

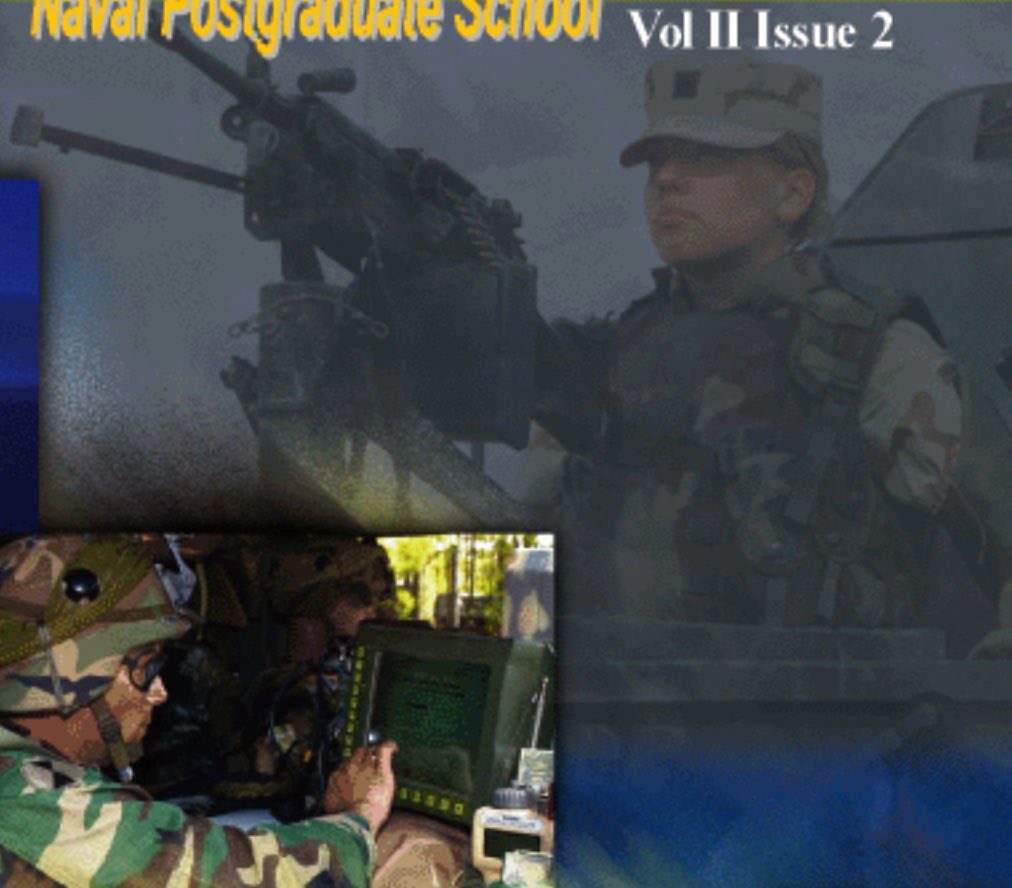
Journal

NPS

Naval Postgraduate School

Spring 2002

Vol II Issue 2



TRANSFORMATION



The Navy's Corporate University

Journal



Naval Postgraduate School

Spring 2002
Vol II, Issue 2

PD21

Navy's PD21 Program



A Revolution In Navy Executive Education



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The editorial content of this magazine is prepared and edited by the Public Affairs Office of the Naval Postgraduate School. It is an authorized publication for members of the military services and their families but its contents do not necessarily reflect the Department of Defense or the U.S. Navy and do not imply endorsement thereof.

NPS Journal is published quarterly by the Naval Postgraduate School, 1 University Circle (Code 004), Monterey, CA 93943. Periodicals postage paid at NPS.

Postmaster: Send address changes to:
NPS Journal, Naval Postgraduate School
Public Affairs Office (Code 004)
1 University Circle, Monterey, CA., 93943.

Editorial Offices: Send submissions and correspondence to:

Naval Postgraduate School Public Affairs Office (Code 004), ATTN: Editor 1 University Circle, Monterey, CA., 93943

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Perspectives in Military Education

by Rear Adm. David Ellison

Much has been said and written over that last couple of years on the value and need for a transformation of the combat capability of the armed forces. Repeatedly, it has been pointed out by both our civilian and military leadership that in order to truly transform the military, we must, as President George W. Bush has said “discard the cold war relic” of doing business and “embrace the productivity revolution that has transformed American business.”

That transformation has required a spirit of innovation that embraces new technology and exploits its advantages in the market place. As President Bush said in a Naval Academy speech on May 25, 2001 “... building a 21st century military will require more than weapons. It will also require a renewed spirit of innovation in our officer corps. We cannot transform our military using old weapons and old

plans. Nor can we do it with an old bureaucratic mindset that frustrates the creativity and entrepreneurship that a 21st century military will need.”

To repeat a common phrase though, you must educate in order to innovate. Education is the key to opening intellectual and conceptual



doors that will lead to success in many areas of concern for the military. Be it logistics support, combat effectiveness or administrative efficiency, they all depend on people who can think through complex problems and have the technical expertise needed in

today's environment to fully exploit all of our asymmetric advantages.

The coming years will tell if we are successful in our innovative efforts toward the transformation of the Armed Forces as mandated by the Department of Defense. True transformation of the Navy and Marine Corps will require intellectual capital to best exploit the technological and efficiency advances that will inevitably be wrought by change.

That will require an officer corps that is well educated, technically competent, managerially adept, and highly motivated. The process which provides the services with men and women possessing these skills and attributes is a critical one, commencing with the recruitment of a cadre of potential officers with the requisite qualifications, then providing them with training and education to instill in them the core values of

service, and developing the key competencies necessary to meet the demands of their careers.

The Naval Postgraduate School is a leading change agent and center of innovation and serves as the corporate university for the Naval services. Additionally, NPS is uniquely positioned to deliver the state-of-the-art technical and non-technical graduate education that the officer corps of both the present and the future will need to effectively transform our services. Through resident and non-resident programs, NPS is setting a framework for a continuum of education for every officer to pursue through his or her career. It is paramount that the Naval Service thinks forward in order to realize the full potential future of the force. This can only be achieved if we invest now in a technically educated and analytical officer corps.

The investment has been reiterated over the almost 100 years of existence of NPS. The impetus to start NPS occurred in 1909 when the Navy realized it had to correct existing deficiencies in technical education amongst the officer corps in the areas of engineering, ordnance and gunnery. Again, in 1944, the Navy conducted a series of formal studies of the education policy within the Department of the Navy and consistently reiterated the principle that graduate education programs have a legitimate role in the professional development of Naval officers.

That education, over a lifetime of service, is the key to innovation. After all, great transformational moments have come when new technology has been matched with new strategy to make great leaps in military advantage. That kind of innovation is the key to transformation. The Director of the Secretary of Defense's Office of Transformation, Vice Adm. Arthur K. Cebrowski, USN, Ret., has stated that "transformation are those continuing processes and activities which create

new sources of power and yield profound increases in military competitive advantage as a result of new, or the discovery of, fundamental shifts in the underlying rule sets."

Those discoveries come from enlightened minds, and that enlightenment can no longer be counted on coming solely from officers developing technical expertise at sea utilizing legacy systems. The rapid shifts in technology in the Information Age are quickly leaving even our brightest young officers behind in their war fighting roles.

Investment in technology is not the complete answer, for technology is useless unless we educate our officer corps not only how to use, but to

"The Naval Postgraduate School is a leading change agent and center of innovation and serves as the corporate university for the Naval services."

**Rear Adm. David Ellison
NPS Superintendent**

exploit the asymmetric advantages that come along with it. This that cannot be done through training alone.

Al Rilling, in his doctorate dissertation on Graduate Education in the United States Navy published in 1972 is prophetic in his definitions of military training and military education. Military Training is defined as a "learning activity of a relatively narrow, technical, and immediately utilitarian nature which is uniformly undertaken by large numbers of individuals and groups."

Whereas Military Education is defined as a "learning activity in recognized fields of academic endeavor, at some level of abstraction, engaged in by individuals in a formal manner, and not necessarily designed for direct and immediate utility. As compared to training, education is intended to prepare individuals to cope with situations and problems rather than specific tasks or objectives."

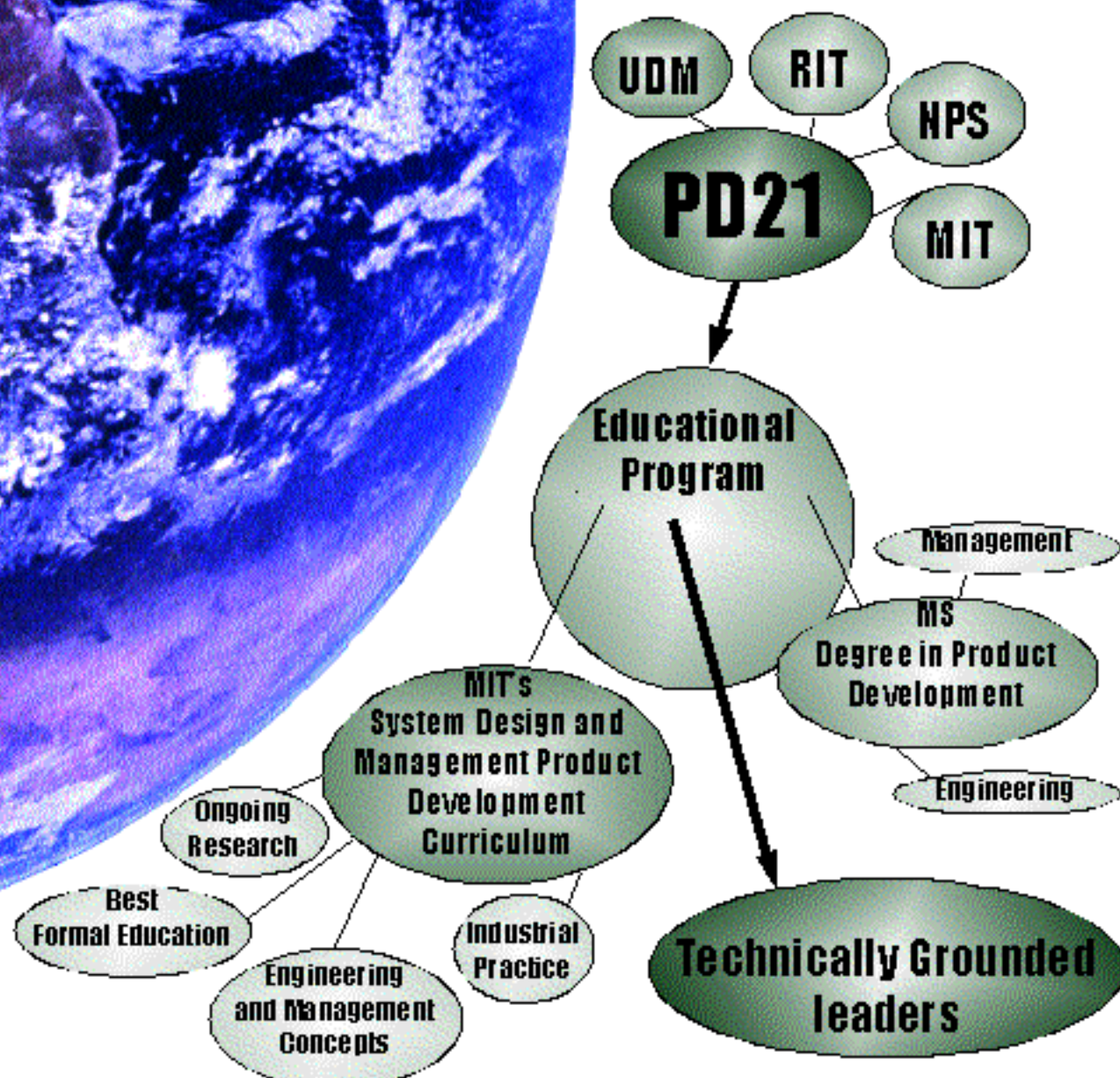
Properly educated, the officer corps of the future will be better decision makers, more creative innovators, and more enlightened leaders. To get there we must get past cultural impediments and realize the value of education and the potential benefits that it offers.

