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Naval Air Systems Command



**NAVAIR Science and Technology Newsletter**

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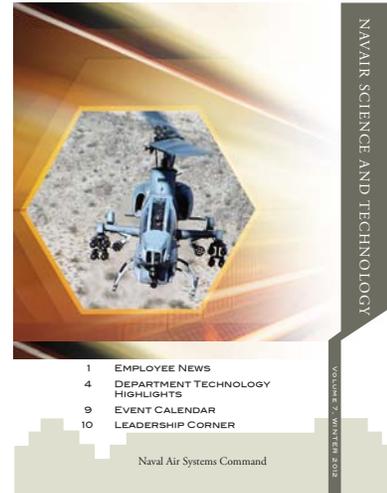
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AH-1W Cobra helicopter flying near the Pinnacles at Naval Air Weapons Station (NAWS), China Lake, California, with Hellfire missiles. (U.S. Navy photo by M. Whalan)

NAVAIR Science and Technology (S&T) Newsletters are published by the Technical Communication Office (4L6200D) to provide unclassified technical information that pertains to chemistry, life sciences, physics, and technical communication. This newsletter also intends to inform the NAWCWD S&T community about updates, professional development opportunities, and technology highlights.

The contents are not necessarily the official views of or are endorsed by the U.S. Government, the Department of Defense, or the United States Navy.

Please direct article submissions and subscription requests to [scitech.fct@navy.mil](mailto:scitech.fct@navy.mil).

**“We are committed to improving the transfer of S&T into Warfighting capabilities.”**

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## WEB ACCESS

All issues of the NAVAIR Science and Technology Newsletter are accessible online.

- For the public

[http://www.navair.navy.mil/nawcwd/nawcwd/employemen/high\\_tech\\_job/scitech/index.html](http://www.navair.navy.mil/nawcwd/nawcwd/employemen/high_tech_job/scitech/index.html)

- For NAVAIR employees

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- To subscribe or submit ideas email the Managing Editor at [sci.fct@navy.mil](mailto:sci.fct@navy.mil)

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## OFFICE OF NAVAL RESEARCH (ONR)- GLOBAL SCIENCE ADVISOR BRIEFS STAFF

On 14 November 2011, Mike Myers, Director, Fleet Forces Division, ONR-Global discussed the ONR-Global Science Advisor Program. The ONR-Global Science Advisor Program provides an opportunity for senior engineers and scientists with at least 10 years experience to do a two to three-year detail assignment at major fleet and force commands around the world.

NAVAIR personnel may call 760.939.1683 for more information about the ONR-Global Science Advisor Program.

## PATENT REFORMS ON THE HORIZON

By Kenrick King, Contractor for Research and Intelligence Department, Technical Communication Office, NAWCWD

Patent reforms are on the horizon at the Naval Air Warfare Center Weapons Division (NAWCWD). President Obama signed the America Invents Act (S.23) on 16 September 2011 shortly after the bill swept through both the Senate and the House with very little challenge. This legislation will result in some major changes to the patent filing process through which new inventions and ground breaking ideas are protected from copyright infringement.

Alongside all-American innovators, our best and brightest at NAWCWD will soon begin to see the effects of the patent reform and, in all likelihood, have to make some fundamental changes to the way procedure is carried out in regards to protecting U.S. Navy-produced innovations. While any change to the “business as usual” system can seem daunting, the transition to working under these new patent reform guidelines can run relatively smoothly as long as certain steps are followed to ensure the protection and continued success of original U.S. Navy concepts.

Patent legislation was originally implemented into the Constitution by our founding fathers as a means of nurturing the creative ingenuity of the American inventor and, with the exception of a minor amendment every

few decades or so, has remained largely unchanged ever since. Under the old system, an American inventor would develop a good, service, or idea. Within the fixed grace period, the inventor had one year to publish writings and conduct market research before filing for a patent or allowing their work to become public domain. Because such publications and research constitutes prior art—a term used to describe evidence of a particular inventor’s connection to the innovation—inventors had the luxury of waiting to file for a patent without the concern of copyright infringement, in turn giving them more time to improve upon their innovation. This is often referred to as the “first to invent” system, by which the original inventor is protected under law regardless of when the submitter decides to file within the allotted grace period.

