

<b>AWARD/CONTRACT</b>		1. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700)		RATING NONE	PAGE OF PAGES 1   27
2. CONTRACT (Proc. Inst. Ident.) NO. HR0011-10-C-0147		3. EFFECTIVE DATE <i>16 Sep 2010</i>		4. REQUISITION/PURCHASE REQUEST/PROJECT NO. Z365700	
5. ISSUED BY DARPA CMO ATTN: ROBIN SWATLOSKI 3701 N FAIRFAX DR ARLINGTON VA 22203-1714		CODE HR0011	6. ADMINISTERED BY (If other than Item 5) DCMA NORTHERN CALIFORNIA P.O. BOX 232, 700 EAST ROAD, BLDG 330 FRENCH CAMP CA 95231-0232		
7. NAME AND ADDRESS OF CONTRACTOR (No., street, city, county, state and zip code) PALO ALTO RESEARCH CENTER INCORPORATED 3833 COYOTE HILL RD PALO ALTO CA 94304-1514		8. DELIVERY [ ] FOB ORIGIN [X] OTHER (See below)		9. DISCOUNT FOR PROMPT PAYMENT	
CODE 1YQ84		FACILITY CODE		10. SUBMIT INVOICES 2 (# copies unless otherwise specified) TO THE ADDRESS SHOWN IN: ITEM Section G	
11. SHIP TO/MARK FOR DARPA KHINE LATT STRATEGIC TECHNOLOGY OFFICE 3701 NORTH FAIRFAX DRIVE ARLINGTON VA 22203-1714		CODE HR0011	12. PAYMENT WILL BE MADE BY DPAS COLUMBUS CENTER WEST ENTITLEMENT OPERATIONS P.O. BOX 182361 COLUMBUS OH 43218-2361		
13. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION: [ ] 10 U.S.C. 2304(c)( ) [ ] 41 U.S.C. 253(c)( )		14. ACCOUNTING AND APPROPRIATION DATA See Schedule			
15A. ITEM NO.	15B. SUPPLIES/ SERVICES	15C. QUANTITY	15D. UNIT	15E. UNIT PRICE	15F. AMOUNT
<b>SEE SCHEDULE</b>					
15G. TOTAL AMOUNT OF CONTRACT					\$472,198.00
16. TABLE OF CONTENTS					
(X) SEC.	DESCRIPTION	PAGE(S)	(X) SEC.	DESCRIPTION	PAGE(S)
PART I - THE SCHEDULE			PART II - CONTRACT CLAUSES		
X A	SOLICITATION/ CONTRACT FORM	1	X I	CONTRACT CLAUSES	21 - 26
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X C	DESCRIPTION/ SPECS/ WORK STATEMENT	4 - 7	X J	LIST OF ATTACHMENTS	27
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X E	INSPECTION AND ACCEPTANCE	9	K	REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFERORS	
X F	DELIVERIES OR PERFORMANCE	10 - 12	L	INSTRS., CONDS., AND NOTICES TO OFFERORS	
X G	CONTRACT ADMINISTRATION DATA	13 - 15	M	EVALUATION FACTORS FOR AWARD	
X H	SPECIAL CONTRACT REQUIREMENTS	16 - 20			
CONTRACTING OFFICER WILL COMPLETE ITEM 17 OR 18 AS APPLICABLE					
17. [X] CONTRACTOR'S NEGOTIATED AGREEMENT Contractor is required to sign this document and return (copies to issuing office). Contractor agrees to furnish and deliver all items or perform all the services set forth or otherwise identified above and on any continuation sheets for the consideration stated herein. The rights and obligations of the parties to this contract shall be subject to and governed by the following documents: (a) this award/contract, (b) the solicitation, if any, and (c) such provisions, representations, certifications, and specifications, as are attached or incorporated by reference herein. (Attachments are listed herein.)			18. [ ] AWARD (Contractor is not required to sign this document.) Your offer on Solicitation Number		
19A. NAME AND TITLE OF SIGNER (Type or print) <i>Mark Bernstein CEO, PARC</i>			20A. NAME OF CONTRACTING OFFICER Robin M. Swatloski, Contracting Officer TEL: 571-218-4542 EMAIL: Robin.Swatloski@darpa.mil		
19B. NAME OF CONTRACTOR BY <i>Mark Bernstein</i>		19C. DATE SIGNED <i>9/16/10</i>	20B. UNITED STATES OF AMERICA (b)(6)		20C. DATE SIGNED <i>16 Sep 2010</i>
(Signature of person authorized to sign)		(Signature of Contracting Officer)			

## Section B - Supplies or Services and Prices

ITEM NO.	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0001		1		\$472,198.00	\$472,198.00

CO2 from Seawater for Liquid Fuel  
FFP

The contractor shall furnish the necessary facilities, personnel, material and other services as may be required to perform the work in accordance with the contract and Attachment 1, Statement of Work, from contractor's proposal entitled "Fuel from the sea: Electromechanical extraction of carbon dioxide from seawater for liquid fuel" submitted 28 APR 2010.

FOB: Destination

AO No. Z965/00

NET AMT	\$472,198.00
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ITEM NO.	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
000101					\$0.00

Funding for CLIN 0001

FFP

FOB: Destination

AO No. Z965/00

NET AMT	\$0.00
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ACRN AA

CIN: 00000000000000000000000000000000

\$472,198.00
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ITEM NO.	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
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0002

NSP

Reports and Other Deliverables

FFP

The contractor shall provide the Research and Development Status Reports, Final Report, and Other Deliverables in accordance with Sections C-2 and F-2. Not Separately Priced (NSP) - included in the cost of CLIN 0001.

FOB: Destination

AO No. Z965/00

NET AMT

## Section C - Descriptions and Specifications

## CLAUSES INCORPORATED BY FULL TEXT

## C-1 Scope of Work

(a) The Contractor shall furnish the necessary personnel, materials, facilities, and other services as may be required to perform Contract Line Items (CLINs) 0001 and 0002, in accordance with the Statement of Work, Attachment No. 1 hereto. The work and services to be performed hereunder shall be subject to the requirements and standards contained in the Contractor's proposal entitled "Fuel from the sea: Electromechanical extraction of carbon dioxide from seawater for liquid fuel" submitted 28 APR 2010, which is in the possession of both parties.

(b) In the event of an inconsistency between the provisions of this contract and the Contractor's proposal, the inconsistency shall be resolved by giving precedence in the following order: (1) the contract, (2) the attachments to the contract, and then (3) the Contractor's proposal.  
(end of clause)

## C-2 Reports and Other Deliverables

(a) The Contractor shall submit the following reports and other deliverables in accordance with the delivery schedule set forth in Section F. Reports and other deliverables shall be submitted in writing, as defined in FAR 2.101, or as specified below:

## (1) R&amp;D STATUS REPORT (Monthly)

This brief narrative, not to exceed five pages in length, shall contain the following:

- (i) For first report only; the date work actually started.
- (ii) Description of progress during the reporting period, supported by reasons for any change in approach reported previously
- (iii) Planned activities and milestones for the next reporting period.
- (iv) Description of any major items of experimental or special equipment purchased or constructed during the reporting period.
- (v) Notification of any changes in key personnel associated with the contract during the reporting period.
- (vi) Summary of substantive information derived from noteworthy trips, meetings, and special conferences held in connection with the contract during the reporting period.
- (vii) Summary of all problems or areas of concern.
- (viii) Related accomplishments since last report.
- (ix) Fiscal status, to include reporting of summary level financial data in the following format:  
(next page)

**R&D STATUS REPORT  
PROGRAM FINANCIAL STATUS**

Work Breakdown		Cumulative to Date			At Completion	
Structure or Task Element	Planned Expend	Actual Expend	% Budget Compl	At Compl	Latest Revised Estimate	Remarks
Subtotal: _____						
Management Reserve: _____						
Or Unallocated Resources: _____						
TOTAL: _____						

Note: Budget at completion changes only with the amount of any scope changes. (Not affected by underrun or overrun)

Based on currently authorized work:

Is current funding sufficient for the current fiscal year (FY)? (Explain in narrative if "NO")

YES NO

What is the next FY funding requirement at current anticipated levels?