The best reflection of that is to look at successes now. Challenge Athena, the satellite-based communications and imagery system commonly used on aircraft carriers and larger ships, started out as an NPS student-led thesis project.

Other pioneering work from NPS has come from our Total Ship Systems Engineering team of professors and students that designed a revolutionary sea-based tactical ship system able to have a near-continuous presence in the littorals. Computer network security has been enhanced; and space-based acquisition, tracking and pointing has been theoretically realized in the laboratory. Other NPS initiated research includes thermo acoustic refrigeration, virtual reality simulations for training, prototype electromagnetic rail gun and a free electron laser.

Secretary of Defense Donald Rumsfeld has stated "... we must transform not only our armed forces, but also the Department that serves them by encouraging a culture of creativity and intelligent risk taking. We must promote a more entrepreneurial approach to developing military capabilities, one that encourages people, all people, to be proactive and not reactive."

These are the same bedrock principles upon which NPS was founded in 1909. They have not changed through time. NPS remains committed to providing a graduate education that is second to none in military relevance, is uniquely tailored to the demands of the war-fighters, is flexible enough to adapt to change quickly, and can be delivered throughout an officer's career.



Navy's PD21 Program Update

The Educational Consortium For Product Development Leadership In The 21st Century

by Wally Owen

A Memorandum of Agreement was signed on May 17, 2000 between the Massachusetts Institute of Technology (MIT), University of Detroit Mercy (UDM), Rochester Institute of Technology (RIT), and the Naval Postgraduate School (NPS) concerning the Educational Consortium for Product Development Leadership in the 21st Century. The founding university members are MIT, RIT and UDM; the fourth university member is NPS. The four institutions have formed an association known as the PD-21 Consortium.

Effective and efficient product development is the new global competitive battleground. Companies that deliver

quality products that fully meet customer requirements rapidly and more efficiently than their competitors are winning the global economic battle. The Consortium believes that the key to strengthening America's competitive position in the global economy and sustaining its economic growth and quality of life is the country's ability to improve its product development capability faster than other nations are improving theirs. This, the Consortium believes, will enable American companies to achieve the highest levels of customer satisfaction and product value and ensure long-term vitality and profitability. To do this, there is a need for technically

grounded leaders – individuals with the special blend of engineering and management skills, understanding of markets and consumer behavior, the experience and the integrated perspective needed to conceive and create today's increasingly complex products. The nation needs a cadre of such leaders, who can rapidly and effectively disseminate and deploy best-in-class product development methods, tools, and practices throughout American industry.

Building on the efforts of the Center for Innovation in Product Development and the System Design and Management Program (SDM) at the Massachusetts Institute of Technology, MIT, RIT, UDM and NPS have allied with industry to create the educational foundation that technical leaders will need to meet the challenges of the next century. The Consortium believes that underlying any product development system are universal codifiable, and teachable principles. Working closely with industry, PD21 will develop a consistent education program based on MIT's SDM Product Development curriculum as a platform. This program blends engineering and management concepts, integrates the best formal education, ongoing research, and industrial practice, and educates the engineering professional, who will take a leadership role in bringing new products to market. Universities in the PD21 consortium will confer a master's degree in the area of product development. This will be a joint degree in engineering and management. The proposed master's degree program will help experienced technical professionals move into product development leadership and management positions.

For such a master's degree program to have significant impact on the American workforce, it must be deployed in many universities across the nation. The Consortium believes each institution offering such a degree must share a common vision, definition of contents, and language. This type of collaborative effort presents a challenge but the Consortium proposes to develop a model of collaboration between not only the schools of engineering and business at each university, but also among the three founding universities, NPS, and participating companies. A successful model of collaboration would ensure that similar concepts and material are taught at all four institutions.

The NPS PD21 program delivers a Master of Science in Product Development with four primary elective tracks

(Acquisition, Systems Engineering, Software Engineering or Information Systems). All Navy PD21 students who complete the Master of Science in Product Development (MPD) program also receive Defense Acquisition University (DAU) equivalency for Systems Planning, Research, Development and Engineering (SPRDE) level III training requirements and PD21 students taking the acquisition elective track also get DAU equivalency for Program Management level III training requirements.

In the long run, the ultimate, sustainable competitive advantage for any company or industry is to have a rate of learning that is faster than its competitors. A world-class master's degree in product development is an important component in obtaining this advantage. Individually, the members of PD21 could develop isolated master's programs in product development leadership, but the ability to scale these programs to a national level would be limited. The PD21 Consortium represents a new synergy of universities, private corporations, and public agencies that will leverage innovation in both research and education to build a community of change agents to help transform American industry.

“We fully expect that the graduates of PD21 will soon become significant leaders.”

**Vice Adm. Pete Nanos, USN
Commander, Naval Sea Systems
Command**

Testimonials focus on the need to transform the Navy

1. PD21 program certified by Secretary of the Navy to Congress allowing contractor civilian participation,

“Our progress in privatizing acquisition has resulted in the migration of many activities once performed by Navy uniformed or civilian personnel to the private sector. It makes sense for Navy personnel and defense industry civilians to participate shoulder to shoulder in graduate studies focusing on improving Navy research, development, and acquisition cost, schedule, and performance. Such a program will greatly enhance the educational experience of both sets of students and will strengthen partnerships between the private and public sectors which is a critical element in our efforts to transform the Navy and Marine Corps acquisition and procurement process.” (Letter to Chairman, Committee on Armed Services, March 9, 2001)

2. Recognized in Business 2.0, (December 2001) as one of the top, “Straight-to-the-Point Executive Education Courses” see <http://www.business2.com/articles/mag/0,1640,35099,FF.html>.

NAVY'S PD21 PROGRAM UPDATE

3. Letter to the President of MIT by the Honorable Mr. Hultin, Undersecretary of the Navy, (May 17, 2000), "PD21 is aligned with our efforts to transform the Navy and Marine Corps acquisition and procurement process. This initiative fits nicely with our broader campaign entitled Revolution in Business Affairs (RBA), a strategic change initiative aimed at dramatically improving the way we acquire, deliver, maintain, deploy and operate the business side of our national defense institution. We fully expect that the graduates of PD21 will soon become significant leaders and change agents in our Revolution in Business Affairs and help reduce the acquisition life cycles and development times for new defense systems by a factor of two or more."

4. Comments from Commander, Naval Sea Systems Command, Vice Adm. Nanos, USN (May, 2000), at a meeting with the Undersecretary of the Navy,

"I intend to use this program as a major means to

identify and begin to develop those employees in warfare centers who will assume major acquisition responsibilities in the Headquarters and PEO organizations as well as the Centers in the future."

The Navy's PD21 Master of Science in Product Development (MPD) degree program is designed to produce a cadre of change agents skilled in engineering and management to bring about dramatic improvements in the way American corporations and the Defense industry develop and build new systems and products. The next class begins September 16, 2002 with a two-week kickoff and orientation in Monterey, California.

Applications are now being accepted by the MPD program office. For more information about PD21 and the MPD degree visit <http://oc1.nps.navy.mil/pd21> or contact Prof. Wally Owen, PD21 program manager and MPD academic associate at (636) 925-2982 or email inquiries to mpd@nps.navy.mil.

"PD21 will develop a consistent education program based on MIT's SDM Product Development curriculum as a platform".

**Vice Adm. Pete Nanos, USN
Commander, Naval Sea Systems Command
(May 2000)**

New Aviation Officer Graduate Education Program Offered

by JOC(SW/AW) Steve Hendrickson,
Navy Personnel Command Public Affairs

A new graduate education program aimed at the enrichment of Naval aviation and the professional growth and development of aviation officers is targeted for roll-out at Naval Air Station's Lemoore and Whiting Field beginning July 2002 and September 2002 respectively. Chief of Naval Operations (N78/79), Commander Naval Air Forces, Naval Postgraduate School, Commander Naval Education and Training, and Commander Naval Personnel Command are working together to provide this unique opportunity to those aviation officers who meet the entrance criteria.

This partnership allows NPS to develop, implement and offer an Executive Master of Business Administration program that brings the classroom to the audience. The EMBA course consists of a 24-month long curriculum, resulting in a financial management degree. Prior to

beginning the course, the student must attend a one-week, no cost (to their command) TAD introductory course at NPS. Most of the program will be conducted on Navy time vice the student's "time off" and will be at no expense to the student.

The combination of web-based, classroom instruction will establish a new model for future education initiatives and will be administered on two Fridays of each month with an occasional requirement for Saturday instruction. Obligated service is a part of the complete degree program (DOD Graduate Education policy GREEMAIN applies) and will be served concurrent with any existing obligation. This obligation will begin one year after program enrollment rather than upon degree completion.



A REVOLUTION IN NAVY EXECUTIVE EDUCATION

by Professor Val Moulé, Deputy Director for Operations, Center for Executive Education

It's Time!

Private industry has long recognized the value in providing professional development opportunities for its executives, including presidents and CEOs. The rate of change is so rapid that it has become critical that high-level decision makers stay current with emerging technologies and best practices and policies in order to

succeed. Personal and professional development maximizes the ability of leaders to successfully move their organizations forward to meet their vision, mission and goals. The Navy is a very large, complex organization with a wide range of business and operational requirements. Flag officers and SES civilians face an ever increasing challenge to steer the right course.

In the past, executive professional development for Navy senior leaders was not considered to be essential. It was often assumed that their experience, past education and training, and demonstrated career success was sufficient to prepare them for their new, more far-reaching roles. Their intensely busy schedules also served as an obstacle to finding time for them to break away and learn

new things.

