Lines 1-4, Columns (c) through (g)

For new applications, leave Columns (c) and (d) blank. For each line entry in Columns (a) and (b), enter in Columns (e), (f), and (g) the appropriate amounts of funds needed to support the project for the first funding period (usually a year).

same as the total amount shown in Section A, Column (g), Line 5. F
grants and changes to grants, the total amount of the increase or de
Columns (1)-(4), Line 6k should be the same as the sum of the amo
Columns (e) and (f) on Line 5.

Line 7—Enter the estimated amount of income, if any, expected to k
this project. Do not add or subtract this amount from the total project
under the program narrative statement the nature and source of inco
amount of program income may be considered by the federal granto
determining the total amount of the grant.

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Section C. Non-Federal Resources

Lines 8-11—Enter amounts of non-Federal resources that will be used on the grant. If in-kind contributions are included, provide a brief explanation on a separate sheet.

Column (a)—Enter the program titles identical to Column (a), Section A. A breakdown by function or activity is not necessary.

Column (b)—Enter the contribution to be made by the applicant.

Column (c)—Enter the amount of the State's cash and in-kind contribution if the applicant is not a State or State agency. Applicants which are a State or State agencies should leave this column blank.

Column (d)—Enter the amount of cash and in-kind contributions to be made from all other sources.

Column (e)—Enter totals of Columns (b), (c), and (d).

Line 12—Enter the total for each of Columns (b)-(e). The amount in Column (e) should be equal to the amount on Line 5, Column (f) Section A.

Section D. Forecasted Cash Needs

Line 13—Enter the amount of cash needed by quarter from the grantor agency during the first year.

Line 14—Enter the amount of cash from all other sources needed by quarter during the first year.

Line 15—Enter the totals of amounts on Lines 13 and 14.

Section E. Budget Estimates of Federal Funds Needed fo Project

Lines 16-19—Enter in Column (a) the same grant program tit
Column
(a), Section A. A breakdown by function or activity is not nece
applications and continuation grant applications, enter in the
amounts of Federal funds which will be needed to complete t
project over the succeeding funding periods (usually in years)
need not be completed for revisions (amendments, changes,
funds for the current year of existing grants.
If more than four lines are needed to list the program titles, su
schedules as necessary.

Line 20—Enter the total for each of the Columns (b)-(e). Whe
schedules are prepared for this Section, annotate accordingly
overall totals on this line.

Section F. Other Budget Information

Line 21—Use this space to explain amounts for individual dir
cost categories that may appear to be out of the ordinary or t
details as required by the Federal grantor agency.

Line 22—Enter the type of indirect rate (provisional, predeter
fixed) that will be in effect during the funding period, the estim
the base to which the rate is applied, and the total indirect ex

Line 23—Provide any other explanations or comments deem

Previous Edition Usable

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OMB Approval No. 0348-0044

Total (g)
$1,994,247
$0
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$1,994,247

Total (5)
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REDACTED EXEMPTION 4
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Page 4 (Rev. 4-92)
Prescribed by OMB Circular A-102

(e) **Totals**
$1,392,709
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LOCKHEED MARTIN
We never forget who we're working for®

ADVANCED COMPOSITE OTEC COLD WATER PIPE PROJECT

Commercialization of ocean thermal energy conversion (OTEC) systems hinges on reducing the capital cost of key components such as the heat exchangers, cold water pipe, and the support platform for floating plants to enable OTEC to be competitive with other renewable energy systems. The Lockheed Martin team proposes to demonstrate an innovative cold water pipe fabrication and deployment approach that is projected to be substantially lower cost and lower risk than previous designs. Our approach uses pre-pultruded segments as sandwich core, molded in between outer and inner face sheets of fatigue-resistant "WindStrand" fiberglass with seawater-resistant 8084 vinyl ester resin to form an integrated structure. This novel design enables simultaneous in-situ fabrication and deployment of the cold water pipe thereby reducing manufacturing costs as well as deployment cost and risk.

Name of Applicant

Lockheed Martin
Maritime Systems & Sensors
Undersea Systems
9500 Godwin Drive
Manassas, VA 20110-4157

Project Director / PI

Dr. Alan Miller
Sr. Staff Materials Engineer
Lockheed Martin, Space Systems

Objectives of the Project

The AWP Project objectives are to validate cold water pipe (CWP) manufacturing techniques at the prototype and Pilot Plant scales. We shall collect actual construction labor hours and materials to validate cost projections for full-scale cold water pipe manufacturing, and validate the mechanical and environmental characteristics of the composite CWP to withstand ocean environment.

Project Description

Our proposed project fabricates the required tooling and fixtures needed for the LM innovative manufacturing method. The tooling is checked out by fabricating sections of CWP on land and refining the procedures and tooling apparatus as necessary. The manufacturing tooling and fixtures and required materials are used to demonstrate CWP manufacturing and deployment on the water while gathering construction labor and material costs. Gathering labor hours and costs to fabricate the CWP provides the information needed to validate cost projections for full-scale production. Non-destructive and destructive testing is performed on test coupons and also on full diameter pipe segments to validate mechanical properties and ability to withstand ocean environment.

Project Impacts

Our proposed AWP Project demonstrates a major advancement toward commercializing OTEC systems by reducing the manufacturing and deployment cost of very large cold water pipes. Results include evidence of manufacturing and deployment costs for OTEC cold water pipes. Demonstrating CWP marine construction establishes the benefits of employing advanced composite and pultruded materials integrated into marine structures for long-life operation. In addition, simultaneous manufacturing and deployment significantly reduces commercialization costs and CWP deployment risks of this promising renewable energy system that has near-term business opportunities.

Major Participants

- Lockheed Martin, Maritime Systems & Sensors
- Lockheed Martin, Space Systems
- Makai Ocean Engineering
- West Virginia University
- Glasforms, Inc

Advanced Water Power Projects Topic Area:

Topic Area #1: Advanced Water Power Renewable Energy In-water Testing and Development Projects.

Advanced Water Power Projects Current Stage of Technology

Technology Area #4: Electricity generation from differentials in ocean temperatures.

PMC-EF1

(2/06/02)

U.S. DEPARTMENT OF ENERGY

EERE PROJECT MANAGEMENT CENTER

ENVIRONMENTAL CHECKLIST

(To Be Completed by Potential Recipient)

PART I: General Information

DOE Project Officer: Gary Nowakowski **Date:** 6/13/2008

Project Title: Advanced Composite OTEC Cold Water Pipe Project **ST:** VA

Organization Name: Lockheed Martin Maritime Systems & Sensors

Solicitation Number: DE-PS36-08GO98030 Award No:

1. Please describe the intended use of DOE funding in your proposed project. For example, would the funding be applied to the entire project or only support a phase of the project? Describe the activity as specifically as possible, i.e. planning, feasibility study, design, data analysis, education or outreach activities, construction, capital purchase and/or equipment installation or modification. If the project involves construction, also describe the operation of the completed facility/equipment.

The AWP Project objectives are to validate cold water pipe (CWP) manufacturing techniques at the prototype and Pilot Plant scales. We shall collect actual construction labor hours and materials to validate cost projections for full-scale cold water pipe manufacturing, and validate the mechanical and environmental characteristics of the composite CWP to withstand ocean environment.

Our proposed project fabricates the required tooling and fixtures needed for the LM proprietary manufacturing method. The tooling is checked out by fabricating sections of CWP on land and refining the procedures and tooling apparatus as necessary. The manufacturing tooling and fixtures and required materials are used to demonstrate CWP manufacturing and deployment on the water while gathering construction labor and material costs. Gathering labor hours and costs to fabricate the CWP provides the information needed to validate cost projections for full-scale production. Non-destructive and destructive testing is performed on test coupons and also on full diameter pipe segments to validate mechanical properties and ability to withstand ocean environment.

The on-water demonstration comprises assembly of tooling & fixturing on barge(s). Fabrication of the CWP is achieved by using pre-pultruded segments as a sandwich core and molding outer and inner layers of composite fiber with vinyl ester resin to form an integrated structure. The approach requires total resin cure so that the cured section can be lowered into the water to allow fabrication of the next section above water.

The proposed effort is stand alone and requires no other resources to complete task objectives. We anticipate conducting further tests on the coupons / segments beyond that funded under this task. Additionally, it should be clear the CWP in itself is a subsystem to a complete Ocean Thermal Energy Conversion power generation plant and therefore is part of a larger effort to commercialize OTEC.

2. Does any part of your project require review and/or permitting by any other federal, state, regional, local, environmental, or regulatory agency? ☐ Yes ☑ No

3. Has any review (e.g., NEPA documentation, permits, agency consultations) been completed?
☐ Yes ☑ No If yes, is a finding or report available and how can a copy be obtained?

4. Is the proposed project part of a larger scope of work? ☑ Yes ☐ No If yes, please describe.
The proposed effort is stand alone and requires no other resources to complete AWPP task objectives. We anticipate conducting further tests on the coupons / segments beyond that funded under this task. Additionally, it should be clear the CWP in itself is a subsystem to a complete Ocean Thermal Energy Conversion power generation plant and therefore is part of a larger effort to commercialize OTEC.

Do you anticipate requesting additional federal funding for subsequent phases of this project?
☐ Yes ☑ No If yes, please describe.

GO-EF1 NEPA EF1 Environmental Checklist

5. Does the scope of your project only involve one or more of the following:

- ☐ Information gathering such as literature surveys, inventories, audits,
- ☐ Data analysis including computer modeling,
- ☐ Document preparation such as design, feasibility studies, analytical energy supply and demand studies, or
- ☐ Information dissemination, including document mailings, publication, distribution, training, conferences, and informational programs.

Preparer: William Munslow	Phone: 703-367-4569	Email: william.d.munslow@lmco.com
Business Contact: Robert Varley	Phone: 703-367-1955	Email: robert.varley@lmco.com

PART II: Environmental Considerations

Section A Conditions or special areas are present, required, or could be affected by your project:

3. New or Modified Federal/State Permits And/or Requests for Exemptions

Summersville Lake is operated by the Army Corps of Engineers. Our partner, West Virginia University (WVU) has worked with the COE in the past on projects involving waterways. WVU has received verbal confirmation from COE for this effort. Formal approval will be sought during year 1.

23. Aesthetics

During the demonstration portion of this task, we propose operating a barge(s) on Summersville Lake to fabricate the CWP segment. There may be recreational boaters, fishermen, local land owners who may take exception to the presence of the barge.

Section B. Would your project use, disturb, or produce any chemicals or biological substances? (i.e., pesticides, industrial process, fuels, lubricants, bacteria)

3. Chemical Storage, Use, and Disposal

☐ Permit Required Quantity: Permit Type:

Specific nature of use:

We plan to utilize vinyl ester resin to fabricate a fiberglass reinforced composite structure.

Section C. Would your project require or produce any radiological materials?

