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Operational Analysis and CONOPS Definition for Next Generation Mine Warfare

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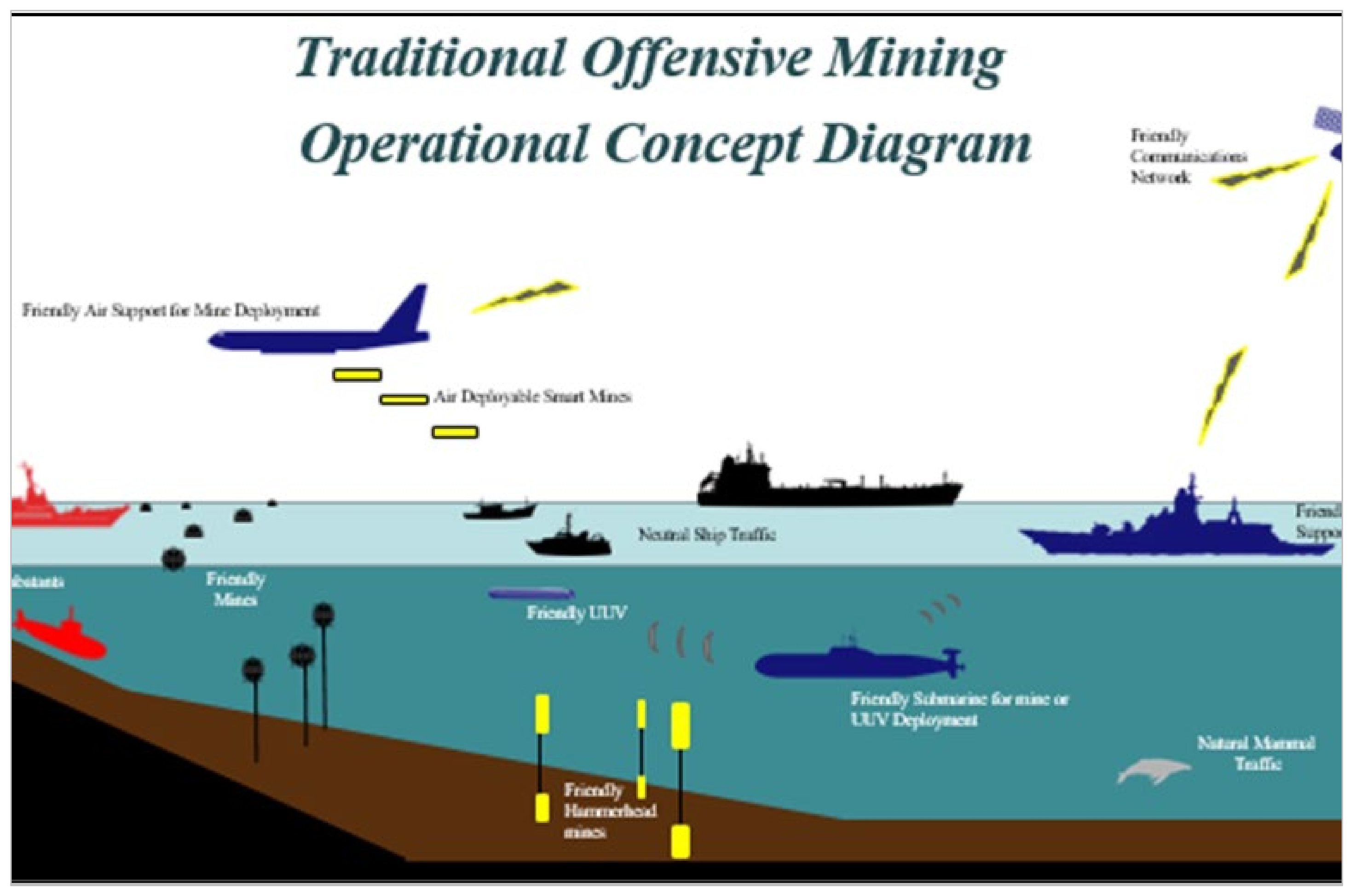
OPERATIONAL ANALYSIS AND CONOPS DEFINITION FOR NEXT GENERATION MINE WARFARE

