SYNERGISM IN NUCLEAR THERMAL/BLAST LOADING

PEARSON,R.J.;WISNIEWSKI,H.L.;SZABADOS,P.D.

Until recently the effects of Nuclear thermal and blast loading have been considered separately assessing vulnerability. This paper is designed to demonstrate that the combined effect of thermal and blast loading is significantly greater than the effect of either type of loading acting alone.

An experimental design, based on a structural response code prediction, was developed to demonstrate the effect of thermal/blast loading on generic aircraft structures. Experiments on instrumented targets were conducted in the BRL Thermal/Blast Simulator. A nuclear loading simulation produced by this device consists of a thermal radiation pulse from a controlled aluminum/oxygen burn followed by a shock wave from a shock tube. In the first test in this program, the target was subjected to a 49 kPa overpressure shock wave without the preceding thermal pulse. In the second test the target was subjected to a 750 kJ/m2 fluence thermal pulse without the following shock wave. In the final test the target was subjected to a 750 kJ/m2 thermal pulse followed two seconds later by a 49 kPa shock wave.

Target loading and response were monitored during all the tests. Strain-gage-type pressure transducers were used to record both diffraction and drag loading on the target. Calorimeters were used to record the flux and fluence of the source, while thermocouples monitored the rise in skin temperature on the target. Strain gages were used to record the response history of the target during each test. Finally pre-shot and post-shot measurements of the target dimensions were used to determine the amount of permanent deflection. The target's configuration and the type of data recorded were both designed to allow detailed comparisons with later structural code model of the tests.

The data generated during these tests clearly shows that the result of thermal/blast loading on the target are different in both magnitude and character from those of thermal or blast loading alone, or even a linear
combination of the two. The results of these tests indicate that thermal/blast synergism can be an important factor in nuclear vulnerability of soft targets.