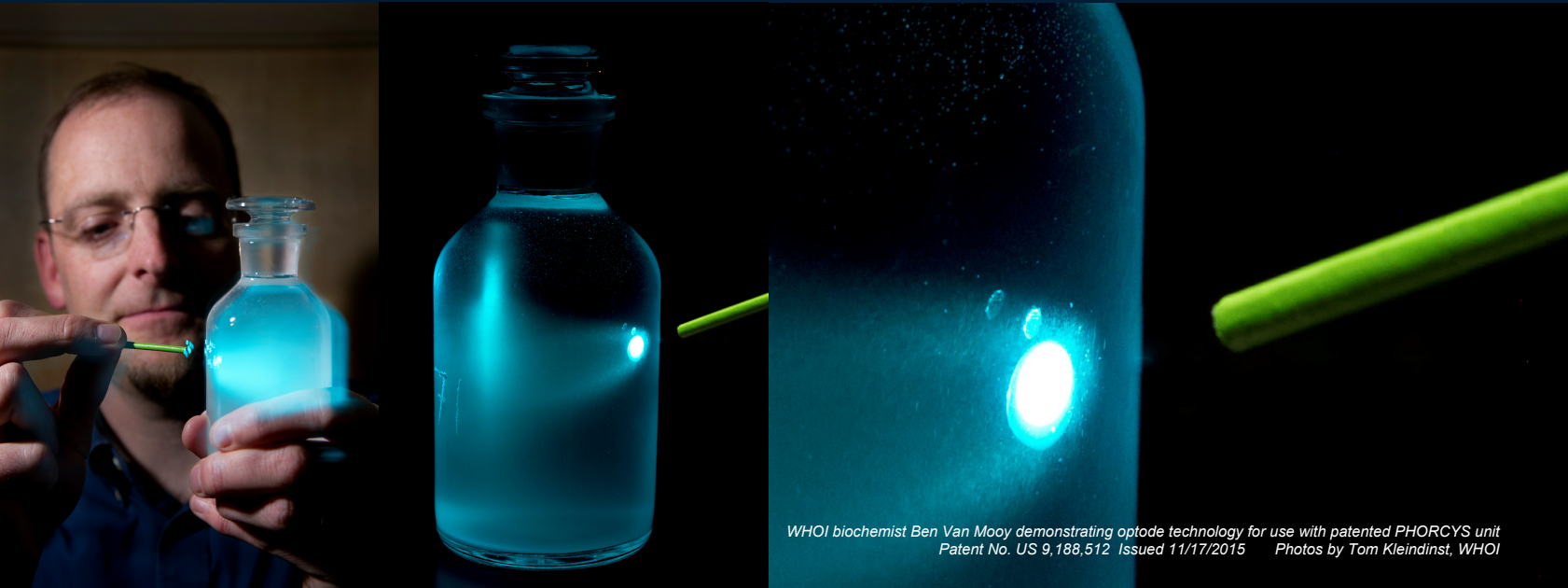


TECHNOLOGY TRANSFER NET

ANNUAL REPORT 2015



WHOI biochemist Ben Van Mooy demonstrating optode technology for use with patented PHORCYS unit
Patent No. US 9,188,512 Issued 11/17/2015 Photos by Tom Kleindinst, WHOI

2015 FEATURES IN FOCUS LETTER FROM THE DIRECTOR PAGE 1 BY THE NUMBERS PAGE 2 TECH TRANSFER NEWS
PAGE 2 & 5 PATENT METRICS PAGE 3 EXPENSE REPORT PAGE 4 INCOME PAGE 5 TECHNOLOGY SPOTLIGHT PAGE 5
PARTNERSHIPS & COLLABORATIONS PAGE 6

FROM THE DIRECTOR

The start of 2016 brings us to the halfway point in WHOI's four year strategic Technology Transfer development plan. Back in late 2014, we established an in-house Technical Patent Writing position that was funded entirely from savings in external patent attorney expenses. We began to reap the benefits of that hire in 2015 as evidenced by a nearly 25% decrease in departmental spending since 2013.

In 2015 we turned our strategic focus towards Technology Transfer's big conundrum: funding the development of technology attractive to potential industry licensees from commercially risky research prototypes. This so called "Technology Funding Gap." represents a greater than \$350,000 unmet annual funding

need for WHOI. We got off to a good start in our first year addressing the gap, by combining donor contributions with 22% of WHOI's existing royalty stream to provide almost \$180,000 of support to WHOI scientific staff for the advancement of the commercial readiness of their technologies.

