Korean researchers reveal new sea defense model

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Military tension between North Korea and the Republic of Korea (South Korea) extends to areas of the Yellow Sea. Now defence experts based in the Republic of Korea have devised improved methods to model underwater warfare, which they believe can aid future decisions about weapons and defence purchases. The details appear today in the *Journal of Defense Modeling and Simulation*.

The researchers based at the Korea Advanced Institute of Science and Technology (KAIST) and Seowon University, both in the Republic of Korea, set out to design an underwater warfare model to gain insight into how factors such as tactics and the performance of underwater weapons influence the measurement of effectiveness (MOE) of a weapons system. Governments considering whether to purchase equipment, such as torpedoes or mobile decoys, use these types of modelling and simulation as part of their decision making process both for purchases, and for making tactical decisions.

The new model uses DEVS formalism. DEVS - Discrete Event System Specification - is a widely used, modular and hierarchical technique for modelling and analyzing general systems.

In their paper, the authors introduce a co-modelling methodology for flexible model architecture, which they use to model the underwater warfare system:

"In the underwater warfare model, change in detailed algorithms and

dynamic equations, such as sensor algorithms, is more frequent than the change in the abstract behavior," explains corresponding author, Kyung-Min Seo. "Therefore, by separating abstract behavior and detailed algorithms, we can test candidate tactics or algorithms of underwater platforms with minimal modification of the model."

One drawback of previous modelling approaches has been that a model cannot be re-used. The Korean researchers overcame this by using a three-part modelling methodology that provides generic representations of underwater platforms. This meant that each sub-model – in this case, a controller model, a sensor model, and a manoeuver model - was then reusable for other platform models.

The researchers tested their model with extensive combat simulations, to investigate the impact of parameters such as tactics or weapons performance on an anti-torpedo combat system's effectiveness. For instance, in the case of simulation of a surface ship's evasion of a torpedo, they use factors including the detection range of a surface ship, the pattern of the decoy operating system, and the speed and operating time of the decoy.

"Experimental results support assessment of anti-torpedo countermeasure effectiveness and the decision-making process for future equipment procurements," Seo suggests. However, he adds that external environmental factors, such as wind speed and ocean current, were not included in this model, which was based on a passive sonar system. The next challenge, to include multi-static acoustics within the underwater environment using multiple sonars, along with environmental factors, is the team's goal for future research.

More information: Measurement of Effectiveness for an Anti-torpedo Combat System Using a Discrete Event Systems Specification-based Underwater Warfare Simulator by Kyung-Min Seo, Hae Sang Song, Se

Jung Kwon and Tag Gon Kim is published today in the *Journal of Defense Modeling and Simulation*. The article will be free to access for a limited period here : dms.sagepub.com/content/early/recent

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