THREAT CONTEXT

- THE MULTI-THREAT DOMAIN AND CHANGING OPERATIONAL ENVIRONMENT -
Ground Vehicle Survivability and Protection (GVSP)

**Mission:** Bring our Soldiers home injury free with superior ground vehicle survivability and protection systems
GVSP owns and operates research equipment valued at $14M in more than 68,000 square feet of lab space at GVSC and Selfridge Air National Guard base

Ground Vehicle Systems Center facilities:

- **Survivability Armor Ballistics Lab**
  - First article tests/manufacture of transparent armor
  - Production control tests
  - Weld coupon tests
  - Projectiles range in size from 5.56mm to 105mm

- **Active Defeat Lab**
  - Testing of Sensors with Lidar/Laser or Radar capabilities
  - Electro Magnetic testing of AC and DC-supplied and activated Magnets
  - Active Defeat Using Magnetic Deflection

- **Vehicle Protection Integration Lab**
  - MAF compliance testing (Army authority)
  - Software development for modular APS/Control systems
  - Virtual Battlespace Environment for M&S

- **Vehicle Armor Lab**
  - Design/build/fabricate/evaluate/test composite systems at a coupon, subsystem and system level to identify material issues early in development stage

- **Sensor Protection Lab**
  - Peak fluence measurement (sensor)
  - Laser-induced damage threshold testing (eye)
  - Laser sensor jamming (cameras and LIDARS)
GVSP LAB OVERVIEW CONTINUED

Camp Grayling facilities:

- **Rapid Evaluation Capability (Mobile experiment lab)**
  - Real-time experiments/evaluations of emerging technologies against high-explosive threats (EFPs, RPGs, ATGMs, Recoiless Rifles, Mines, Direct-Fire Suppression)
  - Verifies medium-caliber armor manufacturing processes

SANG facilities:

- **Fire Lab**
  - Integration/Testing/Evaluation of existing/emerging extinguishing components/agents
  - Integration and engineering test/evaluation of AFES for watercraft, tactical/armed manned/unmanned ground vehicles

- **SABL Bunker**
  - Ballistic weld testing

- **Soft Kill Integration Cell**
  - Evaluation of subsystem performance/integration for RADAR/LASER/Thermal/DE/VBDB blast testing

- **Ballistics Simulation Lab**
  - Close-in and advanced survivability protection technology testing using multiple air-fired projectile threats

Tools available to support external programs for Industry and the PMs. Partners include Fort Polk (NGIC & ERDC); MTU/KRC; ENMTC
SANG facilities continued:

- **Occupant Protection Lab**
  - Crew Compartment Underbody Blast Simulator (CCUBS)
    - Evaluates vehicle crew compartments in simulated underbody blast events
    - Platform holds up to four seated occupants
    - Testing on EA seats/bench seats/restraints/EA floors/floor mats/cargo retention devices/any item requiring dynamic impact testing.
  - Soldier System Interface Impactor (SSII)
    - Dynamic impact testing of energy mitigating materials
    - Testing speeds up to 24 kp/h (15 mph)
    - ISO/IEC 17025 accredited
  - Sub-System Drop Tower (SSDT)
    - Dynamic impact testing evaluation
    - 48” x 48” platform
    - Capable of simulating a wide range of impulses/measuring the effects technology/occupant
  - Floor Interface Technology Accelerator (FITA)
    - Evaluates the performance of energy absorbing floor materials simulating an underbody blast
    - Rigidly-mounted seat with pneumatically-actuated piston that pushes against the foot of the occupant or resistive object
    - Enables quick evaluation of test item performance prior to more extensive testing
  - Anthropomorphic Test Device (ATD) Certification Lab
    - ATD Certification Lab
    - Reduces time/cost of certifying ATDs and downtime between testing
  - Component Impact Simulator (CIS)
    - Shock impulse testing of components/subcomponents
    - Identifies input parameters significant to component failure/occupant injury
    - Provides data to generate algorithms to predict the risk of failure/injury
**GAPS AND NEEDS**

- **FY21/22 FUNDED gaps and needs:**
  - Modular, conformal armor solutions for top attack threats
  - Dual-mode blast/penetration underbody protection appliques
  - Multi-mode, multi-axis energy absorbing devices for vehicle interior occupant protection
  - Dynamic armor mechanisms for protection of critical components from the residual effects of hard-kill APS engagements
  - Armor solutions with balanced ballistic protection and EM transmission characteristics for protection of sensors
  - Armored fuel tank technologies with integrated fire suppression and self-sealing
  - Anthropomorphic Test Devices that represent the extremes of the central 90th soldier population
  - System Architecture for defense systems
  - Logical data controls

