

Feasibility and Design of Blast Mitigation Systems for Naval Applications Using Water Mist Fire Suppression Systems

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The recent trend of using water mist systems to replace HALON-1301 fire suppression systems warrants study into other potential applications of water mist systems. Preliminary research and investigation indicates that fine mists (20-25 μm droplet size) may reduce peak overpressures of a shock wave traveling through a space. Such pressure reductions could be used to mitigate the destructive effects of a shock wave (initiated by an explosive device) traveling through a structure.

Currently these blast mitigation effects have only been demonstrated in small-scale shock tube tests and computer simulations. Uncertainty exists as to the scalability of such a system. This research investigates the applicability of water mist as a blast mitigation system for shipboard use. Study into the degree of mitigation necessary to make a system practical for shipboard installation is conducted. Included in this study is an extensive look at dynamic blast loading of stiffened panels and criteria for preserving the integrity of ship structures. In addition, a theoretical study of the mechanisms of blast mitigation using water mists is included.

Given the recent trend toward tumblehome hull forms in future Naval Combatant designs, there exists strong applicability of this system in the outermost spaces created by the shaping of the tumblehome hull. Further development could include model and full-scale design and testing of such a system with an end goal of a feasible blast mitigation system to be used on Naval Combatants to protect vital system spaces.

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