GO-EF1 NEPA EF1 Environmental Checklist

Update | Print Form | Return to Main Menu

Dr. ALAN MILLER - Principal Investigator

Education and Training.
Cornell University, Ithaca, NY Mechanical Engineering B.S. 1967
Stanford University, Stanford, CA , Mechanical Engineering , M.S., 1968
Stanford University, Stanford, CA , Materials Science and Engineering, Ph.D., 1975

Professional Experience:
Lockheed-Martin Space Systems Company, Advanced Technology Center (Palo Alto, CA) Senior Staff Materials Engineer
For the past 40 years he has focussed on technical challenges involving materials and structures. At Stanford, he originated the "MATMOD" unified constitutive equations for creep and plasticity of metals and alloys, which contributed considerably to that field. His major more recent work has been on the development of improved methods for fabrication of polymer-matrix fiber composite structures. Technologies have included low-cost vacuum-assisted resin transfer molding (VARTM) of thermosets, in-situ consolidation of thermoplastics, and rapid preliminary design and optimization. He was co-investigator on Lockheed's design, fabrication, and testing of fiber composite highway bridges and bridge decks, now in production as "Duraspan" decks made by Martin Marietta Composites and in service on about 25 bridges. He led the Sunnyvale effort on compliant adhesives to enable carbon composite face sheets to be used in metallic heat pipe panels for several satellites, including the New Skies 7 and Echo X communications satellites and the Space Infrared Telescope Facility (SIRTF, now the Spitzer Space Telescope). He was the Principal Investigator for LMSS work exploiting VARTM for aerospace applications including complex missile structures, integral Deep Space antennas, and Large Composite Tooling. During the years 2003-2007 he led the materials selection and qualification work for one section of a major Special Program. As of January 2008 he is leading the Cold Water Pipe effort (under LM's Marine Systems and Sensors Co. project developing Ocean Thermal Energy Conversion (OTEC) as a contribution to the world's alternative energy needs); at this point the material/configuration/manufacturing process for an affordable CWP has been developed under the CWP Trade Study, and experimental validation of the selected process has begun.

Publications:
He has published 100 technical papers and 4 book chapters, has edited one book, holds seven U.S. patents, and was the principal supervisor of 17 completed Ph.D. students at Stanford.

Steve Bailey

Education and Training.
University of Illinois, Champaign-Urbana, Mechanical Engineering, B.S. 1977

Professional Experience:
Lockheed Martin, Maritime Systems & Sensors, Senior Staff Engineer
Mr. Bailey has over 25 years of aerospace and marine experience in mechanical design, test and systems engineering disciplines.

- Currently the Engineering lead for the platform subsystem of conceptual Ocean Thermal Energy Conversion (OTEC) design. Developments for the platform involve novel arrangements of OTEC energy producing equipment within tension leg and semisubmersible platform arrangements.
- Currently the Engineering lead for the Seaframe development of an Unmanned Surface Vessel (USV). Developments for the multihull seaframe include new approaches to structures/materials, unique hullform for lower resistance and improved seakeeping, and new approaches to payload and vessel integration.
- Engineering lead for the E-Craft Feasibility Study and Preliminary Design. E-Craft is a revolutionary approach to ship operations and its development required new approaches to design. Led test program that included seakeeping, powering and launch/recovery operations.
- Mission Systems engineering lead for FMS Ship Concept study proposal and contract. Led an engineering team on the development of novel heavy lift systems for at-sea payload exchange.
- Responsible Engineer for the Nose Fairing and Nose Cap for the submarine-launched Trident Fleet Ballistic Missile program. Led the development of a composite heat shield using vacuum infusion processes with high temperature materials.
- Chief Systems Engineer for the concept and preliminary design phase of the UNOLS oceanographic research vessel AGOR 26, R/V Kilo Moana . Performed seakeeping, ship sizing and costing analysis and completed a trade study on the maneuvering subsystem.
- Systems engineer for the Mission and Launch control subsystems for the Payload Launch Vehicle (PLV) Ballistic Missile Defense (BMDO) program. Developed specifications that were used to successfully install computer systems at the Kwajalein Pacific Missile Range.
- Chief Systems Engineer for the SEA SLICE, high speed SWATH vessel. Performed trade study for the ship size and its propulsion system as a part of a design to cost analysis.
- Systems Engineer on various autonomous and remotely operated vehicle programs. Activities included concept design of a fuel cell propulsion system, launch and recovery systems and director for an at-sea underwater vehicle demonstration program.
- Assistant Site Test Director for the Sea Shadow stealth ship development program. Duties included coordinating activities of ships, aircraft, and other assets during demonstration phase.
- Design engineer for advanced SWATH hullform concepts including fabrication and testing of a remote controlled models for maneuvering systems and structural performance in a seaway.
- Design/Test Engineer as a consultant with Giannotti and Assoc. providing system support for NOAA regarding Ocean Thermal Energy Conversion (OTEC). Developed reports on Deepsea Mooring Systems, OTEC/Mariculture systems, and Shore Based OTEC power plants. Performed test engineering duties for the Cold Water Pipe model basin test program.
- Design Engineer on R/V Glomar Explorer for a deepsea ocean seabed mining system which provided experience at-sea in high power hydraulic propulsion systems for a seabed miner.

HOTA V. S. GANGARAO

Education and Training.

Indian Institute of Technology, Madras, India	Civil Engineering	B. Tech. 1965
N.C.S.U., Raleigh, N.C	Civil Engineering	M.S. 1967
N.C.S.U., Raleigh, N.C	Civil Engineering	Ph. D. 1969

Professional Experience:

Professor, Civil and Environmental Engineering

1988 - Present: Director, Constructed Facilities Center (CFC), WVU In October 1999, the CFC at WVU was designated as a **National Research Center of Excellence** by the United States Congress, work started in August 2001

1979 – Present: Prof. of CEE, WVU

1969 – 1979 Assistant and Associate Professor of CEE, WVU

Thesis Advisor and Postgraduate-Scholar Sponsor

Vadlamani, Deepika, MSME, Strain Energy Density Based Failure Criterion for GFRP Coupons under Tension and Bending, 2007

Shekar, Vimala, MSME, Effect of Fiber Architecture on Properties of Pultruded Composites, 2007

Sadat Abhari, Reza, MSCE, Rehabilitation of Timber Railroad Bridges Using Glass Fiber Reinforced Polymer Composite, 2007

Bataineh, Ayman Talal, MSCE, Live Load Response of Short Span Bridges with Parallam Decks, 2007

Krishnaswamy, Vijayarajan, MSCE, Durability of Nanoclay FRP Bars for Concrete Members, 2006

Aluri, Srinivas, MSME, Updating Low-Profile FRP Deck FE Model Using Experimental Modal Analysis, 2006

Prachasaree, Woraphot, PhD, Performance Evaluation of FRP Bridge Deck under Shear Loads, 2005

Laosiriphong, Krit, PhD, Theoretical and Experimental Analysis of FRP Decks under Thermal Loads, 2004

Advising about 15 graduate students per year on an average with help from CFC's full-time research engineers; Annually about 6 graduate students receiving advanced degrees under my supervision; Over 300 graduate students received MS and PhD degree under Hota's supervision as major advisor.

Publications:

"3-D Stitched Fabrics," with Thippeswamy and Shekar, Canadian Patent # 2,421,735, 2006; US Patent, pending

"Light Weight FRP Composite Modular Panel," with Siva Hota, US Patent # 6,591,567 B2, 2003

"Modular FRP Composite Deck Systems," with R. Lopez-Anido and Ever Barbero, US Patent # 6,544,624, 2003; US Patent # 6,455,131, 2002

"Modular FRP Composite Panel System", with R. Lopez-Anido, US Patent # 6,309,732, 2001

Total Patents: **10** plus **3** others pending

"Failure Load Prediction of GFRP Composites Using Energy Approach", GangaRao HVS, et al, Proceedings of SAMPE Annual Conference, Baltimore, MD, 2007

"Fatigue Response of Fabric – reinforced Polymeric Composites", Journal of Composite Materials, 2005, 39(17) 1541-1559 (with Natarajan V and Shekar V)

"Dynamic Response of Three FRP Bridges", Journal of Bridge Engineering, ASCE, Nov. 2005, 10(6) 722-730 (with Aluri S and Jinka C)

"The Effect of Aging Environment on the Degradation of Glass-Reinforced Epoxy", ASCE Journal of Comp. in Construction, Feb 2002, Vol. 6, No. 1 (co authored with Gupta & Kajorncheapunnagam)

"Thermo-Mechanical Properties of Vinyl Ester/Clay Nano Composites", GangaRao and Gupta, Proceeding, 2nd Int. Conference on Durability of FRP Composites for Construction, Montreal, Canada, 2002, PP 321-331

Synergistic Activities

co-Chair – Steering Committee – National Conference on Integral and Jointless Bridges, 2005, service years 2002-2006; Chair, ASCE – Structural Composites and Plastics Sub-Committee, 2001 and 2005; CERF-ASCE, Member, "GAP Analysis for the Durability of FRP Composites", CERF Report, ASCE, Jul 2001; Chair, ASCE Sponsored Research on FRP Connections, 1999-2002; Worked with various WVDOH Districts to design and help build eight FRP Bridges, 2000-2003; Organized several Sessions for ASCE and SAMPE, 2000-2002; Proposal and/or Review (Panel) Member for NSF, 2001-2002; Review papers for ASCE, ACI and other professional organizations;, 2001-2003

Working with several State Highway Agencies in helping them build FRP bridges; 2001-2003, Organized and Conducted THREE workshops across WV on FRP Bridges; S.D. Foundation, Charleston, WV. (Charitable Trust) Board Member 1998-2001

Ruifeng (Ray) Liang

Education and Training:
Tsinghua University, Beijing, China, Polymer Materials B.E. 1984

Chinese Academy of Sciences Institute of Chemistry, Beijing, China, Polymer Physics, M. Sc. 1987

Chinese Academy of Sciences Institute of Chemistry, Beijing, China, Polymer Physics, Ph.D. 1990

Professional Experience:

Research Assistant Professor, Constructed Facilities Center and Department of Chemical Engineering, West Virginia University, Morgantown, WV

2001- Present Research Assistant Professor, Constructed Facilities Center and Department of Chemical Engineering, West Virginia University

1999- 2001 Post-Doctoral Fellow, Department of Chemical Engineering, West Virginia University (w. Prof. RK Gupta)

1998- 1999 Royal Society Visiting Fellow (3 months) and EPSRC Visiting Fellow (12 months), Department of Chemical Engineering, Cambridge University (w. Prof. MR Mackley)

1996- 1998 Professor of Polymer Physics, Deputy Director of State Key Laboratory of Engineering Plastics and State Engineering Research Center of Engineering Plastics, Chinese Academy of Sciences, Beijing, China

1995- 1997 Professor of Polymer Physics, Graduate School, Chinese Academy of Sciences, Beijing, China

1992- 1994 Royal Society Visiting Fellow (6 months) and National Physics Laboratory Postdoctoral Fellow (18 months), Department of Chemical Engineering, Cambridge University (w. Prof. MR Mackley)

1991- 1996 Associate Professor, Chinese Academy of Sciences Institute of Chemistry, Beijing, China

1990- 1991 Assistant Professor, Chinese Academy of Sciences Institute of Chemistry, Beijing, China

Thesis Advisor and Postgraduate-Scholar Sponsor

Ashish Suresh Bambal, M.S.Ch.E., Mechanical Evaluation and Finite Element Modeling of Composite Sandwich Panels, 2007

Mutnuri, Bhyrav, M.S.M.E., Thermal Conductivity Characterization of Composite Materials, 2006

Hota, Sandilya Venkata Sivaram, M.S.E.E., Development and Evaluation of Smart Materials for Structural Health Monitoring, 2006

Jerry Whitlock, M.S.C.E., Performance of Polymer Concrete Wearing Surfaces on FRP Bridge Decks, 2003

Abhishek Anjanappa, M.S.I.E, Tensile and Thermal Properties of Metal Alloys at Elevated Temperatures. 2003

