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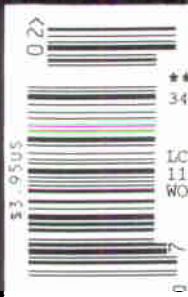
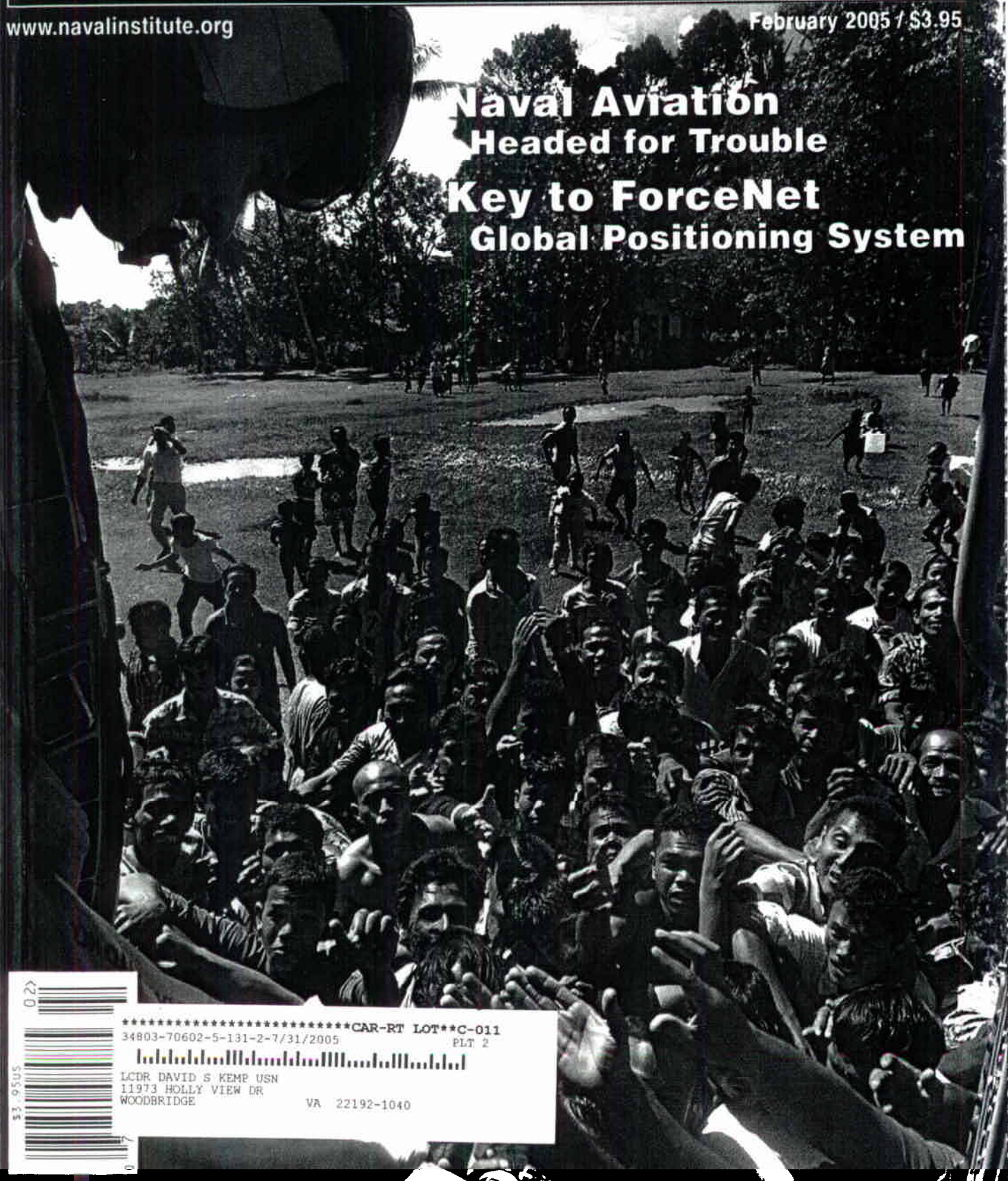
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Naval Aviation Headed for Trouble Key to ForceNet Global Positioning System



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LCDR DAVID S KEMP USN
11973 HOLLY VIEW DR
WOODBIDGE VA 22192-1040

Naval Postgraduate School Aims at Real-World Defense Problems

Captain Chuck Calvano, U.S. Navy (Retired), Captain Jeff Kline, U.S. Navy, and Lieutenant Colonel Dave Olwell and Lieutenant Colonel Mark Stevens, U.S. Army (Retired)

Huddled in various working groups with laptops, calculators, charts, and maps, teams of military officers analyze force capability gaps in a range of scenarios from Malay pirates, to Mindanao terrorists, to war in the South China Sea. By conducting campaign-level analysis within the bounds of established concepts of operations, they are testing the abilities of joint forces to "support forces operating in and from austere or unimproved forward locations" and "to detect and interdict a wide range of threats close to their source and throughout the strategic approaches." Their goal is to measure attributes and shortfalls in the programmed forces across the range of conflicts and forward their findings to a team of system engineers and analysts who are professional officers as well.