\$ \_\_\_\_\_

Have you included in the report narrative any explanation of the above data and are they cross-referenced?

YES NO

**(2) FINAL REPORT**

This report shall document the results of the complete effort and should be delivered at the completion of the contract. If the Government chooses to exercise the options under this contract, the due date for the final report is extended accordingly. Title pages shall include a disclaimer worded substantially as follows:

"The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressly or implied, of the Defense Advanced Research Projects Agency or the U.S. Government."

The Final Technical Report summary shall include:

Task Objectives  
 Technical Problems  
 General Methodology (i.e., literature review, laboratory experiments, surveys, etc.)  
 Technical Results  
 Important Findings and Conclusions  
 Significant Hardware Development  
 Special Comments  
 Implications for Further Research  
 Standard Form 298, August 1998

(b) Reports delivered by the Contractor in the performance of the contract shall be considered "Technical Data" as defined in Section I contract clauses entitled "Rights in Technical Data - Noncommercial Items" and "Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation."

(c) Bulky Reports shall be mailed by other than first-class mail unless the urgency of submission requires use of first-class mail. In this situation, one copy shall be mailed first-class and the remaining copies forwarded by less than first-class.

(d) All papers and articles published as a result of DARPA sponsored research shall include a statement reflecting the sponsorship. In addition, a bibliography of the titles and authors of all such papers are to be included in the Final Technical Report

(1) The cover or title page of each of the above reports or publications prepared, will have the following citation:

Sponsored by  
 Defense Advanced Research Projects Agency  
 Strategic Technology Office (STO)  
 Program: "Fuel from the sea: Electromechanical extraction of carbon dioxide  
 from seawater for liquid fuel"  
 ARPA Order No. Z965/00, Program Code: 0M30  
 Issued by DARPA/CMO under Contract No. HR0011-10-C-0147

(2) The title page shall include a disclaimer worded substantially as follows:

"The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressly or implied, of the Defense Advanced Research Projects Agency or the U.S. Government."

(3) All technical reports must (i) be prepared in accordance with American National Standards Institute (ANSI) Standard Z39.18; (ii) include a Standard Form 298, August 1998; and (iii) be marked with an appropriate Distribution Statement.

(end of clause)

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.  
(end of clause)

Section E - Inspection and Acceptance

INSPECTION AND ACCEPTANCE TERMS

Supplies/services will be inspected/accepted at destination by Contracting Officer's Representative identified herein at Section G. Use of DD Form 250 is required for submission of final report and other deliverables identified in Attachment 2, Deliverables.

CLAUSES INCORPORATED BY REFERENCE

52.246-9	Inspection Of Research And Development (Short Form)	APR 1984
252.246-7000	Material Inspection And Receiving Report	MAR 2008



## Section F - Deliveries or Performance

## DELIVERY INFORMATION

CLIN	DELIVERY DATE	QUANTITY	SHIP TO ADDRESS	UIC
0001	9 mths. ADC		DARPA KHINE LATT STRATEGIC TECHNOLOGY OFFICE 3701 NORTH FAIRFAX DRIVE ARLINGTON VA 22203-1714 571-218-4203 FOB: Destination	HR0011
000101	9 mths. ADC		(SAME AS PREVIOUS LOCATION) FOB: Destination	HR0011
0002	9 mths. ADC		(SAME AS PREVIOUS LOCATION) FOB: Destination	HR0011

## CLAUSES INCORPORATED BY REFERENCE

52.242-15	Stop-Work Order	AUG 1989
52.247-34	F.O.B. Destination	NOV 1991

## CLAUSES INCORPORATED BY FULL TEXT

## F-1 Term of Contract

The term of the contract commences on the effective date of the contract and continues for nine (9) months.  
(end of clause)

## F-2 Reports and Other Deliverables

Delivery of all reports and other deliverables shall be made to the addressee specified in F-3 entitled "Report Distribution" in accordance with the following:

<u>Milestone Number</u>	<u>Description**</u>	<u>Due Date</u>	<u>Milestone Amount</u>
N/A	Monthly R&D Status Report	On a monthly basis due the 10 <sup>th</sup> day of each month. Reports will include a summary of tasks performed, objectives for the next month by task, status of funds and labor hours and such other data as agreed. Data collected will be provided as to be useful (documentation, data format, etc.)	N/A

		to future efforts.	
N/A	Monthly Financial Status Report	On a monthly basis due the 10 <sup>th</sup> day of each month.	N/A
1	Data Progress for Report 1 "Electrodialysis for extracting CO2 from seawater"; Delivery of Progress Report 1; and Completion of Tasks 1A, 2A, 3A, 1B, and 2B as outlined in the Statement of Work	Due three (3) months After Contract Award ("ACA")	\$141,659
2	Partial Progress Report 2a "Scaling and other challenges to using electrodialysis for extracting CO2 from seawater"; and Partial Progress Report 2b "A compact, lightweight device for extracting CO2 from seawater"; and Completion of Tasks 3B, 4B, 1C, and 2C as outlined in the Statement of Work	Due six (6) months After Contract Award ("ACA")	\$141,659
3	Complete Progress Report 2a "Scaling and other challenges to using electrodialysis for extracting CO2 from seawater"; Complete Progress Report 2b "A compact, lightweight device for extracting CO2 from seawater"; Delivery of Final Report and the Prototype. Completion of Tasks 1D, 2D, and 1E as outlined in the Statement of Work	Due nine (9) months After Contract Award ("ACA")	\$141,660
N/A	Briefing Material for DARPA Management	As Required or Requested	N/A
	**The data will be provided as to be useful (documentation, data format, etc.) to future government efforts.		