Publications:
Ruifeng Liang and Hota Gangarao, Comparison of Mechanical Characteristics of Pultruded Glass and Carbon Composite Sandwich Panels, Proceedings of ShipTech 2007 -Shipbuilding Affordability- Working Together to Bring Technology to the Fleet (Jan 30-31, 2007, Biloxi, MS)

Bhyrav Mutnuri, Ruifeng (Ray) Liang and Hota GangaRao, Thermal Conductivity Characterization of FRP Composites: Experimental, SPE 64th ANTEC (May 7-11, 2006, Charlotte, NC), Vol.1, pp.143-147

Hota GangaRao, Ruifeng Liang, Composites Past, Present and Future: Opening Doors for Composite Infrastructure (invited), Composites Technology, April 2004, 6-7(2004)

Jing Wang, Shaofeng Guo, Ruifeng Liang, The Relationship of Discrete Relaxation Spectrum and Melt Flow Index of Polyethylenes, Acta Polymerica Sinica, (4), 422-430(1999)

Ruifeng Liang, Yuanze Xu, Weizheng Cai, Renjie Wu, The Effect of Interface on Rheological and Mechanical Properties of Filled PP, Acta Materiae Compositae Sinica, 10(4), 77-84(1993)

Synergistic Activities

Organizing Committee member and co-Chair for Symposium on Polymer, Composite and Nanocomposite Melts (4th Pacific Rim Conference on Rheology, Shanghai, China, Aug. 7-11, 2005); Organized and Chaired Conferences on Rheology (Beijing, 1997) and Gas-Assisted Injection Molding (Beijing, 1997; 1996); Chair on "Polymer Processing" (National Symposium on Polymers, Hefei, 1997), Organization Committee for "5th National Symposium on Rheology" (Beijing,1996)

Keynote Speaker at 5th National Symposium on Rheology, CSR (Beijing, 1996), North China Symposium on Chemistry, CCS (Baoding, 1996), National Symposium on Polymers, CCS (Guangzhou, 1995)

Sci-Tech Book Award - 1st Place (2002), China PetroChem Ind. Press and 3rd Place (2004), State Press Bureau, China (Contributor and Editorial Board member for Cross-Centuries Polymer Science series, NSF of China, 1998-2001)

Executive Committee Member, Chinese Society of Rheology (CSR, 1997-2002); Panel member on "Complex Fluids/Polymer Processing" with NSF of China (1995-97) and "Gas Injection Molding" with Chinese Plastics Industry Council (1995-97)

JOHN W. ZONDLO

Education and Training.
Allentown College of Saint Francis de Salles, Chemistry, B.S. 1970
University of Maryland, Physical Chemistry, M.S. 1972
Carnegie-Mellon University, Chemical Engineering, M.S. 1980
Carnegie-Mellon University, Chemical Engineering Ph.D. 1982

Professional Experience:

1993 - Present - Professor, Department of Chemical Engineering, West Virginia University, Morgantown, West Virginia

1986 - 1993 - Associate Professor, Department of Chemical Engineering, West Virginia University, Morgantown, West Virginia

1982-1986 - Assistant Professor, Department of Chemical Engineering, West Virginia University, Morgantown, West Virginia

1976-1982 - Instructor, Department of Chemical Engineering, Carnegie Mellon University, Pittsburgh, PA

1973-1976 - Research Associate, Corporate Research and Development, Air Products and Chemicals, Inc., Trexlertown, PA

1972-1973 - Pilot Plant Operator, KRG Chemical Services, Inc., Mertztown, PA

1970-1972 - Teaching Associate, Department of Chemistry, University of Maryland, College Park, MD

Publications.

"Evaluation of Carbon Materials for Use in a Direct-Carbon Fuel Cell," G.A. Hackett, J.W. Zondlo and R. Svennsson, Journal of Power Sources, 168, 111-118, 2007.

"Development of Surface Area and Pore Structure for Activation of Anthracite Coal," J.W. Zondlo and M.R. Velez, Fuel Processing Technology, 88, 369-374, 2007.

"Carbon Foam Derived From Various Precursors," C. Chen, E., Kennel, A. Stiller, P. Stansberry, and J. Zondlo, Carbon, 44(8), 1535-1543, 2006.

"Characteristics and Carbonization Behaviors of Coal Extracts," J. Yang, P.G. Stansberry, J.W. Zondlo, and A.H. Stiller, Fuel Processing Technology, 79, 207-215, 2002.

"Development of Binder Pitches From Coal Extract and Coal-Tar Pitch Blends," P. Stansberry, J.W. Zondlo and R. Wombles, Light Metals, 581-585, 2001.

PATRICK D. R. GRANDELLI

Education and Training.
United States Naval Academy, Ocean Engineering, B.S, 1986
University of Hawaii at Manoa, Ocean Engineering, M.S. 1997

Professional Experience:
Makai Ocean Engineering, Inc. Ocean Engineer
Mr. Grandelli performs structural and hydrodynamic analysis and design of high density polyethylene pipes during installation, mooring and anchoring. He also analyzes and tests the performance of heat exchangers, pumps, and performs engineering feasibility studies. He is Makai's expert in using OrcaFlex, a software system for dynamic structural analysis of pipelines, moorings and floating ocean systems. He has worked at Makai since 1997.

Mr. Grandelli worked on design and/or construction observation for the 400mm diameter 900-meter-deep seawater intake pipeline for the InterContinental Resort & Spa in French Polynesia, the 48" Waikiki Beachwalk sewer force main, the 63" Los Angeles Stone Canyon Water Quality Improvement Project, the 55" NELHA pipeline in Hawaii, Toronto's three 63" Deep Lake Water Cooling pipelines, and Cornell University's 63" Lake Source Cooling Pipeline. He performed the mooring analysis for two different projects to moor an OTEC barge in 1,200m deep water using HDPE pipe. He was responsible for the design of an underwater seabed-mounted 18" pump station and the Simulated Submarine Target, a large buoyant structure moored below the sea surface. He has performed pipeline feasibility studies for several clients.

He is leading an Office of Naval Research project to consider the use of Ocean Thermal Energy Conversion plants. He served as lead operator and data analyst for the 50 kilowatt OTEC heat exchanger test and 1MW Conceptual Design project performed for the Center of Excellence in Research for the Ocean Sciences (CEROS). He designed, built and operated a device to test HDPE pipes subject to cyclic suction loading, as well as a unique coldwater clathrate heat exchanger. A PADI-certified Rescue SCUBA Diver, Mr. Grandelli has specified and performed fieldwork for several sonar and diving surveys.

While attending graduate school, Mr. Grandelli gained six months experience operating and maintaining the Department of Energy's 250 kW open-cycle OTEC plant, and also served as President of the UH Graduate Student Organization. Mr. Grandelli is a member of the American Society of Civil Engineers, Marine Technology Society and U.S. Naval Institute. He is a commander in the U.S. Navy Reserve, with service as a shipboard electrical officer, CIC officer, & navigator, and holds a sub-specialty in command & control

JOSEPH C. VAN RYZIN

Education and Training.
University of Rhode Island, Ocean Engineering, Ph.D., 1977.
University of Rhode Island, Mechanical Engineering M.S., 1968.
Carnegie Institute of Technology, Mechanical Engineering major, Electrical Engineering minor, B.S. 1966.

Professional Experience:
Makai Ocean Engineering, Inc. Vice President and Senior Ocean Engineer
Dr. Van Ryzin is the founder and former President of Makai Ocean Engineering and has been a Senior Ocean Engineer in every major program at Makai. This work includes: project conceptualization and estimation, engineering analysis, project feasibility evaluation, preliminary and final design, testing, system optimization, computer simulation, parametric analysis and software development, computer aided drafting, project coordination and supervision, final report production and presentation, and authorship of scientific papers.

Projects in which Dr. Van Ryzin has been involved as a lead design engineer include:

- Development of deployment concepts and deployment analysis software for deep water HDPE pipelines used for intakes, outfalls and transmission pipelines. Dr. Van Ryzin's concepts and analysis have been fundamental to numerous innovations that have extended the range and application of HDPE pipe for marine applications.

- Numerous deep ocean intake projects for deep ocean water applications including Ocean Thermal Energy Conversion (OTEC). This includes the mooring and pipe design for two floating OTEC research vessels, the design and installation of four separate, mile-long deepwater ocean intake pipelines with intake depths of 2200' and 3000', hydrodynamic tests on large scale pipes, and HDPE pipe research for pipe installations.

- Numerous Outfall designs, including design responsibilities for three HDPE outfalls for American Samoa and one large, 63" outfall for Kimberly-Clark and the city of Everett, Washington.

- Several large-diameter pipeline designs including a 2 mile long, 63" HDPE pipeline for air conditioning Cornell University using deep lake water; intake pipelines for the City of Toronto for potable water and district cooling, submerged 63" dia pipeline for water transmission for the Los Angeles Water Department, and R&D programs for testing 8' diameter pipe installations in very deep water and the R&D design of an innovative, low-cost fabric OTEC pipes.

- The successful development, testing, and operation of a deep water cable laying control and simulation system that accurately placed and tensioned a cable within a few meters of its designated path in 1930 m water depth. Makai designs, develops and markets extensive software for the planning and at-sea real-time control of submarine cable installations.

- The engineering and economic analysis and design of a seawater air conditioning system that utilizes the deep cold seawater provided by Makai's pipelines. Makai provided the detailed design for a two-mile long, 63" diameter lake intake pipeline to provide 20,000 tons air-conditioning to Cornell University.

- The development and design of a Launch, Recovery and Transport vehicle for a 13-ton research submersible. The LRT can safely launch and recover the manned submersible in seas exceeding sea state 6.

- Marine vehicle propulsion and ballast control system of a 3000' depth pipe repair vehicle, design of submersible recovery systems, seawater oxygen extraction systems for submersible vehicles, salvage programs and model testing on a wide variety of surface and subsurface vehicles.

- Design work on diving systems including the refurbishment of an undersea habitat, recompression systems, and deep diving submersibles.

Publications.

Horn, H. M., and J. C. Van Ryzin, 1980. "Deep Ocean Polyethylene Pipe Installations," *Proceedings, International Pipeline Technology Exhibition Conference (Interpipe 80),* Vol. 1, Houston, Texas.

Vuillemot, F., Van Ryzin, J. C., Resnick, A., 1988. "The HOST-STF (OTEC) Project in Hawaii: Planning, Design and Construction;" Pacific Congress on Marine Science and Technology, Honolulu, Hawaii.

Lewis, L. F., Van Ryzin, J. C., Vega, L., 1988. "Steep Slope Seawater Supply Pipelines;" ASME 21st International Conference on Coastal Engineering, Spain.

L. Vega, G. Nihous, PICHTR; L. Lewis, D.O.E.; A. Resnick, J. Van Ryzin, M.O.E. 1989. "OTEC Sea Water Systems Technology Status," Honolulu, Hawaii.

Van Ryzin, J. C., and Leraand, T. K., 1991. "Air conditioning with Deep Seawater; A Reliable, Cost Effective Technology" Proceedings of the IEEE OCEANS 91 Conference, Honolulu, Hawaii.

Van Ryzin, J. C. and Leraand, T. K., 1992. "Air Conditioning with Deep Seawater; A Cost-Effective Alternative" *Sea Technology*, Vol 33, No 9, pp 37-44.

Leraand, T. K., and Van Ryzin, J. C., 1995. "Air Conditioning with Deep Seawater: A Cost-Effective Alternative for West Beach, Oahu, Hawaii," Oceans '95 Conference, Honolulu, HI.