More recently, as technology has been advancing at warp speed, changing the way we live and do business, the Navy realized the need for continued, relevant professional development for its top-level leaders. The Center for Executive Education at the Naval Postgraduate School has been a driving force in filling this need, offering compelling courses such as *Leading Change in the Information Age* and *Revolution in Business Practices*.

NPS Launches All-Navy Visionary-Ideas Incubator, Invites Active Student Participation

by Barbara Honegger

Finally there's a place to send that envelope-busting idea you've been wondering what to do with because it's so out there.

On April 2, NPS Center for Executive Education Director Barry Frew and CEE researcher D. Carney launched an all-Navy new-ideas incubator program called "Outliers" to help visionary thinkers up and down the chain of command hone their revolutionary visions for re-inventing the Navy and bridge them into mainstream publications.

"We want the controversial, even heretical, ideas for military change that aren't easily incorporated into traditional military – sanctioned briefs or publications, to get them into the consciousness of the Navy and mainstream America," Frew said. "We're going to work in faculty advisor-editorial teams with the Navy's as-yet-undiscovered geniuses to help them develop their ideas, get them published, and start the dialogue to get them taken seriously."

A statistical term for out-of-pattern data points on the far ends of the Bell Curve normally thrown out of an analysis, "Outliers" is open to the entire Navy community – active duty Navy and Marine Corps and DoN civilians – as well as graduates of CEE's "Thirty Something" group.

"The NPS Center for Executive Education is already the awareness, practice, and comfort zone boundary expander for Navy flag officers and SES's," Frew noted, "so it was the obvious 'home' to do this, it's desperately needed. There is absolutely no other path to bring these items to the leadership table."

According to Carney, "Outliers" topics are wide open "from the broadest vision of the mission, organization, function, culture and even purpose of the military down to the smallest detail even of galley etiquette and everything in between."

To start the process, all you need is a one- or two-page idea summary. Begin by reading the Outliers web page, at <http://www.cce.nps.navy.mil/NewSite/outliers/index.html>, follow the Proposal Guidelines, and then submit your idea summary by e-mail to dcarney@nps.navy.mil.

The Outliers' Advisory Board will screen the proposals and invite authors of submissions selected for potential development to meet with an Advisory Committee to flesh out their concept and answer questions. Once a proposal has been accepted for full development, an advisory team of NPS faculty experts, writers and editors will work with the author on a plan and timeline for his or her article's progress. The goal is to place professional-quality article in credible, mainstream publications like The Washington Post, New York Times, Naval Institute Proceedings, The Futurist, Time, and Newsweek. Each published article will bear the NPS Center for Executive Education logo and a note about "Outliers."



A REVOLUTION IN NAVY EXECUTIVE EDUCATION

CEE Leads the Way

CEE Director Barry Frew created the center in 1998 and began by forming ties with private industry, academia and other institutions to share their stories and ideas with Navy and DoD senior executive course participants in an innovative, unforgettable way. Readings, exercises and brainstorming idea generating sessions enhanced the experience that helped participants break into a fresh new way of thinking. The RBP became the CEE's flagship course and is well known for its success in achieving the CEE's mission to: "...help senior DoN, DoD executives to better understand emerging strategic and policy issues and practices in conjunction with the opportunities and constraints within their organizational setting."

The RBP quickly attracted an impressive list of guest speakers, including John Chambers, president and CEO of Cisco Systems, Eric Schmidt, chairman and CEO of Novell and Google.com; and Scott McNealy, chairman, co-founder and CEO of Sun Microsystems. Participants visited several forward-moving companies such as CISCO, Sun, IBM, Hewlett-Packard, Franklin Templeton Investments, and 3Com to see their environment first hand and get a feel for the heart beat and business cycle of innovation and change.

Presenters were called from academia as well, including many professors. Influential readings and team building exercises, from rock climbing to hikes at Big Sur were all part of the program.

More details about the RBP and about the Center for Executive Education can be found at <http://www.cee.navy.mil>

Beyond RBP: The Flag SES Professional Development Program

Over time, it became clear that Navy senior executive education programs needed to expand further. New flag officers attend the operationally-oriented Capstone Course, but after that, educational opportunities were

scarce. The RBP provided one opportunity, but the demand for follow-on and variety became evident. As a result, the Flag SES Professional Development Program (previously referred to as "Flag University") was established.

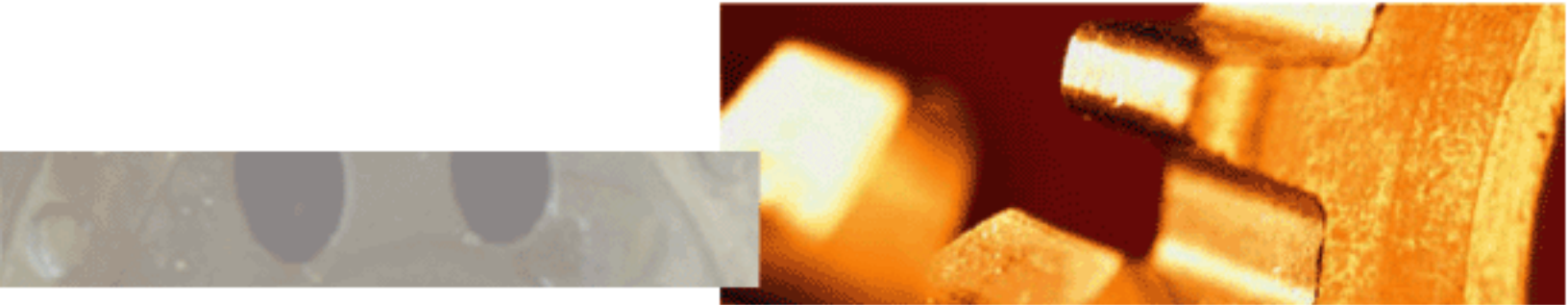
The Chief of Naval Personnel serves as the executive agent for this new program. Reporting to the CNP is the Executive Learning Officer who provides a gateway to professional and career development by coaching, mentoring and advising senior executives, providing information on education and training resources available to match their individual needs, and consulting with education providers and Navy leadership to keep the program relevant and useful. Vice. Adm. (Ret.) Phil Quast, has been active at NPS as a senior lecturer and Boorda chair in transportation

systems in the Graduate School of Business and Public Policy. His office is located at the CEE.

Based on the demonstrated success and popularity of the CEE and other executive education courses, the CEE was selected to play a significant role in the Flag and SES Professional Development Program. Frew, demonstrating his passion for change and customer focus, set the CEE on this new course of expansion to meet the goals of continuous learning throughout flag officer and SES careers. CEE will develop Individual Development Plans to help flag and SES executives manage those opportunities. Based on a corporate model used by Motorola, IBM and GE., Naval executive education is transforming into a multi-dimensional program that is broad and flexible enough to make it easy and useful to customers. Les Berkes, the CEE deputy director for programs is leading the redesign effort with the assistance of the CEE team and resources from NPS, other Navy and outside sources.

Mick McGee, deputy director for assessments for the CEE, is making available a variety of tools to assess leadership, operational, and executive business and personal skills to help guide Navy senior executives in creating their own. Once strengths and weaknesses are

"The Enclave will be a place to live, eat, discuss, debate, and expose students to innovative ideas and practices"



identified, the CEE will make available opportunities to help them learn and grow to include a wide range of courses with different delivery methods such as e-learning, resident and non-resident courses (lectures and seminars), individual or self-study courses and coaching. The CEE coordinates high-quality non-resident programs such as Harvard, Syracuse, Wharton, Center for Creative Leadership (CCL), Mercer-Delta and others. Jodie Dodge, the CEE registrar, is currently registering candidates for the CCL Leadership Development Course and will soon be adding many others to the list.

A key notion of this effort is that education and training courses do not come in a one size fits all approach. Instead, they are offered in tiered packages that address the specific needs. Tier One addresses new flag officers and SESs (O-7 and equivalent). Tier Two addresses O-8 and equivalent and Tier Three addresses O-9, O-10 and equivalent.

Lt. Cdr. Brian Koman, the CEE technical director, is working on projects to bring cutting edge technology projects to greatly enhance the learning environment, to include video teleconferencing, decision support collaboration technologies, distance learning, smart card virtual connectivity and other projects. Both he and Lt. Warren Yu develop and maintain the CEE Web-site and related projects.

Revolution of a Revolution (Revolution2) Where Did the RBP Go?

The CEE's flagship course for the Navy, Revolution in Business Practices was conducted for the thirteenth and final time in Feb. 2002. Although it was hailed as another huge success, the center is transforming the course to take on a new shape. This does not mean that its unique, provocative and informative delivery that focused on change and innovation have gone away. The need for this message and approach will continue to be a critical, powerful piece of resident CEE learning. The first session of this new course was held June 2-14. Current planning includes a mix of course content in business subjects as well as change, creativity and innovation, all enhanced by exciting guest speakers and

industry visits.

CEE Monterey course offerings will not be limited to one course. Current courses such as the acclaimed "30-Something" (see <http://www.cee.navy.mil>) and other innovative approaches that support executive education will continue and new ones will be developed as the demand from IDPs increase.

All of these courses demand a high level of event coordination, logistics and administrative support and the CEE has a reputation of excellence in this department. Marilyn Schneider, Michelle Belcher, Marti Brooks, Lane Fabby, and student aides Irene Ng-Burson and Beth McCaffery work tirelessly to ensure customer expectations are exceeded to new dimensions. This group is led by Val Moulé.

A Whole New World at Monterey - The Summer of 02:

Not only will the courses look different, the environment will soon change. In the Summer the CEE will physically move into "The Enclave," comprised of some of the cottages now serving as senior officer housing between Herrmann and Root Hall, as described in "About the Enclave" on the CEE Website: www.cee.nps.navy.mil.

The Enclave will be a place to live, eat, discuss, debate, and expose students to innovative ideas and practices. Additionally, it will be used as an idea sanctuary for attendees to embrace leading technologies that embody a user friendly, hi-tech, intuitive working environment.

The Enclave will serve to strengthen the learning and networking experience by bringing people together in a learning fostering environment as well as providing hands on new technologies that they may then bring into the fleet.

The Future is Now:

Anyone familiar with the CEE knows that "change" is a word in their dictionary and it is most definitely an action verb. A lot of brainstorming, planning, testing and implementation is underway at a rapid pace. News, to include new programs will be advertised on the CEE website.

Transformational ChrAVE-ings

by Margeret Davis

The word “transformation” is all the buzz in Pentagon conference rooms, “so popular in defense policy circles,” as Wolfowitz observed in his Feb. 22, 2002 remarks at NPS, “that at times it almost seems to have lost its meaning.”

