# ESTIMATION OF BLAST CASUALTIES IN WARSHIPS

BOYD,S.; BURMAN,N.

Current naval war-gaming methods are largely deficient in assessing degraded warship performance due to crew casualties. A quick assessment method is presented to estimate casualties from blast effects in a multi-compartment, multi-level structure, such as the interior of a ship. The method involves the simple application of overlays, which may be applied either physically to a scaled drawing of the structure, or computationally to digitized drawings. The method currently does not account for injuries inflicted by other warhead effects such as fragmentation, fire, or smoke. Although simplified, such fast overlay methods are appropriate in operational research where it is not intended to resolve the detailed physics of a particular weapon/target encounter. However, advanced deterministic methods involving computational fluid dynamics (CFD) and finite-element modeling (FEM) for particular case-studies can be used along with simulation testing to better define the generalized casualty zones which are applied.

The injury criteria employed are currently based on the standard database derived from early free-field blast tests concerning vulnerability of personnel in the field, hence related to simple one-dimensional blast waveforms. However, it is recognized that analysis of injuries in complex blast environments which arise in confinements is a matter of on-going research. Refinements to the casualty zones defined in the current method can be expected from advanced testing and modeling.

Results are presented from application of the current method to full-scale tests involving a decommissioned warship in which damage from various simulated and actual warheads was analyzed. The ship trials involved a 3500-ton Destroyer Escort warship and were conducted near Perth, Australia in late 1994. In a series of tests, warheads of up to 30 kg high-explosive were detonated within various compartments from which casualty zones have been estimated.