The most impacting change to the old system, and consequently the most controversial, is the switch from a “first to invent” system to a “first to file” system. The new legislation implies that regardless of who is actually responsible for the creation of a said idea, good, or service, the first entity to file for a patent will be granted all the rights to the innovation in question.

You may be asking yourself, exactly how do NAWCWD innovators go about protecting up and coming U.S. Navy inventions under this new filing system? To answer that question, I spoke with Charlene Haley (K00000D), NAWCWD’s patent attorney. According to Haley, these new patent reforms present our innovators with a unique set of challenges, but certainly nothing we cannot handle with a little restructuring to our business methods.

“As with the introduction of any new legislation, we do not yet know exactly how the United States Patent and Trademark Office (USPTO), or the court system for that matter, will interpret the ambiguous language used in the bill,” advised Haley. “This process may take years to work through. In the meantime, NAWCWD needs to change the philosophy by which we do business. We need to protect our intellectual property the best way we know how. Immediately filing a patent application with the USPTO is the best possible option for legal protection to naval innovation at this point.”

Legally protecting Navy innovators from intellectual property theft is certainly the primary concern when incorporating these new patent legislation reforms into the NAWCWD business model; however, there are also some really motivating personal incentives associated with filing a patent application in a timely fashion. Dr. Mike Seltzer (4L4000D), Head of the NAWCWD Technical Transfer Office, provided significant information regarding financial benefits associated with filing patent applications. Dr. Seltzer stated, “In addition to inventions being looked upon as important performance metrics for NAWCWD scientists and engineers, there are a number of additional personal incentives as well. Inventors receive \$250 following submission of an invention disclosure, an additional \$500 when a patent is filed, and a further \$500 when an actual patent is issued. The rewards do not end there. When the Navy licenses inventions to the private sector for commercial development, Navy inventors are entitled to a share of the revenues derived from licensing fees and royalties. On an annual basis, each inventor receives a

minimum of \$2,000 plus up to 20% of the remaining balance of those revenues.”

All newly introduced legislation requires an adjustment period, but as long as our U.S. Navy scientists and innovators are proactive about immediately filing patent applications with the USPTO, there should be relatively few issues along the way.

Changes to policy and procedure can be challenging. This newly enacted patent reform is certainly going to impact the methods by which NAWCWD proceeds with developing ground-breaking innovations, but it most certainly will not affect our levels of creativity and production. As long as NAWCWD continues to diligently file patent applications, our nation will surely remain at the forefront of science and technology innovation.

For further information regarding patent laws, please contact the NAWCWD Legal Department at 760.939.5630, or visit [www.uspto.gov](http://www.uspto.gov).



## SAFETY

Safety reminder for NAWCWD personnel:

If you think you may have potentially radioactive or hazardous items in your work area, do not move or attempt to dispose of it yourself. Please contact the Command Radiation Safety Officer at 760.939.3071.

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## INSIDE THE BLAST: SCIENCE AND TECHNOLOGY FOR THE U.S. FLEET

By Kimberly R. Silver, Sr. Technical Writer/Editor, Research and Intelligence Department, Technical Communication Office, NAWCWD



AH-1W Cobra flying in the Pinnacles at NAWCWS China Lake, California, with Hellfire missiles. (U.S. Navy photo by D. O'Connor)

The AGM-114N, an air-to-ground precision strike weapon designed to defeat individual hard point targets, contains a warhead design that is the culmination of over 40 collective years of research and development (R&D), collaboration, production, and refinement. The improved metal augmented charge (MAC) thermobaric warhead for the AGM-114N produces an enhanced blast that is deadly against threats and targets inside confined structures including tunnels, caves, buildings, and bunkers.

