

GROUND MOBILE SYSTEM VULNERABILITY

Proper understanding and assessment of ground mobile combat system vulnerability are critical to improving system survivability, thereby enhancing mission success and personnel survivability in combat. The SURVICE Engineering Company uses its expertise to develop vulnerability specification requirements, perform trade studies (e.g., armor optimization and vulnerability reduction), assess system vulnerability for comparison against design specifications, support live fire test and evaluation (LFT&E), and provide general programmatic vulnerability support throughout the acquisition cycle. Results and findings from these efforts are used to enhance system and personnel survivability by supporting designers, program-level decision-makers, and higher-level mission analyses. For fielded systems, SURVICE conducts vulnerability assessments to help the warfighter understand how his/her combat system will fare on the battlefield.

SURVICE exercises specific steps that must be accurately performed to ensure that the results of the assessment are valid and reasonable. These steps include the following.

SYSTEM ENGINEERING CHARACTERIZATION

SURVICE develops detailed physical and functional descriptions of the system and its components from the perspective of system vulnerability to combat threats. These descriptions are accomplished using manufacturer's drawings, operator manuals, computer design files, intelligence information, and other data.

WEAPON CHARACTERIZATION

SURVICE researches and identifies characterization data for munitions, including

penetrator mass, impact velocity, fuze timing, fragment distribution zones, and projectile core breakup. This characterization is also based upon expected emissions and threat engagement scenarios.

CRITICALITY ANALYSIS

SURVICE identifies a system's critical mission functions and the components critical to the accomplishment of those functions. Those critical components are evaluated to determine if they are singly vulnerable or redundant, and fault trees are prepared to define these relationships.

DAMAGE MODES & EFFECTS ANALYSIS (DMEA)

SURVICE determines the type of damage that may be sustained from different threats and engagement conditions. The effects of such damage modes on the continued operation and mission completion capabilities of the system are also determined.

PCD|H DEVELOPMENT

Based upon the expected damage, SURVICE estimates probability of component dysfunction for each critical component using component design, weapon effects data, engineering analysis, and empirical test data.

TARGET GEOMETRY MODEL DEVELOPMENT

SURVICE uses BRL-CAD, Pro/E, other commercial software packages, and SURVICE proprietary software and processes to efficiently develop detailed geometric target models, containing all critical components and shielding. This geometry development is based on available design data (e.g., CAD data and drawings) and assessment requirements. In

addition, reverse engineering is often used as a means to support model development when the asset is available and design data are not. This process may include defining a system's physical layout using SURVICE's numerous 3D laser-scanning measurement processes and tool suites.

VULNERABILITY ANALYSIS

SURVICE compiles the information from the previous steps and exercises appropriate vulnerability analysis models to examine the response of the ground mobile weapon system to various damage mechanisms. Vulnerability metrics, such as vulnerable area, probability of kill, loss of function, and degraded states, are calculated to understand and evaluate system vulnerability.

LETHALITY ANALYSIS

In addition to understanding vulnerability (primarily a defensive concept), understanding munition and weapon system lethality (primarily an offensive concept) is also an important part in assessing element mission effectiveness. Assessing lethality is similar to assessing vulnerability, but the focus is shifted from protecting against damage on friendly (or blue) systems to inflicting it on enemy (or red) systems.

Ground mobile systems that SURVICE has assessed include the EFV, M2A3, M1A2, HET, Spoon Rest C Radar, SA-13A, SA-12 C3V, HMMWV, HEMTT, BRDM-2, High Screen Tracked Radar, MTLB, Buffalo, ASV, MRAP, Styker, and FCS (Common Chassis, C2V, NLOS-M, NLOS-C, ICV, MCS).