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Systems engineering students detail operational scenarios for UUVs

Stewart, Kenneth A.; Naval Postgraduate School Public Affairs Office

Naval Postgraduate School

Systems Engineering Students Detail Operational Scenarios for UUVs

Article By: Kenneth A. Stewart

A team of systems engineering analysis students at the Naval Postgraduate School recently completed detailed analyses of various operational scenarios utilizing the latest unmanned undersea vehicles (UUVs), and briefed their preliminary findings during a presentation in mid-April.

“We were tasked to design a system of unmanned undersea vehicles that will provide an operational undersea force available for tasking over a range of missions by 2024,” said NPS student and project manager Lt. J.P. Kish of Houston, Texas.

“We were originally tasked to see if we could contribute to undersea dominance,” continued Kish. “We were given 11 missions to evaluate, but we scaled them down to four that we felt held the most promise of being influenced by unmanned technologies by the year 2024.”

According to project members, the Navy is investing considerable intellectual capital into utilizing UUV technology.

“UUVs are a major focus of the Chief of Naval Operations,” said Lt. Chris Caraway of San Diego, Calif. “We, and the [CNO’s] Strategic Studies Group are essentially working on the same project with different time frames.”

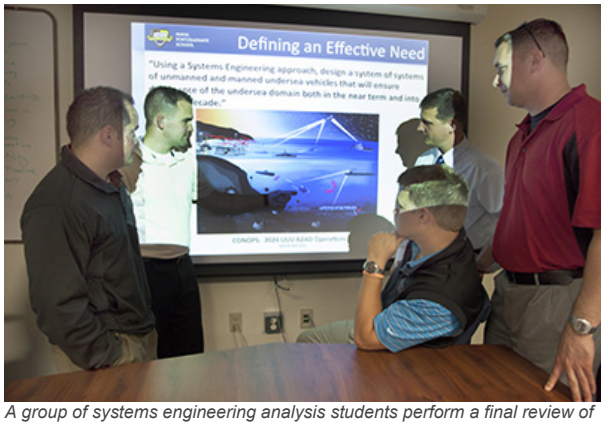
Preliminary findings suggest that UUVs may be both cost and operationally effective in several key naval mission sets, especially in high-risk areas where traditional naval platforms may fall victim to anti-access area denial warfare. Team members found that UUV operations were particularly well suited to intelligence, anti-mine warfare, and both information and offensive operations.

Within each of the four defined mission areas, students evaluated the ability of UUV platforms to complete their assigned missions, determined optimal sensor and weapons packages, and considered logistical restraints.

“Using UUVs in mine countermeasures (MCM) operations is the most promising,” said Lt. Sam Fromillie. “MCM operations leverage work that is already being done by private industry … Commercial enterprises have developed a robust capability.”

In order to evaluate each undersea system and its associated mission set, students employed a series of complex mathematical models. Each system was run through hundreds of simulations utilizing a strident series of constraints designed to demonstrate UUV capabilities and limitations in highly challenging undersea environments.

“We also conducted site visits to Panama City’s Naval Surface Warfare Center and to the Penn State Applied Research Laboratory where students met with operators and industry professionals responsible for the advancement of UUV technologies,” said Lt. Kris Blandin of Boise, Idaho.



A group of systems engineering analysis students perform a final review of their group presentation detailing their analyses of various operational scenarios utilizing the latest unmanned undersea vehicle (UUV) technologies. Their results of their project was briefed to university leadership and fellow students during a presentation in mid-April.

Students demonstrated that UUVs, when used in conjunction with traditional platforms, were a significant “force multiplier.” Student analysis also revealed that UUVs are a viable replacement for legacy equipment and that they can increase the capabilities of more modest naval platforms. Still, challenges were identified in the areas of endurance, data transfer and mine neutralization.

In the area of information operations, UUVs were shown to be effective in military deception and enhance the effectiveness of submarines to conduct other operations. Challenges included object avoidance, particularly in cluttered littoral areas, and the ability of the systems to conduct autonomous operations.

“Military deception is an area where UUVs can provide an immediate impact with current technology. It opens up new mission capabilities that we don’t currently have,” said Fromille

The use of UUVs in offensive operations showed promise as well, particularly in shallow areas of operations where the UUVs stealth abilities were an advantage. The risk to conducting combat operations with UUVs was also found to be significantly less than the risk associated with manned platforms. Still, analysis team members insist that the submarine remains the most potent combat platform.

“UUVs may be effective in an attack role in large numbers, but the submarine remains the most effective offensive weapon. ” said Lt. Jamie Cook of Montgomery County, Md.

In conjunction with their analyses of proposed and extant systems, team members evaluated optimal sensing packages and demonstrated the value added by mixing shipboard and sensor equipped UUVs. These sensing packages became particularly beneficial when evaluating the role of UUVs as pathfinders. UUVs were show to be an effective means of traversing heavily mined areas and were shown to be able to create safe passages for manned systems in high threat areas.

Finally, members concluded that a greater number of less capable, and therefore less expensive UUVs, were more effective than fewer numbers of highly capable systems. They also found that when equipped with a “sprint” capability, UUVs were more likely to survive enemy contact, and that their use significantly enhances the effectiveness of intelligence collection.

“In the future, we will employ UUVs,” said Fromille. “It will be interesting to see if the future matches what we have demonstrated here.”

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