The revolutionary technology for the AGM-114N warhead was developed and rapidly transitioned from the earlier AGM-114M from requirement definition to production by an imaginative federation of civilian scientists and weaponeers at the Naval Air Warfare Center Weapons Division (NAWCWD) at China Lake, California. The center is responsible for R&D, acquisition support, test, evaluation, and in-service engineering for U.S. Navy weapons systems.

## Innovation and Dominant Weapons

In the twenty-first century, American scientific ingenuity has grown increasingly important to the security of our nation.

“We support a higher cause: national defense. Our enemies are smart and adaptive. We must be able to meet those challenges and help the Warfighter meet that challenge,” said Scott O’Neil, the NAWCWD Executive Director for Research and Engineering.

The civilian scientist’s delivery of superior instruments of war is vital to the safety and dominance of the U.S. Armed Forces. Today, the world is acutely aware that scientific innovation requires agile talent and specialized knowledge, as well as a significant investment of time in R&D. In terms of defense, the benefits, however far outweigh the costs as targets are defeated and soldiers return home to their families unscathed.

Arming the fleet with more accurate weapons also helps to minimize the collateral damage and environmental destruction during times of engagement.

## Knowledge Management and Superior Weapons

The ability to quickly transition weapon systems can be partially attributed to the steady evolution of knowledge management capabilities, thus adding to the speed and dexterity of knowledge transfer within the center as a whole.

Under Defense Threat Reduction Agency (DTRA) management and requirements provided by the U.S. Marine Corps (USMC) Department of Aviation (APW-72), NAWCWD scientists designed and produced the AGM-114N warhead and collaborated with Redstone Technical Test Center for missile assembly support. Range test support was provided by NAWCWD; White Sands Army Missile Range; Eglin Air Force Base Open Air Range; and Naval Surface Warfare Center, Indian Head Division.

# TECHNOLOGY HIGHLIGHTS



AH-1W Cobra helicopter flying near the Pinnacles at Naval Air Weapons Station (NAWS), China Lake, California, with Hellfire missiles.  
(U.S. Navy photo by M. Whalan)

Since the 1950s, NAWCWD researchers have studied the complexities of volumetric explosives that use a combination of materials to enhance the internal blast characteristics of weapons. In the early 1960s, NAWCWD researchers worked to explore liquid fuel-air explosive (FAE) weapons that were effective against soft targets. These studies led to the development of the surface-launched FAE (SLU-FAE) and the CBU-55/72 family of weapons.

The technology for the original FAE used liquid fuels and, as such, increased potential hazards during handling that were too risky for shipboard operations. By the early 1990s, researchers funded by the Office of Naval Research (ONR) weaponized a safer, solid fuel design for the FAE warhead. Subsequent testing clearly demonstrated better performance against confined targets.

The rapid transition of the MAC technology into AGM-114N emerged from a symbiotic relationship between a cadre of military personnel with clear requirements and civilian scientists with a long history of weaponizing.

## From the Laboratory to the Fleet: A Rapid Technology Transition

Following the 9/11 terrorist attacks in the United States, President Bush approved military plans to begin Operation Enduring Freedom in Afghanistan. DTRA

personnel recognized that U.S. Marines fighting against the Taliban regime and al-Qaeda in Afghanistan needed more advanced weapons that could be used in military operations in urban terrain (MOUT). So, the effort to improve the AGM-114M began.

At the time, NAWCWD scientists were formulating a powerful new energetic fill, which consisted of a central explosive charge of PBXN-112 surrounded by a dense aluminum liner, resulting in the MAC ordnance package to enhance warhead blast characteristics.

“We were in a competitive R&D program and they [DTRA] wanted a weapon system that was more effective against confined targets such as tunnels and multiroom structures,” explains G. Phil Dixon, head of the Fuze and Warhead Division, NAWCWD. “Our design approach was based on improving warhead blast effectiveness of the weapon through use of a condensed aluminum material, forming a liner surrounding the explosive.”

By 2002, NAWCWD scientists were given the green light to enhance the Hellfire for the USMC through an advanced concept technology demonstration program. In just 13 months, the ambitious R&D effort resulted in the completion of warhead design/qualification, the completion of missile quick reaction assessment testing, and the delivery of 60 AGM-114N missiles with the MAC (thermobaric) warhead for field use.