(end of clause)

## F-3 Report Distribution

(a) DARPA/STO

Attn: Ms. Khine Latt, Program Manager  
 3701 North Fairfax Drive  
 Arlington, VA 22203-1714

Email: Khine.Latt@darpa.mil  
(one copy each report)

(b) DARPA/STO  
Attn: ADPM-STO  
3701 North Fairfax Drive  
Arlington, VA 22203-1714  
Phone: (703) 696-5277  
Fax: (703) 807-0968  
Email: adpm-sto@darpa.mil  
(one copy each report)

(c) DARPA/Library  
3701 North Fairfax Drive  
Arlington, VA 22203-1714  
Email: ResearchServices@darpa.mil  
(one copy of the Final Technical Report)

(d) Defense Technical Information Center

(1) Email: TR@dtic.mil  
(one electronic copy of the Final Technical Report, if unclassified)

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)

(e) DARPA/CMO  
Attn: Robin Swatloski, Contracting Officer  
3701 North Fairfax Drive  
Arlington, VA 22203-1714  
Phone: (571) 218-4542  
Fax: (703) 741-7801  
Email: Robin.Swatloski@darpa.mil  
(one copy each report)  
(end of clause)

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.  
(end of clause)

## Section G - Contract Administration Data

## ACCOUNTING AND APPROPRIATION DATA

AA: 9700400 1320 Z965 POM30 2525 DPAC 0 5487 S12136 62303E  
 AMOUNT: \$472,198.00  
 CIN 00000000000000000000000000000000: \$472,198.00

## CLAUSES INCORPORATED BY FULL TEXT

## G-1 Procuring Office Representative

The Procuring Office Representative is Robin Swatloski, Contracting Officer, DARPA/CMO, 3701 North Fairfax Drive, Arlington, VA 22203-1714, telephone: (571) 218-4542, e-mail: Robin.Swatloski@darpa.mil.  
 (end of clause)

## G-2 Electronic Submission of Payment Requests

(a) Invoices for goods received or services rendered under this contract shall be submitted electronically through Wide Area Work Flow – Receipt and Acceptance (WAWF):

(1) Vendors that have never used WAWF shall follow the directions in the WAWF Vendor Getting Started Guide available at the following website:  
<http://www.dfas.mil/contractorpay/electroniccommerce/wideareaworkflow.html>. This website also contains links for Vendor training and practice. Additional support can be obtained by calling WAWF Customer Service at 866-618-5988.

(2) Back up documentation (such as timesheets, monthly status reports, etc.) can be included and attached to the invoice in WAWF. Attachments should be in PDF format, but Attachments created in any Microsoft Office product may be attached. Total limit for the size of files per invoice is 5 megabytes.

(b) The following information, regarding invoice routing DoDAAC's, must be entered for completion of the invoice in WAWF:

WAWF Invoice Type:	2-in-1
Issuing Office DoDAAC	HR0011
Admin Office DoDAAC(Acceptor for all but final voucher)	S0507A
Service Acceptor DoDAAC (Acceptor for final voucher only)	HR0011, Extension 15
Paying Office DoDAAC	HQ0339

c) The amount due for payment, upon the completion of the milestone described in Section F, is as follows:

CLIN 0001 and CLIN 0002	
Milestone Number	Amount
1	\$141,659

2	\$141,659
3	\$141,660
4 - Final Payment	\$47,220

(d) For each performance-based invoice submitted for milestone payments, the Contractor shall directly send a copy of the invoice by email to both the Program Manager and Contracting Officer. Once the Program Manager communicates to the Contractor that the invoice is acceptable, the Contractor shall submit the performance-based invoice to WAWF, with the PM acceptance as an attachment, and identify S0507A as the Acceptor. For the final completion invoice only, the contractor shall submit the final invoice to WAWF and identify the appropriate extension HR0011 extension 15.

Name	E-mail	Phone	Role
Robin Swatloski	Robin.Swatloski@darpa.mil	571-218-4542	Contracting Officer
Khine Latt	Khine.Latt@darpa.mil	571-218-4203	Program Manager

(end of clause)

#### G-3 Delegation of Authority for Contract Administration

DCMA Lathrop (Michael Hurrell, ACO, [Michael.Hurrell@dcma.mil](mailto:Michael.Hurrell@dcma.mil) , (209) 941-7056), is hereby designated as the Contracting Officer's authorized representative for administering this contract in accordance with current directives.

(end of clause)

#### G-4 Contracting Officer's Representative (COR)

Performance of work under this contract shall be subject to the technical direction of Ms. Khine Latt. Such technical direction includes those instructions to the Contractor necessary to accomplish the Statement of Work. The COR is not otherwise authorized to make any representations or commitments of any kind on behalf of the Contracting Officer or the Government. The COR does not have the authority to alter the Contractor's obligations or to change the specifications of the contract. The COR's contact information is the following:

DARPA/STO  
 Attn: Ms. Khine Latt, COR  
 3701 North Fairfax Drive  
 Arlington, VA 22203-1714  
 Email: [Khine.Latt@darpa.mil](mailto:Khine.Latt@darpa.mil)

#### G-5 Payment Instructions for Multiple Accounting Classification Citations

If there is more than one ACRN within a contract line item, the payment office will make payment using the oldest fiscal year appropriations first, exhausting all funds in the previous fiscal year before disbursing from the next fiscal year. In the event there is more than one ACRN associated with the same fiscal year, the payment amount shall be disbursed from each ACRN within a fiscal year in the same proportion as the amount of funding obligated for each ACRN within the fiscal year.

(end of clause)

#### G-6 Fully Funded Contract

This contract is fully funded.  
(end of clause)

## Section H - Special Contract Requirements

## CLAUSES INCORPORATED BY FULL TEXT

## H-1 Contracting Officer

Notwithstanding any other provision of this contract, 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 contract. If, as a result of technical discussions, it is desirable to alter contract obligations or statement of work, a modification must be issued in writing and signed by the Contracting Officer.

(end of clause)

## H-2 Type of Contract

This is a Firm Fixed Price (FFP) Payable Milestones contract.

(end of clause)

## H-3 Public Release or Dissemination of Information

- (a) At this time, DARPA expects the work performed under this contract will NOT be fundamental research, and it is, therefore, subject to the following publication restrictions:

There shall be no dissemination or publication, except within and between the Contractor and any subcontractors, of information developed under this contract or contained in the reports to be furnished pursuant to this contract without prior written approval, which will be communicated to the Contractor by email through the DARPA Public Relations Center (PRC) ) at [PRC@darpa.mil](mailto:PRC@darpa.mil). All technical reports will be given proper review by appropriate authority to determine which Distribution Statement is to be applied prior to the initial distribution of these reports by the Contractor. These restrictions must be flowed down to all subcontractors. Any publications shall incorporate an Acknowledgement of Support and Disclaimer in accordance with DFARS 252.235-7010.

- (b) When submitting material for written approval for open publication as described in subparagraph (a) above, the Contractor must submit a request for public release request to the PRC and include the following information: 1) Document Information: document title, document author, short plain-language description of technology discussed in the material (approx 30 words), number of pages (or minutes of video) and document type (briefing, report, abstract, article, or paper); 2) Event Information: event type (conference, principle investigator meeting, article or paper), event date, desired date for DARPA's approval; 3) DARPA Sponsor: DARPA Program Manager, DARPA office, and contract number; and 4) Contractor's Information: POC name, e-mail and phone. Allow four weeks for processing; due dates under four weeks require a justification. Unusual electronic file formats may require additional processing time. Requests can be sent either via e-mail to [PRC@darpa.mil](mailto:PRC@darpa.mil) or via hard copy to 3701 North Fairfax Drive, Arlington VA 22203-1714, telephone (571) 218-4235. Refer to [www.darpa.mil/prc](http://www.darpa.mil/prc) for information about DARPA's public release process.

(end of clause)

## H-4 Key Personnel

- (a) The Contractor shall notify the Contracting Officer prior to making any change in key personnel. Key personnel are defined as follows:

- (1) Personnel identified in the proposal as key individuals to be assigned for participation in the performance of the contract;
- (2) Personnel whose resumes were submitted with the proposal; and
- (3) Individuals who are designated as key personnel by agreement of the Government and the Contractor during negotiations.