One way Gap funding was distributed in 2015 was through the well-received "Shark Tank" competition, described later in this report. Going forward, we will continue to seek out creative solutions to meet our Gap funding needs. For those of you who sometimes wonder about the actual commercial potential of WHOI's technologies, the estimated aggregate market size of the technologies presented by our shark tank participants was well over \$500 million.

The shark tank experience was just one of the many accomplishments helping to make 2015 a great year for WHOI Tech Transfer. Many of these are documented in this annual report and the overarching theme for all is efficiency. Chart 1 depicts how the dramatic increase in patent activity over the last three years was coincident with an overall drop in departmental spending. Surprisingly, these lower expense numbers include the hiring of a full time Technical Marketing Specialist who, in addition to implementing web-based technology marketing and redesigning the OTT web site, also prepared this annual report.

Have a great 2016!
Dave Knaack

BY THE NUMBERS

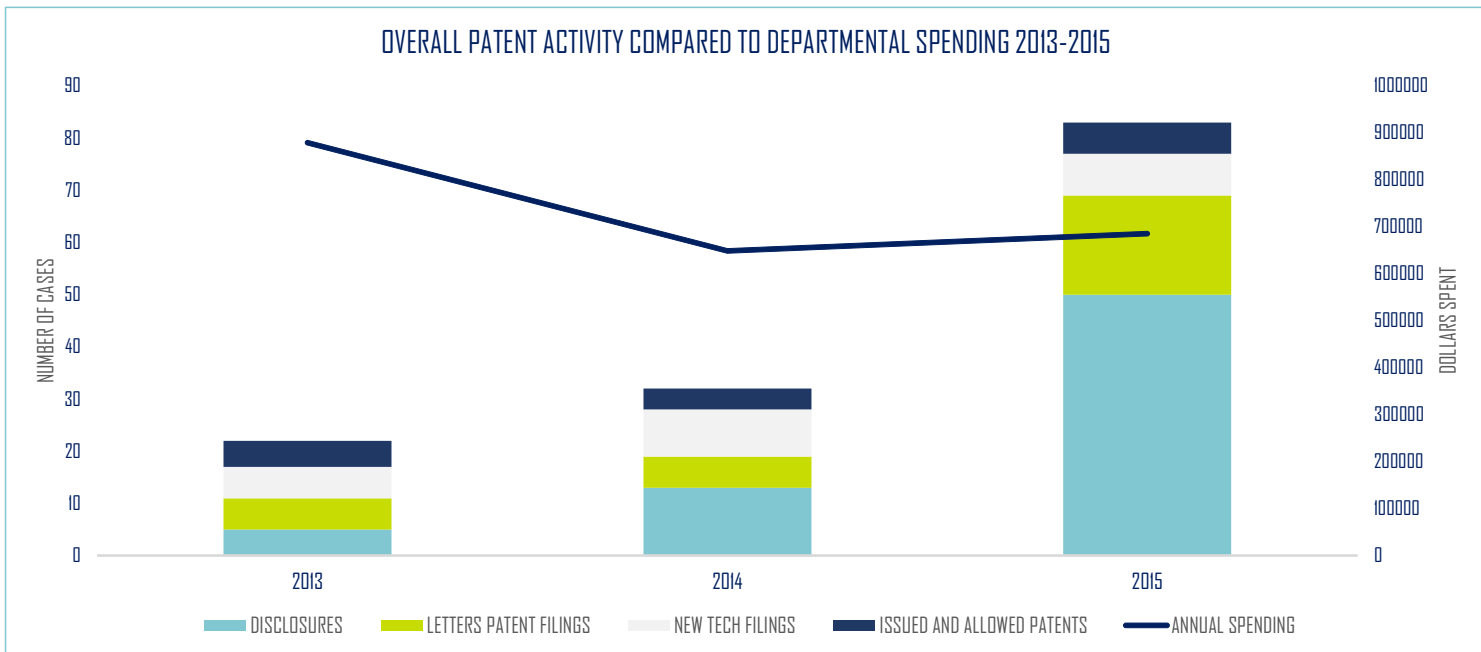


CHART 1: OTT departmental spending has declined 22% since 2013 (solid line), while overall patent activity has increased 3 fold (bars). In addition to a dramatic increase in patent activity, 2015 also saw an increase in headcount from 2.5 to 3.5 FTE and the initiation of two start-ups. *For budget reasons, WHOI limits new technology filings to 8-10 per year.*

OTT LAUNCHES NEW WEBSITE

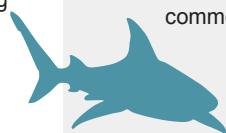
We are excited to announce the 2016 launch of a new website for WHOI’s Office for Technology Transfer (OTT). The site is designed to provide our inventors, investors, and patrons additional easy-to-access resources and information. It will feature a streamlined design, simple navigation, and improved

content. Through regular updates and dynamic material, the new site will allow us to better communicate with site visitors while increasing opportunities for interaction and follow-up. By connecting with technology networking sites and driving traffic to our available technology listings, the new site is intended to facilitate increased licensing opportunities.