“Normally, that would be about a 3-year project,” noted John Ayers, Hellfire System Engineer.

Building on these experiences and knowledge, the AGM-114N is identical to the AGM-114M except for the warhead. Unlike its predecessor, the AGM-114N warhead is slightly larger in diameter (5.06 inches), filled with 5 pounds of PBXN-112 explosive, and includes the pressed aluminum liner, thus offering a higher payload capacity. The PBXN-112 explosive disperses the liner as a reacting powder, providing a fuel to react with ambient air. The reaction yields greater impulse, which is effective in defeating MOUT targets.

“It is simply a better performing warhead all around against confined threats,” said Dixon.



AH-1W Cobra piloted by Major Brenden Riley, with Hellfire missiles and 2.75 rocket pods. (U.S. Navy photo by Terry Pascarella)

## Weapon of Choice

“The Hellfire missile has proven to be a highly effective system for our Warfighters,” said Jun Ralleca, Hellfire Missile Team Lead, Joint Attack Munitions Systems Project Management Office (JAMS PMO), U.S. Army.

Because the AGM-114N was so effective against threats and targets inside tall buildings and tunnels, it quickly became the rotary-wing weapon of choice in the Global War on Terror. During Operation Iraqi Freedom in 2003, AGM-114N missiles were rapidly flown into theatre and used in combat by the USMC AH-1W SuperCobras.

“NAWCWD produced over 400 warheads before completing the transition of production to ATK. This effort included warheads used to support development test events, the first production build of 65, the second production run of 130 for DTRA, and the last in-house production of 200 warheads for the U.S. Army,” said Phillip Gattis, Hellfire System Engineer, NAWCWD.

ATK was contracted to supply 1,500 MAC warheads later that year. In 2005, warhead production transition from NAWCWD to ATK was completed. “The success of this missile is a direct result of the joint cooperation between the Defense DTRA, U.S. Navy, and U.S. Army. It is a demonstration of what the Government can accomplish when we work together as a cohesive and effective team,” commented Ralleca.

AGM-114N missiles had reportedly been deployed by the North Atlantic Treaty Organization (NATO) fighters during the 2011 Libyan civil war. Today, AGM-114N missiles are fielded on a variety of platforms, including U.S. Navy and U.S. Marine Corps helicopters: AH-1 and H-60. The U.S. Army employs Hellfire weapons on the AH-64, OH-58, and AH-6. The missiles are also launched from the United States Air Force’s Predator unmanned aerial vehicle and the United Kingdom’s AH-MK1.

## INNOVATION IN ACTION: THE CHINA LAKE HIGH TECHNOLOGY CONSORTIUM

By Michelle Campbell, Contractor for Research and Intelligence Department, Technical Communication Office, NAWCWD

“What else can your technology do?” This question, posed by the Deputy Director of the Research and Engineering Department Andy Corzine (400000D), is at the heart of a young but thriving China Lake High Technology Consortium. Established in 2009 as the result of an ongoing discussion within a small group at NAWCWD, the consortium focuses on proactively providing “innovative solutions to the issues of tomorrow,” in the words of one of its collaborators, Dylan Riley (472100D). With successes that include cooperative research, new product development with industry, and technology licensing, the flourishing consortium is making a mark in the military and commercial marketplace.

The participant-driven consortium compliments the Navy’s core work by developing unique partnerships between government, industry, academia, non-profit, and investor entities. Through these partnerships, the consortium collaboratively addresses military and commercial marketplace technology requirements.

The consortium is a “network of awareness,” shared Corzine, explaining that the consortium follows a self-governing model and takes an informal approach to problem and solution sets. It has neither membership dues nor a formal reporting structure. And although China Lake is in the name, the intention is to indicate regional locality without using NAWCWD as part of the title in order to emphasize the fact that NAWCWD is a participant on the same level as other participants. The benefit of a less centric model is that every participant has an equal importance, which fosters a collaborative spirit.