Van Ryzin, J. C., 1996. "Cold Water Pipe Technology: Hawaii Experience," US Navy-Industry Symposium on Ocean Thermal Energy Conversion, Kailua-Kona, HI.

Rabas, T. J., Methot, R. L., Van Ryzin, J. C., and Wahnon, J. C., 1997. *Thermocline - Driven Desalination System (TDDS) for the Republic of Cape Verde*, to be presented at the IDA World Congress on Desalination and Water Resuse, Madrid, Spain, October 1997.

Armand J. Silva, Robert L. Methot, Michael Panich, Joseph Van Ryzin, John C. Whanon, 1998. "Thermocline Driven Desalination: Status of Cape Verde," *Proceedings, Ocean '98 Conference.*

Van Ryzin, J. C., Grandelli, P., Lipp, D., Argall, R., "The Hydrogen Economy of 2050: OTEC Driven?" MTS-IEEE Oceans 2005, May, 2005, Washington, DC

DALE N. JENSEN

Education and Training.
University of Hawaii, Mechanical Engineering, B.S, 1983.
University of Minnesota, English Literature, B.A, 1975.

Professional Experience:
Makai Ocean Engineering, Inc. Ocean Engineer
Mr. Jensen joined Makai Ocean Engineering in December, 1983 and has participated in a wide variety of design and construction management projects for our firm. Since 1990 he has been a principal member of the Makai offshore pipeline design team and has been a lead engineer in in the design of cold and warm water intake pipelines, submarine fresh water transmission pipelines and open ocean outfalls undertaken by Makai. Mr. Jensen's most recent work has been in completing the design and construction management for a 400 millimeter (16") deep ocean cold water intake pipeline and pump/heat exchanger station for an innovative seawater air-conditioning system for a new resort in Bora Bora, French Polynesia. The HDPE pipeline extends to 900 meter (2952') depth and brings up 5°C (41°F) seawater to the heat exchanger plant where a fresh water loop transfers this cold energy to the guests rooms and common areas in this luxury hotel (Bora Bora Intercontinental Resort and Spa). Mr. Jensen's primary responsibilities for this work were in the pipeline hydraulic analysis, pump station design, design group management, and he was the lead in construction management activities.

Other recent projects in which Mr. Jensen has taken a key role include:

- the 55" deep water and near shore intake pipelines for the Natural Energy Laboratory of Hawaii Authority (NELHA). He designed the onshore pump station used in this project, as well as all the onshore distribution pipeline and pump station mechanical equipment. Mr. Jensen led Makai's construction management team during the pipeline and pump station installation.

- the Enwave Toronto deep lake water cooling project. This project involved the design of 3 each 63" diameter intake pipelines each extending 18,000 feet into Lake Ontario. Mr. Jensen designed the intake structure that was installed on each pipe at the 300 foot deep intake depth.

- the Cornell Lake Source Cooling marine design team. He designed the unique retrievable intake structure that could independently float on the lake surface for cleaning and maintenance, and he prepared the technical specifications and bid packages for a number of owner purchased items included in this project.

- The Kimberly-Clark' and the City of Everett, Washington outfall to dispose of treated discharge water from K-C's Everett plant and treated wastewater from the City of Everett. Mr. Jensen was lead design engineer on the deep water portion of this outfall which was constructed from 63" diameter high density polyethylene (HDPE) pipe; it extended from 50' depth to 350' depth and included in its 2741' length a 1590' foot long diffuser section that had 80 each 8" diffuser ports.

Earlier pipeline and pump station work for which Mr. Jensen was responsible includes:

- Mr. Jensen has been responsible for the design or refurbishment of several primary and booster pump stations at NELHA;
- Mr. Jensen served as project manager and lead engineer in the design and construction management of several HDPE ocean outfalls in American Samoa for the American Samoa Power Authority and Starkist Tuna Corporation;

- He performed analysis on catenary shapes of polyethylene pipelines, modeling the transition portion of a 40" HDPE pipeline installed off Keahole Point, at NELHA on the island of Hawaii;
- He designed a 6" HDPE potable water transmission pipeline to cross a 1000' long channel to serve a small island in Kaneohe Bay off the coast of Oahu, Hawaii.
- He served as lead engineer of the 50KW Ocean Thermal Energy Conversion (OTEC) heat exchanger test and 1MW Conceptual Design study performed for the Center of Excellence in Research for the Ocean Sciences (CEROS) in Hawaii.

In addition to his design experience, he has also gained onsite construction engineering experience in fabrication and deployment while "on loan" to the Hawaiian Dredging & Construction Co. Advanced Projects Group during the 1/3 Scale model OTEC Cold Water Pipeline At-Sea Test, Down-The-Slope Phase III deployment. He has gained extensive experience in all aspects of the design and construction process including permit requirements, cost estimating, preparation of construction bid packages, technical specification writing and construction inspection and management.

Publications.

A.M. Resnick and Dale N. Jensen, 1990. "Computing for Real Time Cable Control," MTS '90 Conference, Washington, D.C.

J.M. Andres, S.R. Jefferies and D.N. Jensen, 1990. "Hawaii Deep Water Cable Program: Results of the At-Sea Test Cable Lay," MTS '90 Conference, Washington, D.C.

Ben Hochman

Education and Training.
University of California at Davis, **Aeronautical Engineering, Mechanical Engineering** B.S., 2005
Attended University of California, San Diego, September 2000 – June 2001

Professional Experience:
Market and Product Development Manager, Glasforms, Inc., San Jose, CA
Project manager for carbon fiber products business area, pultrusion
New projects development coordinator for custom engineered products, continuous resin transfer molding
Market development and research lead for corporate growth initiatives
Composites Manufacturing/Product Design Engineer, Lockheed Martin Space Systems, Special Programs
TS/SCI Access with SSBI and Counterintelligence Polygraph; DoD Top Secret
Advanced large structure, tight tolerance composites manufacturing
Primary Manufacturing Engineer for dev., tooling, and flight hardware for component of program
Materials and Process understanding including CTE, Resin Properties, and Laminate Properties
Interface between Customers, Design Engineering, cost & schedule, Technicians and Supervisors
Managed acceptance, training, operations, and maintenance for new high value equipment & machinery

DE-PS36-08GO98030
SF424
Question 16 Congressional Districts

CA-014
WV-001
H-002
CA-016

Year 1

LM Cost Share	Hours	Labor	ALA	OH	Material	MHX	Cost PreG&A
	-	$ -	$ -	$ -	$ -	$ -	$ -
	-	$ -	$ REDACTED	$ -	$ -	$ -	$ -
		$	$ EXEMPTION 4		$ -	$ -	$
	-	$ -	$ -	$ -	$ -	$ -	$ -

DoE	Hours	Labor	ALA	OH	Material	MHX	Cost PreG&A
	-	-	-	-			
	-	-	REDACTED	-			
			EXEMPTION 4		-	-	
	-	-	-	-			

Year 2

LM Cost Share	Hours	Labor	ALA	OH	Material	MHX	Cost PreG&A
	-	$ -	$ -	$ -	$ -	$ -	$ -
	-	$ -	$ REDACTED	$ -	$ -	$ -	$ -
			EXEMPTION 4 $		$ -	$ -	$ -
	-	$ -	$ -	$ -	$ -	$ -	$ -

DoE	Hours	Labor	ALA	OH	Material	MHX	Cost PreG&A
	-	$ -	$ -	$ -	$ -	$ -	$ -
	-	$ -	$ REDACTED	$ -	$ -	$ -	$ -
		$	EXEMPTION 4 $		$ -	$ -	$ -
	-	$ -	$ -	$ -	$ -	$ -	$ -

Year 1 Total

REDACTED
$ EXEMPTION 4

Year 2 Total

REDACTED
$ EXEMPTION 4

Year 1 Total

REDACTED
$ EXEMPTION 4

Year 2 Total

REDACTED
$ EXEMPTION 4

Mr. Peter Krone
Lockheed Martin Corporation
9500 Godwin Drive
Manassas, VA 20110

Dear Mr. Krone:

SUBJECT: Award No. DE-FC36-08GO18172; Amendment No. M001; "Advanced Composite OTEC Cold Water Pipe Project"

Enclosed are two copies of the subject award, which have been executed on behalf of the Department of Energy (DOE). Please sign both copies of the award in Block 20 of the Notice of Financial Assistance Award (NFAA), DOE F 4600.1, retain one copy for your file, and return the remaining copy to me no later than two weeks from the date received.

Note the Reporting Requirements in Attachment 4 of your award, which require submission of certain standard and DOE forms as part of the performance of your award. Each of the forms required by this award can be accessed on the website at: http://management.energy.gov/business_doe/business_forms.htm and may be reproduced for your continued use. Instructions for preparation/completion of the forms are included on each of the forms.

Please note that the DOE uses the Automated Standard Application for Payments System (ASAP) as the standard civilian Federal award payment system. Our records indicate you are not currently enrolled in ASAP. Information provided in your application will be used by the Department's Enrollment Initiator to enroll you in ASAP. An e-mail will be sent to you with further instructions that will allow you to complete the enrollment process. It is imperative that you adhere to these instructions, since ASAP will be the only means by which you will receive payment. Upon completion of the ASAP enrollment process, you will receive an ASAP Recipient Organization (RO) ID and password from the Department of Treasury via e-mail. Upon receipt, you must immediately forward this e-mail from the Department of Treasury to me.

For your reference, please note that in the ASAP system, you are required to enter the following information to access your account:

1. Agency Locator Code (ALC): 8900-0001;
2. Region Code: 04; and
3. Account Identification Number: GO18172.

You indicated that you intend to request an advance waiver of patent rights in accordance with applicable statutes and DOE Procurement Regulations. In order for the waiver to be considered, DOE must receive your request for an advance waiver of patent rights within 30 days of the award date. A waiver application form is available at the forms website referenced above, and from me upon request.

Mr. Krone

Please take a moment to read the Federal policies on lobbying activities contained in DOE's Lobbying Brochure found at https://www.eere-pmc.energy.gov/Forms.aspx. Organizations that receive financial assistance from the DOE are required to post the Equal Opportunity Poster (DOE F 1600.4), found at https://www.eere-pmc.energy.gov/Forms.aspx.

During fiscal year 2009, this office will implement a new electronic, paperless procurement system called STRIPES. Upon implementation of STRIPES, ALL organizations currently doing or wanting to do business with this office MUST BE registered with the Central Contractor Registration (CCR) and with FedConnect. As a result, it is imperative that you read and react to information provided in the document entitled "CCR and FedConnect Registrations" on the above referenced PMC website.

Questions or comments of a technical nature concerning this award should be addressed to the Project Officer identified in Block 11 of the NFAA. Matters of an administrative nature should be addressed to me at the phone number or e-mail address in Block 12 of the NFAA.

Sincerely,

Pamela Brodie
Grants and Agreements Specialist

Enclosures

SPECIAL TERMS AND CONDITIONS
JULY 2008

Table of Contents

1. RESOLUTION OF CONFLICTING CONDITIONS

Any apparent inconsistency between Federal statutes and regulations and the terms and conditions contained in this award, as shown in Block 18 of the Notice of Financial Assistance Award (NFAA) must be referred to the DOE Award Administrator identified in Block 12 of the NFAA for guidance.