SHARK TANK AWARDEES SELECTED

OTT recently made its first Gap-Funding Award for projects too advanced to receive further basic research support but still too immature for licensing. The Gap-funding award is for milestone-driven applied research aimed at reducing the technological risk of commercializing technology.

For these awards, OTT held its first ever “Shark Tank.” Seven Applications were received and were then reviewed by a team including Board of Trustees member Edmund Woollen, Honorary Corporation member George Chamillard, and Director of Research Larry Madin. Applicants were required to make a 10 minute business presentation showing both the [continued on Pg. 5]



2015 U.S. PATENT ISSUANCES & ALLOWANCES

Systems and Methods for Establishing an Underwater Optical Communication Network

Patent No. 8,953,944

Inventors: Casey Machado, Lee Freitag, Andy Bowen, Norman Farr

Aquatic Sample Analysis System

Patent No. 9,188,512

Inventors: Benjamin Van Mooy, Richard Keil

Bioactive Compounds from Phytoplankton Containing Glycoside Residue for Apoptosis and Cancer Treatment

Patent No. 9,217,741

Inventors: Benjamin Van Mooy, Helen Fredricks, Kay Bidle, Assaf Vardi, Liti Hamarty

Optical Communication Systems and Methods

Patent No. 9,231,708

Inventors: Norman Farr, Jonathan Ware, Clifford Pontbriand

Marine Environment Antifouling System and Methods

Patent No. 9,235,048

Inventors: Norman Farr, Clifford Pontbriand, Timothy Peters

Cobalamin Acquisition Protein and Use Thereof

Patent No. 9,234,012

Inventors: Mak Saito, Erin Bertrand

Use of Marine Algae for Producing Polymers

Patent Application No. 13/298,576

Inventors: Christopher Reddy, Scott Lindell

A FEW 2015 NUMBERS...