“We can get out of the proverbial box, which stifles creativity,” shared Riley.

“The global technology base is more complex and moves more rapidly than ever,” Riley added. “To deliver the best capabilities to the Warfighter, we must be exposed to that technology base. Our scientists and engineers do a great job of keeping up with their peers, but it is becoming [increasingly] more important to look at things that don’t appear to relate to the defense industry.”

Such innovation is one of the consortium’s main goals. After all, NAWCWD success with multi-use technology has been a game changer throughout NAWCWD’s history. The chemiluminescent light stick, ultrasonic scanning, and stop action video are three of many influential innovations initially developed at NAWCWD in order to meet Warfighter needs and yet have highly successful commercial applications. Likewise, the Warfighter has benefitted from successful technologies from the commercial sector that did not first appear to be defense related.

“Alflight is an example of a consortium participant who developed laser technology for miniature projectors that connected to PCs and found another application for hand-held laser devices the Army now uses for crowd control,” shared Riley. “A classic example from outside the consortium is ScanEagle, which was originally developed to track dolphins and tuna from fishing boats. That platform has now flown over 500,000 combat hours.”

“We want to be a creative forum for multi-use technology innovation,” emphasized Corzine. “Sometimes, accessing technological developments outside of the gate will give our Warfighters the decisive advantage and sometimes what is developed in the lab has commercial applications from which values can be extracted and given back to the Warfighter.”

The consortium’s recent successful collaborations include midshipmen tours at NAWCWD, MBA professor collaborations at Stanford and MIT, technology discussions with Chico State, exchanges with NASA Ames and Livermore focusing on enhanced use leasing

## TECHNOLOGY HIGHLIGHTS

of commercial research facilities, and technology discussions with Alflight and Kairos Autonomi. Anticipated future endeavors include participating in the MIT i-teams course, which teaches students to develop commercialization strategies for existing technologies. The consortium also wants to reach small businesses.

“Most innovative technologies start out with small businesses,” said Riley. “Participation in the consortium gives us access to new technology while it’s still new.”

Current consortium members include high technology businesses such as Cobalt Technologies, Millenniata, and HP Labs; academic institutions such as Stanford, MIT, and the Naval Academy; government laboratories such as NAWCWD, SPAWAR, and NASA Dryden; local entities such as NDTI, the City of Ridgecrest, and the Mojave Air & Space Port; partnership intermediaries such as China Lake Technologies and InSitech; and venture capitals such as Chart Venture Partners and Knowledge Capital.

For information on the China Lake High Tech Consortium, NAVAIR personnel may call 760.939.1683, inquiries from the general public may be directed to 608.266.5321.



# EVENT CALENDAR

## JANUARY

### **Call for Abstracts: NAVAIR Journal for Scientists & Engineers**

Date: 13 January 2012

Description: Share your knowledge by submitting an article for publication in the new NAVAIR Journal for Scientists & Engineers.

Additional Info: Contact the NAVAIR Journal via email at [NAVAIR\\_Journal@navy.mil](mailto:NAVAIR_Journal@navy.mil).

### **Birthday of Martin Luther King, Jr.**

Date: 16 January 2012

Description: This holiday is designated as “Birthday of Martin Luther King, Jr.” in section 6103(a) of title 5 of the United States Code, which is the law that specifies holidays for Federal employees.

Additional Info: For a listing of all 2012 Federal holidays, see the OPM website at [http://www.opm.gov/Operating\\_Status\\_Schedules/fedhol/2012.asp](http://www.opm.gov/Operating_Status_Schedules/fedhol/2012.asp).

### **NAWCWD Fellowship Program Applications Due**

Date: 19 January 2012

Description: The NAWCWD Fellowship Program is now accepting applications for the FY13 cycle through Friday, 19 January 2012. Employees can apply for either full or part-time fellowships for graduate level course work. For detailed information, go to the fellowship web site via the TFS&M website link below,

select “Employees,” “Training,” and then “Fellowship Program.”