(b) The Contractor must demonstrate that the qualifications of the prospective personnel are equal to or better than the qualifications of the personnel being replaced. Notwithstanding any of the foregoing provisions, key personnel shall be furnished unless the Contractor has demonstrated to the satisfaction of the COR that the qualifications of the proposed substitute personnel are equal to or better than the qualifications of the personnel being replaced.

(end of clause)

#### H-5 Restrictions on Printing

Unless otherwise authorized in writing by the Contracting Officer, reports, data, or other written material produced using funds provided by this contract and submitted hereunder shall be reproduced only by duplicating processes and shall not exceed 5,000 single page reports or a total of 25,000 pages of a multiple-page report. These restrictions do not preclude the writing, editing, preparation of manuscript or reproducible copy of related illustrative materials if required as part of this contract, or incidental printing such as forms or materials necessary to be used by the Contractor to respond to the terms of the contract.

(end of clause)

#### H-6 Contractor Representations and Certifications

The Contractor's Representations and Certifications dated September 13, 2010 are incorporated herein by reference.

(end of clause)

#### H-7 Insurance Schedule

The Contractor shall maintain the types of insurance listed in FAR 28.307-2 (a), (b) and (c), with the minimum amounts of liability indicated therein. The types of insurance coverage listed in paragraphs (d) and (e) shall also be maintained when applicable.

(end of clause)

#### H-8 Travel

(a) University Performers: Reimbursement for travel-related expenses shall be as stipulated in OMB Circular A-21 (2 CFR 220) as prescribed by FAR Part 31.3.

(b) Non-Profit Performers: Reimbursement for travel-related expenses shall be as stipulated in OMB Circular A-122 (2 CFR 230) as prescribed by FAR Part 31.7

(c) Non-University/For-Profit Performers: Reimbursement for travel-related expenses shall be in accordance with the Contractor's approved travel policy. The Federal Travel Regulations, Joint Travel Regulations (JTR), and Standardized Regulations as stated in FAR 31.205-46 will be used as a guide in determining reasonableness of per diem costs. Costs for travel shall be allowable subject to the provisions of FAR 31.205-46.



(d) In connection with direct charge to the contract of travel-related expenses, the Contractor shall hold travel to the minimum required to meet the objectives of the contract, and substantial deviations from the amount of travel agreed to during contract negotiation shall not be made without the authorization of the Contracting Officer.

When applicable, the Contractor shall notify the COR of proposed travel of an employee beyond that agreed to during negotiations.

(e) Approval of the Contracting Officer shall be obtained in advance for attendance by personnel at training courses, seminars, and other meetings not directly related to contract performance if the costs for the courses, seminars, and other meetings are charged to the contract.

(f) All foreign travel shall be authorized and approved in advance, in writing, by the Contracting Officer. Request for such travel must be submitted to the Contracting Officer at least forty five (45) days in advance of traveler's anticipated departure date, and shall include traveler's itinerary of United States Flag Air Carriers.  
(end of clause)

#### H-9 Metric System

(a) The Defense Advanced Research Projects Agency (DARPA) will consider the use of the metric system in all of its activities consistent with operational, economical, technical and safety requirements.

(b) The metric system will be considered for use in all new designs. When it is deemed not to be in the best interest of the DoD to provide metric design, justification shall be provided.

(c) Physical and operational interfaces between metric items and U.S. customary items will be designed to assure that interchangeability and interoperability will not be affected.

(d) Existing designs dimensioned in U.S. customary units will be converted to metric units only if determined to be necessary or advantageous. Unnecessary retrofit of existing systems with new metric components will be avoided where both the new metric and existing units are interchangeable and interoperable. Normally, the system of measurement in which an item is originally designed will be retained for the life of the item.

(e) During the metric transition phase hybrid metric and U.S. customary designs will be necessary and acceptable. Material components, parts, subassemblies, and semi-fabricated material, which are of adequate or when it is otherwise specifically determined to be in the best interest of the Department of Defense. Bulk materials will be specified and accepted in metric units when it is expedient or economical to do so.

(f) Technical reports, studies, and position papers, (except those pertaining to items dimensioned in U.S. customary units) will include metric units of measurement in addition to or in lieu of U.S. customary units. With respect to existing contracts, this requirement applies only if such documentation can be obtained without an increase in contract costs.

(g) Use of the dual dimensions (i.e., both metric and U.S. customary dimensions) on drawings will be avoided unless it is determined in specific instances that such usage will be beneficial. However, the use of tables on the document to translate dimensions from one system of measurement to the other is acceptable.  
(end of clause)

#### H-10 Contractor Acquired Property (IT)

(a) Performance of this contract will require use of the information technology (IT) resources listed below, acquisition of which (or equivalent) is hereby authorized:

ITEM	Quantity	TOTAL AMOUNT
Data Acquisition Hardware	1	As Proposed
Protocol Converter	1	As Proposed

(b) The costs incurred by the Contractor in acquiring the IT listed in paragraph (1.) above shall be considered allowable costs under the contract provided that the total net amount of the IT does not exceed \$1,070. The Contractor shall have no obligation to acquire IT and the Government shall have no obligation to reimburse any amount for IT in excess of the amount set forth above unless the contract is modified to increase this amount.

(c) The IT resources listed above shall be considered Government Property and shall be subject to the provisions of FAR 52.245-1, incorporated in Section I.

(d) The Contractor shall not use Contractor acquired property listed above for work other than that performed pursuant to this contract unless so authorized in writing by the Contracting Officer.

(end of clause)

#### H-11 Contractor Code of Business Ethics

The "agency Office of the Inspector General" referenced in FAR clause 52.203-13, "Contractor Code of Business Ethics" (DEC 2008) contained in Section I of this Contract, shall be the Department of Defense Office of the Inspector General (DoD OIG). Contact information is as follows:

Office of the Inspector General  
United States Department of Defense  
Investigative Policy and Oversight  
Contract Disclosure Program  
400 Army Navy Drive, Suite 1037  
Arlington, VA 22202-4704  
Toll Free Telephone: 866-429-8011

(end of clause)

#### H-12 Invention Disclosure and Reports

All written communications required for invention disclosures and reports shall be submitted to the Administrative Contracting Officer (ACO). All unclassified required reporting shall be accomplished using the i-Edison.gov reporting website (<https://s-edison.info.nih.gov/iEdison/>).

(end of clause)

#### H-13 Export Control Clause

Should this project develop beyond fundamental research (basic and applied research ordinarily published and shared broadly within the scientific community) with military or dual-use applications the following apply:

(a) The contractor shall comply with all U. S. export control laws and regulations, including the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 through 130, and the Export Administration Regulations (EAR), 15 CFR Parts 730 through 799, in the performance of this contract. In the absence of available license exemptions/exceptions, the Contractor shall be responsible for obtaining the appropriate licenses or other

approvals, if required, for exports of (including deemed exports) hardware, technical data, and software, or for the provision of technical assistance.

(b) The Contractor shall be responsible for obtaining export licenses, if required, before utilizing foreign persons in the performance of this contract, including instances where the work is to be performed on-site at any Government installation (whether in or outside the United States), where the foreign person will have access to export-controlled technical data or software.

(c) The Contractor shall be responsible for all regulatory record keeping requirements associated with the use of licenses and license exemptions/exceptions.