- **FY21/22 UNFUNDED gaps and needs:**
  - Lightweight, low-cost armor solutions for medium caliber KE defeat including multi-hit
  - Energy absorbing seats in highly reclined configurations for low-profile vehicle applications
  - Passive technologies for reduction of acoustic/thermal signatures
  - Spall liners with improved ballistic performance and good flammability, smoke, and toxicity properties
  - Mine/IED rollers with improved threat effectiveness and greater vehicle mobility
  - Machine Learning or Artificial Intelligence in support of system controls and architecture
  - Modeling and simulation for the integration of system of systems
  - Non-stroking blast protection bench seats
  - Crash and rollover protection
Join my GVSP team tomorrow for One-on-One conversations
BACKUP
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US8272311B2 -- Multi-axial explosive, laterally-shearing, tiled reactive mechanism—MAELSTRM
US8333140B2 -- Self diagnostic armor structure
US9527413B1 -- Reclining seat to mitigate the effects of mine blast load on spine and lower leg injuries
US8424443B2 -- Vented armor V structure
US8448560B1 -- Propelled impacter reactive armor
US8453553B2 -- Radially orthogonal, tubular energetically rotated armor (ROTERA)
US8485084B1 -- Multi-axial explosive, laterally-shearing, reactive mechanism
US8490054B2 -- Software and related software tracking during software modification
US9885543B2 -- Mechanically-adaptive, armor link/linkage (MAAL)
US8673103B2 -- Method of fabricating an armor panel
US8747041B1 -- Stress distributing threaded fastener assembly
US8746741B2 -- Truncated V underbody protection enhancement
US8746124B2 -- Multi-axial explosive, laterally-shearing, tiled reactive mechanism—MAELSTRM
US8752432B2 -- Self diagnostic composite armor
US8781672B2 -- System and method for importance sampling based time-dependent reliability prediction
US8826796B1 -- Tapered V underbody protection enhancement
US8826795B2 -- Blast hop mitigation device
US8854003B2 -- Technique for rapid battery capacity testing
US8860159B2 -- Spintronic electronic device and circuits
US8868238B1 -- Apparatus and method for systematic control of robotic deployment and extraction
US8893604B1 -- Modular munitions deployment platform
US8905164B1 -- Vehicle with sacrificial underbody structure
US8950275B2 -- System and method for tracked vehicle dynamometer testing
US10230137B2 -- Estimating core temperatures of battery cells in a battery pack
US10245985B1 -- Reclining seat to mitigate the effects of mine blast load on spine and lower leg injuries
US10252094B1 -- Fire extinguisher manifold with safety interlock cross-bolt
US9003562B2 -- Body armor
US9011067B1 -- System and method for vehicle deployment, extraction, and stowage
US10425622B2 -- Method of generating a predictive display for tele-operation of a remotely-operated ground vehicle
US10445442B2 -- System and method for game theory-based design of robotic systems
US8176832B1 -- System and method for obstruction deflection
US9347898B1 -- Measuring thermal properties of layered structure in situ
US10670375B1 -- Adaptive armor system with variable-angle suspended armor elements
US9557146B2 -- Wire neutralization system
US20190308724A1 -- Enclosure For An Unmanned Aerial System
US20200244178A1 -- High Power Direct Current/Alternating Current Inverter
US20200241062A1 -- Adjustable Spacer Assembly For Electromagnetic Compatibility Testing
US20200131804A1 -- Signal Based Arrangement of Pin Tumbler Pins
US20190151799A1 -- DEFECT DETECTION SYSTEM USING FINITE ELEMENT OPTIMIZATION AND MESH ANALYSIS
US20130265395A1 -- System and Method for Generation of Stereo Imagery
US20100305798A1 -- System And Method For Vehicle Drive Cycle Determination And Energy Management
US20060006023A1 -- Combination rear impact guard, ladder, and ramp for military cargo vehicles
US20060005519A1 -- Hedge breaching device
US20050225635A1 -- Video based security system
US20050111156A1 -- Continuous status indicator for electrical protection device
Mission
Bring our Soldiers home injury free with superior ground vehicle survivability and protection systems

Vision
To be the renowned leaders in decisive survivability and protection products and services throughout the ground domain lifecycle