Nevertheless, the concept emerges grimly ascendant after Sept. 11. Suddenly, evolutionary improvements in weapons and tools, however rapid, are not enough. Never mind the hundredth iteration in the refinement of the widget. This is the hour of the different drummer. “We need smart people,” said Wolfowitz, “who can think about old things in new ways that make sense.” Wolfowitz’s most prominent example of transformational thinking is a special forces captain in Afghanistan who directed air strikes via satellite from horseback. This synthesis of wild west and Wired Magazine John Wayne meets Jeff Goldblum typifies the resourcefulness and technological moxie the Pentagon

covets today.

Here at NPS, Marine Corps Maj. Mark Lennerton has also been taking two plus two and making 10. For his thesis work in 3D simulators at the MOVES Institute (Modeling, Virtual Environments and Simulation), Lennerton has reconceived the flight-training simulator, transforming this well worn idea through a combination of experimental technology, applied psychology, and vintage Hollywood.

Flight simulators began some forty years ago as a great idea that went pretty much straight to production without thoughtful preliminaries. “We just presumed simulators would work,” said Lennerton. “We never took the time to examine what aspects of flying could and couldn’t be – or even shouldn’t be – trained through simulations, and just went with the assumption that the greater the fidelity to an actual aircraft, the better.”

“Bravery is still part of it all, but bravery with modern communications at its disposal.”

**Paul Wolfowitz
Deputy Secretary of Defense**

MOVES Takes Steps Towards Training, Simulation

Prof. Rudy Darken, MOVES director of human-performance engineering and Lennerton’s thesis advisor, describes the ChrAVE project as part of a larger development in training and simulation.

“We’re changing the whole field by adding a step one and step three to the development process.” Step one is research into the psychology and potential of training via simulators. Step two-hitherto the only step-has been building the machine. Step three is verification of results.

In contrast with the traditional engineering mindset that sees the final product in terms of new and improved equipment, Darken defines a well-trained aviator as the goal.

“Ultimately it doesn’t matter what form the box takes or how realistic the gear; if a magic wand could get results, great. What

is crucial is to ascertain what the mind and body specifically require to perform a given task, and to simulate those elements effectively. This is where human-performance and training studies come in.”

“We’re interested in concepts, in bringing a rigorous process to simulation. Without a bias towards any particular product or approach, we can focus on asking fundamental questions and developing methodologies for analyzing results.”

This independent stance is extremely valuable to decision-makers in search of the bottom line. “Sharp guys out there are bewildered by all the competing claims and marketing hype. They turn to us for a scientific, disinterested rationale as a basis for purchasing. I anticipate MOVES serving that role increasingly in the future.”

Yet flight simulators have always been more or less disappointing. "Simulators are fine for some functions, like learning instrument flight procedures," said Lennerton, a CH-53D helicopter pilot. "But I haven't met a simulator yet I liked for terrain navigation."

Navigation and orientation (knowing what's above and below) and one's whereabouts on the map is the fulcrum of any successful mission and typically represent the pilot's greatest challenge. Yet simulators have not been able to offer what pilots need most and real life can't provide: navigational practice over enemy terrain. "You can't practice where the bad guys are," as Lennerton wryly noted.

"You have a keen-edged squadron that has been practicing missions over home ground. You stick them and their helos in a Navy ship for a week or two, unload them on enemy shores, send them up for their first look at the terrain under conditions of war. It's been God speed, God bless, goodbye."

Naturally, a pilot prepares as best he can by studying maps and photos but reading a flat, two-dimensional rendering and translating it to three-dimensional space is an imaginative leap fraught with subjectivity and approximation.

Lennerton posited that by returning without prejudice to the original problem of building a flight simulator by finding a new answer using virtual environment technologies - an answer that would include training over any terrain, offering an experience as lifelike as a walk in the park. For his master's thesis, he took on the job.

Lennerton identified poor visuals as the biggest shortcoming of conventional flight simulators, which, at best, offer a big screen or couple of computer monitors to contain the simulated field of vision. However, this limitation creates problems. With the eyes locked in place, natural motor skills quickly atrophy. The pilot abandons the casual, habitual movements that tell the mind what's happening, such as craning around for a view behind or rocking the head slightly to create the parallax that yields depth perception. Instead, he learns to fly as though head and torso were in a vise--overwriting and degrading his real-world skills. Moreover, in such a patently false situation, the pilot

never believes he's in any actual danger, and grows sloppy and overconfident in navigation, communications and coping skills.

To create a world that looks and feels like reality, Lennerton went Hollywood. Borrowing the familiar chroma key "blue-screen" technique by which a TV weather forecaster appears against a swirling weather map, he designed a chroma key augmented virtual environment, or ChrAVE. The ChrAVE consists of a simplified generic helicopter cockpit with pilot's seat, basic controls (collective, cyclic, rudder pedals), and a computer monitor that, switched on, becomes the instrument panel.

The cockpit's walls and window frames are built of black cloth and PVC pipe, which obstruct

the view and require the pilot to find

good vantages, as in real life. In front of the cockpit is a floor-to-ceiling swath of chroma key blue canvas, wrapping to the right from about 11 o'clock to 6 o'clock. In the simulation, this blue field carries images representing the viewing responsibilities of the right-side pilot in a two-person crew.

The pilot takes a seat and dons a helmet-like apparatus known as a head-mounted display or HMD.

The HMD bristles with gadgetry. First, as the name implies, it contains two small computer monitors, mounted in front like a pair of binoculars. The pilot looks through these at all times. An inch above the monitors is a video camera that captures the pilot's view inside the cockpit--the ordinary, actually-present elements the pilot needs to orient himself and carry on navigation: his hands and body, maps, pens, instrument panel, the cockpit's walls and frames.

Atop the HMD, facing upward, are two dime-sized sensors that talk to an inertial-motion tracker overhead. The tracker, a crossbars with microphones at each tip, pulses infrared light to the HMD sensors below, which respond with ultrasonic chirps. The microphones pick up these sounds and send them to a Windows PC, which in turn, identifies where the pilot is looking by calculating the lag between pulses and chirps as the pilot moves his head--analogous to a bat's echolocation, but distortion-



Transformational ChrAVE-ings

free. This coordinate information is key to the simulator's performance.

With cockpit, blue-screen, HMD, tracker, and pilot, the players are in place. Add a bank of satellite-captured images (textured onto terrain geometry), cue the ambient din of chopper blade and radio-squawk, switch on the digital mixer, and the show begins.

If you were to watch someone using the simulator, you'd see someone wearing headgear sitting in a pretend cockpit hung about with canvas. He's looking all over: now down at his map, now scrutinizing the blank, blue canvas, eyes roving. He's pointing at invisible things on the cloth in answer to Lennerton's questions. He's active, tense, immersed in what he's doing.

He appears to be seeing things. Step around to Lennerton's triplex of monitors, which show what the pilot's perceiving through his HMD, and you'll understand what's up. On every bit of chroma key-blue field-and only on the chromakey field-the computer has patched contiguous terrain images, creating the illusion of a seamless panorama. Whenever the pilot moves his head, even slightly, the landscape moves with him in tight correlation. When he looks up, he sees sky. When he looks down, he sees the ground through the "chin bubble" at his feet. Because only the blue canvas is painted with terrain, the cockpit environment is also plainly visible (thanks to the contributions of the HMD's video camera).

What the pilot is seeing is himself in a helicopter, flying over a terrain through which he is being asked to chart a course. The visual logic of the scene tricks him into believing in the flight at a visceral level. Now, the transformational benefits roll in.

"We can teach navigation as it really happens, with the pilot looking around constantly, folding and marking maps while coping with flight gloves and a heavy headset," Lennerton explained. "We add huge dividends by cranking up the stress--speeding things up, introducing fog, mechanical failures, night, teaching him to maintain procedures that tend to go by the wayside under anxiety. And obviously, we're giving him experiential knowledge of enemy terrain, which may well save his skin."

Stress, fog and failures are difficult to plan for and costly to train in real life, whether in time, budgets, maintenance or personnel. "You could network a whole squadron to one central computer system. An obvious practical use would be embedded training aboard ship on the way to a mission. Rather than let their skills rust, pilots go down to the hold and get in their own helos to practice flying what they're going to see on shore."

That's not necessarily so in isolation. Lennerton's system can be expanded to allow multiple users to share the same virtual reality, seeing and communicating with each other as if they were all physically together in the air. With genuine helicopters to

practice in rather than a ChrAVE, equipment requirements would be minimal--mainly individual motion trackers, HMDs, and blue-screens (each cut to fit a helo canopy like a tea cozy).

"You have to train the way you fight," said Lennerton, "because the corollary is, you'll fight the way you trained. I want naval aviators who are on the pointy end of the spear to fight smart and win because they have the advantage of knowing where they are and what's around the corner."

The project is still in its infancy. "Who knows where it may evolve? This doesn't apply just to helos, but tanks, AAVs, any combat vehicle," says Lennerton. He expects to see ChrAVEs in general use within twelve to fourteen years.

Mike Zyda, director of the MOVES Institute, disagrees. "This is going to transform flight simulation. We'll see it in five years max."

Major Lennerton has flown helicopters for the Marines since 1991. He earned his master's degree in April, 2002: The ChrAVE project is sponsored by the Office of Naval Research's as part of the VIRTE (virtual training and environments) program.



Research and Education

THE CROSSBOW PROJECT



Total Ship Systems Engineering

Naval Postgraduate School students from across campus and from a variety of curricula recently completed a year-long study and assessment of small, fast, surface combatants operating in large groups that are capable of distributed combat operations. The study effort required a level of interdisciplinary and interdepartmental collaboration not previously attempted at NPS. The final product is a concept called CROSSBOW, and is a strong demonstration that NPS has the ability to conduct large-scale investigations of relevant Navy issues.

The Project

The CROSSBOW project originated with the president of the Naval War College, who proposed studies to determine the technical feasibility and operational worth of CORSAIR, a small high-speed aircraft carrier concept. The central intent was to investigate the extent to which new technology and changing strategic environment warrant rethinking the relative merits of dispersion versus concentration and attendant economies of scale.

NPS elements contributing to the project are presented in Figure 1. The second cohort of students enrolled in the Systems Engineering and Integration (SEI) curriculum were assigned CROSSBOW as their integration

project. Students in the Total Ship Systems Engineering (TSSE) Capstone Ship Design Courses constituted the ship design team. The Capstone Aircraft Design Courses provided the air vehicle design team. Students from the Graduate School of Business and Public Policy produced a thesis on requirements and cost of CROSSBOW logistics and maintenance. A contributing thesis explored free electron lasers as “electric warship” weapons. In addition, the Operations Research Department tailored an existing campaign analysis course for the express purpose of evaluating a notional CROSSBOW force in scenarios representing the full spectrum of conflict. Also, the project benefited greatly from expertise and advice provided by the Electrical and Computer Engineering Department, as well as the Meteorology and Oceanography Department (MOD).