(d) The Contractor shall be responsible for ensuring that the provisions of this clause apply to its subcontractors.

(end of clause)

#### H-14 Proprietary Technical Data and Computer Software

Any deliverable technical data or computer software developed or generated at private expense and considered to be proprietary by the Contractor or subcontractors shall be delivered in accordance with DFARS 252.227-7013 and 252.227-7014. A list of such data and/or software is incorporated into the contract as Attachment No. 2.

(end of clause)

## Section I - Contract Clauses

## CLAUSES INCORPORATED BY REFERENCE

52.202-1	Definitions	JUL 2004
52.203-3	Gratuities	APR 1984
52.203-5	Covenant Against Contingent Fees	APR 1984
52.203-6	Restrictions On Subcontractor Sales To The Government	SEP 2006
52.203-7	Anti-Kickback Procedures	JUL 1995
52.203-8	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity	JAN 1997
52.203-10	Price Or Fee Adjustment For Illegal Or Improper Activity	JAN 1997
52.203-12	Limitation On Payments To Influence Certain Federal Transactions	SEP 2007
52.203-13	Contractor Code of Business Ethics and Conduct	APR 2010
52.204-4	Printed or Copied Double-Sided on Recycled Paper	AUG 2000
52.204-7	Central Contractor Registration	APR 2008
52.209-6	Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment	SEP 2006
52.215-2	Audit and Records--Negotiation	MAR 2009
52.215-8	Order of Precedence--Uniform Contract Format	OCT 1997
52.215-10	Price Reduction for Defective Cost or Pricing Data	OCT 1997
52.215-14	Integrity of Unit Prices	OCT 1997
52.215-15	Pension Adjustments and Asset Reversions	OCT 2004
52.215-16	Facilities Capital Cost of Money	JUN 2003
52.215-18	Reversion or Adjustment of Plans for Postretirement Benefits (PRB) Other than Pensions	JUL 2005
52.215-19	Notification of Ownership Changes	OCT 1997
52.215-21	Requirements for Cost or Pricing Data or Information Other Than Cost or Pricing Data--Modifications	OCT 1997
52.219-8	Utilization of Small Business Concerns	MAY 2004
52.219-28	Post-Award Small Business Program Rerepresentation	APR 2009
52.222-3	Convict Labor	JUN 2003
52.222-21	Prohibition Of Segregated Facilities	FEB 1999
52.222-26	Equal Opportunity	MAR 2007
52.222-35	Equal Opportunity For Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans	SEP 2006
52.222-36	Affirmative Action For Workers With Disabilities	JUN 1998
52.222-37	Employment Reports On Special Disabled Veterans, Veterans Of The Vietnam Era, and Other Eligible Veterans	SEP 2006
52.222-50	Combating Trafficking in Persons	FEB 2009
52.223-6	Drug-Free Workplace	MAY 2001
52.223-14	Toxic Chemical Release Reporting	AUG 2003
52.225-13	Restrictions on Certain Foreign Purchases	JUN 2008
52.226-1	Utilization Of Indian Organizations And Indian-Owned Economic Enterprises	JUN 2000
52.227-1 Alt I	Authorization And Consent (Dec 2007) - Alternate I	APR 1984
52.227-2	Notice And Assistance Regarding Patent And Copyright Infringement	DEC 2007
52.228-7	Insurance--Liability To Third Persons	MAR 1996
52.229-3	Federal, State And Local Taxes	APR 2003
52.230-3	Disclosure And Consistency Of Cost Accounting Practices	OCT 2008

52.230-4	Disclosure and Consistency of Cost Accounting Practices for	JUN 2010
	Contracts Awarded to Foreign Concerns	
52.230-6	Administration of Cost Accounting Standards	JUN 2010
52.232-2	Payments Under Fixed-Price Research And Development	APR 1984
	Contracts	
52.232-9	Limitation On Withholding Of Payments	APR 1984
52.232-17	Interest	OCT 2008
52.232-23	Assignment Of Claims	JAN 1986
52.232-25	Prompt Payment	OCT 2008
52.232-32	Performance-Based Payments	AUG 2010
52.232-33	Payment by Electronic Funds Transfer--Central Contractor	OCT 2003
	Registration	
52.233-1	Disputes	JUL 2002
52.233-2	Service Of Protest	SEP 2006
52.233-3 Alt I	Protest After Award (Aug 1996) - Alternate I	JUN 1985
52.233-4	Applicable Law for Breach of Contract Claim	OCT 2004
52.242-4	Certification of Final Indirect Costs	JAN 1997
52.242-13	Bankruptcy	JUL 1995
52.243-1	Changes--Fixed Price	AUG 1987
52.244-2	Subcontracts	JUN 2007
52.244-6	Subcontracts for Commercial Items	JUN 2010
52.245-1	Government Property	AUG 2010
52.245-9	Use And Charges	JUN 2007
52.246-23	Limitation Of Liability	FEB 1997
52.249-1	Termination For Convenience Of The Government (Fixed	APR 1984
	Price) (Short Form)	
52.253-1	Computer Generated Forms	JAN 1991
252.203-7000	Requirements Relating to Compensation of Former DoD	JAN 2009
	Officials	
252.203-7001	Prohibition On Persons Convicted of Fraud or Other Defense-	DEC 2008
	Contract-Related Felonies	
252.203-7002	Requirement to Inform Employees of Whistleblower Rights	JAN 2009
252.204-7000	Disclosure Of Information	DEC 1991
252.204-7003	Control Of Government Personnel Work Product	APR 1992
252.204-7004 Alt A	Central Contractor Registration (52.204-7) Alternate A	SEP 2007
252.204-7005	Oral Attestation of Security Responsibilities	NOV 2001
252.204-7008	Export-Controlled Items	APR 2010
252.209-7004	Subcontracting With Firms That Are Owned or Controlled By	DEC 2006
	The Government of a Terrorist Country	
252.211-7000	Acquisition Streamlining	DEC 1991
252.215-7000	Pricing Adjustments	DEC 1991
252.215-7002	Cost Estimating System Requirements	DEC 2006
252.215-7004	Excessive Pass-Through Charges	MAY 2008
252.219-7003	Small Business Subcontracting Plan (DOD Contracts)	APR 2007
252.223-7004	Drug Free Work Force	SEP 1988
252.225-7002	Qualifying Country Sources As Subcontractors	APR 2003
252.225-7004	Report of Intended Performance Outside the United States	MAY 2007
	and Canada--Submission after Award	
252.225-7006	Quarterly Reporting of Actual Contract Performance Outside	MAY 2007
	the United States	
252.225-7012	Preference For Certain Domestic Commodities	JUN 2010
252.225-7013	Duty-Free Entry	DEC 2009
252.225-7031	Secondary Arab Boycott Of Israel	JUN 2005