Additional Information: <https://mynavair.navair.navy.mil/totalforce>

Applicants to the NAWCWD Fellowship Program are also encouraged to apply to the SMART program (<http://smart.asee.org>). SMART Retention Participants may be eligible to receive supplemental funding from the NAWCWD Fellowship Program.

All interested applicants please contact Jim Diderrich, the Fellowship Program Manager, before beginning the fellowship program application process.

### **NAVAIR Book Club Meeting**

Date: 26 January 2012

Time: 1200-1300 Pacific Time

Location: China Lake Golf Course Grill

Description: The NAVAIR Book Club will meet to discuss “If We Can Put a Man on the Moon: Getting Big Things Done in Government” by William D. Eggers and John O’Leary. Check with the NAWCWD Technical Library for available copies.

Additional Information: To RSVP or request membership email [kimberly.silver@navy.mil](mailto:kimberly.silver@navy.mil).

# EVENT CALENDAR

## FEBRUARY

### NAWCWD Renewable Energy Symposium

Date: February 2012

Location: More details are forthcoming.

Description: NAWCWD will host a Renewable Energy Symposium to demonstrate alignment of WD's Strategic Plan to the Presidential, SECNAV and CNO Energy Goals by highlighting various energy technology partnerships. The symposium will serve as a platform for the NAWCWD S&T community to highlight energy related efforts, hear from private industry and other government agencies with similar interests, and explore opportunities for collaborative R&D.

### Washington's Birthday Observed

Date: 20 February 2012

This holiday is designated as "Washington's Birthday" in section 6103(a) of title 5 of the United States Code, which is the law that specifies holidays for Federal employees.

Additional Info: For a listing of all 2012 Federal holidays, see the OPM website at [http://www.opm.gov/Operating\\_Status\\_Schedules/fedhol/2012.asp](http://www.opm.gov/Operating_Status_Schedules/fedhol/2012.asp).

### Submissions Due for Spring NAVAIR S&T Newsletter

Date: 29 February 2012

Please submit your newsletter articles, photos, and announcement to the Managing Editor at [kimberly.silver@navy.mil](mailto:kimberly.silver@navy.mil)

## MARCH

### NAWCWD 2012 Honorary Awards

Date: 31 March 2012

Description: Supervisors/managers will submit nominations through their local WD chain of command to the appropriate WD Level 1 Competency Leader for review and endorsement. Endorsed nominations will be forwarded to the WD Awards Program Administrator, for final processing. For assistance preparing (writing, editing, submitting) award nominations email [tco.fct@navy.mil](mailto:tco.fct@navy.mil).



*Dr. Scott Munro*

NAWCWD ILIR and IAR  
Program Manager  
Source: NAWCWD

## NAVAL AIR WARFARE CENTER WEAPONS DIVISION (NAWCWD) IN-HOUSE LABORATORY INDEPENDENT RESEARCH (ILIR) AND INDEPENDENT APPLIED RESEARCH (IAR) PROGRAM UPDATES

By Dr. Scott Munro, Research and Intelligence Department,  
NAWCWD

NAVAIR has major research and development facilities that participate in the In-House Laboratory Independent Research (ILIR) and Independent Applied Research (IAR) Programs that are located at the Naval Air Warfare Center (NAWC) sites. The Lakehurst, New Jersey; Patuxent River, Maryland; and Orlando, Florida sites together comprise the Naval Air Warfare Center Aircraft and Training Systems Divisions (NAWCAD and NAWCTSD), while the China Lake and Point Mugu, California, sites comprise NAWCWD. This report covers the NAWCWD ILIR and IAR Programs.

Dr. Scott Munro is responsible for managing NAWCWD ILIR and IAR Program documentation, proposal calls, and reporting. Dr. Chris Hicks at Patuxent River serves as the NAWCAD ILIR and IAR Site Manager.

### NAWCWD Investment Strategy

The NAVAIR ILIR and IAR Programs are constructed through bottom-up (i.e., science driven, supportive of NAWCWD's interest areas for its future) and top-down processes (i.e., requirements driven, supportive of both civilian and military long-term needs). In the past, for example, NAWCWD has focused resources on the development of laser radars, commonly known as ladars, for use in weapon seekers. Currently, this focus has shifted to support directed energy laser and optical component research.