DISCLOSURES
50

U.S. PATENT
FILINGS
18

PATENT
ALLOWANCES
6

See Appendix

DISCLOSURES 2013-2015

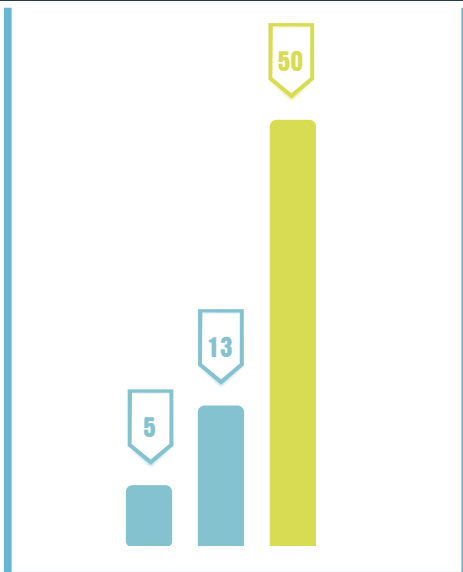


CHART 2

U.S. PATENT FILINGS 2013-2015

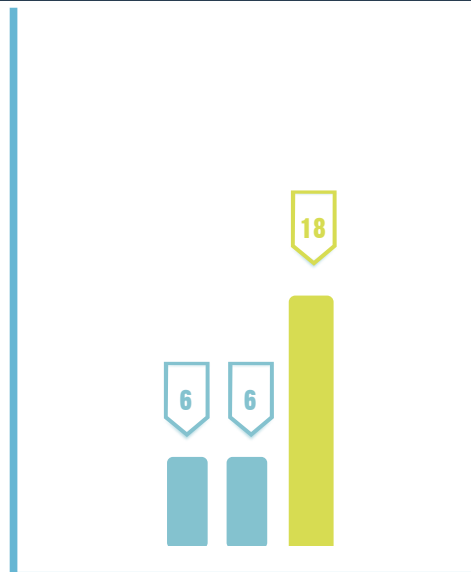


CHART 3

ALLOWED PATENTS 2013-2015

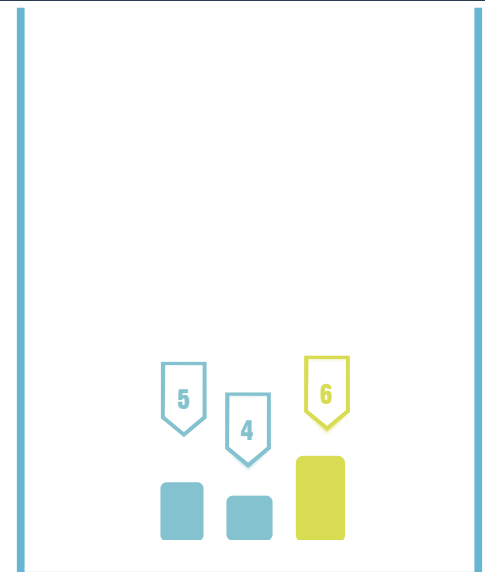
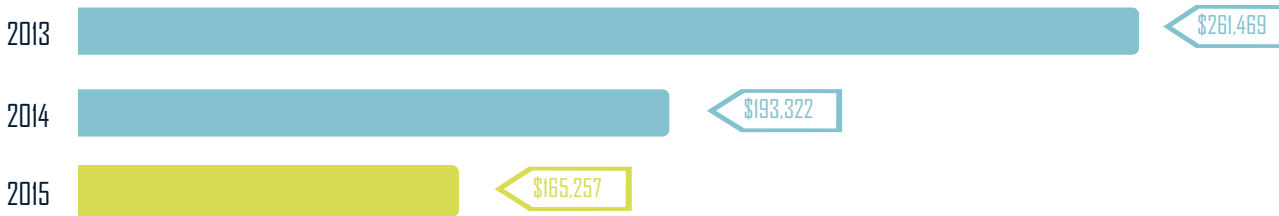


CHART 4

Scale varies by graph*

PENDING PATENT EXPENSES CHART 5



AVERAGE MONTHLY PENDING PATENT EXPENSES PER CASE CHART 6



AVERAGE COST PER NEW FILING CHART 7



OVERALL DEPARTMENTAL SPENDING CHART 8



INCOME

2009	\$334673
2010	\$298868
2011	\$276850
2012	\$405210
2013	\$405753
2014	\$656778
2015	\$433633

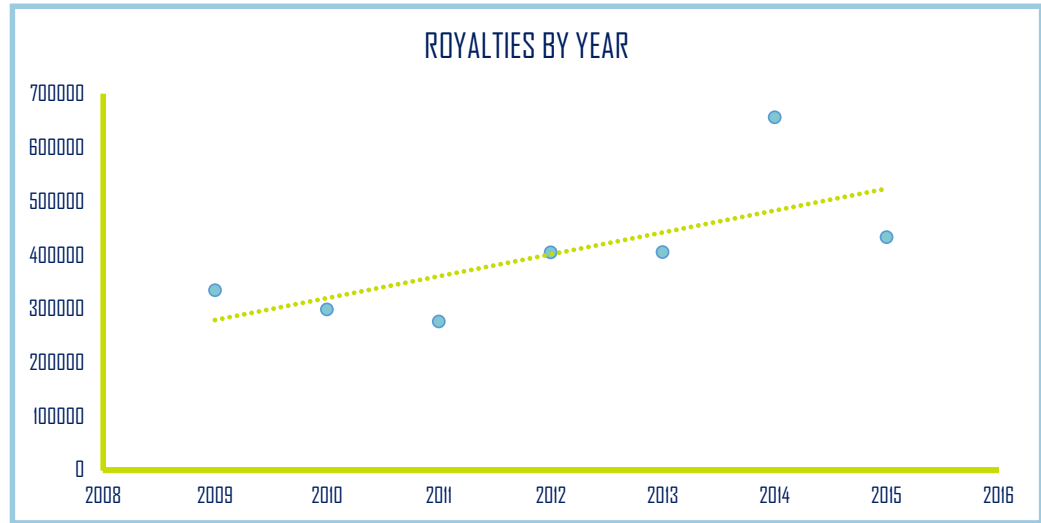


CHART 9

SHARK TANK AWARDEES SELECTED [cont.]

commercial potential of their technology, as well as the development milestones they planned to reach with the funding in 2016. The seven applicants requested nearly \$500,000 in support from an available pool of \$124,000.

