercial practices to meet the packing requirements of the carrier, and to ensure safe delivery at destination.

SECTION E Inspection and Acceptance

Supplies/services will be inspected/accepted at:

<table>
<thead>
<tr>
<th>CLIN</th>
<th>INSPECT AT</th>
<th>INSPECT BY</th>
<th>ACCEPT AT</th>
<th>ACCEPT BY</th>
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<tbody>
<tr>
<td>0001</td>
<td>Destination</td>
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<td>0003</td>
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</table>

OPTION 1

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<th>INSPECT AT</th>
<th>INSPECT BY</th>
<th>ACCEPT AT</th>
<th>ACCEPT BY</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Destination</td>
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</tr>
<tr>
<td>0005</td>
<td>Destination</td>
<td>Government</td>
<td>Destination</td>
<td>Government</td>
</tr>
</tbody>
</table>

SECTION F Deliveries or Performance

CLAUSES INCORPORATED BY FULL TEXT

F-1 Term of Contract

The term of this task order commences on the effective date of the task order and continues through twelve (12) months thereafter. The Option 1, if exercised by the government, shall run twelve (12) months from date of execution.

F-2 Reports and Other Deliverables - JHU/APL shall submit the following reports:

<table>
<thead>
<tr>
<th>CLIN</th>
<th>Description</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>0003</td>
<td>Technical and Business Status Reports</td>
<td>30 days after the effective date of the Task Order and monthly thereafter</td>
</tr>
<tr>
<td>0003</td>
<td>Final Report</td>
<td>Upon Completion of Task Order</td>
</tr>
<tr>
<td>0005</td>
<td>Technical and Business Status Reports</td>
<td>30 days after the effective date of the Task Order Option 1 and monthly thereafter</td>
</tr>
<tr>
<td>0005</td>
<td>Final Report OPTION 1</td>
<td>Upon Completion of Task Order Option 1</td>
</tr>
</tbody>
</table>
F-3 Report Distribution

(a) DARPA/CMO
Attn: Patricia S. Matyskiela, Contracting Officer
3701 North Fairfax Drive
Arlington, VA 22203-1714
Phone: (571) 218-4686
FAX: (703) 696-2208
Email: pmatyskiela@darpa.mil
(one copy each report)

(b) DARPA/ATO
Attn: Dr. Khine Latt, Program Manager
3701 North Fairfax Drive
Arlington, VA 22203-1714
Phone: (571) 218-4203
FAX: (703) 696-9781
Email: klatt@darpa.mil
(one copy each report)

(c) DARPA/ATO
Attn: Patrick Bailey, Assistant Director for Program Management
3701 North Fairfax Drive
Arlington, VA 22203-1714
Phone: (703) 696-5277
FAX: (703) 696-9781
Email: pbailev@darpa.mil
(one copy each report)

(c) DARPA/ATO
Attn: Cathy Fortier, Program Specialist Assistant
3701 North Fairfax Drive
Arlington, VA 22203-1714
Phone: (571) 218-4313
FAX: (703) 696-9781
Email: cfortier@darpa.mil
(one copy each report)

(e) DCMA/Maryland
Attn: Diane Rich, ACO
217 E. Redwood Street
Suite 1800
Baltimore, MD 21202-5299
Phone: (410) 962-9253
FAX: (401) 962-3405
Email: Joyce.Rich@dcma.mil
(one copy each report)
F-4 Notice Regarding Late Delivery

In the event the Contractor anticipates difficulty in complying with the contract delivery schedule, the Contractor shall immediately notify the Contracting Officer in writing, giving pertinent details, including the date by which it expects to make delivery; PROVIDED, however, that this date shall be informational only in character and the receipt thereof shall not be construed as a waiver by the Government of any contract delivery schedule, or any rights or remedies provided by law or under this contract.

SECTION G Contract Administration Data

ACCOUNTING AND APPROPRIATION DATA

| AA:         | 9740400 1320 U014 P4B20 2525 DPAC 4 5586 S12136 63763E |
| AMOUNT:     | $1,614,316 (U014/00) |
| AB:         | 9750400 1320 U014 P5X20 2525 DPAC 5 5201 S12136 63766E |
| AMOUNT:     | $626,542 (U014/01) |

TOTAL AMOUNT: $2,240,858

SECTION H Special Contract Requirements

CLAUSES INCORPORATED BY FULL TEXT

H-1 Contracting Officer

The Contracting Officer is the only individual authorized to redirect the effort or in any way amend or modify any of the terms of this Task Order. If, as a result of technical discussions, it is desirable to alter the Task Order obligations or statement of work, a modification must be issued in writing and signed by the Contracting Officer.
Travel costs in the amount of $24,327 are authorized during the period of performance of the Basic Task Order.

Travel costs in the amount of $30,462 for Option 1, if exercised by the government, shall be authorized during the period of performance of Option 1.

*NOTE: The prime contractor may deviate +/- 20 percent from the individual values delineated above for travel without prior authorization from the DARPA Contracting Officer. In no event, however, will the contractor exceed the maximum value of this task order for the BASE effort.