2. PAYMENT PROCEDURES

a. Method of Payment. Payment will be made by reimbursement through the Department of Treasury's ASAP system.

b. Requesting Reimbursement. Requests for reimbursements must be made through the ASAP system. Requests for reimbursement should coincide with the Awardee's normal billing pattern, but not more frequently than every two weeks. Each request must be limited to the amount of disbursements made for the federal share of direct project costs and the proportionate share of allowable indirect costs incurred during that billing period.

c. Adjusting payment requests for available cash. The Awardee must disburse any funds that are available from repayments to and interest earned on a revolving fund, program income, rebates, refunds, contract settlements, audit recoveries, credits, discounts, and interest earned on any of those funds before requesting additional cash payments from DOE.

d. Payments. All payments are made by electronic funds transfer to the bank account identified on the ASAP Bank Information Form that you filed with the U.S. Department of Treasury.

3. INCREMENTAL FUNDING AND MAXIMUM OBLIGATION

If at any time during the award a budget period is funded on an incremental basis, the maximum obligation of the DOE is limited to the amount shown in Block 16.b.(3) "CUMULATIVE DOE OBLIGATIONS Project Period to Date" on the Notice of Financial Assistance Award. The Awardee is not obligated to continue performance of the project beyond the total amount shown in Block 16.b.(3) and its pro rata share of the project costs, if cost share is required. Subject to the availability of additional funds, DOE anticipates obligating the total amount shown in Block 16.a.(4) for the current budget period.

4. COST SHARE

a. Total Estimated Project Cost is the sum of the DOE share and Awardee share of the estimated project costs. The Awardee's cost share must derive from non-Federal sources unless otherwise allowed by law. By accepting federal funds under this award, the Awardee agrees to be responsible for its percentage share of total allowable project costs, on a budget period basis, even if the project is terminated early or is not funded to its completion. This cost is shared as follows:

Budget Period No.	Budget Period Start Date	DOE Cost Share $ / %	Awardee Cost Share $ / %	Total Estimated Costs
1	9/15/2008	REDACTED EXEMPTION 4	REDACTED EXEMPTION 4	REDACTED EXEMPTION 4
2	9/15/2009			
Total Project				

b. If the Awardee is unable to provide cost share of the amount identified in paragraph a of this article, the Awardee shall notify the DOE Award Administrator identified in Block 12 of the Notice of Financial Assistance Award, indicating whether you will continue or phase out the project. If the project will continue, the notification must describe how replacement cost share will be secured.

c. The Awardee must maintain records of all project costs that are claimed as cost share, including in-kind costs, as well as records of costs to be paid by DOE. Such records are subject to audit.

d. Failure to provide the cost share required by this Article may result in the subsequent recovery by DOE of some or all the funds provided under the award.

5. REBUDGETING AND RECOVERY OF INDIRECT COSTS

a. If actual allowable indirect charges are less than those budgeted and funded under the award, the Awardee may use the difference to pay additional allowable direct costs during the project period. If at the completion of the award DOE's share of total allowable costs (i.e., direct and indirect), is less than the total costs reimbursed, the Awardee must refund the difference.

b. Awardees are expected to manage their indirect costs. DOE will not amend an award solely to provide additional funds for changes in indirect cost rates (See "Incremental Funding and Maximum Obligation" article). DOE recognizes that the inability to obtain full reimbursement for indirect costs means the Awardee must absorb the underrecovery. Such underrecovery may be allocated as part of the organization's required cost share.

c. The budget for this award includes indirect and labor costs that incorporate a fringe benefit cost component, but does not include fringe benefits as a directly chargeable item. Therefore, fringe benefit costs shall not be directly charged to this project. This restriction does not apply to subawardees' fringe benefits.

d. Estimated Indirect Costs are subject to additional negotiation. The recipient shall not be reimbursed on this project for any final indirect costs that are in excess of the following specific amount, until the recipient receives written approval and/or a notice of revised negotiated Indirect Costs from the Contracting Officer. In addition, the recipient shall neither count costs in excess of the stated specific amount as cost share, nor allocate such costs to other federally sponsored project, unless approved by the Contracting Officer. In accordance with FAR 31.109, the prime recipient will not be reimbursed for, nor count as cost share, Indirect Costs in excess of $303,977 until the recipient receives written approval and/or a notice of revised negotiated Indirect Costs from the Contracting Officer. This restriction does not apply to subawardees' indirect costs.

6. STATEMENT OF FEDERAL STEWARDSHIP

DOE will exercise normal Federal stewardship in overseeing the project activities performed under this award. Stewardship activities include, but are not limited to, conducting site visits; reviewing performance and financial reports; providing technical assistance and/or temporary intervention in unusual circumstances to correct deficiencies which develop during the project; assuring compliance with terms and conditions; and reviewing technical performance after project completion to ensure that the award objectives have been accomplished.

7. STATEMENT OF SUBSTANTIAL INVOLVEMENT

DOE, in its project management oversight role for the Hydropower Technologies Program, will work closely with Lockheed Martin Corporation, including attending multiple project site visits and planning meetings, in order to assure the optimal overall performance of the project toward meeting DOE's programmatic goals. Also, the proposed scope of the project includes Ocean Thermal Energy Conversion (OTEC), which is a technology of particular importance to DOE. DOE will closely monitor the progress of this technology.

8. SITE VISITS

DOE's authorized representatives have the right to make site visits at reasonable times to review project accomplishments and management control systems and to provide technical assistance, if required. The Awardee must provide, and must require its subawardees to provide, reasonable access to facilities, office space, resources, and assistance for the safety and convenience of the government representatives in the performance of their duties. All site visits and evaluations must be performed in a manner that does not unduly interfere with or delay the work.

9. REPORTING REQUIREMENTS

a. Requirements. The reporting requirements for this award are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to this award. Failure to comply with these reporting requirements is considered a material noncompliance with the terms of the award. Noncompliance may result in withholding of future payments, suspension or termination of the current award, and withholding of future awards. A willful failure to perform, a history of failure to perform, or unsatisfactory performance of this and/or other financial assistance awards, may also result in a debarment action to preclude future awards by Federal agencies.

b. Dissemination of scientific/technical reports. Scientific/technical reports submitted under this award will be disseminated on the Internet via the DOE Information Bridge (www.osti.gov/bridge) unless the report contains patentable material, protected data or SBIR/STTR data. Citations for

journal articles produced under the award will appear on the DOE Energy Citations Database (www.osti.gov/energycitations).

c. Restrictions. Reports submitted to the DOE Information Bridge must not contain any Protected Personal Identifiable Information (PII), limited rights data (proprietary data), classified information, information subject to export control classification, or other information not subject to release.

10. PUBLICATIONS

a. The Awardee is encouraged to publish or otherwise make publicly available the results of the work conducted under the award.

b. An acknowledgment of DOE support and a disclaimer must appear in the publication of any material, whether copyrighted or not, based on or developed under this project, as follows:
Acknowledgment: "This material is based upon work supported by the Department of Energy [National Nuclear Security Administration] [add name(s) of other agencies, if applicable] under Award Number(s) [enter the award number(s)]."

Disclaimer: "This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof."

11. FEDERAL, STATE, AND MUNICIPAL REQUIREMENTS

The Awardee must obtain any required permits and comply with applicable federal, state, and municipal laws, codes, and regulations for work performed under this award.

12. INTELLECTUAL PROPERTY PROVISIONS AND CONTACT INFORMATION

The intellectual property provisions applicable to this award are provided as an attachment to this award. Questions regarding intellectual property matters should be referred to the DOE Patent Counsel for the Golden Field Office, Julia Moody, who may be reached at 303-275-4867 or Julia.moody@go.doe.gov.

13. CONTINUATION APPLICATION AND FUNDING

a. Continuation Application. A continuation application is a non-competitive application for an additional budget period within a previously approved project period. At least 90 days before the end of each budget period, the Awardee must submit a continuation application to the DOE Project Officer identified in Block 11 and the DOE Award Administrator identified in Block 12 of the Notice of Financial Assistance Award. This application must include the following information:

1. A report on Awardee progress towards meeting the objectives of the project, including any significant findings, conclusions, or developments, and an estimate of any unobligated balances remaining at the end of the budget period. If the remaining unobligated balance is estimated to exceed 20 percent of the funds available for the budget period, an explanation of why the excess funds have not been obligated and how they will be used in the next budget period must be included.

2. A detailed budget and supporting justification for the upcoming budget period if additional funds are requested, a reduction of funds is anticipated, or a budget for the upcoming budget period was not approved at the time of award.

3. A description of Awardee plans for the conduct of the project during the upcoming budget period, if there are changes from the DOE approved application.

b. Continuation Funding. Continuation funding is contingent on (1) availability of funds; (2) A DOE determination that the Awardee has made substantial progress towards meeting the objectives of the approved application; (3) submittal of required reports; and/or (4) compliance with the terms and conditions of the award; and (5) DOE's determination that successful land-based fabrication of the prototype Cold Water Pipe (CWP) milestone has been achieved.

14. NATIONAL SECURITY: CLASSIFIABLE RESULTS ORIGINATING UNDER AN AWARD

a. This award is intended for unclassified, publicly releasable research. The Awardee will not be granted access to classified information. DOE does not expect that the results of the research project will involve classified information. Under certain circumstances, however, a classification review of information originated under the award may be required. The Department may review research work generated under this award at any time to determine if it requires classification.

b. Executive Order 12958 (60 Fed. Reg. 19,825 (1995)) states that basic scientific research information not clearly related to the national security shall not be classified. Nevertheless, some information concerning (among other things) scientific, technological, or economic matters relating to national security or cryptology may require classification. If the Awardee originates information during the course of this award that is believed to require classification, the Awardee must promptly:

1. Notify the DOE Project Officer identified in Block 11 and the DOE Award Administrator identified in Block 12 of the Notice of Financial Assistance Award;

2. Submit the information by registered mail directly to the Director, Office of Classification and Information Control, SO-10.2; U.S. Department of Energy; P.O. Box A; Germantown, MD 20875-0963, for classification review.

3. Restrict access to the information to the maximum extent possible until you are informed that the information is not classified, but no longer than 30 days after receipt by the Director, Office of Classification and Information Control

c. If the Awardee originates information concerning the production or utilization of special nuclear material (i.e., plutonium, uranium enriched in the isotope 233 or 235, and any other material so determined under section 51 of the Atomic Energy Act) or nuclear energy, the Awardee must:

1. Notify the DOE Project Officer identified in Block 11 and the DOE Award Administrator identified in Block 12 of the Notice of Financial Assistance Award.

2. Submit the information by registered mail directly to the Director, Office of Classification and Information Control, SO-10.2; U.S. Department of Energy; P. O. Box A; Germantown, MD 20875-0963 for classification review within 180 days of the date the Awardee first discovers or first has reason to believe that the information is useful in such production or utilization.

3. Restrict access to the information to the maximum extent possible until the Awardee is informed that the information is not classified, but no longer than 90 days after receipt by the Director, Office of Classification and Information Control.

d. If DOE determines any of the information requires classification, the Awardee agrees that DOE may terminate the award by mutual agreement in accordance with 10 CFR 600.25(d). All material deemed to be classified must be forwarded to DOE, in a manner specified by DOE.

e. If DOE does not respond within the specified time periods, the Awardee is under no further obligation to restrict access to the information.

15. LOBBYING RESTRICTIONS

By accepting funds under this award, the Awardee agrees that none of the funds obligated on the award shall be expended, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. 1913. This restriction is in addition to those prescribed elsewhere in statute and regulation.

16. NOTICE REGARDING THE PURCHASE OF AMERICAN-MADE EQUIPMENT AND PRODUCTS -- SENSE OF CONGRESS

It is the sense of the Congress that, to the greatest extent practicable, all equipment and products purchased with funds made available under this award should be American-made.