252.226-7001	Utilization of Indian Organizations and Indian-Owned Economic Enterprises, and Native Hawaiian Small Business Concerns	SEP 2004
252.227-7013	Rights in Technical Data--Noncommercial Items	NOV 1995
252.227-7014	Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation	JUN 1995
252.227-7015	Technical Data--Commercial Items	NOV 1995
252.227-7016	Rights in Bid or Proposal Information	JUN 1995
252.227-7019	Validation of Asserted Restrictions--Computer Software	JUN 1995
252.227-7027	Deferred Ordering Of Technical Data Or Computer Software	APR 1988
252.227-7028	Technical Data or Computer Software Previously Delivered to the Government	JUN 1995
252.227-7030	Technical Data--Withholding Of Payment	MAR 2000
252.227-7032	Rights In Technical Data And Computer Software (Foreign)	JUN 1975
252.227-7037	Validation of Restrictive Markings on Technical Data	SEP 1999
252.227-7038	Patent Rights--Ownership by the Contractor (Large Business)	DEC 2007
252.227-7039	Patents--Reporting Of Subject Inventions	APR 1990
252.228-7000	Reimbursement for War-Hazard Losses	DEC 1991
252.228-7003	Capture and Detention	DEC 1991
252.231-7000	Supplemental Cost Principles	DEC 1991
252.232-7003	Electronic Submission of Payment Requests and Receiving Reports	MAR 2008
252.232-7010	Levies on Contract Payments	DEC 2006
252.235-7010	Acknowledgment of Support and Disclaimer	MAY 1995
252.235-7011	Final Scientific or Technical Report	NOV 2004
252.242-7004	Material Management And Accounting System	JUL 2009
252.243-7001	Pricing Of Contract Modifications	DEC 1991
252.243-7002	Requests for Equitable Adjustment	MAR 1998
252.244-7000	Subcontracts for Commercial Items and Commercial Components (DoD Contracts)	AUG 2009
252.247-7023	Transportation of Supplies by Sea	MAY 2002
252.247-7024	Notification Of Transportation Of Supplies By Sea	MAR 2000

## CLAUSES INCORPORATED BY FULL TEXT

## 52.215-19 NOTIFICATION OF OWNERSHIP CHANGES (OCT 1997)

(a) The Contractor shall make the following notifications in writing:

(1) When the Contractor becomes aware that a change in its ownership has occurred, or is certain to occur, that could result in changes in the valuation of its capitalized assets in the accounting records, the Contractor shall notify the Administrative Contracting Officer (ACO) within 30 days.

(2) The Contractor shall also notify the ACO within 30 days whenever changes to asset valuations or any other cost changes have occurred or are certain to occur as a result of a change in ownership.

(b) The Contractor shall--

(1) Maintain current, accurate, and complete inventory records of assets and their costs;

(2) Provide the ACO or designated representative ready access to the records upon request;

(3) Ensure that all individual and grouped assets, their capitalized values, accumulated depreciation or amortization, and remaining useful lives are identified accurately before and after each of the Contractor's ownership changes; and

(4) Retain and continue to maintain depreciation and amortization schedules based on the asset records maintained before each Contractor ownership change.

The Contractor shall include the substance of this clause in all subcontracts under this contract that meet the applicability requirement of FAR 15.408(k).

(End of clause)

#### 52.247-1 COMMERCIAL BILL OF LADING NOTATIONS (FEB 2006)

When the Contracting Officer authorizes supplies to be shipped on a commercial bill of lading and the Contractor will be reimbursed these transportation costs as direct allowable costs, the Contractor shall ensure before shipment is made that the commercial shipping documents are annotated with either of the following notations, as appropriate:

(a) If the Government is shown as the consignor or the consignee, the annotation shall be:

"Transportation is for the Defense Advanced Research Project Agency (DARPA) and the actual total transportation charges paid to the carrier(s) by the consignor or consignee are assignable to, and shall be reimbursed by, the Government."

(b) If the Government is not shown as the consignor or the consignee, the annotation shall be:

"Transportation is for the Defense Advanced Research Project Agency (DARPA) and the actual total transportation charges paid to the carrier(s) by the consignor or consignee shall be reimbursed by the Government, pursuant to cost-reimbursement contract no. HR0011-10-C-0147. This may be confirmed by contacting the Contracting Officer."

(End of clause)

#### 52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

<http://farsite.hill.af.mil>

(End of clause)

#### 52.252-6 AUTHORIZED DEVIATIONS IN CLAUSES (APR 1984)

(a) The use in this solicitation or contract of any Federal Acquisition Regulation (48 CFR Chapter 1) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the date of the clause.

(b) The use in this solicitation or contract of any Defense Federal Acquisition Regulation (48 CFR Part 201 et seq.) clause with an authorized deviation is indicated by the addition of "(DEVIATION)" after the name of the regulation.

(End of clause)

252.225-7006 QUARTERLY REPORTING OF ACTUAL CONTRACT PERFORMANCE OUTSIDE THE UNITED STATES (MAY 2007)

(a) Definition. United States, as used in this clause, means the 50 States, the District of Columbia, and outlying areas.

(b) Reporting requirement. Except as provided in paragraph (c) of this clause, within 10 days after the end of each quarter of the Government's fiscal year, the Contractor shall report any subcontract, purchase, or intracompany transfer that--

- (1) Will be or has been performed outside the United States;
- (2) Exceeds the simplified acquisition threshold in Part 2 of the Federal Acquisition Regulation; and
- (3) Has not been identified in a report for a previous quarter.

(c) Exception. Reporting under this clause is not required if--

- (1) A foreign place of performance is the principal place of performance of the contract; and
- (2) The Contractor specified the foreign place of performance in its offer.

(d) Submission of reports. The Contractor shall submit the reports required by this clause to: Deputy Director of Defense Procurement and Acquisition Policy (Contract Policy and International Contracting), OUSD(AT&L)DPAP(CPIC), Washington, DC 20301-3060.

(e) Report format. The Contractor--

- (1) Shall submit reports using--
  - (i) DD Form 2139, Report of Contract Performance Outside the United States; or
  - (ii) A computer-generated report that contains all information required by DD Form 2139; and
- (2) May obtain copies of DD Form 2139 from the Contracting Officer or via the Internet at <http://www.dtic.mil/whs/directives/infomgt/forms/formsprogram.htm>.

(f) Subcontracts. The Contractor--

- (1) Shall include the substance of this clause in all first-tier subcontracts exceeding \$550,000, except those for commercial items, construction, ores, natural gases, utilities, petroleum products and crudes, timber (logs), or subsistence;
- (2) Shall provide the number of this contract to its subcontractors required to submit reports under this clause; and



(3) Shall require the subcontractor, with respect to performance of its subcontract, to comply with the requirements directed to the Contractor in paragraphs (b) through (e) of this clause.

(End of clause)

Section J - List of Documents, Exhibits and Other Attachments

Exhibit/Attachment Table of Contents

<b>DOCUMENT TYPE</b>	<b>DESCRIPTION</b>
Attachment 1	Statement of Work (SOW)
Attachment 2	Asserted Rights

**HR0011-10-C-0147**  
**Attachment 1**

**Statement of Work**

All work will be performed at Palo Alto Research Center by PARC personnel. A statement of work with a schedule of tasks and milestones is given in Table 1.