Allied officers also made significant contributions to the CROSSBOW effort. Eight of the fifteen SEI students were combat officers from the Singapore Armed Forces. The 11 members of the ship design team included two naval officers from Turkey, one Ministry of Defense civilian from Singapore and one naval officer from Greece. Finally, senior naval leadership Navy and government laboratories, and industry visitors provided valuable insights.

The Concept

The NPS students chose to pursue a high-speed ship design that supports an air wing composed primarily of Unmanned Air Vehicles (UAVs). CROSSBOW combines a SEA LANCE (or “street fighter”) variant (SEA LANCE II) with SEA ARCHER (a small, high-speed UAV Tactical Support Ship), and SEA QUIVER (a notional high-speed support ship). The SEA ARCHER air wing comprises eight multi-mission SEA ARROWS, Unmanned Combat Air Vehicles (UCAVs), eight multi-mission support UAVs, and 2 MH-60 multi-mission helicopters.

Assessment

CROSSBOW was assessed for its capability to perform a wide variety of military missions. The students assessed the CROSSBOW force as being highly capable as a complement to Carrier Battle Groups (CVBGs) in performing operations in the littorals in high-intensity combat scenarios, and a supplement to CVBGs providing sea-based forward presence in low to medium threat environments. The students concluded: “CROSSBOW provides the stunning jab while the CVBG delivers the knockout punch.”

In addition, the project considered cost, advantages of distributed combat capability, and technical feasibility.

(Continued on page 16)

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Army National Guard
Maj. Kalman Terek, Hungarian Army
Cmdr. Michael Kweku Addison
Ghana Navy
Maj. Igor G. Bulgakov
Ukrainian Armed Forces
Lt. Col. Othman Bin Abdullah
Royal Malaysian Air Force
Mr. Harry Lahtein
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Lt. Tony Jay Stockton

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Lt. Mark S. Scorgie
Lt. Victor L. Spears III

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Swiss Air Force
Ens. Kacha Jitpanya, Royal Thai Navy
Lt. Konstantinos Kamaras
Hellenic Navy
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Capt. Scott E. Vasquez
U.S. Marine Corps
Capt. Michael B. Williams
U.S. Marine Corps
Capt. Mark W. Zipsie
U.S. Marine Corps

i- Denotes students who are presented
in absentia

u- Denoted students who completed
their Joint Professional
Military Education

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Research and Education

THE CROSSBOW PROJECT

Estimates of the costs to acquire, operate, and support a CROSSBOW force of 32 ships and 144 aircraft appear reasonable: about \$11.3 Billion (constant Fiscal Year 2002 dollars) for acquisition and \$410 Million per year in Operations and Support. The project also discovered significant benefits from distributed combat forces. These included a more diffuse center of gravity, which complicates enemy attacks on the force. Because of their relatively small size, SEA ARCHER and SEA LANCE II are “combat consumables,” in that loss of one vessel does not constitute a catastrophic loss of overall combat capability. In addition, distributed combat forces have greater ability to mount multi-axis attacks, and therefore pose more difficult problems for an adversary.

While the technology to field CROSSBOW is not fully in hand at present, there is good reason to believe that it could be by 2012. Developing the technology could, in turn, result in a deployable CROSSBOW force in 2020. Studies and assessments of availability (and potential availability) of key technologies were pervasive in all aspects of the project. Technological issues were an integral part of the ship and air vehicle design projects. In addition, SEI students undertook a number of individual supporting studies of various technical issues – including command and control networks, automated ship operations — as well as means to defend against air, submarine and mine threats.

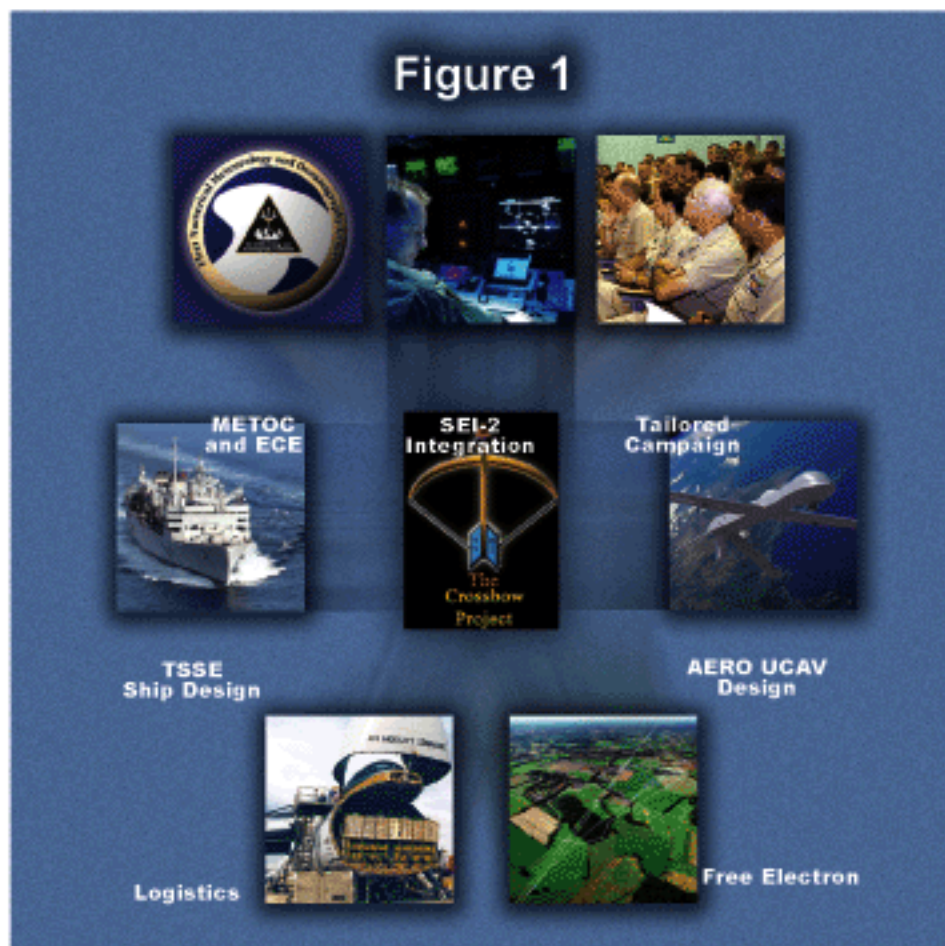
Bottom Line Conclusions

The project members concluded that CROSSBOW is a highly promising concept. It has significant capabilities for a wide variety of naval missions. The CROSSBOW force itself is highly flexible and can be a useful complement to a Carrier Battle Group. The depth of study the CROSSBOW project could undertake does not support an immediate and unqualified endorsement. However, the concept deserves serious consideration. It also warrants further exploration through development of relevant technologies and operational

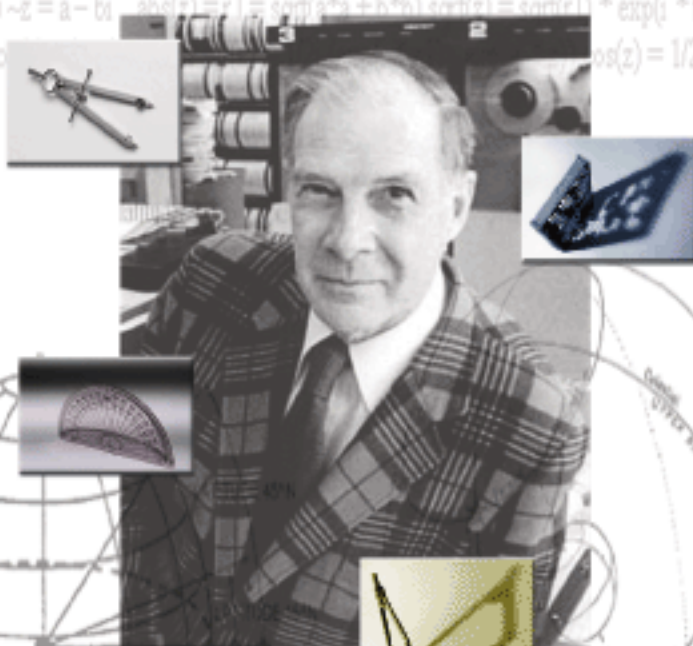
experimentation.

Also, the CROSSBOW project is an excellent example of NPS in its role as the Navy’s Corporate University. NPS students, with faculty guidance and assistance, have undertaken an interdisciplinary, integrated, imaginative, broad gauge research of a topic that is both highly sensitive and very important. The project convincingly demonstrates NPS’ ability to achieve educational excellence while simultaneously undertaking research that’s relevant to the Navy’s future.

Figure 1



Hamming Award Honor goes to NPS' Dean of Research



Shown above is the late NPS Professor, Richard W. Hamming, whose name has become synonymous with "Excellence in Teaching."

by JO2 J. Anthony Reese

NPS Distinguished Prof. David Netzer, associate provost and dean of research received the third Hamming Award in NPS history. This teaching award, recognized in the memory of Naval Postgraduate School professor and retired Bell Labs scientist Richard W. Hamming, was established to complement the Rear Adm. John Jay Schieffelin Award of Excellence in teaching. The Hamming award exists because of a grant given to the NPS Foundation by the late professor's wife, Wanda Hamming.

"Netzer exemplifies the spirit of the Richard Hamming Award by his broad and balanced outlook," said Prof. Chuck Calvano, chair of the Hamming Award selection committee. "Perhaps most importantly is his positive leadership and devotion to the Navy, intelligence, patience, foresight, and wisdom identify him as the epitome of interdisciplinary accomplishment."

"As Dean of Research, he is universally respected for his balanced approach to campus-wide research across many fields and disciplines. His knowledge of

many academic and military disciplines is legendary."

The award also recognizes teachers with superb supervision of graduate students and their thesis. In addition, the award also focuses on the successes of teachers at the graduate school level that encompasses lecturing in the classroom, and providing an atmosphere in which the students can take full advantage.

Calvano said Netzer has become known for his teaching and exhibited depth of knowledge among students and peers alike. His colleagues declare his research as exemplary, notably in aircraft propulsion. Netzer's professionalism in aeronautics is evidenced by his membership on many congressional defense committees.

Netzer joined the NPS Department of Aeronautics and Astronautics in April 1968, and was promoted to professor in 1981. He was awarded the title of Distinguished Professor in 1994.