#### Investment Strategy

- Create science “push.”
- Respond to naval requirements “pull.”
- Support multiple product lines.
- Conduct high-risk, high-payoff research.
- Conduct collaborative projects.
- Recruit new scientific talent; develop new capabilities.
- Develop current personnel.

NAWCWD's Investment Strategy.

## Bibliometrics

This year ILIR/IAR research led to 14 papers that have appeared in the scientific literature and several more that are in preparation. The scientific and engineering journals in which our researchers are publishing reflect the wide range of activities that the ILIR/IAR Programs cover. ILIR/IAR researchers also presented their results at conferences and seminars this year. NAVAIR researchers submitted 17 new patents. They also published two unrefereed papers.

Type	Number of Submissions
Patent Application Submitted	17
Published Paper/Report (Refereed)	14
Professional Society Presentation	11
Other	10
Paper Accepted for Publication	4
Published Paper (Unrefereed)	2
Government Report (Archived)	1
Patent Awarded	1

NAWCWD ILIR/IAR Bibliometric Performance in FY11.

## Hiring Success Stories and Other Indicators of Success

NAVAIR believes that the presence of talented scientists engaged in research and interacting with other scientists and engineers has a positive influence on the organization.

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### **Measurable Benefit to the Warfighter and Potential Fleet Impact**

Several of our ILIR researchers are involved in rapid response programs with the Irregular Warfare Technology Office at NAWCWD. Our ILIR research into alternative fuels shows significant promise, and additional funding leveraging the ILIR work has begun. Our physicists and mathematicians are providing improved algorithms for the next generation of Digital Precision Strike Suite.

### **Support to Navy and Naval Aviation with Directed Research Efforts**

Our investigators carefully align their projects to the Naval S&T Strategy, NAE S&T Strategic Plan, as well as emerging Fleet requirements. Our program will continue to be responsive to Aviation and Weaponry directed research needs.

A strategic planning process is being developed that will incorporate the requirements guidance and strategic plans of OSD, ONR, and NAVAIR. In addition, our Intelligence Division will assist by translating the S&T requirements into S&T gaps. Gaps in skill base and in infrastructure will be identified. We will also work closely with the NAWCWD Horizontal Integration Capability Assessment Program, the Irregular Warfare Technology Office, and the Warfighter Response Center to ensure alignment with current Warfighter needs. Doing so will enable us to have a greater influence on transition of ONR-supported S&T to Global War on Terrorism (GWOT) and Fleet requirements.

The ILIR Program continues to be one of the primary mechanisms by which NAWCWD conducts discretionary research to maintain and expand core competencies, recruit new scientists, and retain its existing scientific staff. We look forward to maintaining an excellent ILIR Program that will contribute to the future warfighting capabilities for the U.S. Navy.

### PIONEERING THE FIELD OF PENTADIENYL CHEMISTRY

By Michelle Campbell, Contractor for Research and Intelligence Department, Technical Communication Office, NAWCWD

Although a relatively new field, pentadienyl chemistry is applicable to a variety of pertinent defense areas: chemical vapor deposition, catalysis, organic synthesis, polymer synthesis, composites, and renewable fuels. Pentadienyl chemistry can also greatly benefit the development of sensors, photovoltaics, supercapacitors, batteries, and a host of other devices.

On 28 June 2011, Dr. Richard Ernst, a pioneer in the field of open pentadienyl organometallic chemistry, shared his up and coming research with Naval Air Warfare Center Weapons Division (NAWCWD), China Lake personnel at a Distinguished Colloquium Speaker Series event.

“Professor Ernst’s body of work began with an ingenious idea that was followed by a comprehensive investigation of virtually every aspect of metal pentadienyl compounds,” said audience member Dr. Ben Harvey (4L4200D), who is currently collaborating with Dr. Ernst. “His research has covered the entire spectrum from fundamental measurements and bonding studies to applications in organic synthesis and catalysis. Along the way, his work has had a broad impact and has been mentioned in several textbooks.”