17. INSOLVENCY, BANKRUPTCY OR RECEIVERSHIP

a. The Awardee shall immediately notify the DOE Administrator identified in Block 12 of the Notice of Financial Assistance Award of the occurrence of any of the following events: (i) the Awardee or its parent's filing of a voluntary case seeking liquidation or reorganization under the Bankruptcy Act; (ii) the Awardee's consent to the institution of an involuntary case under the Bankruptcy Act against the Awardee or its parent; (iii) the filing of any similar proceeding for or against the Awardee or its parent, or its consent to the dissolution, winding-up or readjustment of its debts, appointment of a receiver, conservator, trustee, or other officer with similar powers over the Awardee, under any other applicable state or federal law; or (iv) the Awardee's insolvency due to its inability to pay debts generally as they become due.

b. Such notification shall be in writing and shall: (i) specifically set out the details of the occurrence of an event referenced in paragraph (a); (ii) provide the facts surrounding that event; and (iii) provide the impact such event will have on the project being funded by this award.

c. Upon the occurrence of any of the four events described in the paragraph a. of this provision, DOE reserves the right to conduct a review to determine Awardee compliance with the required elements of the award (including such items as cost share, progress towards technical project objectives, and submission of required reports). If a DOE review determines that there are significant deficiencies or concerns with Awardee performance under the award, DOE reserves the right to impose additional requirements, as needed, including (i) a change of payment method; or (ii) institution of payment controls.

d. Failure of the Recipient to comply with this provision may be considered a material noncompliance of this financial assistance award by the Contracting Officer.

18. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) REQUIREMENTS

The Awardee is restricted from taking any action using DOE funds which would have an adverse affect on the environment or limit the choice of reasonable alternatives prior to DOE providing either a NEPA clearance or a final NEPA decision regarding this project. Prohibited actions include restrictions on taking any action using federal funds, which would have an adverse affect on the environment or limit the choice of reasonable alternatives prior to DOE providing either a NEPA clearance or a final NEPA decision regarding the project. Other prohibited actions include all task and activities in Budget Period 2. This restriction does not preclude you from all tasks and activities in Budget Period 1.

If the Awardee moves forward with activities that are not authorized for federal funding by the DOE Contracting Officer in advance of the final NEPA decision, the Awardee is doing so at risk of not receiving federal funding and such costs may not be recognized as allowable cost share.

If this award includes construction activities, the Awardee must submit an environmental evaluation report/evaluation notification form addressing NEPA issues prior to DOE initiating the NEPA process.

19. SUBCONTRACT APPROVALS

a. At Risk Notice: The Recipient must obtain written approval by the Contracting Officer for reimbursement of costs associated with subcontractors/activities listed in paragraph b. below. No funds shall be expended on the subcontracts supporting the tasks identified in paragraph b. below unless DOE approval is provided. DOE does not guarantee or assume any obligation to reimburse costs incurred by the Recipient or subcontractor for these tasks, until approval is provided in writing by the Contracting Officer.

b. Contracting Officer approval as set out above is requested for the following:

Subcontractor	Activity	Total Amount ($)
Lockheed Martin – Advanced Technology Center (LM-ATC)	Fringe Benefits	$248,176
Lockheed Martin – Advanced Technology Center (LM-ATC)	Indirect Costs	$655,532

The DOE Contracting Officer may require additional information concerning these tasks prior to providing written approval.

c. Upon written approval by the Contracting Officer, the Recipient may then receive payment for the subs identified in paragraph b. above for allowable indirect costs incurred, or DOE will recognize costs incurred toward cost share requirements, if any, in accordance with the payment provisions contained in the Special Terms and Conditions of this agreement.

Applicant Name: Lockheed Martin Corporation

Award Number: DE-FC36-08GO1817 M001

Budget Information - Non Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. BP 1	81.087			$601,537	$1,392,710	$1,994,247
2. BP 2	81.087			$594,221	$1,333,761	$1,927,982
3.						$0
4.						$0
5. Totals		$0	$0	$1,195,758	$2,726,471	$3,922,229

Section B - Budget Categories

	Grant Program, Function or Activity				Total (5)
	(1) BP 1	(2) BP 2	(3)	(4)	
6.	EX.4	EX.4			EX.4
a.	$0	$0			$0
b.	EX.4	EX.4			EX.4
c.	$0	$0			$0
d. REDACTED EXEMPTION 4	$0	$0			$0
e.	EX.4	EX.4			EX.4
f.	$0	$0			$0
g.	$0	$0			$0
h.	REDACTED EXEMPTION 4	REDACTED EXEMPTION 4	$0	$0	REDACTED EXEMPTION 4
i.	$1,994,247	$1,927,982	$0	$0	$3,922,229
j.					$0
k. **Totals** (sum of 6i-6j)					
7. Program Income					

SF-424A (Rev. 4-92)
Prescribed by OMB Circular A-102

Previous Edition Usable

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Section C - Non-Federal Resources

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8. Cost Share	$2,726,471			$2,726,471
9.				$0
10.				$0
11.				$0
12. **Total** (sum of lines 8 - 11)	$2,726,471	$0	$0	$2,726,471

Section D - Forecasted Cash Needs

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th quarter
13. Federal	$601,537	$150,384	$150,384	$150,384	$150,385
14. Non-Federal	$1,392,710	$348,177	$348,177	$348,178	$348,178
15. **Total** (sum of lines 13 and 14)	$1,994,247	$498,561	$498,561	$498,562	$498,563

Section E - Budget Estimates of Federal Funds Needed for Balance of the Project

(a) Grant Program	Future Funding Periods (Years) (b) First	(c) Second	(d) Third	(e) Fourth
16. DOE	$594,221			
17.				
18.				
19.				$0
20. **Total** (sum of lines 16-19)	$594,221	$0	$0	REDACTED EXEMPTION 4

Section F - Other Budget Information

21. Direct Charges $ REDACTED EXEMPTION 4 $ REDACTED EXEMPTION 4

23. Remarks

Instructions for the SF-424A

General Instructions

This form is designed so that application can be made for funds from one or more grant programs. In preparing the budget, adhere to any existing Federal grantor agency guidelines which prescribe how and whether budgeted amounts should be separately shown for different functions or activities within the program. For some programs, grantor agencies may require budgets to be separately shown by function or activity. For other programs, grantor agencies may require a breakdown by function or activity. Sections A, B, C, and D should include budget estimates for the whole project except when applying for assistance which requires Federal authorization in annual or other funding period increments. In the later case, Sections A, B, C, and D should provide the budget for the first budget period (usually a year) and Section E should present the need for Federal assistance in the subsequent budget periods. All applications should contain a breakdown by the object class categories shown in Lines a-k of Section B.

Section A. Budget Summary Lines 1-4 Columns (a) and (b)

For applications pertaining to a **single** Federal grant program (Federal Domestic Assistance Catalog number) and **not requiring** a functional or activity breakdown, enter on Line 1 under Column (a) the catalog program title and the catalog number in Column (b).

For applications pertaining to a **single** program **requiring** budget amounts by multiple functions or activities, enter the name of each activity or function on each line in Column (a), and enter the catalog number in Column (b). For applications pertaining to multiple programs where none of the programs require a breakdown by function or activity, enter the catalog program title on each line in **Column** (a) and the respective catalog number on each line in Column (b).

For applications pertaining to **multiple** programs where one or more programs **require** a breakdown by function or activity, prepare a separate sheet for each program requiring the breakdown. Additional sheets should be used when one form does not provide adequate space for all breakdown of data required. However, when more than one sheet is used, the first page should provide the summary totals by programs.

Lines 1-4, Columns (c) through (g)

For new applications, leave Columns (c) and (d) blank. For each line entry in Columns (a) and (b), enter in Columns (e), (f), and (g) the appropriate amounts of funds needed to support the project for the first funding period (usually a year).

For continuing grant program applications, submit these forms before the end of each funding period as required by the grantor agency. Enter in Columns (c) and (d) the estimated amounts of funds which will remain unobligated at the end of the grant funding period only if the Federal grantor agency instructions provide for this. Otherwise, leave these columns blank. Enter in columns (e) and (f) the amounts of funds needed for the upcoming period. The amount(s) in Column (g) should be the sum of amounts in Columns (e) and (f).

For supplemental grants and changes to existing grants, do not use Columns (c) and (d). Enter in Column (e) the amount of the increase or decrease of Federal funds and enter in Column (f) the amount of the increase or decrease of non-Federal funds. In Column (g) enter the new total budgeted amount (Federal and non-Federal) which includes the total previous authorized budgeted amounts plus or minus, as appropriate, the amounts shown in Columns (e) and (f). The amount(s) in Column (g) should not equal the sum of amounts in Columns (e) and (f).

Line 5—Show the totals for all columns used.

Section B. Budget Categories

In the column headings (a) through (4), enter the titles of the same programs, functions, and activities shown on Lines 1-4, Column (a), Section A. When additional sheets are prepared for Section A, provide similar column headings on each sheet. For each program, function or activity, fill in the total requirements for funds (both Federal and non-Federal) by object class categories.

Lines 6a-i—Show the totals of Lines 6a to 6h in each column.

Line 6j—Show the amount of indirect cost.

Line 6k—Enter the total of amounts on Lines 6i and 6j. For all applications for new grants and continuation grants the total amount in column (5), Line 6k, should be the same as the total amount shown in Section A, Column (g), Line 5. For supplemental grants and changes to grants, the total amount of the increase or decrease as shown in Columns (1)-(4), Line 6k should be the same as the sum of the amounts in Section A, Columns (e) and (f) on Line 5.

Line 7—Enter the estimated amount of income, if any, expected to be generated from this project. Do not add or subtract this amount from the total project amount. Show under the program narrative statement the nature and source of income. The estimated amount of program income may be considered by the federal grantor agency in determining the total amount of the grant.

Section C. Non-Federal Resources

Lines 8-11—Enter amounts of non-Federal resources that will be used on the grant. If in-kind contributions are included, provide a brief explanation on a separate sheet.

Column (a)—Enter the program titles identical to Column (a), Section A. A breakdown by function or activity is not necessary.

Column (b)—Enter the contribution to be made by the applicant.

Column (c)—Enter the amount of the State's cash and in-kind contribution if the applicant is not a State or State agency. Applicants which are a State or State agencies should leave this column blank.

Column (d)—Enter the amount of cash and in-kind contributions to be made from all other sources.

Column (e)—Enter totals of Columns (b), (c), and (d).

Line 12—Enter the total for each of Columns (b)-(e). The amount in Column (e) should be equal to the amount on Line 5, Column (f) Section A.

Section D. Forecasted Cash Needs

Line 13—Enter the amount of cash needed by quarter from the grantor agency during the first year.

Line 14—Enter the amount of cash from all other sources needed by quarter during the first year.

Line 15—Enter the totals of amounts on Lines 13 and 14.

Section E. Budget Estimates of Federal Funds Needed for Balance of the Project

Lines 16-19—Enter in Column (a) the same grant program titles shown in Column
(a), Section A. A breakdown by function or activity is not necessary. For new applications and continuation grant applications, enter in the proper columns amounts of Federal funds which will be needed to complete the program or project over the succeeding funding periods (usually in years). This section need not be completed for revisions (amendments, changes, or supplements) to funds for the current year of existing grants.
If more than four lines are needed to list the program titles, submit additional schedules as necessary.

