

KEYWORDS

Blast Loading
Impact Loading
Ballistic Impact
Fragment Impact
Vulnerability
Survivability
Mine Blast
Armored Vehicles
Structural Dynamics
Structural Dynamics Simulations
Vibration Analyses
Materials Evaluation
Army Vehicles
Navy Vehicles
Air Force Vehicles
Aircraft
Tanks
HMMWV
Land Mines
Shaped Charges
Rocket-Propelled Grenade
Explosively Formed Projectile
High-Explosive Incendiary
Armor-Piercing Incendiary
Ballistic Shock
Homeland Security

DYNAMIC LOADING ON VEHICLE SYSTEMS

Southwest Research Institute (SwRI) performs research in a wide variety of complementary technology areas to improve resistance of vehicle systems to the catastrophic results of dynamic loads. Directed toward commercial and military land, air and sea vehicles, the studies include bomb blast or ballistic impact effects with instrumented experiments; bird strike; structural analyses and calculations; materials evaluation, selection and testing; vibration and extreme environment testing. SwRI maintains extensive laboratory facilities and computational capabilities to support these efforts. Studies are conducted to verify existing hardening features in vehicles, or toward their design and development.

Specific military applications include vulnerability testing, hydrodynamic ram in liquid tanks, and ballistic/blast-induced fire vulnerability. Various armor concepts have been evaluated experimentally and numerically against a gamut of ballistic and blast threats. SwRI is world-renowned for work conducted in penetration mechanics, highlighted by the development of penetration models, including the widely recognized Walker-Anderson Model.

Capabilities

- .30 cal to 50 mm gunfire ballistics with a wide variety of projectiles
- Up to 1000 lbs of TNT blast test (mines, shaped charges/rocket-propelled grenades, explosively formed projectiles, bombs, etc.)

- Bird strike testing
- High-speed digital imaging up to 100,000,000 frames per second
- 95+ channels of high-speed data acquisition up to 200 MHz
- Test fixture fabrication, structural assembly, welding
- Institute ISO-compliant QA
- Numerical analysis using a suite of codes: CTH, ALE3D, CALE, LS-DYNA, EPIC 03, PRONTO, ProEngineer, FLOW-3D
- Materials evaluation, including high-rate testing

Representative Experience

- Identification and qualification of ballistic protection foam for the A-10 wing
- Analyses and testing to enhance mine resistance of the HMMWV
- Bird strike impact testing and qualification of commercial and military aircraft leading-edge structures and canopies
- Numerical modeling and explosives testing on a variety of US Army heavy vehicles and trucks subject to mine blast
- Cruise missile and sympathetic detonation in missile magazines for the next-generation Navy ship
- Conventional weapons effects and structural response for a composite deckhouse (next-generation Navy ship)
- Explosive hazard assessment for next-generation reusable and expendable launch vehicle systems (Orbital Space Plan Program and Crew Exploration Vehicle Program)



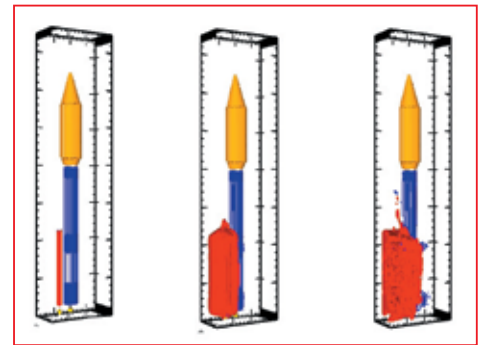
A high-explosive projectile impacted a simulated wing section containing fuel as part of a test series to validate the safety of an SwRI-designed replacement foam insert.



SwRI analyzed armor design and retrofits that greatly improved crew survivability against mine blast for the HMMWV.

D013975

Simulation of catastrophic failure of a generic solid rocket motor and subsequent pressure loading on a generic launch vehicle. Red material is the solid rocket motor propellant and explosive products.



D013974



Southwest Research Institute is an independent, nonprofit, applied engineering and physical sciences research and development organization using multidisciplinary approaches to problem solving. The Institute occupies 1,200 acres in San Antonio, Texas, and provides more than 2 million square feet of laboratories, test facilities, workshops and offices for more than 3,300 employees who perform contract work for industry and government clients.

We welcome your inquiries. For additional information, please contact:

Alex B. Bernardo, Senior Research Engineer
Ballistics and Explosives Engineering
(210) 522-5128
alex.bernardo@swri.org

Donald J. Grosch, Manager
Ballistics and Explosives Range Operations
(210) 522-3176
donald.grosch@swri.org

Engineering Dynamics Department
Mechanical and Materials Engineering Division
Southwest Research Institute
6220 Culebra Road • P.O. Drawer 28510
San Antonio, Texas 78228-0510

Southwest Research Institute Website:
www.swri.org
Engineering Dynamics Department Website:
www.engdyn.org