The systems team uses the macro-analysis as a starting point for more detailed functional analysis and requirements generation. When systems-level engineering requirements emerge to match needed force capabilities, they are passed to various engineering design teams (also comprised of military officers). Within months, these teams create engineering proposals for joint command-and-control systems, ships and aircraft, satellites, unmanned vehicles (UVs), remote sensors and weapons, land delivery systems, and manpower programs, all of which provide alternatives to current and programmed systems.

The systems team collects the various engineering, architecture, and manpower design proposals and integrates them into the system-of-systems proposal for the alternative joint force. The team tests the conceptual joint force against its original requirement lists and the legacy force and then passes the proposal back to the campaign analysis team to evaluate its ability across a range of scenarios.

The foregoing cycle is completed every 18 months. Does it sound like exciting transformational work? If you are interested in becoming one of the many teams participating in a structured joint view of alternative force creation, pack your bags for the Naval Postgraduate School (NPS) in Monterey, California.

Where Theory Meets Application

Navy Lieutenants Jeff Winslow and Matt Holmes participate weekly in unmanned vehicle roundtable discussions with faculty and students across the campus. They are not typical master's degree candidates. In addition to years of operational experience, they are combining recent practical education in strategic, technical, analytical, and engineering topics with NPS research programs to focus on real-world combat and combat support issues. As motivated systems engineering and analysis students at NPS, their work underpins three major research initiatives:

- Special operations experimentation with new tactics and communication links using tactical airborne sensors
- Navy development of a tactical memorandum to assist the fleet in deploying battle group UVs in support of maritime missions
- Integrated development of forces that can ensure access in the littorals

Students from all services work closely with our faculty members to conduct applied research in numerous areas. NPS and its sister technical defense school, the Air Force Institute of Technology, provide unique environments where officers can experience a joint technical education and immediately put it to use on defense-oriented challenges. The following is a sample of the hundreds of research projects being conducted by joint teams at NPS:

- Critical infrastructure analyses
- High-powered microwaves for use as ship self-defense systems
- Tactical aids for undersea warfare and theater ballistic missile defense
- Joint command-and-control systems
- Joint sea basing logistics
- Revolutionary business practices
- Human systems integration

Preparing Future Forces

Operationally experienced officers with advanced educations in specialties ranging from engineering to strategic disciplines are well positioned for leveraging current and emerging technologies to enhance combat effectiveness. Today's NPS graduate education process is designed to

generate professional growth in students by teaching them to learn advanced technical concepts, conduct independent research, and apply that research to military problems. It gives them a mental template to use throughout their careers when presented with unfamiliar and usual challenges at sea or in the field—and inside the Pentagon.

The NPS graduate has explored the unknown in a rational way and is not afraid to seek new solutions to military requirements. He or she is prepared technically for undertaking innovative and transformational efforts. An officer corps that lacks graduate education risks subservience to rote training, industry-provided manuals, and civilian intellectual talent. Furnishing a wide base of officers with advanced education increases the chances the Navy will have the right officer in the right place at the right time. Many unique NPS degree programs—Undersea Warfare, Systems Engineering and Analysis, Information Warfare, Defense Analysis, Applied Physics (Combat Systems), and (defense-oriented) Operations Research—prepare officers for combat operations.

The skills provided by NPS degrees enable officers to excel in their careers, benefit the service, and provide postcareer opportunities in the civilian community. In addition, naval officers share classrooms with officers of the other uniformed services, which creates a joint learning environment. The faculty delivers graduate-level information to students; students pass recent operational knowledge to the faculty; and students exchange service-centric and joint information among themselves. Through joint professional military education exchanges, NPS students gain an appreciation for the current technical capabilities and operational concepts of other services.

Unique Combat Education

The Systems Engineering and Analysis (SEA) program provides Navy unrestricted line officers with a broad-based education in strategic, operational, and tactical analysis, various engineering technologies, systems design and engineering

methodologies, and joint professional military education. Its goal is to teach the "combat arms" technical skills immediately applicable to their next tours at sea while also providing valuable education that can be applied ashore. The officers' long-term benefit is a master's degree.

Rather than submitting a thesis, SEA students form the nucleus of an integrated project related to maritime and joint warfare. The SEA team reaches out to their NPS classmates studying applied physics, engineering, operations research, and other subjects to assist in solving overarching problems, such as assured access, expeditionary warfare, or littoral warfare. Thesis work of officers in other programs, classroom projects, and extracurricular research are undertaken to cover specific topics in the SEA charter.