Travel costs are authorized in accordance with the master IDIQ MDA972-01-D-0005 contract and the following:

(a) Travel authorization changes shall be approved by the DARPA Contracting Officer.

(b) Travel shall be approved in advance by the DARPA Program Manager.

(c) Travel costs shall be reimbursed in accordance with applicable Federal Joint Travel Regulations and Federal Acquisition Regulation (FAR) 31.205-46.

(d) Travel costs are authorized only to the minimum extent necessary to perform the objectives of the Task Order Statement of Work.

(e) Travel costs for events not directly related to the Task Order Statement of Work (to include training, seminars, etc.) shall be approved in advance, in writing, by the DARPA Contracting Officer.

(f) All foreign travel shall be authorized 30 days in advance and approved by the Administrative Contracting Officer.

Subcontracts

(a) Pursuant to FAR 44-202 and Subpart 52.244-2, the following subcontractors are approved under this Order.

<table>
<thead>
<tr>
<th>Subcontractors Base</th>
<th>Estimate</th>
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</thead>
<tbody>
<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Subcontractors Option 1 (If exercised)</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Blank]</td>
<td>[Blank]</td>
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<tr>
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</tbody>
</table>

(b) Pursuant to FAR 44-202 and Subpart 52.244-2, the following subcontractor is approved under this Order subject to the concurrence of the ACO/Diane Rich/DCMA/Baltimore

<table>
<thead>
<tr>
<th>Subcontractors Base</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
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<td>[Blank]</td>
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</tbody>
</table>
Subcontractors Option 1 (If exercised)

(c) The subcontractor’s estimated price shall not exceed the total amount unless approval is coordinated with the Contracting Officer.

SECTION J List of Attachments

Statement of Work

Station-Keeping Buoy

This proposal is focused on developing and demonstrating an environmentally powered station-keeping buoy. The buoy package will unfold into a vessel that is capable of harvesting wind and solar energy and efficiently using the environmentally derived energy in a station-keeping mode. This statement of work outlines the developmental, integration and testing for design and development of a functional station-keeping buoy prototype. Designing, purchasing or developing appropriate assemblies and sensors per se is simply the first step in developing a station-keeping vessel. An iterative, build / test / build approach is envisioned to accomplish station-keeping. Once the initial design is determined and a prototype developed, a series of basin and at-sea tests are planned to refine the systems autonomous station-keeping ability.

In addition, a high fidelity simulation model will be developed to determine the system’s station-keeping ability as a function of design details. The model will utilize environmental inputs from the National Security Technology Department (NSTD) of the JHU/APL Environmental Support System climatological and sea test data archives, the Naval Climatology Data Center, the National Oceanographic Data Center and NAVOCEANO. Data from at-sea prototype testing will be fed back to refine the simulation model.

Phase 1 (Base) Statement of Work

1. Management and oversight
   a. Review designs, subcontracts and prototype development
   b. Develop and manage tests phases
   c. Task budget management
2. Design system
   a. Hull / sail
      i. Determine technical constraints of system including size, shape, power consumption, weight, packaging capability, wind harvesting ability
      ii. Utilize consultants to define hull and sail parameters
   b. Power distribution system
      i. Determine most suitable high energy density, rechargeable battery suites
      ii. Develop battery charging circuitry to harvest energy from solar cells and thruster-based water turbine
      iii. Develop power distribution system to all motor controllers and thruster
   c. Controls systems
      i. Develop control system algorithms for autonomous sail control
      ii. Design / determine control system hardware (mechanical and electronic)
   d. Sensor development
      i. Determine sensors required for station-keeping operation
      ii. Evaluate suitability of available sensors
e. Solar system – Evaluate available solar panels; specifically, flexibility (to package in a standard buoy) and derived energy density
f. Thruster
   i. Subcontract with TSL Technology to develop asymmetric thruster
      1. Size versus efficiency (design only in phase 1)
      2. Thruster utilized as a water turbine (lab testing only in phase 1)
g. Mechanical structure- Design basic structure
   1. Structural assembly for all major sub-systems
   2. Flexible packaging links

3. Characterize environmental parameters
   a. Utilize in simulation model
   b. Determine design requirement and develop prototype

4. Develop high fidelity simulation model
   a. Utilize environmental inputs from multiple locations
   b. Determine station-keeping performance as a function of design
   c. Quantify hydrophone performance

5. Prototype development
   a. Hull / sail – Build 1 or 2 most promising hull shapes from the design phase
   b. Power distribution system
      i. Select batteries
      ii. Build charging circuit
      iii. Build electronic link between batteries, thruster and motors
   c. Control systems
      i. Build prototype control circuitry
      ii. Write version 1 autonomous sailing software
   d. Solar system – Select, modify and mount solar panels
   e. Thruster
      i. Lab-tested TSL prototype sent to APL
      ii. Thruster installation / testing
   f. Incorporate GPS – required for station-keeping navigation
   g. Documentation
      i. Mechanical drawings
      ii. Schematics
      iii. Software documentation

