		ORD	ER FOR S	UPPLIES OR	SERV	ICES			P	AGE 1 OF 8
I. CONTRACT/PURCE AGREEMENT NO. MDA972-01-D-000		0050		ALL NO. 3. DATE OF (TTYTHAN) 2005	NDD)	LL 4. REQ. See Sohe	dula		5. 🕅	RIGRITY
6. ISSUED BY DARFA CMO ATTN: PATRICIA MA 3701 MORTH FAIRF ARLINGTON VA 222	X DRIV		0011	7. ADMINIST EB Doma Marylani 217 EAST REDWO Suite 1809 Baltimore MD 2	DOD STREE		6) CODE	S2101A		DELIVERY FOB X DESTINATION OTHER CTHER
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							MAIL INVOIC	ESTOT	IE ADDRES	IN BLOCK
14. SHIP TO DARPA MS. KHINE LATT ATTN: ADVANCED 3701 NORTH FAIRF ARLINGTON VA 222	AX ORIN		11	15. PAYMENT A DFAS COLUMBUS SOUTH ENTITLEN P.O. BOX 182214 COLUMBUS OH 4	CENTER		CODE		10	MARK ALL ACKAGES AND APERS WITH ENTIFICATION NUMBERS IN OCK5 1 AND 2.
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18. ITEM NO.		19. SCHEDULE	OF SUPPLIES	V SERVICES		QUANTIT ORDERED ACCEPT E	/ 21. UNIT	22. UNIT	PRICE	23. AMOUNT
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runntity accepted below	ce by X. quaniliy	if different, miss actual ordered and encircle.	TEL:	ATEL OF AMERICA	L /	Maty S	ORDERING OFFI	- · · ·	25. TOTAL 26. DIFFBRENCES	\$2,240,858.08
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MDA972-01-D-0005 0050 Page 2 of 8

Section B - Supplies or Services and Prices

ITEM NO SUPPLIES/SERVICES

0001

Research & Development

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, "Station-Keeping Buoy," dated December 20, 2004, copies of which are in possession of both parties.

ACRN AA

ESTIMATED FIXED COST FEE

TOTAL EST. COST PLUS FIXED FEE

\$2,240,858.00

\$2,240,858.00

ITEM NO	SUPPLIES/SERVICES	ESTIMATED COST	FIXED FEE	TOTAL EST. COST PLUS FIXED FEE
0003	R&D Technical, Business Status & Final	\$0.00	\$0.00	\$0.00
	CPFF			NSP

MDA972-01-D-0005 0050 Page 3 of 8

ITEM NO SUPPLIES/SERVICES

0004

Station-Keeping Buoy

OPTION1- 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, "Station-Keeping Buoy," dated December 20, 2004, copies of which are in possession of both parties. ESTIMATED COST FIXED FEE TOTAL EST. COST PLUS FIXED FEE

TOTAL EST.

>

\$2,178,423.00

ITEM NO	SUPPLIES/SERVICES	ESTIMATED COST	FIXED FEE	COST PLUS FIXED FEE
0005	R&D Technical, Business Status & Final	\$0.00	\$0.00	\$0.00
	OPTION 1			NSP

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:

CLIN	INSPECT AT	INSPECT BY	ACCEPT AT	ACCEPT BY
0001	Destination	Government	Destination	Government
0003	Destination	Government	Destination	Government
OPTION1 CLINS 0004 0005	INSPECT AT Destination Destination	INSPECT BY Government Government	ACCEPT AT Destination estination	ACCEPT BY Government Government

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:					
CLIN	Description	Due Date				
0003	Technical and Business Status Reports	30 days after the effective date of the Task Order and monthly thereafter				
0003	Final Report	Upon Completion of Task Order				
0005	Technical and Business Status Reports OPTION 1	30 days after the effective date of the Task Order Option 1 and monthly thereafter				
0005	Final Report OPTION 1	Upon Completion of Task Order Option 1				

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: <u>pbailey@darpa.mil</u> (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: <u>cfortier@darpa.mil</u> (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: <u>Joyce.Rich@dcma.mil</u>. (one copy each report)

- (f) DARPA/Library
 3701 North Fairfax Drive
 Arlington, VA 22203-1714
 Email: <u>library@darpa.mil</u>
 (One copy of the Final Technical Report)
- (g) Defense Technical Information Center
 - (1) Email: <u>TR@dtic.mil</u> OR
 - (2) Attn: DTIC-BCS
 8725 John J. Kingman Road, Suite 0944
 Fort Belvoir, VA 22060-0944
 (two hard copies of the Final Technical Report if unclassified)

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.

H-2 Travel

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.

H-3 Subcontracts

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



(b) Pusuant 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

Subcontractors Base		Estimate	
	а - с. - а		

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

Attachment 1 - Statement of Work entitled, "Station-Keeping Buoy," dated February 14, 2004.

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
 - MAST trials (4 day trial at Naval Surface Warfare Center/Carderock(NSWC-CD))
 - b. Near shore testing (R/V Chessie) 2 trials planned

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- 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 Quarterl financial reports Prototype hardware (as required) and a level 2A drawing package

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A final report that summarizes the project and tasking involved at the conclusion of Phase 2 performance period.

