

Crawley named a top Navy engineer

SSC Charleston's Ken A. Crawley has been selected a Top Navy Engineer of the Year by the Assistant Secretary of the Navy (Research, Development, and Acquisition.)

Crawley was one of seven SPAWARSSYSCOM employees honored in the competition, which included nearly 60 submissions.

The award recognizes Crawley's work with advanced antenna and RF systems, particularly his contribution to the Expanded Maritime Interdiction Operations (EMIO) communications system. The system provides high speed data and voice to crews boarding vessels of interest (VoI) while underway.

Crawley improved the antenna and radio system operation to greatly reduce service interruption and provide reliable communications between staff on the host vessel and the boarding party. The award citation noted that the electronics engineer's efforts "have made the task of interdiction much more effective and safer for our warfighters."

SSC Charleston supports the EMIO program by providing ship-to-ship Line of Sight (LoS) communications to boarding parties. The system design utilizes commercial-type wireless network systems to provide easy implementation and interoperability with common commercial network and computer systems.

Designing a dependable wireless link to operate between moving vessels on open seas offers challenges beyond those of a normal terrestrial link. A terrestrial LoS microwave link does not move, although path loss can vary over time due to ducting effects. Engineering a successful data communications link over land is straightforward, even when including static water segments between the two terrestrial endpoints.

A maritime LoS microwave link is entirely different. All of the difficulties and losses inherent in a terrestrial link are present, plus the relative positions of the two end points of the link vary and the variability of the transmission medium between them also varies.

Maritime LoS microwave links are also different with respect to terrestrial microwave equipment design and the data processing software algorithms for negotiating the best modulation waveforms. These are optimized for the highest data rates under static conditions. Commercial Off-the-Shelf (COTS) solutions are not optimized for continuous renegotiation of the variables presented in a maritime environment. As a result, the path must be engineered with the greatest signal margins possible to keep the maritime effects at a minimum.

Also, COTS antennas are designed with the assumption they are bolted in place and will not move in relative position. Maritime antennas are displaced in three dimensions simultaneously and quickly.

Crawley was called upon to review the implementation design, test the radio frequency (RF) components and overall system operation, and recommend system improvements to ensure communications reliability to meet mission requirements. After undertaking research and practical testing at SSC Charleston's Sullivan's Island lab facility and in on-water testing, Crawley proposed improvements to the system to increase effectiveness and reliability in a wide range of conditions.

Initial testing showed that variable sea conditions greatly affect the reliability of the link and additional signal gain must be designed into the system to achieve minimum re-

quirements for distance and data rate. Most notably, wave induced rolls expected during interdiction operations will exceed the vertical beam angle of the original antenna system.

Antennas are optimized to provide the highest transmit/receive focus (gain) in a particular direction or elevation based on the designed use of the system. Generally the higher the gain an antenna provides, the more directional the beam. The radiation pattern of the antennas installed on the vessels provided effective communications when both were mounted vertically, but as the vessel rolled, the antennas tilted from vertical resulting in reduced signal amplification.

Crawley's test and evaluation process resulted in several recommendations, including adding amplifiers to both the Vessel of Interest (VOI) system and the host vessel to keep the system design "symmetrical." He also recommended replacing the antenna on the VOI system to increase the vertical beam width and adding another antenna for use in higher sea states, and selecting an RF transmission line with the lowest loss practicable. Crawley also provided procedures and training to the boarding team to install the VOI antenna as near vertical as possible.

These improvements provided a system that worked acceptably in varying sea states under which actual operations

occur. The continuous contact and large volume of data the boarding teams will have access to will not only increase the effectiveness of operations, but also reduce operational costs and potentially save lives.

Referring to RF engineering as an "art form," Crawley attributed his success with the EMIO system to "... education, experience, motivation, and humility. Lack any one of these elements and you will fail," he said. "RF Engineering has colors that are the electromagnetic spectrum, each behaves differently. Often a textbook solution, or a product brochure solution, will fail because there are complications that lie outside of the problem statement," he said.

Crawley's work in RF propagation/antenna design in SSC Charleston's communications department has taken him around the world. He also performs antenna and RF system performance review and testing to identify system deficiencies and recommend performance enhancements to improve systems to meet operational requirements.

He was selected SSC Charleston Engineer of the Year in 2002 for a telemetry relay he designed, built and installed in Antarctica. During a six-month tour in Iraq in 2004 he helped establish the SSC Charleston office in Balad, locating a site and negotiating with the Army and Air Force for its use. He and Jim Watson of SSC Charleston's Pensacola site, along with some willing Iraqis, cleared Operation Desert Storm war debris from the site.

In 2004 he, along with fellow SPAWARriors Don McCormick and Dean Glace (who has since retired from SSC Charleston,) received a patent on a high efficiency, compact antenna assembly. Crawley has also filed a patent for a tactical AM broadcast antenna.

"This is wonderful recognition of your contributions to both Department of the Navy, as well as DoD," said SPAWARSSYSCOM Commander Rear Adm. Michael Bachmann in a note to the SPAWAR honorees in the Navy Top Engineers and Scientists competition.

Crawley and other SPAWAR award winners — SSC San Diego's James Finneran, Dr. John Meloling, Paul A. Miller, Hoa G. Nguyen, Dr. J. Scott Rodgers and Mihajlo Tomic — were honored in a Pentagon ceremony May 29. During the presentation Crawley was lauded for providing "the warfighter with a reliable tool they can count on for information and force protection during dangerous operations at sea. Your efforts have improved the product, saved money, and ensured greater success in assigned operations," his award citation noted.

The Department of the Navy has over 35,000 scientists and engineers pursuing research, development, acquisition and sustainment. The award was established to honor those who reached superior technical achievements and to promote continued scientific and engineering excellence.

Last year SSC Charleston's Chris All of Code 5521 was honored in this competition for his inflatable satellite antenna innovation.

- Susan Piedfort, Chronicle Editor



Ken Crawley



Crawley's work with RF propagation and antenna design has taken him around the world to Iraq, above, and to Antarctica, where he is pictured below with _____, left.

