CHARLES (LEE) FREY

Senior Ocean Engineer & Project Manager
Harbor Branch Oceanographic Institution
Center for Ocean Engineering & Technology
5600 US Hwy 1 North, Ft. Pierce, Florida 34946
Email: cfrey@hboi.fau.edu Web: http://www.lfrey.com

OVERVIEW

Mr. Frey has expertise in the areas of ocean systems engineering, including software, electronics, data acquisition, robotics, and controls. He has extensive experience in the development of underwater vehicles and oceanographic instrumentation, and has organized and served as lead engineer on over 12 at-sea expeditions. His Master's Degree research focused on the development of a small Autonomous Underwater Vehicle (AUV) for use in environmental monitoring of under-ice drilling operations in Prudhoe Bay, Alaska. Professional projects include the design and development of a series of unique optical oceanographic instruments for measuring and recording bioluminescence and the behavior of deep-sea fauna, known as HIDEX, LoLAR, and Eye-In-The-Sea, as well as the design of an advanced telemetry & control system for a deep-sea rescue-class robot, the Nemesis ROV. Other research interests and current projects include development of distributed sensor systems and autonomous swarm robots, applied to coastal monitoring and underwater exploration tasks.

EDUCATION

PhD (Pursuing) Electrical Engineering - University of Wyoming, Laramie, WY.
Research Area: Swarm Robotics and Distributed Intelligence
Advisors: Dr. Jerry Hamann & Dr. William Spears

M.S. (2002) Ocean Engineering (Robotics & Controls Option) – Florida Institute of Technology, Melbourne, FL. Thesis Research: ***"Development of an Autonomous Underwater Vehicle for Sub-Ice Environmental Monitoring in Prudhoe Bay, Alaska"***

B.S. (1999) Ocean Engineering (*Summa Cum Laude*) - Florida Institute of Technology, Melbourne, FL.

ACADEMIC POSITIONS

Adjunct Professor of Ocean Engineering, **Florida Institute of Technology** (2005 – Present)
Sr. Ocean Engineer and Principal Investigator, **Harbor Branch Ocean. Inst.,** (2004 – Present)
Research Assistant in Electrical Engineering, **University of Wyoming** (2005)
Research Assistant in Ocean Engineering, **Florida Institute of Technology** (2000-2002)

PROFESSIONAL EXPERIENCE

03/02 – Present Sr. Ocean Engineer and Project Manager – ***Harbor Branch Oceanographic Institution (HBOI), Center for Ocean Engineering & Technology,*** Fort Pierce, FL.

- Function as lead engineer, principal investigator, and project manager for various research and development projects.
- Organize and lead scientific research expeditions.
- **Ongoing & Recent Projects:**
  - ***DRONE Autonomous Swarm Surface Vehicles*** – Serving as Principal Investigator and Lead Engineer on Office of Naval Research (ONR) funded project to develop a series of autonomous swarm surface robots, designed to perform nearshore bioluminescence mapping and environmental monitoring tasks.
  - ***HIDEX Gen III Bathyphotometer*** – Serving as lead engineer, software developer, and project manager on ONR funded bioluminescence measurement instrument. The result is the most sensitive and sophisticated bioluminescence research tool in the world. The system is currently operating in regular monthly field expeditions off of the Florida coast. Additional research & development is ongoing.
  - ***Eye-In-The-Sea & Eye-In-The-Sea on MARS*** – Serving as lead engineer, software developer, and project manager on two National Science Foundation (NSF) funded projects to develop an unobtrusive, exploratory deep-ocean video monitoring system. The first unit was designed to be autonomous and has been field tested extensively, deployed from the HBOI JSL

submersibles as well as the MBARI Ventana ROV. Several recorded species still remain unidentified. The second system is currently under development for the MBARI MARS cabled observatory in Monterey Bay, CA.

- ***Nemesis ROV*** – Developed Ethernet-based telemetry & control system for 50HP custom built electric/hydraulic rescue-class Remotely Operated Robotic Vehicle for use in the offshore oil industry. System is currently operated by Deep Marine Technology (DMT) in the Gulf of Mexico.
- ***LoLAR II*** – Development of the Low Light Auto-calibrating Radiometer, an extremely sensitive optical instrument used to measure downwelling of light in the ocean as well as various bioluminescent phenomena. The project was funded by NSF and ONR.
- ***HIDEX Gen II Bathyphotometer*** – Served as lead software engineer for second-generation development of the High-Intake Defined-Excitation Bathyphotometer, a bioluminescence measurement instrument funded by the Naval Oceanographic Office. System is currently in use by NAVO.