AMENDMENT OF SOLICI	TATION/MODIFIC	CATION OF CONTRACT		I. CONTRACT		DE PAGE OF PAG 1 2
AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.			5. PRO	JECT NO.(If applicable)
ISSUED BY COI DARPA CMO ATTN: PATRICIA MATYSKIELA 3701 NORTH FAIRFAX DRIVE ARLINGTON VA 22203-1714		7. ADMINISTERED BY (If other than item DCMA MARYLAND 217 EAST REDWOOD STREET SUITE 1800 BALTIMORE MD 21202-8280	6)	00	DE [2101A
NAME AND ADDRESS OF CONTRACT JOHNS HOPKINS UNIVIAPL 1100 JOHNS HOPKINS ROAD LAUREL NO 20723-4099	OR (No., Street, County, St	ate and Zip Code)	\square	9A. AMENDM 9B. DATED (S		SOLICITATION NO
			×	10A MOD. 05 MDA972-01-0	CONT	RACT/ORDER NO.
ODE 88898	FACILITY COL)8	×	108. DATED (18-Mar-2005	SEE IT	EM 13)
	I. THIS ITEM ONLY APPL	IES TO AMENDMENTS OF SOLICITA	TION	NS		
The above numbered solicitation is amended as Other must acknowledge receipt of this amend		nd date specified for receipt of Offer pecified in the solicitation or as amended by on	• • • •	is extended.	•	t extended.
(a) By completing items 8 and 15, and retarnin or (c) By separate letter or telegram which inc RECEIVED AT THE PLACE DESIGNATED REJECTION OF YOUR OFFER. If by virtue	agcopies of the amendm index a reference to the solicitation FOR THE RECEIPT OP OFFEL of this amendment you desire to	est; (b) By acknowledging receipt of this amen to and amendment numbers. FAILURE OF YC RS PRIOR TO THE HOUR AND DATE SPEC change an offer slreedy submitted, such change	dmont FUR A SIPIED 1 Mary 1	on each copy of th CKNOWLEDGMI MAY RESULT () be made by telegra	e offer su ENT TO N	BE
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13. THIS IT	EM APPLIES ONLY TO M	ODIFICATIONS OF CONTRACTS/ORI	DERS		· ·	
· · · · · · · · · · · · · · · · · · ·		ROER NO. AS DESCRIBED IN ITEM				
A. THIS CHANGE ORDER IS ISSUED CONTRACT ORDER NO. IN ITEM 1		utbority) THE CHANGES SET FORTH I	IN ITI	em 14 are ma	DE IN 1	THE
B. THE ABOVE NUMBERED CONTRA office, appropriation date, etc.) SET FC		TO REFLECT THE ADMINISTRATIVE ANT TO THE AUTHORITY OF FAR 43			changes	in paying
C. THIS SUPPLEMENTAL AGREEMEN		SUANT TO AUTHORITY OF:				
D. OTHER (Specify type of modification Mutual Agreement of the Parties	and authority)					
IMPORTANT: Contractor is no	t, \mathbf{X} is required to sig	n this document and return1	cop	ies to the issuing	office.	
4. DESCRIPTION OF AMENDMENT/MO where feasible.) Modification Control Number: jande Correct Estimated Cost Plus Fixed Fee I	rs05563		ntion/	contract subject i	matter	
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cept as provided barein, all terms and conditions of A. NAME AND TITLE OF SIGNER (Type		16A, NAME AND TITLE OF CON	the second s		the second s	the second s
Nicholas J. Langhauser	, CFO	TEL:		EMAIL:		
	15C. DATE SIGNED	16B. UNFED STATES OF AMER	W	at. L.		16C. DATE SIGNED
	ula L.	BY Manulla S.	114	MATHE		04/20/01
B. CONTRACTOR OFFICER Signature of person authorized to sign)	- 4/20/05	BY MULLION S	cor)	igne	_	04/2010

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

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 ITEM NO	SUPPLIES/SERVICES	ESTIMATED COST	FIXED FEE	TOTAL EST. COST PLUS FIXED FEE
0004	Station Keeping Buoy			\$2,178,423.00
	OPTION1 – The contractor shall furnish the necessary personnel, materials, facilitie and other services as may be required to per contract Line Item Number (CLIN) 0001, 0003, in accordance with the Statement of Work, Attachment 1 hereto, and as specific in the Contractor's proposal entitled, "Station-Keeping Buoy," dated December 20, 2004, copies of which are in possession of both parties.	erform ed		
INSERT				
				TOTAL EST.
ITEM NO	SUPPLIES/SERVICES	ESTIMATED COST	FIXED FEE	COST PLUS FIXED FEE
0004	Station Keeping Buoy			\$2,172,307.00
	OPTION 1 – The contractor shall furnish the necessary personnel, materials, facilitie and other services as may be required to per contract Line Item Number (CLIN) 0001, 0003, in accordance with the Statement of Work, Attachment 1 hereto, and as specific in the Contractor's proposal entitled, "Station-Keeping Buoy," dated December 20, 2004, copies of which are in possession of both parties. The contractor shall also fa a prototype hardware (as required) and a le drawing package as deliverables.	xform xd urnish		

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