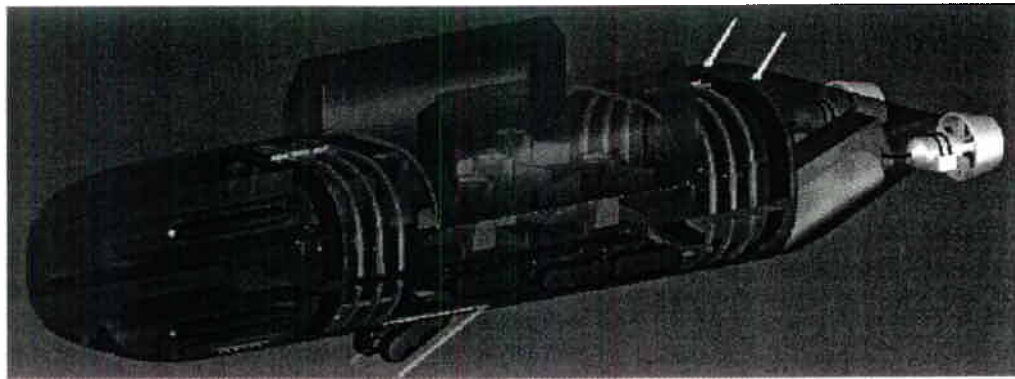
What Has NPS Done for You Lately?

NPS study efforts have a telling effect outside the school grounds. The expeditionary warfare studies and engineering designs have been cited in various professional journals and reviewed by the Chief of Naval Operations (CNO) staff.² The Defense of the Sea Base study was published in *Proceedings* and reviewed by Naval War College students and the CNO N-76 staff to demonstrate the advantages of distributed technological systems.³ Individual papers related to these projects have been recognized by program officers, combatant commander staffs, the Navy Warfare and Development Command, Department of Defense planners, and naval leaders.

These projects and studies do not, however, provide *the answer*. At the same time, unconstrained by political and bureaucratic limitations, NPS faculty and students are free to explore the full range of alternatives. And that is their true advantage: offering out-of-the-box thinking and alternatives grounded in physical and engineering possibilities that can benefit operational staffs working the problems day to day.

Transformational Education

The SEA program's delivery of broad-based technical and analytical education



At the Naval Postgraduate School, professional military officers combine practical experience in operations and planning with research programs to focus on real-world combat and combat support issues. The unmanned delivery carrier, above, was designed as part of the school's Maritime Dominance Study.

to war fighters is its biggest challenge in seeking to survive a 20th-century military education system designed to provide subspecialists for various staff positions ashore. Sponsors of NPS curricula are normally flag and general officers filling positions associated with subspecialties. They help signal demands for the curriculum. But who sponsors a curriculum designed for the naval war fighter and where does the billet requirement come from? This approach demonstrates that the SEA concept—and its associated integrated research—is transformational education. It goes beyond the current subspecialty-centric model and does not fit in a neat education category.

When the program was started more than two years ago, Navy leaders in Washington and at the type commands saw the value of a broad-based curriculum and offered suggestions for its development and signaled initial needs. Since then, with continuous improvement based on student feedback, the SEA program is realizing the goals envisioned for unrestricted line officers.

The advantages and challenges of the SEA program highlight a larger issue than educational delivery. Broad-based, continuous education is a benefit for all naval personnel, especially in a Navy moving toward ships with highly advanced technologies and smaller crews, and in light of the steadily increasing emphasis on joint operations. On the other hand, with fewer personnel and demanding operational and professional requirements inside career paths, there is less time to devote to 18 months' resident education. In this regard, the Naval Education and Training Command, Naval War College, and NPS are exploring a range of new educational initiatives. These endeavors re-

quire close coordination with manpower experts at the Naval Personnel Command.

Conclusions

The Naval Postgraduate School presents demanding advanced technical education that emphasizes real-world defense problems. Officers obtain joint technical education that prepares them for leadership positions at sea and ashore. This broad-based education is essential to a creative, innovative, and smaller Navy.

Delivery of this type of education is threatened by adherence to an older subspecialty-oriented education system and the fact that a smaller Navy has less flexibility with respect to resident education. Solutions to availability and delivery of relevant education, both in residence and at fleet concentration areas, require a holistic approach to manpower development—from the way the Navy programs education dollars to its management of officer career paths.

¹Chairman of the Joint Chiefs of Staff General Richard Myers, "National Military Strategy of the United States of America 2004: A Strategy for Today; A Vision for Tomorrow," pp. 15-16.

²Scott Truver, "U.S. Navy in Review," U.S. Naval Institute *Proceedings*, May 2004, p. 84; "The Load Lifters: U.S. Explores Ship-to-Objective Concepts," *Jane's Defence Weekly*, 27 August 2003, p. 20.

³LCdr. Ronald Higgs, LCdr. Eric Higgins, LCdr. Gregory Parkins, Lt. Vincent Tionquiao, Lt. Christopher Wells, USN, "Systems Engineering Contributes to Expeditionary Force Protection," U.S. Naval Institute *Proceedings*, April 2004, pp. 76-78.

Dr. Calvano is a professor emeritus of the Mechanical Engineering Department at the Naval Postgraduate School (NPS). He currently serves in the Office of Naval Research in London, England. Captain Kline, a surface warfare officer, holds the Chair of Warfare Innovation at NPS. Dr. Olwell chairs the Department of Systems Engineering at NPS; Mr. Stevens is a professional engineer and lecturer for that department.