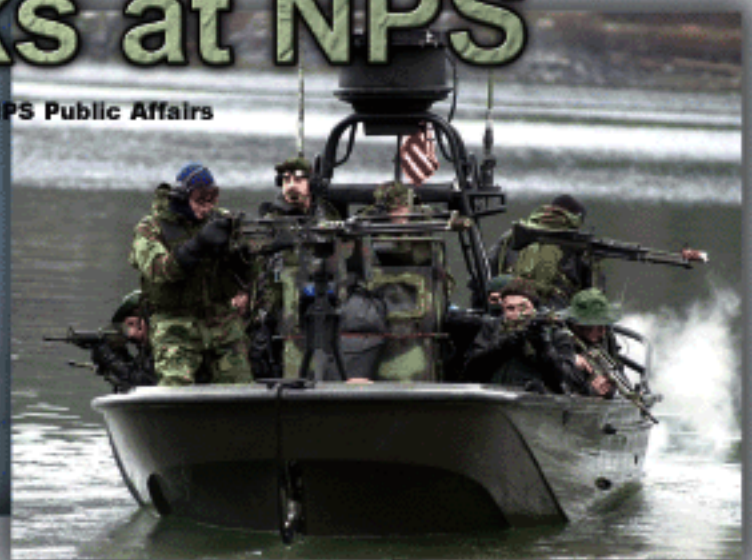
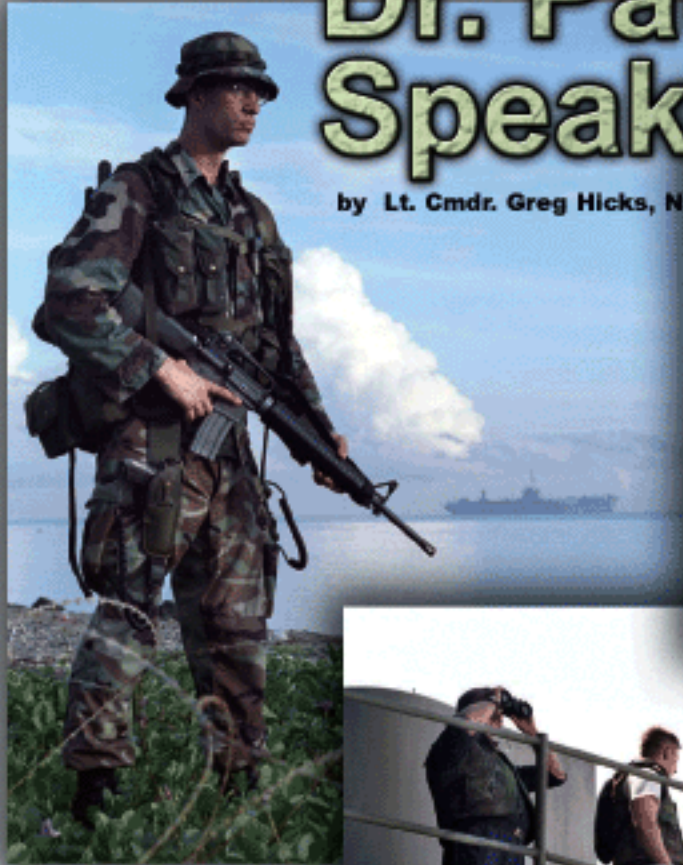
Netzer leads an NPS multi-department research project in unmanned aerial vehicles of many sizes, modes of propulsion, and payloads. This design work is inherently multidisciplinary in nature, said Calvano.

During the past year, his talents were drawn upon in two vital ways, said Calvano. He was responsible for overseeing the establishment of three new NPS research institutes, and was the leader and integrator of the year-long study at NPS called CROSSBOW. It involved at least 10 faculty members and more than 40 students. The project entails the use of unmanned aircraft designs, innovative warship configurations, compatible sensors, complex electronic networks for communications and control, and logistics.

Netzer now oversees research programs totaling more than \$60 million. Calvano said this is the most extensive interdisciplinary work yet done at NPS.

Dr. Paul Wolfowitz Speaks at NPS

by Lt. Cmdr. Greg Hicks, NPS Public Affairs



Addressing his largest wardroom, Deputy Secretary of Defense Paul Wolfowitz told NPS students, faculty and staff at an assembly in King Hall on Feb. 22 that “the key to transformation is people and ideas - the kind of people and ideas that institutions like this one can generate.”

Quoting Secretary Donald Rumsfeld, Wolfowitz added that today’s revolution in technology is about more than the bombs and the bullets, or the dollars and cents it takes to fight the war against terrorism. “It’s about new approaches, new culture, and new mindsets, about new ways of thinking about things,” said Wolfowitz. “We need new capabilities and new investments. We need smart people who can think about old things in new ways that make sense.”

Arriving fresh from Twenty-Nine Palms Marine

Corps Air Ground Combat Center in Southern California, Secretary Wolfowitz commented, “Sept. 11 was the surprise for which we should have been prepared (because) we live in a world of so much greater uncertainty.” He pointed to the Quadrennial Defense Review released by the Department of Defense less than a month after the terrorist attacks. The report concluded that surprise and uncertainty are overarching themes that will guide defense strategy for the next four years and beyond.

Wolfowitz said that uncertainty has forced a shift in defense planning from a “threat-based” approach to a “capabilities-based” approach. “Capabilities-based planning requires taking account of an adversary’s existing potential capabilities and assessing them against our own. It requires thinking about asymmetric threats,

threats aimed at our points of weakness.”

He added that capabilities-based planning takes a careful look at potential weaknesses by evaluating how adversaries might threaten the U.S. and what they might threaten us with, rather than concentrating on who might threaten the U.S.

“We are in one of those periods of history that portends a revolution in military affairs, a revolution based in considerable part on the revolution in technology that is changing so many aspects of non-military life as well,” Wolfowitz said.

An example of that, Wolfowitz pointed out, was the German Army prior to World War II, which transformed only ten percent of their Army yet achieved decisive victory in a relatively short time. The “Blitzkrieg” concept was not about new technology – airplanes, tanks and radio had been around since the last world conflict. The Germans achieved a revolution in military affairs by coupling these technologies together efficiently and effectively, he said.

“Transformation is about using old things in new ways,” added Wolfowitz, citing the use of Special Forces calling in air strikes from horseback and pilots flying UAVs from remote airbases in the conflict in Afghanistan.



Six goals for DoD:

1. Protect our bases of operation, particularly our homeland.
2. Deny our enemies sanctuary by exploiting our capabilities for long-range precision strike.
3. Operate globally, especially in regions where hostile countries attempt to prevent U.S. access.
4. Leverage information technology.
5. Conduct effective information operations both defensive and offensive
6. Maintain unhindered access to space.

Utilizing colorful examples to explain each point, Wolfowitz discussed eight principle concepts that are key to defense transformation. DoD planners must:

- *Engage all elements of national power, not just the military.
- *Lean forward, not backward.
- *Rule out nothing.
- *Avoid personalizing the war against terrorism.
- *Understand that there is a link between terrorism and mass destruction.
- *Recognize that this is a global war with many different theaters requiring multiple coalitions in multiple areas.
- *Exploit the weaknesses of the other side at the same time fully exploiting our own asymmetric advantages.
- *Include humanitarian operations from the beginning of every operation.

Technologies alone will not bring necessary changes in defense capability, Wolfowitz said. DoD needs the talents of trained warriors, like those at NPS, who are capable of grasping transformation principles and exploiting them to their full advantage.



Father of Aegis

Rear Adm. Wayne E. Meyer (Ret.)

Namesake Adorns NPS Newest Institute for System's Engineering

by JO2 J. Anthony Reese

The Naval Postgraduate School and the Surface Navy Association named the NPS new institute for systems engineering after "The Father of Aegis."

The unveiling of the institute took place May 28, in conjunction with the Surface Navy Association's Ninth Annual Symposium West 2002.

"We are honored to dedicate and name the institute after (Rear

Adm. Wayne E.) Meyer and highlight the role that Aegis has pioneered and continues to play in the surface warfare community," said NPS Superintendent Rear Adm. David Ellison. Meyer stood proudly in front of

the NPS Institute of Systems Engineering along with the Commander Naval Surface Forces Pacific Fleet, Vice Adm. Timothy W. LaFleur; Ellison; and Philip Depoy, the first director of the institute.

The theme for the 2002 symposium, "Transformation ... Surface Navy Leading the Way," addressed the acceleration of the Navy's surface forces to continue to provide America with combat capabilities necessary to maintain national security. During the symposium, Surface Warfare Officers discussed the charted course for the surface Navy and what the surface force will look like in the year 2025. In contemplating the surface Navy of the future, the SNA's leaders talked about achieving these goals with the Monterey SNA Chapter, which is the only chapter exclusively run by junior officers.

Most all the officers on the Monterey Chapter board are all pre-department heads, having come to NPS just after finishing their division officer tours. NPS student and Monterey SNA board member Lt. Jonathan Schmitz said the junior officers on the board have plenty of mentorship. For the most part, however, they are given a long leash, and they admittedly take advantage of that.

The Aegis system, which Meyer is credited with helping to pioneer in the Surface Navy, was designed as a total weapon system, from detection to kill. The heart of the system is an advanced, automatic detect and track, multi-function phased-array radar. This high-powered radar is able to perform search, track and missile guidance functions simultaneously with a track capacity of over 100 targets.

The Navy built the first Aegis cruisers using the hull and machinery designs of Spruance-class destroyers. The commissioning of USS Bunker

Hill in 1986 (CG 52) opened a new era in allowing greater missile selection, firepower and survivability. The improved Aegis radar system went to sea in USS Princeton (CG 59), ushering in another advance in Aegis capabilities.

"The Aegis system saved surface warfare," said retired Navy Vice Adm. Phil Quast, president of the West Coast SNA, during his surface community salute to Aegis and keynote address of the institute

"The Aegis system saved surface warfare"

**Vice Adm. Phil Quast (Ret.),
President West Coast SNA**

dedication. LaFleur said Meyer built the fleet we have today. Nearly three decades later from the developmental stage of the program, Aegis is aboard 62 surface ships, and is the foundation for today's new technologies.

"It is very appropriate that we name the new systems institute after him. It will remind all of us, as we look at the future of surface warfare and how to train the surface warriors to come – what it means to be a surface warrior, and to have a systems look at what we do," said LaFleur.

According to Ellison, Surface Warfare Officers must to have an analytical mind, and must look at the systems that the Navy's providing to the fleet, and make sure that they are providing what the Navy needs to do the job.

"Second place is unacceptable." Ellison also addressed the need to increase the education of the Navy's unrestricted line officers in order to

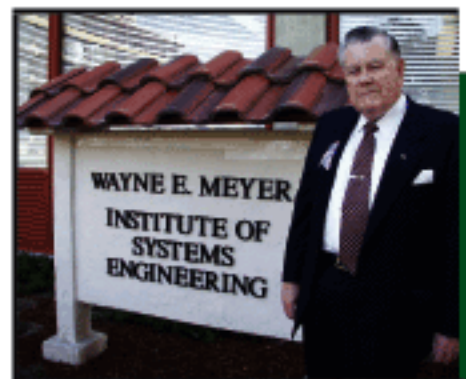
cope with the increasing complexity that is seen in the Navy environment today. The system's complexity is increasing exponentially day by day.