08/00 – 12/02 Graduate Research Assistant – ***Florida Institute of Technology***, Melbourne, FL.

- Paid thesis research and management of the FIT Underwater Technologies Laboratory.

06/99 – 01/01 Software Engineer - ***Presideo, Inc***. *(formerly Integrated Visions, Inc.),* Sebastian, FL.

- Software/Hardware Development for Biometric Authentication & Internet Security (using fingerprint, iris, facial, and handprint recognition technologies)
- Majority of clients were within the medical industry, moving towards HIPAA compliance.
- Programmed in C/C++ (using the Win32 API, MFC, STL), Java (applets & servlets, using JNI, AWT, Swing), CORBA/IDL, HTML, JavaScript.
- Familiarity with PKI using PKCS12 Certificates, MD5 hashing, & the RSA encryption algorithm.

09/96 – 12/96 Engineering Co-Op – ***US Army Corps of Engineers, CERC Field Research Facility***, Duck, NC

- Coastal surveying using RTK Differential GPS and HYPACK with the CRAB crawling vehicle
- Video Image Processing and Time Series data analysis of coastal wave action
- Oceanographic instrumentation calibration & field deployment (current meters, CTDs, etc.)

RESEARCH EXPEDITIONS

16 research expeditions, 12 as lead engineer, 10 as expedition manager, to the Gulf of Maine, Gulf of Mexico, and the Atlantic Ocean between Florida and the Bahamas. Dives logged to 2000ft. deep in the Johnson-Sea-Link I Submersible.

Also holds NAUI & PADI advanced SCUBA diver and ASA sailing certifications.

PROFESSIONAL SOCIETIES

- Marine Technology Society (MTS)
- IEEE Oceanic Engineering Society
- Tau Beta Pi

PUBLICATIONS

Zarzhitsky, D., D. Spears and C.L. Frey, et. al. (in prep). A Physicomimetics Control Framework for Swarms of Autonomous Surface Vehicles. **Marine Technology Society of the IEEE, Oceans 2008**.

Widder, E.A., E. Raymond, C.L. Frey, and D.C. Smith (in prep) Eye-In-The-Sea: a deep sea observatory for unobtrusive observations. **Biol. Bull.**

Davis, J.W., Thosteson, E.D., Widder, E.A, & C.L. Frey. Examination of Bioluminescent Excitation Response using Empirical Orthogonal Function Analysis. **Marine Technology Society of the IEEE, Oceans 2005**.

Widder, E.A., C.L. Frey and J.R. Bowers (2005) Improved bioluminescence measurement instrument. **Sea Technology** 46(2): 10-16

Widder, E.A., C.L. Frey and L.J. Borne (2003) HIDEX Generation II: A New and Improved Instrument for Measuring Marine Bioluminescence. **Marine Technology Society of the IEEE, Oceans 2003,** 4:2214-2221

Frey, C.L and S.L. Wood (2003) Development of an Autonomous Underwater Vehicle for Sub-Ice Environmental Monitoring in Prudhoe Bay, Alaska. **Marine Technology Society of the IEEE, Oceans** 2:1161-1173

Frey, Charles L. Development of an Autonomous Underwater Vehicle for Sub-Ice Environmental Monitoring in Prudhoe Bay, Alaska. Master's Thesis, **Florida Institute of Technology**, 2002.

Public Outreach:

2008 HBOI Ocean Science Lecture Series – Speaker:
"Intelligent Swarms: The Next Evolution in Marine Robotics"

2007 HBOI Ocean Science Lecture Series – Speaker:
"Eye In The Sea on MARS: A Real-Time Window Into the Deep"

2006 Florida Tech DMES Lecture Series – Speaker:
"Eye In The Sea on MARS: A Real-Time Window Into the Deep"

Little, Jane B. "Eye In The Sea". **Popular Mechanics**, May 2006: 40-43.

2005 Operation Deep Scope II, posts on NOAA's Ocean Explorer Webpage
http://oceanexplorer.noaa.gov/explorations/05deepscope/background/explorers/explorers.html#explorer_6
http://oceanexplorer.noaa.gov/explorations/05deepscope/logs/aug31/aug31.html

2005 Operation Deep Scope II, post on HBOI's At-Sea Webpage
http://www.at-sea.org/missions/deepscope2/day10.html

2005 Florida Tech DMES Lecture Series – Speaker:
"Optical Instrumentation Research at Harbor Branch"

2003 HBOI Ocean Science Lecture Series – Speaker:
"Robot Explorers: A Look at Unmanned Underwater Vehicles"