Line 20—Enter the total for each of the Columns (b)-(e). When additional schedules are prepared for this Section, annotate accordingly and show the overall totals on this line.

Section F. Other Budget Information

Line 21—Use this space to explain amounts for individual direct object-class cost categories that may appear to be out of the ordinary or to explain the details as required by the Federal grantor agency.

Line 22—Enter the type of indirect rate (provisional, predetermined, final or fixed) that will be in effect during the funding period, the estimated amount of the base to which the rate is applied, and the total indirect expense.

Line 23—Provide any other explanations or comments deemed necessary.

STATEMENT OF PROJECT OBJECTIVES

Lockheed Martin Maritime Systems & Sensors, Undersea Systems
Advanced Composite OTEC Cold Water Pipe Project

A. PROJECT OBJECTIVES

The objectives of the Advanced Composite OTEC Cold Water Pipe Project are to:
1. Validate fabrication of the Lockheed Martin (LM) composite CWP design at prototype and Pilot Plant scales,
2. Validate the advanced tooling designs, construction methods, and associated projected cost savings relative to traditional technologies, and
3. Validate the simultaneous construction and deployment concept for a 70m length of 4m diameter CWP into the marine environment.

B. PROJECT SCOPE

Under prior Lockheed Martin investment, we have reduced to practice an innovative approach to Cold Water Pipe fabrication. Our plans for the Advanced Composite OTEC Cold Water Pipe Project are to construct the required tooling and fixtures and demonstrate this innovative fabrication method at a scale required for initial OTEC plants, namely 4m diameter, further scalable to full-size OTEC plants. We design the 4m-size tooling, get it fabricated, assemble it in the laboratory, and check it out by producing a short section of CWP. The LM team then moves the tooling to an existing high-bay test stand in Sunnyvale and demonstrates the entire fabrication and deployment approach. It produces a one-piece Cold Water Pipe with no macroscopic joints. Upon completing the high bay demonstration of the process, the tooling is disassembled and transported to West Virginia University where it is re-assembled for demonstration of the simultaneous construction and deployment operation at Summerville Lake, a location under management of the US Army Corp of Engineers. Fabrication and deployment of a one-piece CWP 70 m long directly into the water from a floating platform are demonstrated and actual construction labor and material costs for use in projecting full-scale commercial plant costs are gathered. The LM team then performs non-destructive evaluation of coupons and full diameter pipe segments to validate the geometry and quality of the Cold Water pipe.

C. TASKS TO BE PERFORMED

BUDGET PERIOD 1

Task 1.0 CWP Fabrication Plans, Procedures & Tooling

Subtask 1.1 Develop Fab Plans & Procedures
During the first year, LM further refines and develops the CWP Fabrication Plans, Procedures & Tooling, starting with the point of departure from the IR&D efforts. This work is done primarily by the PI, consulting with the rest of the team.

Subtask 1.2 Design Tooling and Fixtures
Prototype tooling is designed and documented.

Subtask 1.3 Tooling & Fixtures Fab, Assy, and Checkout
The tooling is fabricated and assembled in the Materials and Processes Development Lab in Sunnyvale and checked out by a small run in that same facility.

Task 2.0 Pultruded Core
In parallel with Task 1.0, we design, fabricate, and prove out the pultrusion setup for the prototype size hollow core segments, and produce the pultruded core pieces for Task 3.0.

Task 3.0 Land Checkout and Test of CWP Manufacturing Process

Subtask 3.1 Manufacturing Platform Integration
This is the capstone work for the first year: We move the prototype tooling to a manufacturing platform providing sufficient "runout" space underneath it for fabrication of a 9 m long section of prototype CWP. This high-bay platform is in Sunnyvale. We integrate the prototype tooling onto the platform. In parallel, we order all of the other materials necessary for the fabrication, including fiberglass, resin, promoters and other chemicals for controlled cure of the resin, and other needed materials.

Subtask 3.2 Prototype Fabrication Demonstration
We perform the land-based fabrication trials allowing any necessary improvements to be incorporated, followed by the actual demonstration fabrication.

Subtask 3.3 Data Collection & On-water Training
During the trials and the demo, we collect labor time data which we expect will be of great value later in credibly estimating the cost of future CWP's. During this demo, the crew that conducts the on-water demo during the second year participates in training for their subsequent duties.

Go / No Go Criteria
Successful land-based fabrication of the prototype CWP is the go/no-go milestone and criterion for continuation into Budget Period 2.

BUDGET PERIOD 2

Task 4.0 At-Sea Demonstration of CWP

Subtask 4.1 Marine Construction Platform
West Virginia University will arrange with the Army Corps of Engineers for the use of Lake Summerville and an appropriate number of barges to make up a suitable and safe Marine Construction Platform. The marine platform is outfitted with the prototype tooling, support equipment, and demonstration material.

Subtask 4.2 Dockside Checkout
We operate and check out the prototype tooling at dockside.

Subtask 4.3 On-Water CWP Fabrication
We conduct CWP Fabrication Trials on the lake and perform the capstone second-year activity, namely on-water (into-the-water) fabrication of 70 m of CWP all as one piece. Again, labor time data is collected for future estimates of costs of on-water CWP fabrication for OTEC plants.

Task 5.0 CWP Test, Evaluation, and Comparison of At-Sea vs. On-Land Results
We evaluate the CWP demonstration pieces and coupons cut from them. Non-destructive evaluation includes inspection by ultrasonic and X-ray.

Task 6.0 Project Management and Reporting (Applies to Budget Periods 1 and 2)
Throughout the schedule, the LM team has included two efforts for Project Management.

- Overall Technical Oversight will ensure continuity and coordination of technical tasks.
- Technical Schedule and Cost Monitoring will ensure that programmatic schedule and cost targets are maintained.

Progress Briefings are scheduled quarterly to ensure that the entire team remains on task with aligned objectives, and the DoE customer is kept informed. Reports and other deliverables will be provided in accordance with the Federal Assistance Reporting Checklist following the instructions included therein. The results of this effort will be presented at future EnergyOcean conventions. It is anticipated that an interim first year status report will be provided in the June 2009 time frame. Completion of first year efforts and, if funded, the status of 2nd year efforts will be presented at EnergyOcean 2010 followed by final results presented in 2011.

Year 1 Total

REDACTED
$ EXEMPTION 4

Year 1 Total

REDACTED
$ EXEMPTION 4

Year 2 Total

REDACTED
$ EXEMPTION 4

Year 2 Total

$ REDACTED
EXEMPTION 4

R&D Laboratory Questions

Answers for Advanced Composite OTEC Cold Water Pipe Project

In order for a recipient to receive financial assistance, their project must be reviewed under the National Environmental Policy Act (NEPA) for potential environmental impacts. For research and development laboratory activities, the following questions must be sufficiently answered before the review can be completed. Please add as much detail as possible.

These answers apply to the first year of the new program

1. Please provide and describe the location of the facility or facilities where lab work will take place.

Lockheed Martin Space Systems Company, Sunnyvale, CA – Bldgs 152 and 156G

2. What type of safety protocols are in place in the areas where work will take place?

Lockheed Martin Space Systems Company has standard Command Media which are the protocols under which the program will operated. These standard Environment, Safety, and Health protocols include the following (copies will be provided upon request) :

Accessory hoisting equipment
Air quality program
Control of Hazardous Energy (Lockout/Tagout)
Emergency Eyewash and Safety Showers
Fall Protection
Hazard Communication
Laboratory Safety
Ladder Safety
Local Exhaust Ventilation
Machine Safety
Monthly Self-Inspection Checklist for Manufacturing, Test, Production, and Laboratory Areas
National Environmental Policy Act
Overhead Cranes
Personal Protective Equipment
Personnel Aerial Lifting Devices
Pollution Prevention

Portable Hand and Power Tools
Respiratory Protection Program
Suspended load operations
Waste Management

Who monitors these? Internally and externally?

LMSSC Sunnyvale Environment, Safety, and Health Department. Mark Weston (408-742-0164) is the assigned safety specialist for this project.

OSHA standards?

LMSSC Command Media fully implements or exceeds Cal-OSHA standards

3. How are the gases, chemicals, heavy metals, etc...handled, stored and disposed?

All chemicals used in the program are handled, stored and disposed per the previously listed command media

4. What type of safety equipment is in place for the facilities (i.e. fume hoods, alarms, scrubbers, etc...)?

Fume hoods and personal protective gear (respirators) are in place. Fall protection equipment (guardrails, toeboards) will be included in the platforms build for the program.

5. What permits are in place for the facility for this type of work? Please list.

- Air quality - LMSSC Sunnyvale Local Bay Area Air Quality Management District permit
- Hazardous waste – City of Sunnyvale Dept. of toxic substances and control hazwaste permit
- Hazardous material storage – City of Sunnyvale Fire Dept. Hazmat storage permit

6. What permits are needed or will be acquired for this type of work? Please list.

No new permits are needed

7. How is liquid effluent handled and discharged?

There is no liquid effluent from this project

8. How is toxic waste handled, stored, disposed?

Surplus chemicals and process waste are disposed of as hazardous waste per command media listed above in answer to question #2

9. Will the work being done create any air pollutants? If so please explain how these are handled/disposed/mitigated.

The vinyl ester resin for the Prototype Cold Water Pipe will be mixed with the promoter and accelerator into a "Master batch". This mixing will be done under a fume hood, and the process will release a small amount of VOC into the air through the fume hood exhaust. The amount released is well within the allowed amount per LMSSC's permit with the Local Bay Area Air Quality Management District. Final mixing of the Master Batch with the catalyst as part of the CWP fabrication process will be done using an on-line mixer which is a closed system and does not gives off any air pollutants. The resin is cured under vacuum, and the curing resin will give off a small amount of VOC which will emerge from the exhaust of the vacuum system, again in quantities well within the allowed amount per LMSSC's permit.

10. Are Genetically Modified Organisms (GMOs) being used? If so please describe how these will be transported, stored, handled and disposed. ? How are these classified by APHIS?

No GMOs are being used

11. Will prototypes be tested in a separate location, if so, please describe the location and answer questions #1-9?

No. The prototypes will be evaluated at the same site (LMSSC Sunnyvale) where the basic work is being done.

12. Are subcontractors being used for some of the work? If so please answer Questions #1-11 for work being completed by subcontractors.

There are no subcontractors being used for the work, with a subcontractor being defined as a separate company doing special work of the same R&D character as is being done by the prime contractor.