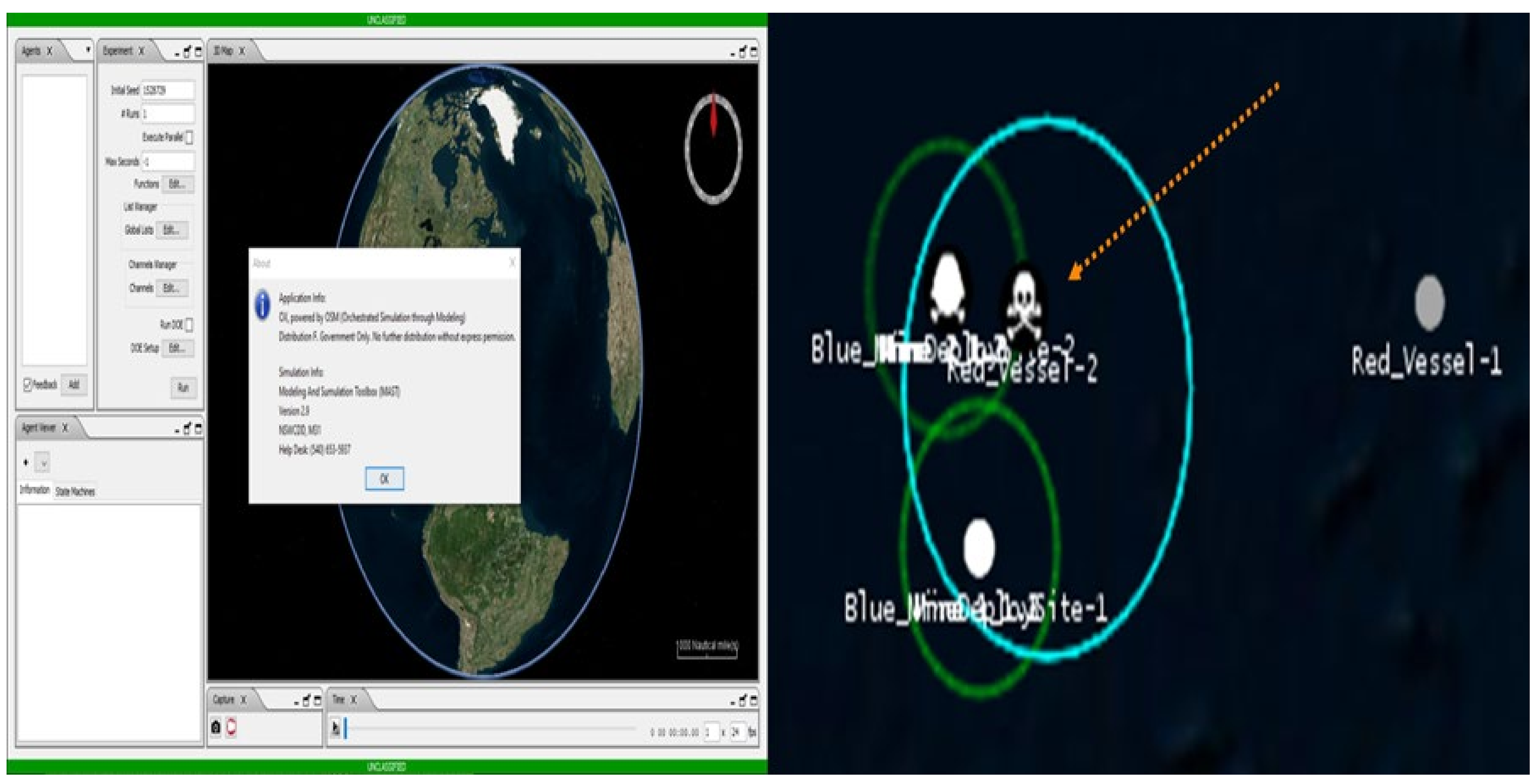
NAVAL POSTGRADUATE SCHOOL

Background & Objectives

This project conducted operational effectiveness analysis to inform future operational concepts for mining. The project developed and analyzed an agent-based simulation model using the Modeling and Simulation Toolbox (MAST) feature of the Orchestrated Simulation through Modeling (OSM) framework developed by the Naval Surface Warfare Center, Dahlgren