"The thread that runs through all of this is systems, system orientation, integration, interdisciplinary – that's the stream of thought that runs through what we are trying to do here at the postgraduate school," he said.

"Meyer said much of his education came from right here at the Naval Postgraduate School, and it was a very fortuitous education."

Meyer said he would not be where he is today if it were not for the incredible professors and officers who guided him and caused him to study, in particular, fire control.

"I can think of no more fitting a name to adorn our institute than Wayne E. Meyer," said Ellison. A big believer in making people better, Meyer said, "We will all be here spiritually, and occasionally temporally, to ensure you are doing your duty, as was intended to be done by the name that is on the institute's sign. Then you will be an extraordinary credit to your Navy and to your nation."





Navy, Air Force to Jointly Develop Twin-Mirror Laser-Retargeting Satellite Technology

by Barbara Horegger

U.S. global power projection took a giant leap forward June 5 with the dedication of a groundbreaking Navy and Air Force Research Laboratory focused on developing technology for a revolutionary new satellite able to receive and re-target laser beams anywhere on earth. The jointly-sponsored lab at the Naval Postgraduate School is part of a long-term agreement between NPS and the Air Force Research Lab to coordinate research and accelerate the development of new spacecraft.

"Today is the culmination of a ten-year relationship with AFRL and the beginning of many more years of joint research to come," said NPS Superintendent Rear Adm. David R. Ellison before the ribbon cutting. "This project is the epitome of the joint, interdisciplinary research efforts that will drive our nation's future military capabilities, and which none of us could do alone."

In the newly-christened NPS AFRL Optical Relay Spacecraft Laboratory, joint team leaders successfully demonstrated the laser tracking ability of a prototype twin-mirror Bifocal Relay Spacecraft designed to receive "up" beams and refocus them via a "steering" mirror and second main mirror onto targets of choice on the ground. If fielded, a constellation of 27 of the twin-mirror satellites will orbit at 715 kilometers sometime in the next decade.

"Auspicious," "awesome" and "groundbreaking" were some of the comments from assembled officials, faculty, officer students, and journalists who watched in the dark as a ruby red laser instantly homed in on a green pin-point target randomly moving over a map of the world.

"This is breakthrough work towards our goal of instantaneous global power with global reach," said Dr. R. Earl Good, director of AFRL's Directed Energy Directorate at Kirtland Air Force Base, which is co-sponsoring the project. "It gives NPS students the opportunity to do cutting edge research, and it's a wonderful opportunity for us all."

The Bifocal Relay Mirror Spacecraft project, owes its very existence to NPS students.

"This all started as a student spacecraft design project," said Aeronautics and Astronautics Professor Brij Agrawal, director of the NPS Spacecraft Research and Design Center. "After the students did an excellent job in preliminary design of the spacecraft, everything started to go up." In 2000, Agrawal and the NPS AFRL team won the National Reconnaissance Office Director's Innovation Initiative Award. With it came \$340,000, to further develop the technology. Over the next five years, the new laboratory and research effort will receive approximately \$3.5 million in Air Force and Missile Defense Agency funding.

"What you're seeing is the only integrated spacecraft control optical technology demonstration anywhere," said USAF Capt. Mary Hartman, program manager for AFRL's Relay Mirror Technology Program. "This project not only brings together our two technical areas, it also brings the Navy and Air Force together on an important, high-profile national program."

AFRL research scientists have the lead on the project's

optics, while the Navy's corporate university has major responsibility for spacecraft control.

"The Bifocal Relay Mirror Spacecraft project marries the best expertise of our two groups – NPS's in spacecraft attitude and vibration control and AFRL's in high technology optics," said Agrawal.

Good said the most likely future system will be a mix of ground-based, airborne, and space-based lasers in addition to the beam-retargeting space-based mirrors. "This is not an 'either or' proposition," he said. "They're complementary."

According to project managers, the bifocal mirror tracking and targeting system is likely to first be tested on a lighter-than-air balloon or airship as a stepping stone to the ultimate space platform.

Agrawal stressed that the technology being developed for the space-mirror project is widely applicable to a number of other areas. Reconnaissance, space optics, space communications, remote imaging, enhancing night vision capabilities, camouflage detection and penetration, chemical warfare agent detection and identification, theater wind profiling, tunnel and underground structure detection, and cloud ceiling detection. One of the most intriguing potential uses of the space mirrors would be as giant flashlights to light up future battlefields.

One thing is certain. As the Bifocal Relay Spacecraft finally moves from its many test beds into space, Capt. Kirk's famous "Star Trek" line will have to be rewritten, to :

"Beam me up – and down – Scotty!"
For more information on NPS's Bifocal Relay Spacecraft Research Program, or on the NPS-AFRL Optical Relay Spacecraft Laboratory, contact Prof. Agrawal at agrawal@npss.navy.mil .



NAVICP Challenges NPS to Become Data Quality Hub for DoD

by Rob Bourke
Director of Alumni Relations

When Lt. Cmdr. Stanley Dobbs (NPS '01), the Program Manager for Data Quality Engineering at Naval Inventory Control Point Philadelphia (NAVICP-P), realized he had systemic data problems that required new procedural insight to solve, he knew NPS was the ideal resource to meet the challenge. As a graduate of the institution, he recognized the unique ability of NPS Operations Research to investigate the problem. The results of this new research initiative will transform the way NAVICP does business.

Dobbs's unit is a critical link in the complex organizational chain that meets all the materiel needs of the Navy in its globe spanning deployments. NAVICP-P tracks over 68,500 depot-level repairable items, all of which have direct bearing on operational readiness in the fleet. The value of the NAVICP inventory is over \$15 billion with annual sales of more than \$3 billion.

"NAVICP maintains a demand forecast model," explained Dobbs, "which needs large volumes of data on all aspects of the Naval supply chain, to keep up to date. The data quality must be reliable

to maintain inventory levels, to monitor the repair cycle, and for policy analysis."

The supply system makes materiel available to the Fleet in two ways: through the procurement process, and by restoring damaged or failed items to ready-for-issue condition. The Naval Inventory Control Points at Philadelphia and Mechanicsburg forecast the quarterly demand for tens of thousands of items, balancing the new and ready-for-issue items with the rate of failed parts to keep the Navy inventory efficiently stocked at a level that supports operational requirements.

"My experience and education told me that data quality shortfalls existed," said Dobbs.

He envisioned creating a data quality management methodology that would optimize use of Fleet data by quantifying the quality of the data in the operational databases. "We knew that programs similar to this exist at MIT and VCU as well as NPS," said Dobbs, "but we wanted to support NPS as the (data quality) hub for DoD."

His boss, Rear Adm. Michael Finley (NPS '82 with distinction),

Commander of the Naval Inventory Control Point, Philadelphia and Mechanicsburg, agreed. "The foundation of logistic support is data integrity," said Finley. "Data quality issues are pervasive both in government and industry."

"The Naval Postgraduate School has always been responsive to the needs of the U.S. Armed Services, government organizations and our allies. There is a surprising lack of available research in this field of inquiry. NPS has a superb pool of academic talent most willing to tackle this important field of study."

"NPS is uniquely positioned. They understand the mission of the Fleet customer from a global perspective and are dedicated to providing a useful end product. In addition, there is not a lot of "start-up" expense with NPS and you can tap into the student resources to obtain the real world logistics experience."

NPS Operations Research Professors Robert Koyak and Samuel Buttrey are experts in this area and will spearhead the research.

While supervising a recent

Master's thesis that analyzed a proposal to reduce the depot level repair cycle time for F/A-18 C/D aircraft, Koyak and his student, Lt. Cmdr. Shawn Grunzke (NPS '01), observed anomalies in shipping data for faulty parts. "Nine percent of one batch of records we looked at had point-of-origin dates that were the same as, or later than, the point-of-receipt dates," noted Koyak. "Nine percent of obviously incorrect records raised questions about the quality of the entire data."

Buttrey cautioned, "It is tempting to draw analogies to the private sector, where the collection of supply chain data is considered a normal business practice. In the Navy, data is collected by warfighters for whom that collection is a secondary duty, it is not of secondary importance. In order to realize a cost-effective supply chain, the supply system must be guided by data analysis that is comprehensive and of high quality."

Two thesis students began working on this research in

April. Finley and Dobbs have challenged the investigation team to identify components of the supply chain data system that exhibit the most serious data-quality shortfalls. Their objective is to characterize the nature of the problem and to quantify the extent of data quality shortfalls.

"It is also important to learn about data that are not captured in the data collection system," said Koyak. "How frequently are transactions not reflected in data? To answer this question, information must be obtained from the operational end of the supply chain — a potentially difficult and sensitive area to study."

The researchers will also determine why the problems

with data capture and quality that they identify occurred, and what it would take to fix them. They will develop an educational tool to educate Navy warfighters about the importance of data collection for combat effectiveness.

Describing the product of the NPS research, Finley said,

"We are moving away from systems that produce interim results for human review. We are becoming more data driven relying on artificial intelligence systems for decisions ... poor data will yield poor decisions! The end result (of the research) will be a more responsive, resourceful and ready logistics platform to the Fleet customer."

Dobbs, immersed in his first tour since graduating from NPS last September, echoed Finley's words. "In the future, we can't just manage parts. We have to learn to better manage data about parts. That information is what will make us responsive, resourceful, and ready."



Photo by Javier Chaurava



NPS Alumnus Shoots Famous Photo

by JO2 J. Anthony Reese

Passion runs cold for NPS graduate and amateur photographer Jay Adeff (NPS '91, '99). As a staff engineer in the NPS Physics Department, Adeff focuses his work on thermo-acoustic refrigeration technology. Outside work, he cools his heels as a well-respected amateur photographer of high level competitive figure skating. This winter, his hobby earned Adeff an extraordinary honor, apart from his accomplishments in academe.

"I'm a two time grad of NPS," said Adeff. "I earned a Physics degree in '91, and a Master of Engineering Science in '99." Adeff's 1991 thesis measured the performance of the NPS experimental Space Thermo-Acoustic Refrigerator (STAR).

The principal of acoustic refrigeration was inspired by a traditional observation of artisan glass blowers. When one end of a glass tube was heated to craft a desired shape, and the other end kept cool enough for human lips to blow into, the tube would

sometimes "sing". Thermo-acoustic refrigeration inverts this principal, using a standing acoustic wave to create a heat differential. The idea is well suited for space applications, requiring only one moving part; a powerful loudspeaker.

STAR was tested aboard the space shuttle Discovery in 1992, and the concept continues its development at NPS today. Adeff earned his second master's degree in 1999 with a thesis on a solar-powered thermo-acoustic refrigerator.