Three partial awards were made:

AutoBOD, a real time biological oxygen demand sensor for use in wastewater treatment facilities by Ben Van Mooy was awarded \$50,000.

A **Ropeless Fishing System** to reduce whale entanglement in lobster trap

lines by Jim Partan and Keenan Ball was awarded \$30,000.

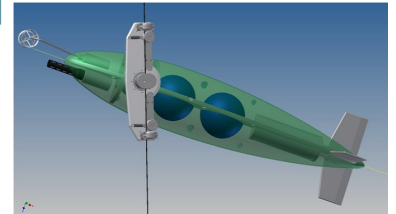
Lastly, **CHANOS**, a channelized optical system for simultaneous in-situ measurement of CO₂ parameters in aquatic systems by Aleck Wang and Fritz Sonnichsen was awarded \$44,000.

Gap Funding comes in part from WHOI's royalty stream and the research it funds is expected to generate additional future royalties through successful commercialization of the funded technologies.

TECHNOLOGY SPOTLIGHT

Moored profilers are designed to autonomously sample the water column while propelled along a fixed mooring with a microprocessor-controlled traction drive. On board sensing capabilities may include sea water conductivity, temperature, current speed and direction, chlorophyll fluorescence, turbidity, photosynthetically active radiation and dissolved oxygen. The presence of an underwater inductive modem optionally provides real-time communication between the profiler and a surface buoy or seabed node.

In 2015 John Toole's team challenged the traditional design concept of a rigidly positioned rectangular instrument with a flow-aligning moored profiler concept; torpedo shaped and streamlined, the body pivots both horizontally and vertically to align with the incident 3D relative current flow to minimize drag and present



sensors to undisturbed water at the front of the vehicle. The new design solves an array of shortcomings of current profilers, enabling longer deployment times and significantly improved data reliability. Designed to use many of the components of existing commercially produced profilers, it is anticipated the commercial transition from 1st generation profilers to the 2nd generation design will occur with minimal cost and effort. Prototypes are currently under development. Based on the expression of local commercial interest, further development of the technology was supported through a \$50,000 award of OTT discretionary funding in 2015.

PARTNERSHIPS & COLLABORATIONS

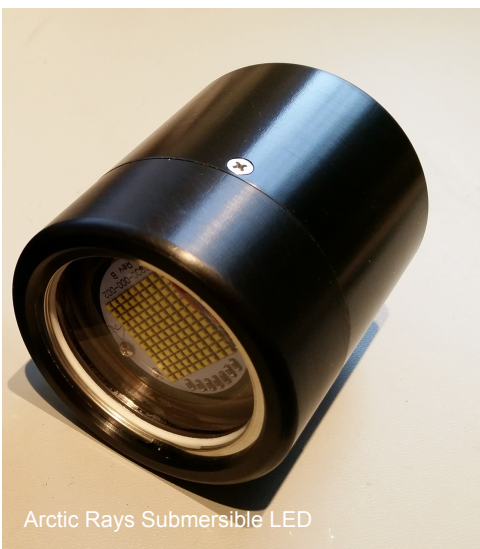
In 2015, OTT launched its **Tech Mentors and Champions program**, intended to build a strong network of entrepreneurs and industry professionals to provide mentorship and entrepreneurial expertise for WHOI scientists and engineers. The program will match Mentors and Champions with inventors who have technologies at various stages of business development to help address business challenges and connect to industry resources. OTT plans to grow our network of experienced Mentors and Champions through public outreach and local presentations at forums such as the the Cape Cod Technology Council (CCTC) and the Southern New England Entrepreneurs Forum (SNEEF). We believe tapping into the expertise of local entrepreneurs to be a critical element in a successful licensing program.

TWO NEW START-UPS WERE FORMED IN 2015 WITH LICENSED WHOI TECHNOLOGIES

ARCTIC RAYS

Arctic Rays is a Massachusetts-based ocean engineering company specializing in the design, development and customization of deep sea technologies; from lighting systems to beacons and sensors.

Their goal is to provide leading edge products, with attention to performance, control, modularity, and reliability in deep water applications.



Arctic Rays Submersible LED

COASTAL OCEAN VISION

Coastal Ocean Vision Inc. was founded with the goal of creating products that support educational and research objectives to better understand biophysical and geochemical ocean processes. Their integrated instrumentation platforms produce real time data to study the behavior of a given aquatic environment over time.

Their products include OceanCubes- unmanned underwater observatory systems, image analysis and organization softwares, CPICS- an in-situ continuous particle imaging and classification system, as well as a low-cost plankton camera for laboratory and classroom use.

