UNIVERSITY of NEW ORLEANS

OFFICE OF RESEARCH AND SPONSORED PROGRAMS

December 18, 2014

Defense Technical Information Center
8725 John J Kingman Road Ste 0944
Fort Belvoir, VA 22060-6218

Naval Research Laboratory
ATTN: CODE 5596
4555 Overlook Avenue SW
Washington, DC 20375-5320

RE: Award No. N00014-09-1-0145 issued to University of New Orleans; Final Technical Report; Interim Research Performance Report (As Required)

Dear Sirs:

We are attaching the final technical report. In addition, for your review, you may download Dr. Christopher Mckesson's dissertation titled "Innovation in Ship Design" from http://scholarworks.uno.edu/do/search/?q=Christopher%20McKesson&start=0&context=2119629.

Your support to this important project is greatly appreciated. Please contact our office at 504-280-6836 if you need additional information.

Sincerely yours,

Office of Research & Sponsored Programs (ORSP)
Fax # (504) 280-3176
E-mail: orsp@uno.edu;
http://www.uno.edu/orsp/

Report Information

Name: CHRISTOPHER MCKESSON
Organization: UNIVERSITY OF NEW ORLEANS
Email: chris@mckesson.us

Contract Information
Contract Number: N000140910145
Contract Title: Innovative Naval Ship Design
Program Officer: Kelly Cooper
CO-PI Information: None

Abstract

In 2011 PI completed a textbook on "Practical Design of Advanced Marine Vehicles" and has commenced a follow-on work on "Tools for Innovation in Naval Engineering Design." The completed textbook was made available as a PDF file with private distribution on the members-only website of the Society of Naval Architects and Marine Engineers.

In 2013 PI completed the follow-on textbook "Innovation in Ship Design." Whereas the first work forms the core of an undergraduate course in the design of innovative ships – i.e. Advanced Marine Vehicles – the second work will form the core in a Graduate course in innovation more generally. The present version covers the nature and definition of innovation in the context of ship design, and then describes the characteristics of successful innovators, the characteristics of the innovation-friendly organization, and the tools and techniques used in innovation.

The completed text also includes the outline for a three-course Graduate sequence on innovation, aimed at equipping engineers with tools for greater innovation. This latter course has not been fully developed.

Effort in FY 14 included beginning the development of the graduate course. A textbook for this course is now approximately 35% complete. In addition, the earlier textbook "Practical Design of Advanced Marine Vehicles" has been revised and is now publicly available for purchase through Amazon.

PI has also made several technical presentations regarding the work, in the interest of socializing the conclusions reached.

Technical Section

Technical Report File: N0001409101451.pdf Cleared for Public Release
Slide File: EOY_Summary Chart_N000140910145_2014.ppt

Progress Statement

Undergraduate Textbook: As mentioned above the undergraduate textbook has been finished and used in multiple offerings of NAME 4177 – Advanced Marine Vehicles at the University of New Orleans. The work is now publicly available as a 392-page paperback book ISBN-13: 978-1497396890, distributed by Amazon.

Graduate Textbook: The second major product of the project is a graduate-level investigation into the nature of innovation generally, in the context of naval engineering. This work is complete and is available for free download from the University of New Orleans, or for purchase via Amazon.com. The structure of the work is to present an actionable definition of what innovation is, in ship design, what the characteristics are of successful innovators, what the characteristics are of innovation-friendly organizations, and finally what the tools are the facilitate the execution of innovation.

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These insights and conclusions have been vetted by briefings given at the Naval Surface Warfare Center, Carderock, and to members of the naval engineering community.

Academic Element is also complete. PI was granted a Ph.D in Engineering and Applied Sciences in May of 2013.

Refereed Journal Articles

- 2013: "Scaling of Resistance From Surface-Effect Ship Model Tests" Journal of Ship Production and Design, Volume 29, Number 2, May 2013 , pp. 66-75(10), with Dr. Lawrence J. Doctors

- 2012: "The Application of Knowledge Management in Early-Stage Warship Design" Naval Engineers Journal Volume 124, Number 4, December 2012 , pp. 101-109(9)

- 2012: "Sustainable Energy for the Marine Sector" with Dr. Julio Vergara and Magdalena Walczak. Journal of Energy Policy 49 (2012) pp 333-345.

- 2012: "A Very Simple Model for the Wake Hollow Behind a High-Speed Displacement Hull" with Dr. Brandon Taravella and Dr. William Vorus. Naval Engineers Journal September 2012, pp 85-91.

Books And Chapters

- 2013: "Innovation in Ship Design" May 2013. ISBN-13: 978-1482319033

- 2014: "The Practical Design of Advanced Marine Vehicles" ISBN-13: 978-1497396890

Technical Reports

- None

Contributed Presentations

- Description: *Frusta Limosus* - Innovation opportunities in ship synthesis modeling
  Presented to NATO AVT ET-132
  Date: April, 2013

Patents

- None

Honors

- None

Related Sponsored Work

- None

ONR Statistics

Grad Students(total):	6
PI/Co-PI Women:	0
PI/Co-PI Minority:	0
Grad Students Women:	2
Grad Students Minority:	0
Post Docs Students:	0
Post Doc Women:	0
Post Doc Minority:	0
Under Grad Students(total:	20
Under Grad Students Women:	3
Under Grad Students Minority:	0
Degrees Granted:	1
Invention disclosures citing ONR support:	0
Other funding sources:	0

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Title and Award Number

Objective:

What is innovation in naval architecture, and can it be taught? This was the question that spurred the present project.