6. Sub system testing
   a. Laboratory testing of major subsystems
   b. Near-by creek testing – Prototype system (essential sub-system testing)
      i. Hull / sail, power system, controls, GPS and thruster

7. System Integration
   a. Adjust / refine sub-systems based on Part 5 test results and integrate

8. Basin and at-sea testing
   a. MAST trials – (4 day trial at Naval Surface Warfare Center/Carderock(NSWC-CD))
   b. Near shore testing (R/V Chessie) – 2 trials planned
c. Advanced near shore testing (R/V Chessie) – 2 trials planned (solar system and thruster)

9. Phase 1 DARPA demonstration – Demonstrate station-keeping technology to maintain 250 m water radius over a 24 hr period

10. Prepare for and attend DARPA quarterly reviews

**Phase 2 (Option 1) Statement of Work**

1. Management and oversight
   a. Review designs, subcontracts and prototype development
   b. Develop and manage tests phases
   c. Task budget management

2. Refine station-keeping technology designs or change techniques based on Phase 1 results: Sails / controls, GPS, Thruster, Solar, Battery Charging system

3. Replace insufficient energy harvesting equipment, lab testing, integration testing, near shore testing

4. Update simulation model – demonstrate endurance of one month.
   a. Upgrade buoy model dynamics to six degrees of freedom
   b. Conduct parametric design and performance studies

5. Incorporate energy harvesting techniques and refine system – Near shore testing(Chessie)
   a. Sails / controls, GPS, Thruster as energy generator (water turbine), Solar – flexible panels for packaging and battery charging system

6. Lab / at sea testing – System refinements (Mk 2)
   a. Sails / controls, GPS, Thruster as energy generator (water turbine), Solar – flexible panels for packaging and Battery charging system

7. Prepare and attend DARPA quarterly reviews

8. Prepare Phase 3 proposal

9. DARPA Phase 2 demonstration - Demonstrate station-keeping and energy-harvesting technologies to maintain 250 m water radius over a 7 day period.

**Deliverables**

**Phase I (Base) Deliverables**

Quarterly status reports
Quarterly financial reports
A final report that summarizes the project and tasking involved at the conclusion of Phase 1 performance period.

**Phase 2 (Option 1) Deliverables**

Quarterly status reports
Quarterly financial reports
Prototype hardware (as required) and a level 2A drawing package
A final report that summarizes the project and tasking involved at the conclusion of Phase 2 performance period.
**AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT**

<table>
<thead>
<tr>
<th>1. CONTRACT ID CODE</th>
<th>2. AMENDMENT/MODIFICATION NO.</th>
<th>3. EFFECTIVE DATE</th>
<th>4. REQUISITION/PURCHASE REQ. NO.</th>
<th>5. PROJECT NO. (If applicable)</th>
<th>6. ISSUED BY CODE</th>
<th>7. ADMINISTERED BY (If other than Item 6) CODE</th>
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</thead>
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<td></td>
<td></td>
<td>HR0011</td>
<td>S2101A</td>
</tr>
</tbody>
</table>

8. NAME AND ADDRESS OF CONTRACTOR:

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Hopkins University</td>
<td>1100 John Hopkins Road, Baltimore, MD 21202</td>
</tr>
</tbody>
</table>

9A. AMENDMENT OF SOLICITATION NO.

10A. MOD. OF CONTRACT/ORDER NO.

10B. DATED (SEE ITEM 13)

CODE 88888

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT/ORDER NO. IN ITEM 10A.

B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as change in paying office, appropriation data, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(c).

C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

D. OTHER (Specify type of modification and authority)

Mutual Agreement of the Parties

E. IMPORTANT: Contractor is not, X is required to sign this document and return copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

Modification Control Number: janders00563

Contract Estimated Cost Plus Fixed Fee for Contract Line Item Number (CLIN) 0004.

Except as provided herein, all terms and conditions of the document referenced in Items 9A or 10A, as hereofere changed, remain unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)

Nicholas J. Langhauser, CFO

15B. CONTRACT/ORDER No.

(Signature of person authorized to sign)

15C. DATE SIGNED

04/20/05

16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)

16B. UNITED STATES OF AMERICA

(Contracting Officer)

16C. DATE SIGNED

04/20/05

STANDARD FORM 30 (Rev. 10-83)

Prescribed by GSA

FAR (48 CFR) 52.243
The following items are applicable to this modification:

SECTION B - SUPPLIES OR SERVICES AND PRICES

The purpose of this modification is to correct Option 1 total and make administrative changes to ITEM NO 0004, Supplies/Services as follows:

**DELETE**

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>SUPPLIES/SERVICES</th>
<th>ESTIMATED COST</th>
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<td></td>
<td>$2,178,423.00</td>
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**INSERT**

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Except as provided herein, all other terms and conditions of MDA972-01-D-0005/0053 remain unchanged and in full force and effect.