To learn more about Coastal Ocean Vision, visit their website:

www.coastaloceanvision.com



Plankton images generated by CPICS (<http://www.coastaloceanvision.com>)

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WHOI Office for Technology Transfer staff & consultants outside of Vincent House

Top row: Wallace Stark, Steve Withrow

Bottom row: David Knaack, Tony Pirri, Cristy Salanga, Allison Nangle

Photo: Tom Kleindinst, WHOI

2015 PROVISIONAL PATENT FILINGS

System for the Deployment of Marine Objects

Provisional Patent Application No. 62/109,994

Inventors: Tom Austin, Frederic Jaffre, Robin Littlefield, Gwyneth Packard, Mike Purcell, Glenn McDonald, Christopher Rauch

Sentry Precision Robotic Impeller Driven Sampler

Provisional Patent Application No. 62/197,117

Inventors: Carl Kaiser, Andrew Billings

Compact Marine Winch

Provisional Patent Application No. 62/201,133

Inventors: James Haley, Joshua Eaton

Articulating Moored Profiler System

Provisional Patent Application No. 62/236,288

Inventors: John Toole, Kenneth Doherty, Jeffrey O'Brien, Fredrik Thwaites

Early Algal Bloom Detection by Raman Spectroscopy

Provisional Patent Application No. 62/241,835

Inventors: Scott Gallager

Carousel Peptides for Absolute Protein Quantification

Provisional Patent Application No. 62/242,137

Inventor: Mak Saito

Alkenone-Based Formulations for Topical Applications

Provisional Patent Application No. 62/255,961

Inventors: Christopher Reddy, Gregory O'Neil

2015 U.S. PATENT FILINGS

Use of Marine Algae for Co-Producing Alkenones, Alkenone Derivatives, and Co-Products

Patent Application No. 14/599,460

Inventors: Christopher Reddy, Gregory O'Neil

Mechanical Tether System for a Submersible Vehicle

Patent Application No. 14/627,515

Inventors: Robert McCabe, Andrew Bowen, Matthew Heintz

Asymmetric Propulsion and Maneuvering System

Patent Application No. PCT/US15/23970

Inventors: Tom Austin, Jeffrey Kaeli, Michael Purcell, Ben Allen, Frederic Jaffre, Robin Littlefield

Environmental Monitoring Assembly and Method

Patent Application No. PCT/US15/26691

Inventor: Ken Buesseler

Optical Communication Systems and Methods

Patent Application No. 14/470,456

Inventors: Norman Farr, Lee Freitag, James Preisig, Dana Yoerger, Sheri White, Alan Chave

System and Method to Measure Dissolved Gases in Liquid

Patent Application No. 14/722,370

Inventors: Aleck Wang, Frederick Sonnichsen

Improved Efficiency Submersible Thruster

Patent Application No. PCT/US15/37548

Inventors: Carl Kaiser, Andrew Billings

Thermal Transfer System

Patent Application No. 14/759,953

Inventor: Glenn McDonald

Method for Reducing Antibiotic Resistance Through Efflux Pump Inhibition

Patent Application No. 14/797,951

Inventors: Tracy Mincer, Kristen Whalen

2015 U.S. PATENT FILINGS [CONT.]

High Throughput Multi-Layered Stretch Hose

Patent Application No. 14/743,551

Inventor: Don Peters

Aquatic Sample Analysis System

Patent Application No. 14/808,757

Inventors: Benjamin Van Mooy, Richard Keil

Platform-Independent Sonar Calibration Enabling System

Patent Application No. 14/844,038

Inventor: Kenneth Foote

Continuous Particle Imaging and Classification System

Patent Application No. PCT/US15/51121

Inventors: Scott Gallager et al.

Optical Communication Systems and Methods

Patent Application No. 14/947,859

Inventors: Norman Farr, Jonathan Ware, Clifford Pontbriand

Multi-Modal Optical Communication Systems and Methods

Patent Application No. 14/947,989

Inventors: Norman Farr, Clifford Pontbriand, Jonathan Ware

Cobalamin Acquisition Protein and Use Thereof

Patent Application No. 14/958,293

Inventors: Mak Saito, Erin Bertrand

Cobalamin Acquisition Protein and Use Thereof

Patent Application No. 14/958,321

Inventors: Mak Saito, Erin Bertrand

Portable Turntable and Winch

Patent Application No. 14/963,570

Inventors: James Haley, Joshua Eaton