Division. The OSM MAST model was used to compare airborne, surface, and subsurface deployment strategies as well as the key performance drivers (in terms of operational activities, hostile behavior, and system design decisions) that drive operational effectiveness.



Offensive Mining Operational Concept



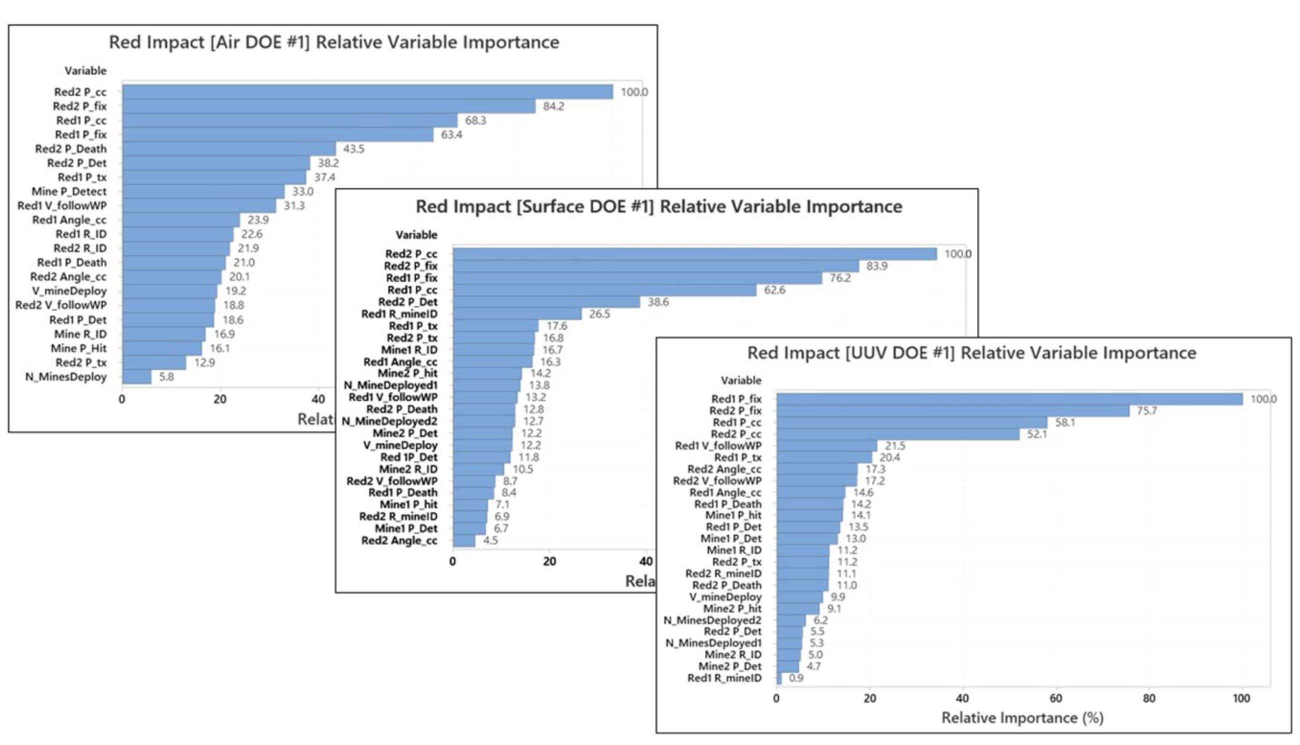
OSM MAST Application Menu (left) and Single Run Visualization of Mine Engagement