	<b>Project tasks and milestones</b>
<b>Month 1-3</b>	Task 1A: Modification of existing electrodialysis unit for CO <sub>2</sub> -from-seawater tests (ST, CE) Task 2A: Proof-of-concept demonstration (ME, ST, CE) Task 3A: CO <sub>2</sub> -from-seawater experiments to characterize efficiency, energy consumption, CO <sub>2</sub> extraction rate using "seawater" solutions without divalent cations (ME) Interim Milestone A: Proof-of-concept demonstration and experimental characterization of the CO <sub>2</sub> -from-seawater concept Deliverables: Data for Progress Report 1, "Electrodialysis for extracting CO <sub>2</sub> from seawater" Task 1B: Design of lightweight, compact prototype unit based on results of Tasks 1A-3A (ST, CE) Task 2B: Start construction of lightweight, compact prototype unit (ST, CE)
<b>Month 4-6</b>	Task 3B: Complete construction prototype (ST, CE) Task 4B: Testing of prototype using "seawater" solutions without divalent cations (ME, ST, CE) Interim Milestone B: Design, construction, and initial testing of prototype Deliverables: Data for Progress Report 2b, "A compact, lightweight device for extracting CO <sub>2</sub> from seawater" Task 1C: CO <sub>2</sub> -from-seawater experiments to characterize efficiency, energy consumption, CO <sub>2</sub> extraction rate using real seawater and reverse osmosis brine (ME, NC) Task 2C: Characterize the effect of seawater on membrane performance (ME, NC, KL) Interim Milestone C: Experimental characterization of the CO <sub>2</sub> -from-seawater concept for real seawater and reverse osmosis brine solutions Deliverables: Data for Progress Report 2a, "Scaling and other challenges to using electrodialysis for extracting CO <sub>2</sub> from seawater"
<b>Month 7-9</b>	Task 1D: Testing of prototype under a wide range of experimental conditions, including using real seawater and reverse osmosis brine (ME, CE, ST) Task 2D: Determine the limits of operation of the prototype (ME, CE, ST) Interim Milestone D: Characterize and optimize performance of prototype for real-world operation Deliverables: Data for Progress Report 2b, "A compact, lightweight device for extracting CO <sub>2</sub> from seawater" Task 1E: Demonstrate improved performance in the electrodialytic extraction of CO <sub>2</sub> from seawater by reducing problems due to scaling (ME, NC, KL) Interim Milestone E: Determine limits of operation Deliverables: Data for Progress Report 2a, "Scaling and other challenges to using electrodialysis for extracting CO <sub>2</sub> from seawater"
<b>End-of-project milestone</b>	CO <sub>2</sub> -from-seawater prototype meeting the following specifications: <ul style="list-style-type: none"> <li>• Electrodialysis unit, seawater pumps, and CO<sub>2</sub> vacuum pump in one integrated unit</li> <li>• Total volumetric footprint (including pumps) <math>\leq 0.02 \text{ m}^3</math></li> <li>• Energy consumption (excluding electrodes) <math>\leq 1000 \text{ kJ/molCO}_2</math></li> <li>• Rate of CO<sub>2</sub> extraction <math>\geq 0.1 \text{ L(CO}_2\text{)/minute}</math></li> </ul> Deliverables: Final Report and prototype

**Table 1:** Statement of work, including a timeline and assignment of responsibility among team members. Researchers responsible for each task listed in parentheses: ME=Matthew Eisaman, KL=Karl Littau, NC=Norine Chang, CE=Craig Eldershaw, ST=Sasha Tuganov.

*This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed - in whole or in part - for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of, or in connection with, the submission of this data, the Government shall have the right to duplicate, use, or disclose this data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use the information contained in the data if it is obtained from another source without restriction. The data subject to this restriction are contained in all sheets. (FAR 52.215-1)*

*Months 1 - 3*

The first three months will focus on demonstrating the proof-of-concept, and characterizing the performance of the system for idealized seawater and RO brine solutions that do not contain divalent cations ( $\text{Mg}^{2+}$  or  $\text{Ca}^{2+}$ ). The solutions will essentially be  $\text{NaCl/KCl/NaHCO}_3/\text{KHCO}_3$  solutions with concentrations equal to those in seawater and RO brine. These experiments will be performed using the electrodialysis unit constructed at PARC during DARPA contract NBCHC090074. These experiments will characterize the fundamental efficiency, voltage, energy consumption, and  $\text{CO}_2$  extraction rate of the process without the complicating factor of membrane scaling and fouling due to the presence of divalent cations

As discussed in Section III.D, the Henry's Law  $\text{CO}_2$  partial pressure in equilibrium with the concentration of  $\text{CO}_2$  in seawater means that a vacuum pump will be required to extract  $\text{CO}_2$  from the acid solution. The electrodialysis unit at PARC will be retrofit with a vacuum pump for this purpose. The electrodialysis unit is outfit with automatic data-taking ability that will measure the pH, conductivity, temperature, flow rate, input pressure, and output pressure of all solutions every 5 seconds. In addition, the rate of  $\text{CO}_2$  gas evolution from the acid solution will be measured, as will the current and voltage. This data will be gathered for a range of flow rates, concentrations, and currents to understand the dependence of voltage, energy consumption, and  $\text{CO}_2$  extraction rate on these parameters. Computational modeling of the chemistry involved will be performed as needed to understand the behavior of the system.

After the  $\text{CO}_2$ -from-seawater concept has been demonstrated, characterized and understood, we will focus on using this knowledge to begin design and construction of the prototype. The prototype will have all pumps integrated into one unit with the electrodialysis stack, and this integrated unit will measure less than  $0.02 \text{ m}^3$ . One possible design we envision is a unit that floats on the sea, pumping seawater through the system from which it extracts  $\text{CO}_2$ . Although this initial prototype will not have an integrated power source, one can imagine future prototype generations that would also have an integrated power source (solar panels or mobile nuclear, for example). Design will be accomplished using SolidWorks® and COSMOSWorks FEA (Finite Element Analysis) CAD software.

*Months 4 - 6*

The next three months will involve the completion of the prototype construction and initial testing. This includes, for example, leak testing and testing electrical connections. Once this initial testing is complete, the prototype will be tested with idealized seawater solutions that do not contain divalent cations ( $\text{Mg}^{2+}$  or  $\text{Ca}^{2+}$ ). The solutions will essentially be  $\text{NaCl/KCl/NaHCO}_3/\text{KHCO}_3$  solutions with concentrations equal to those in seawater.

Concurrent with this effort, we will perform a complete characterization of the performance of the  $\text{CO}_2$ -from-seawater concept on the existing lab unit at PARC using real seawater and RO brine solutions. This data will be gathered for a range of flow rates, concentrations, and currents to understand the dependence of voltage, energy consumption, and  $\text{CO}_2$  extraction rate on these parameters. Computational modeling of the chemistry involved will be performed as needed to understand the behavior of the system, and to understand the difference in performance for  $\text{CO}_2$  extraction from the idealized (i.e., divalent-cation free) seawater and RO brine tested in months

*Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.*

1-3 versus the real seawater and RO brine tested during months 4-6. In addition, we will characterize the change in performance over time of the membranes and electrodes after integrated exposure to the divalent cations in real seawater and RO brine samples.

#### *Months 7-9*

During the final three months, we will perform a complete characterization of the performance of the lightweight prototype using real seawater and RO brine solutions. This data will be gathered for a range of flow rates, concentrations, buffer concentrations, and currents to understand the dependence of voltage, energy consumption, and CO<sub>2</sub> extraction rate on these parameters. We will also test the limits of operation of the prototype, including maximum volumetric seawater flow and current density, and maximum continuous operation before degradation due to membrane scaling and fouling. To mitigate the possible destructive effects of membrane scaling and fouling due to divalent cations, we will: (1) Test various membranes and electrodes for their performance and resistance to scaling, (2) Test the effect of periodic anti-scaling cycles where the acid compartment effluent is used as the anti-scaling agent; (3) Test the effect of commercial anti-scaling agents; and (4) Test the effect of pretreatment of the seawater to remove divalent cations prior to CO<sub>2</sub> extraction.