“Metal pentadienyl chemistry, when coupled with transition metals, is the type of research on the frontiers of science,” explained audience member John Stenger-Smith (4L4200D). “I think this type of research lends itself well to many basic material research areas.”

One specific benefit of open pentadienyl organometallic chemistry is that in contrast to conventional cyclopentadienyl based organometallic compounds, the open and edge-bridged pentadienyl ligands have been shown to be both more strongly bound to the metal center as well as more reactive. This key difference has opened up an impressive array of applications.



*Dr. Richard Ernst*

Source: NAWCWD Technical Communication Office

“We [the defense community] will always need new materials for electronics, coatings, and sensors,” said Stenger-Smith. “Dr. Ernst’s research is exactly in this area.”

“In my opinion, Professor Ernst’s most influential contribution to science has been his discovery and elegant description of carbon-carbon to metal agostic interactions, which have revolutionized the mechanistic understanding of a variety of catalytic processes,” said Dr. Harvey. “An important example is the olefin metathesis reaction, which was the basis for the 2005 Nobel Prize in chemistry. Professor Ernst has also explored the organometallic chemistry of the potent greenhouse gas sulfur hexafluoride. [His] seminal work in this area has resulted in a fundamental shift in the perception of this traditionally unreactive gas and was highlighted in *Science*, one of the most prestigious journals in the world.”

## 2012 EXPANDING YOUR HORIZONS NETWORK MOTIVATES YOUNG WOMEN

By Alicia Blueyes, Operations Research Analyst, Naval Air Warfare Center Weapons Division

Since 2002, the Ridgecrest Women of Math and Science, Inc. have held an annual conference that is part of an international network. Expanding Your Horizons (EYH) is a conference designed to heighten the awareness of 6th, 7th, and 8th grade young women to the importance of adequate math and science preparation.

The EYH Network, (formerly the Math/Science Network) started in 1974 as an informal group of women scientists and educators in the San Francisco Bay Area who were concerned about low female participation in math courses. EYH conferences nurture girls' interest in science and math courses to encourage them to consider careers in Science, Technology, Engineering and Mathematics (STEM). Through participation in hands-on workshops, participants are introduced to applications in math, science, and technology for traditional and non-traditional careers.

The Network is a non-profit membership organization of educators, scientists, mathematicians, parents, community leaders, and government and corporate representatives. The goal is to provide STEM role models and motivate girls to become innovative and creative thinkers to meet our countries future challenges. Over 26,000 girls attend EYH conferences every year. Up to now our local chapter has inspired 1,282 students to engage in a STEM education.

Unique to our local conference is the support we receive from the community. Local businesses



*EYH 2012 "Blast off!" Workshop, Demonstrating Aeronautical Engineering*



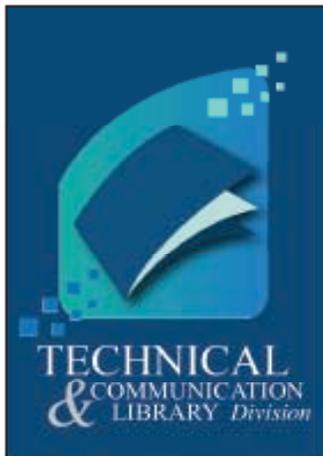
*"Gadget Girls" speakers Bettye Moody and Julie Stoddard demonstrating fuze development using cake batter*



contribute financially as well as provide free publicity for the conference. The Naval Air Warfare Center Weapons Division at China Lake opens its facilities for the conference. Ridgecrest has a high population of female professionals in a variety of STEM careers. We were the only conference in the world to host on a Navy base. Inspired by our model and ideas from past China Lake workshops, other military bases are planning to host their own conferences this coming year.

The Ridgecrest EYH 2012 conference will be held on March 10, 2012 at McLean Laboratory at China Lake. For more information on the local chapter and the national organization please visit our website: <http://ridgecresteyh.org/>.





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