Simulation Structure

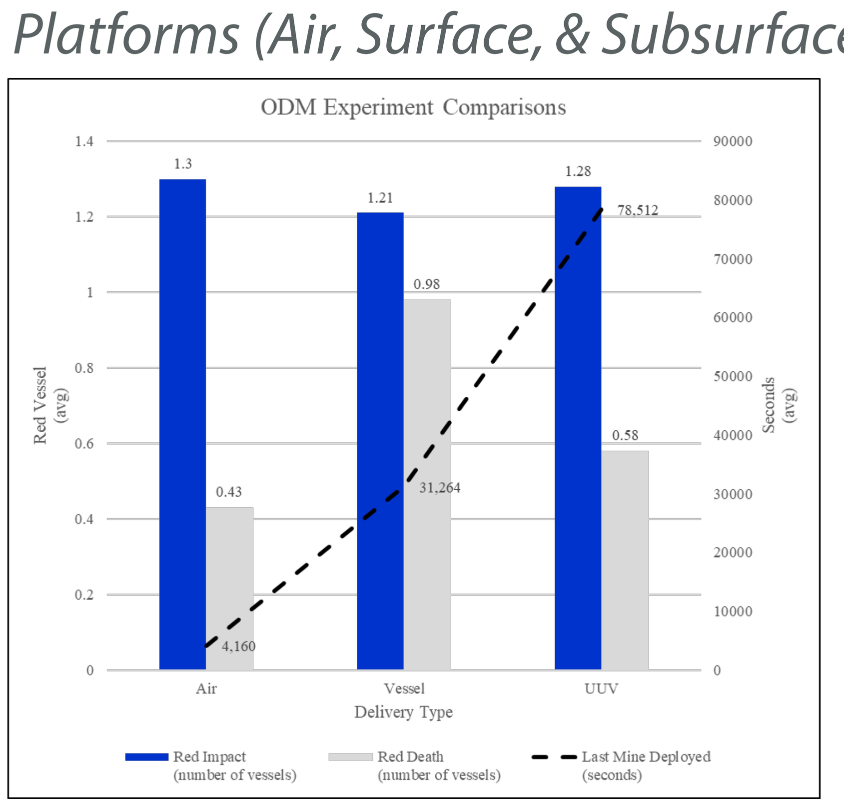
The OSM MAST model simulated a friendly (blue) force deploying a minefield to disrupt the operations of a hostile (red) force. The model implemented a standard sequence of events where a blue delivery vehicle is generated and, based on the vehicle type and mine type the vehicle is employing, proceeds to either one or multiple deployment sites located approximately 50 nautical miles from the generation site. Upon deployment, the blue delivery vehicle exits the deployment zone, and red vessels in the area move to a destination point that may require transit through one of the minefields.

Results and Recommendations

NPS Hamming High Performance Computing machines were used to conduct 27,740 runs of the MAST model. Findings were grouped into two categories. Broadly, the propensity of the hostile vessel to change course or fix position upon mine detection dominated the analysis. This indicates that shaping actions which may cause an enemy to operate boldly or to distrust that a minefield is present may have a larger impact on minefield effectiveness than any characteristics of the delivery vessels or of the minefield itself. In terms of minefield deployment and configuration, the total number of mines had a larger impact than any other design or operational employment decision. Notably, the increase in the number of mines had a larger impact when the minefield size was restricted to less than 20 mines, indicating that there may be diminishing returns for larger minefield. Note that the largest minefield modeled was 120 mines and findings may change again at larger numbers. Finally, when comparing the overall effectiveness of the categories of blue vessels, airborne deployment outperformed both surface and subsurface deployment in terms of both the delay and stop MOE



Relative Importance of Minefield Deployment and Design Characteristics for Alternative Delivery Platforms (Air, Surface, & Subsurface)



Comparison of Red Vessel Impact, Red Vessel Death, and Total Deployment Time for Alternative Delivery Platforms (Air, Surface, & Subsurface)

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