#### *End-of-project milestone*

The critical milestone for this work is the design, construction, and testing of a lightweight, compact, and robust electrodialysis prototype for CO<sub>2</sub> concentration from seawater that meets the following criteria: (1) Electrodialysis unit and all pumps in one integrated unit; (2) Total volumetric footprint (including pumps)  $\leq 0.02 \text{ m}^3$ ; (3) Energy consumption (excluding electrodes)  $\leq 1000 \text{ kJ/molCO}_2$ ; (4) Rate of CO<sub>2</sub> extraction  $\geq 0.1 \text{ L(CO}_2\text{)/minute}$ .

All data and observations related to proof-of-concept experiments and the performance of the prototype will be collected into three technical reports and a final summary report. Technical report I, will be delivered to DARPA at the end of month 3; technical reports 2a, 2b, and the final summary report will be delivered to DARPA at the conclusion of the project. ***The prototype itself, in addition to the reports and the data they contain, will constitute the deliverables of this project.*** The performance of the prototype and the content and conclusions of the report will help make a go/no-go decision as to whether a formal DARPA program focused on liquid fuel synthesis from seawater is justified.

## Attachment 2

### Asserted Rights

**252.227-7017 IDENTIFICATION AND ASSERTION OF USE, RELEASE, OR DISCLOSURE  
RESTRICTIONS (JUN 1995)**

(a) The terms used in this provision are defined in following clause or clauses contained in this solicitation-

(1) If a successful offeror will be required to deliver technical data, the Rights in Technical Data--Noncommercial Items clause, or, if this solicitation contemplates a contract under the Small Business Innovative Research Program, the Rights in Noncommercial Technical Data and Computer Software--Small Business Innovative Research (SBIR) Program clause.

(2) If a successful offeror will not be required to deliver technical data, the Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation clause, or, if this solicitation contemplates a contract under the Small Business Innovative Research Program, the Rights in Noncommercial Technical Data and Computer Software--Small Business Innovative Research (SBIR) Program clause.

(b) The identification and assertion requirements in this provision apply only to technical data, including computer software documents, or computer software to be delivered with other than unlimited rights. For contracts to be awarded under the Small Business Innovative Research Program, the notification requirements do not apply to technical data or computer software that will be generated under the resulting contract. Notification and identification is not required for restrictions based solely on copyright.

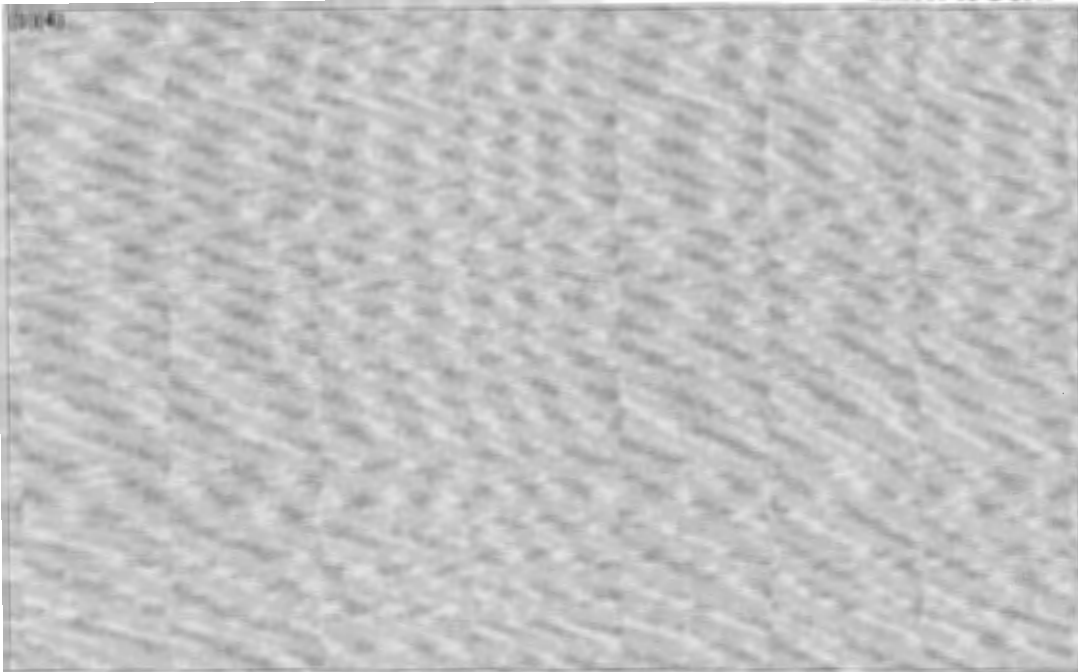
(c) Offers submitted in response to this solicitation shall identify, to the extent known at the time an offer is submitted to the Government, the technical data or computer software that the Offeror, its subcontractors or suppliers, or potential subcontractors or suppliers, assert should be furnished to the Government with restrictions on use, release, or disclosure.

(d) The Offeror's assertions, including the assertions of its subcontractors or suppliers or potential subcontractors or suppliers shall be submitted as an attachment to its offer in the following format, dated and signed by an official authorized to contractually obligate the Offeror:

Identification and Assertion of Restrictions on the Government's Use, Release, or Disclosure of Technical Data or Computer Software.

The Offeror asserts for itself, or the persons identified below, that the Government's rights to use, release, or disclose the following technical data or computer software should be restricted:

Technical Data or Computer Software to be Furnished With Restrictions *	Basis for Assertion **	Asserted Rights Category ***	Name of Person Asserting Restrictions ****
(LIST) *****	(LIST)	(LIST)	(LIST)
(b)(4)			



\*For technical data (other than computer software documentation) pertaining to items, components, or processes developed at private expense, identify both the deliverable technical data and each such items, component, or process. For computer software or computer software documentation identify the software or documentation.

\*\*Generally, development at private expense, either exclusively or partially, is the only basis for asserting restrictions. For technical data, other than computer software documentation, development refers to development of the item, component, or process to which the data pertain. The Government's rights in computer software documentation generally may not be restricted. For computer software, development refers to the software. Indicate whether development was accomplished exclusively or partially at private expense. If development was not accomplished at private expense, or for computer software documentation, enter the specific basis for asserting restrictions.

\*\*\*Enter asserted rights category (e.g., government purpose license rights from a prior contract, rights in SBIR data generated under another contract, limited, restricted, or government purpose rights under this or a prior contract, or specially negotiated licenses).

\*\*\*\*Corporation, individual, or other person, as appropriate.

\*\*\*\*\*Enter "none" when all data or software will be submitted without restrictions.

Date 09/13/10

Printed Name and Title Bruce Karnacki, Grants Manager

Signature Bruce Karnacki

(End of identification and assertion)

(e) An offeror's failure to submit, complete, or sign the notification and identification required by paragraph (d) of this provision with its offer may render the offer ineligible for award.



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(f) If the Offeror is awarded a contract, the assertions identified in paragraph (d) of this provision shall be listed in an attachment to that contract. Upon request by the Contracting Officer, the Offeror shall provide sufficient information to enable the Contracting Officer to evaluate any listed assertion.

(End of clause)