But designing the refrigerator of the future is not Adeff's only chilly interest. Photography of world-class competitive figure skating is a hobby that he has pursued relentlessly around the nation since the 1990s. "At the U.S. Nationals in Los Angeles in January," laughs Adeff, "I shot about 50 rolls of film. The Nationals were the Olympic Trials for figure skating. All the top U.S. skaters were there."

Adeff has developed a special talent for freezing the action on the ice. It was his photography that put his picture on the front of Wheaties boxes all over America –

his picture of Olympic Gold Medalist Sarah Hughes, that is.

"Wheaties prepared cover photos for all the U.S. Olympic hopefuls before the games were held," explained Adeff. "When Sarah saw her cover, she didn't like it, she thought the picture that Wheaties chose was too old. So, she and her manager went on line to find newer photos. They selected one from my web site."

With an aw-shucks attitude, Adeff makes his hobby appear easy, "We didn't have particularly good seats; they were OK, but not great. Occasionally, a skater would pass close by. I got lucky with this shot."

Adeff's photography can be seen in grocery stores around the nation right now, and on his website, www.jayadeff.com, where he sells prints of his images to raise money for up and coming U.S. skaters. "It's not my job, just a hobby, but I'd like to raise more. For some of these juniors, even \$100 can go a long way to launching a career." Jay Adeff is definitely one of our coolest alumni.

NPS Inducts Singapore Official

Superintendent Rear Adm. David Ellison dedicated the new NPS Hall of Fame during the March graduation ceremony, with the help of the newest inductee, Prof. Pao Chuen Lui of Singapore.

Prof. Lui was recognized as both a Distinguished Alumnus and inducted into the NPS Hall of Fame for accomplishments through out his career. "The decision of NPS to have a Hall of Fame came as a surprise to me," said Lui. "I was delighted to be given the NPS Distinguished Alumni Award. It was an unexpected honor to be inducted into NPS Hall of Fame." Lui holds two degrees from the Naval Postgraduate School, in Operations Research and Systems Analysis.

The Chief Defence Scientist of the Singapore Ministry of Defence since 1986, Prof. Lui's relationship with NPS spans decades. "In 1977 I led a team from the (Singapore) Ministry of Defence to study postgraduate educational opportunities for our military officers in military technology. We visited USA, UK, France, Sweden and Israel.

"Our conclusion was that top institutions like MIT and Stanford could provide an academically more rewarding experience, but NPS alone would be the ideal institution for postgraduate education in military systems and technology."

In the mid-1980s, Lui initiated an operations analysis organization in the Singapore Ministry of Defence, which in less than twenty years has expanded to embrace information technology, systems engineering, and operations research as core elements of the defense establishment.

In recent years, Lui's influence in many high tech activities, both in and outside of the Singapore government, has resulted in a close relationship between Singapore and NPS. Over 115 Singapore students have come to live and study in Monterey, and many more students have been instructed by visiting NPS faculty in Singapore. As a member of the NPS teaching faculty, Lui has taught the Systems Analysis and Integration course on the Monterey campus.

At his induction ceremony, Lui recognized the work of all the Singaporeans who have come to NPS. "This honor is not for me, but for my country and my colleagues who have over the last 30 years contributed to the intellectual capital of NPS. I am therefore very grateful for the recognition that NPS has accorded to Singapore."

NPS has established two distinct new recognitions. The NPS Distinguished Alumni Award honors alumni based on significant accomplishments, recognition in a field of study or practice, or impact on the education programs at NPS. The NPS Hall of Fame was created

to recognize the accomplishments of individuals who, by attaining positions at the highest level of public service, have made the greatest contributions to society, their country, and to the NPS.

Ellison explained the need for the new programs, "Many of our alumni have made remarkable achievements in their professional lives. With two graduates, Jim Roche (NPS '66) and Tom White (NPS '74) serving respectively as Secretaries of the Army and Air Force in the Bush Administration, the time has come for NPS to formally recognize alumni who have had a positive impact on NPS and in service to their nation."

Lui joins Roche and White as the earliest inductees in the Hall of Fame, located in the lobby of Herrmann Hall. All NPS alumni may nominate candidates (including themselves) for the Hall of Fame and for the Distinguished Alumni award by contacting the Alumni Relations Office e-mail, alumni@nps.navy.mil, or postal mail at:

Alumni Relations Office
1 University Cir #127E
Monterey, CA 93943





Class Notes

Class of 1966

David McCullough is an assistant professor at Lewis-Clark State College located in Northern Idaho. He works in the area of Information Systems Technology.

Class of 1973

Capt Richard C. Tuggle is the Commander of the Defense Subsistence Region, Pacific, located in Alameda, Ca. He is responsible for the acquisition, management, quality control, and physical distribution of brand name and troop issue subsistence to all armed forces in the ten westernmost United States and Pacific Theater.

He managed five subordinate subsistence field activities responsible for the acquisition, inventory control, and distribution of perishable subsistence items in support of military activities and other federal agencies in assigned support areas.

Class of 1975

Jack Johnson was recently promoted to the Cessna Aircraft Company Director of Government Programs, which involves him heading up the special missions aircraft programs.

Class of 1980

Tadeusz M. Drezewiecki, Ph. D., is the president of Defense Research Technologies, Inc. Rockville, MD. He

has been named a Fellow American Society of Mechanical Engineers International.

ASME International is a worldwide engineering society focused on technical, educational and research issues.

Drzewiecki earned his doctorate in mechanical engineering from NPS. He is also a member of Sigma Xi, the Scientific Research Society, the Institute of Electrical and Electronic Engineers and the Instrumentation, Systems and Automation Society.

Class of 1983

Capt. Dennis T. Stokowski, returned from a six-month deployment to the Mediterranean Sea and Arabian Gulf while assigned to the guided missile cruiser USS Gettysburg, (CG 64) home ported in Mayport.

Stokowski's ship was one of the first to respond to our nation's call to fight terrorism, proudly participating in Operation Enduring Freedom.

During the deployment Stokowski's ship visited several ports including Croatia, France, Italy, Malta, Greece, Turkey and United Kingdom.

Stokowski graduated with a master of science degree.

Class of 1985

C. Michael McCarthy successfully completed his second marathon, the 106th Boston Marathon, April 15. His time was 4:19:54, which was a 13

minutes improvement to his previous marathon's time. Not only did McCarthy running a marathon, he also raised money for the National Multiple Sclerosis Society. McCarthy plans to run in future marathons.

Dan Rigtterink retired in July of 2000 as an O-6 with 13 years active and 11 years reserve duty. Rigtterink is currently a captain for American Airlines based in Boston.

Rigtterink graduated with a master of science degree in Aeronautical Engineering and Avionics.

Class of 1992

Lt. Cmdr. Thomas M. Conlon, returned from a six-month to the Mediterranean Sea and Arabian Gulf while assigned to the guided missile destroyer USS O'Kane, (DDG 77) home ported in Pearl Harbor.

Conlon is one of more than 10,000 Pacific Fleet Sailors and Marines aboard the ships of the USS Carl Vinson Carrier Battle Group and the USS Peleliu Amphibious Ready Group who were among the first to respond to our nation's call to fight terrorism, proudly participating in Operation Enduring Freedom.

During the deployment, Conlon's ship visited several ports including Australia, East Timor, India and Singapore.

Conlon graduated with a master of science degree.

Class of 1994

Cmdr. Steve Frick became the 25th NPS graduate to fly in space when the space shuttle Atlantis launched on April 8. Frick made his first space flight as the pilot on STS-110. During STS-110, Atlantis and her crew continued construction of the International Space Station, where Frick had the

opportunity to visit with Capt. Dan Bursch (NPS '91) who has been living aboard the orbiting facility since November. Bursch is scheduled to return to Earth this month.

Class of 1996

Cmdr. Philip J. Candrea is returning to NPS to serve on the faculty of the Graduate School of Business and Public Policy. Upon graduating NPS with distinction and as a Conrad Scholar in Financial Management, Candrea served as a Business and Financial Manager at the Naval Systems Command in Patuxent River.

Recently, he was the ERP Implementation Department Director at the Navy Fleet Material Support Office in Mechanicsburg, PA. Leading a team of systems analysts, technical architects, and programmers on the SMART ERP project for NAVSUP Headquarters.

In addition to his master of science degree from NPS, he has a bachelor of science degree from Penn State University and recently earned a Masters Certificate in Project Management from George Washington University. Candrea is a member of the Acquisition Professional Community and is DAWIA Level 3 certified in Business, Cost Estimating, and Financial Management.

Class of 1997

Lt. Cmdr. Anthony J. Lesperance was promoted to his current rank while serving with Destroyer Squadron 31, Pearl Harbor, Hawaii.

His promotion was based on sustained superior job performance and proficiency in his designated specialty.

Lesperance graduated with a master of science degree.

Class of 1999

Maj. Ronald C. Braney recently was promoted to his current rank while serving with Headquarters and Support Battalion, Marine Corps Base, Camp Lejeune, N.C.

His promotion was based on sustained superior job performance and proficiency in his designated specialty.

Braney graduated with a master of science degree.

Class of 2001

Lt. Stephen D. Donald recently graduated from the Naval Cryptologic Officer Basic Course while assigned to Naval Technical Training Center, Corry Station, Pensacola, Fla.

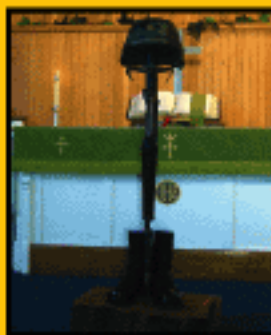
During this 13-week course, Donald received classroom instruction on job fundamentals ranging from physical security, electronic warfare, and military communications to computer networks, digital data communications and satellite fundamentals.

Donald graduated with a MSCS and MSSE degree.

Lt. Christopher P. Slattery recently graduated from the Naval Cryptologic Officer Basic Course while assigned to Naval Technical Training Center, Corry Station, Pensacola, Fla.

During this 13-week course, Slattery received classroom instruction on job fundamentals ranging from physical security, electronic warfare, and military communications to computer networks, digital data communications and satellite fundamentals.

Slattery graduated with a master of science degree.



Class of 2002

Maj. Andy Clements NPS mourns the passing of classmate Maj. Andrew Clements, USA (NPS '02). Clements was killed in a tragic car accident while driving his car from Monterey to Virginia. On May 26, a barge struck and collapsed the I-40 Bridge in Oklahoma just as Clements was crossing.

Clements is survived by his wife, Nicole, and four children. He graduated in March with a Master's Degree in Management. NPS joins his family in grieving for the loss of an American patriot, husband, father, and friend.

The family asks that anyone desiring, can contribute to the following fund that will benefit his children.

United Bonn
Attn: Vicki Schofield
301 S. Washington St
Alexandria, Va 22314
Check to Nicole Clements
Remarks: Memorial Fund

-GOT NEWS?

Send your update to the NPS Alumni Relations
Office at alumni@nps.navy.mil
or visit
www.npsfoundation.org

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