PMC-EFI

(2/06/02)

U.S. DEPARTMENT OF ENERGY

EERE PROJECT MANAGEMENT CENTER

ENVIRONMENTAL CHECKLIST

(To Be Completed by Potential Recipient)

DOE Project Officer: Gary Nowakowski **Date:** 6/13/2008

ST: VA

PART I: General Information

Project Title: Advanced Composite OTEC Cold Water Pipe Project

Organization Name: Lockheed Martin Maritime Systems & Sensors

Solicitation Number: DE-PS36-08GO98030 Award No:

1. Please describe the intended use of DOE funding in your proposed project. For example, would the funding be applied to the entire project or only support a phase of the project? Describe the activity as specifically as possible, i.e. planning, feasibility study, design, data analysis, education or outreach activities, construction, capital purchase and/or equipment installation or modification. If the project involves construction, also describe the operation of the completed facility/equipment.The AWP Project objectives are to validate cold water pipe (CWP) manufacturing techniques at the prototype and Pilot Plant scales. We shall collect actual construction labor hours and materials to validate cost projections for full-scale cold water pipe manufacturing, and validate the mechanical and environmental characteristics of the composite CWP to withstand ocean environment. Our proposed project fabricates the required tooling and fixtures needed for the LM proprietary manufacturing method. The tooling is checked out by fabricating sections of CWP on land and refining the procedures and tooling apparatus as necessary. The manufacturing tooling and fixtures and required materials are used to demonstrate CWP manufacturing and deployment on the water while gathering construction labor and material costs. Gathering labor hours and costs to fabricate the CWP provides the information needed to validate cost projections for full-scale production. Non-destructive and destructive testing is performed on test coupons and also on full diameter pipe segments to validate mechanical properties and ability to withstand ocean environment. The on-water demonstration comprises assembly of tooling & fixturing on barge(s). Fabrication of the CWP is achieved by using pre-pultruded segments as a sandwich core and molding outer and inner layers of composite fiber with vinyl ester resin to form an integrated structure. The approach requires total resin cure so that the cured section can be lowered into the water to allow fabrication of the next section above water. The proposed effort is stand alone and requires no other resources to complete task objectives. We anticipate conducting further tests on the coupons / segments beyond that funded under this task. Additionally, it should be clear the CWP in itself is a subsystem to a complete Ocean Thermal Energy Conversion power generation plant and therefore is part of a larger effort to commercialize OTEC.

2. Does any part of your project require review and/or permitting by any other federal, state, regional, local, environmental, or regulatory agency? ☐ Yes ☑ No

3. Has any review (e.g., NEPA documentation, permits, agency consultations) been completed? ☐ Yes ☑ No If yes, is a finding or report available and how can a copy be obtained? 4. Is the proposed project part of a larger scope of work? ☑ Yes ☐ No If yes, please describe.The proposed effort is stand alone and requires no other resources to complete AWPP task objectives. We anticipate conducting further tests on the coupons / segments beyond that funded under this task. Additionally, it should be clear the CWP in itself is a subsystem to a complete Ocean Thermal Energy Conversion power generation plant and therefore is part of a larger effort to commercialize OTEC. Do you anticipate requesting additional federal funding for subsequent phases of this project? ☐ Yes ☑ No If yes, please describe.5. Does the scope of your project only involve one or more of the following: ☐ Information gathering such as literature surveys, inventories, audits, ☐ Data analysis including computer modeling, ☐ Document preparation such as design, feasibility studies, analytical energy supply and demand studies, or ☐ Information dissemination, including document mailings, publication, distribution, training, conferences, and informational programs.

Preparer: Phone: Email:

William Munslow
Business Contact:
Robert Varley

703-367-4569
Phone:
703-367-1955

william.d.munslow@lmco.com
Email:
robert.varley@lmco.com

PART II: Environmental Considerations

Section A Conditions or special areas are present, required, or could be affected by your project:

3. New or Modified Federal/State Permits And/or Requests for Exemptions

Summersville Lake is operated by the Army Corps of Engineers. Our partner, West Virginia University (WVU) has worked with the COE in the past on projects involving waterways. WVU has received verbal confirmation from COE for this effort. Formal approval will be sought during year 1.

ART- VERBAL CONFIRMATIONS ARE NICE BUT BUT not BINDING. Lets get a written confirmation now of anticipated intent and major potential concerns.

23. Aesthetics

During the demonstration portion of this task, we propose operating a barge(s) on Summersville Lake to fabricate the CWP segment. There may be recreational boaters, fishermen, local land owners who may take exception to the presence of the barge.

Section B. Would your project use, disturb, or produce any chemicals or biological substances? (i.e., pesticides, industrial process, fuels, lubricants, bacteria)

ART – LM did not answer this even though they will be using chemicals extensively, perhaps a SAFETY plan for containment would be appropriate.

3. Chemical Storage, Use, and Disposal

☐ Permit Required Quantity: Permit Type:

Specific nature of use:

We plan to utilize vinyl ester resin to fabricate a fiberglass reinforced composite structure.

Section C. Would your project require or produce any radiological materials?

ART – LM did not answer this.

EF2

U.S. DEPARTMENT OF ENERGY
EERE PROJECT MANAGEMENT CENTER
NEPA REVIEW AND RECOMMENDATIONS
(To Be Completed By DOE Project Officer)

PART I. PROJECT INFORMATION

Project Title: Advanced Composite OTEC Cold Water Pipe Project **State:** VA

Recipient: Lockheed Martin Maritime Systems & Sensors

Funding Opportunity Announcement Number	**Procurement Instrument Number**	**CID Number**
DE-PS36-08GO98030		GO18172

1. Is this an ongoing project? Yes: ☐ No: ☑ If no, skip to part II.

Original NEPA Determination Category Original NEPA Control Number

2. Has there been a change in the original scope, environmental conditions, and/or determination? Yes: ☐ No: ☑

If yes, please describe the nature of the change.

PART II. RECOMMENDED CATEGORY OF EVIRONMENTAL REVIEW

Please provide answers to the following questions and indicate your recommended category of environmental review. If you need assistance, please contact Steve Blazek (Contact information listed below)

1. Please describe the intended use of DOE and cost share funding associated with this award.

DOE intends to use the DOE and cost share funding to support 'The AWP Project' objectives to validate cold water pipe (CWP) manufacturing techniques at the prototype and Pilot Plant scales. Lockheed shall collect actual construction labor hours and materials to validate cost projections for full-scale cold water pipe manufacturing, and validate the mechanical and environmental characteristics of the composite CWP to withstand ocean environment. The proposed project fabricates the required tooling and fixtures needed for the LM proprietary manufacturing method. The tooling is checked out by fabricating sections of CWP on land and refining the procedures and tooling apparatus as necessary. The manufacturing tooling and fixtures and required materials are used to demonstrate CWP manufacturing and deployment on the water while gathering construction labor and material costs. Gathering labor hours and costs to fabricate the CWP provides the information needed to validate cost projections for full-scale production. Non-destructive and destructive testing is performed on test coupons and also on full diameter pipe segments to validate mechanical properties and

ability to withstand ocean environment. The on-water demonstration comprises assembly of tooling & fixturing on barge(s). Fabrication of the CWP is achieved by using pre-pultruded segments as a sandwich core and molding outer and inner layers of composite fiber with vinyl ester resin to form an integrated structure. The approach requires total resin cure so that the cured section can be lowered into the water to allow fabrication of the next section above water. The proposed effort is stand alone and requires no other resources to complete its objectives.

Lockheed anticipates conducting further tests on the coupons / segments beyond that funded under this project..

This effort to develop the CWP is in itself a subsystem to a complete Ocean Thermal Energy Conversion power generation plant and therefore is part of a larger effort to commercialize OTEC. The further development effort is NOT being funded under this DOE funded project.

2. Please list any applicable **existing** documentation (i.e. programmatic EAs, technical studies, state level environmental reviews). For each, please list the type of document, and its title, document number (if applicable), and date of publication.

There have been a number of analytical and experimental Cold Water Supply Pipe (CWSP) efforts for applications to floating and land based OTEC plants. There have been four (4) known successful designs and deployments. The one closest to applicability to the current effort from a NEPA perspective is the successful effort conducted on the Island of Hawaii at the Keahole Point HELHA facility. The project involved on shore construction of a 40inch diameter polyethalene pipe 5,721ft long constructed Kawahihae Harbor The pipe was constructed in 3 sections, towed to the site and installed to a depth of 2257ft. A comprehensive EIS was conducted. The project was reported in the ASCE Engineering Achievment award-1989.

3. Concerns or Issues

For the project in hand the primary concerns are: Safety of the deployment in a recreational lake area, breakaway of the construction platform and/or pipe and inadvertent material discharge into the lake and or atmosphere (resins, VOC.s).

4. Is there enough information available to make a final NEPA determination for the entire award at this time?

Yes: ☐ No: ☑

If no, please describe what additional information will be needed prior to making a final NEPA determination

See No. 3 above.

5. CX, EA, EIS

Category

Appendix and Number

Recommendation is a determineation for a CX - _____

PART III. CONTACT INFORMATION

DOE Project Officer: Nowakowski, Gary **Date:** 10/6/2008 **EERE Office:** Golden Field Office

Email: gary.nowakowski@go.doe.gov **Phone:** 303-275-4808 **Fax:** 303-275-4788

Second Year

	Federal	Non-Federal	Total
REDACTED EXEMPTION 4	EX.4	EX.4	EX.4 note
REDACTED EXEMPTION 4	EX.4	-	EX.4
Supplies		-	
REDACTED EXEMPTION 4	EX.4	EX.4	EX.4
Construction		-	
Other		-	
REDACTED EXEMPTION 4	EX.4	EX.4	EX.4
	EX.4	EX.4	EX.4
Totals	594,221	1,333,762	1,927,983

First Year Only

	Federal	Non-Federal	Total
REDACTED EXEMPTION 4	EX.4	EX.4	EX.4 note
REDACTED EXEMPTION 4	EX.4	-	EX.4
		-	
REDACTED EXEMPTION 4	EX.4	EX.4	EX.4
Construction		-	
Other		-	
REDACTED EXEMPTION 4	EX.4	EX.4	EX.4
	EX.4	EX.4	EX.4
Totals	601,537	1,392,709	1,994,247

REDACTED EXEMPTION 4

Approved by OMB
0348-0046

Disclosure of Lobbying Activities

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352
(See reverse for public burden disclosure)

1. Type of Federal Action:	2. Status of Federal Action:	3. Report Type:
a. contract _C__ b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance	a. bid/offer/application __B__ b. initial award c. post-award	a. initial filing __A__ b. material change

4. Name and Address of Reporting Entity:	5. If Reporting Entity in No. 4 is Subawardee, Enter Name and Address of Prime:
Lockheed Martin Corporation Maritime Systems and Sensors Business Unit 9500 Godwin Drive Manassas, VA 20110 _X___ Prime **Congressional District, if known: VA-010**	n/a **Congressional District, if known:**
6. Federal Department/Agency: **Department of Energy** **Golden Field Office** **1617 Cole Boulevard** Golden, CO	**7. Federal Program Name/Description:** **Advanced Compoiste OTEC Cold Water Pipe Project** CFDA Number, *if applicable*: 81.087
7. Federal Action Number, *if known:* DE-FG36-08GO018172	**9. Award Amount,** *if known:* **$**
10. a. Name and Address of Lobbying Registrant *(if individual, last name, first name, MI):* None	**b. Individuals Performing Services** *(including address if different from No. 10a)* *(last name, first name, MI):* None
11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.	**Signature:** P Krone **Print Name: Peter Krone** **Title: Senior Manager, Contracts** **Telephone No.: 703-367-5301 __ Date: 9/24/08__**
Federal Use Only	**Authorized for Local Reproduction** **Standard Form - LLL (Rev. 7-97)**

the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1 Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.

2. Identify the status of the covered Federal action.

3. Identify the appropriate classification of this report. If this is a followup report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.

4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.

5. If the organization filing the report in item 4 checks "Subawardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.

6. Enter the name of the federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.

7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.

8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitations for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Included prefixes, e.g., "RFP-DE-90-001."

9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.

10. (a) Enter the full name, address, city, State and zip code of the lobbying registrant under the Lobbying Disclosure Act of 1995 engaged by the reporting entity identified in item 4 to influence the covered Federal action.

(b) Enter the full names of the individual(s) performing services, and include full address if different from 10(a). Enter Last Name, First Name, and Middle Initial (MI).

11. The certifying official shall sign and date the form, print his/her name, title, and telephone number.