Innovation is a force multiplier and an economic engine. Capturing and formalizing innovation tools and techniques is a service to the nation, especially when the information is disseminated in the context of an engineering curriculum.

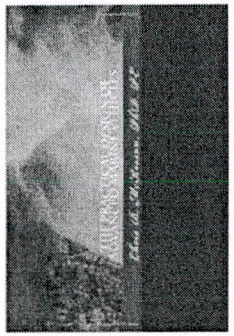
Approach:

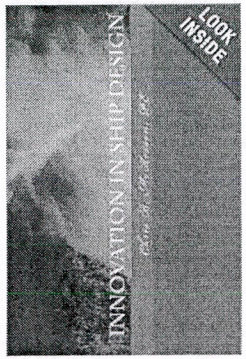
This project has produced two key products aimed at inculcating innovation skills in a future generations of naval engineers:

- Teaching undergraduate engineers how to include Advanced Marine Vehicles in their tool box of design solutions, by providing a practical guide to the design of these vessels
- Teaching graduate engineers how to innovate more generally, and how to grow and maintain their innovation skills, by providing a textbook and course sequence to this end

Figure:

Undergraduate Textbook:
The Practical Design of Advanced Marine Vehicles





Graduate Textbook:
Innovation in Ship Design

Scientific or Naval Impact/ Results:

Breakthrough, disruptive, game-changing innovations in naval engineering are force multipliers that enhance the deterrent power of a naval force.

Metrics of success will include the quantity of engineers in the naval engineering enterprise who possess these skills as a result of study of the works produced under this task.

Since these products are no, no metric data is yet available.

Innovative Naval Ship Design

Chris B. McKesson – ONR Grant N00014-09-1-0145

STATUS QUO

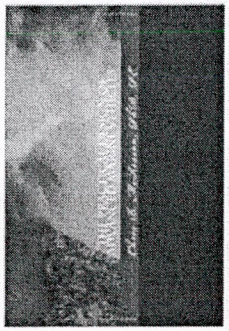
Innovation in ship design obviously has military and industrial value. But innovation is not taught in Universities, and employers discover innovators only by watching them work. Would it not be desirable to teach innovation explicitly, just as we teach engineering? And would it not be nice if there were a test we could give to engineers to learn whether they are innovators?

NEW INSIGHTS

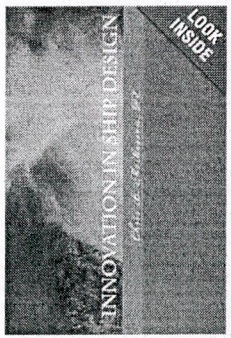
- Innovation in ship design is found be subject to some standard rules and forms. There exist "formulae" for innovation.
- These formulae are amazingly diverse – some being based entirely on pictures, others being based on statistical analysis of the patent database.
- But all of the formulae appear to follow a common morphology.
- Discovery of this morphology allows a practitioner to tailor the use of these techniques, by cutting and splicing different methods at logical break points.

Main Achievements

- Project Completed
- Two books published:
- Design of Advanced Marine Vehicles:
  - Nature of AMVs
  - Niches for AMVs
  - Journeyman instruction in naval architecture of AMVs



- Innovation in Ship Design:
  - What is innovation?
  - Can it be taught?
  - Can it be done by everybody?
  - Are there specific tools?
  - Can innovators be identified by testing?



IMPACT

Current Impact

The project has identified techniques that can be taught, and tools for qualifying candidates to receive this teaching. This replaces an ad hoc or luck-based procedure.

Planned Impact

Future impact will be increased when the results of t his project are implemented in university-level coursework.

END OF PHASE GOAL

Research Goals

Project is complete.
Project has delivered two textbooks, one on innovative craft and how to design them, the second on innovation in general, where it comes from, and how to incubate it.

Innovative Naval Ship Design

Chris B. McKesson – ONR Grant N00014-09-1-0145

Books Published

2013: *"Innovation in Ship Design"* University of New Orleans PhD Dissertation, May 2013, Paperback: 158 pages, ISBN-13: 978-1482319033

2014: *"The Practical Design of Advanced Marine Vehicles"* Paperback: 392 pages, ISBN-13: 978-1497396890

Objectives

Inculcate innovation skills in future generations of naval engineers by:

- Teaching undergraduate engineers how to include Advanced Marine Vehicles in their tool box of design solutions, by providing a practical guide to the design of these vessels
- Teaching graduate engineers how to innovate more generally, and how to grow and maintain their innovation skills, by providing a textbook and course sequence to this end

Schedule:

Project is complete

Relevance to DOD and ONR Missions

Breakthrough, disruptive, game-changing innovations in naval engineering are force multipliers that enhance the deterrent power of a naval force.

Innovation is also an economic engine. Capturing and formalizing innovation tools and techniques is a service to the nation, especially when the information is disseminated in the context of an engineering curriculum.