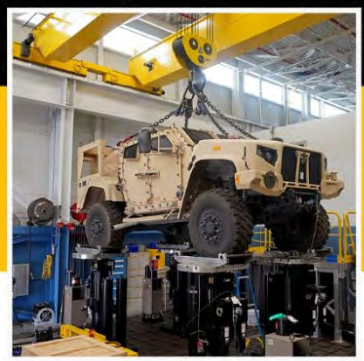
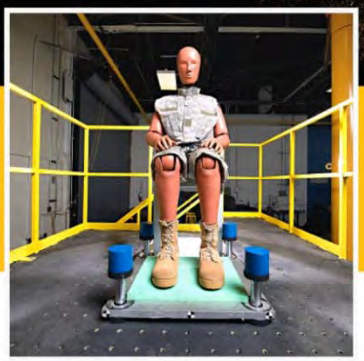
GVSC LABORATORY CAPABILITIES SOURCEBOOK

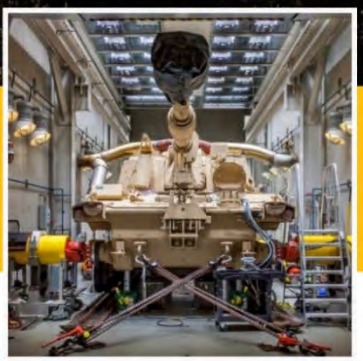
U.S. ARMY GROUND VEHICLE SYSTEMS CENTER











U.S. ARMY

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WELCOME TO THE GVSC LABORATORY CAPABILITIES SOURCEBOOK

At the U.S. Army Ground Vehicle Systems Center (GVSC), our goal is to provide warfighters with advanced technological solutions to ground vehicle systems challenges.

This handbook is designed to introduce you to GVSC's unique laboratory and testing capabilities and the expertise of our technicians, scientists, and engineers. Our technical staff leads research in ground systems survivability, power and mobility, intelligent ground systems, force projection, vehicle electronics architecture and ground systems cyber engineering.

TO USE OUR TESTING LABS:

Once you have reviewed the labs in this Sourcebook and determined your requirements, review the next page to learn about Test Services Agreements (TSAs) and how to initiate one. Afterward, reach out to the Lab Point of Contact listed in this guide or submit an inquiry via the contact form on our website.

OUR MISSION:

Accelerate delivery and sustainment of ground system capabilities to our partners ensuring overmatch for our Warfighters.

OUR VISION:

The center of excellence for Department of War (DoW) ground vehicle systems modernization and sustainment solutions.

GVSC'S FOUR PRIMARY MISSION AREAS:

- Develop and integrate the next generation technologies to ensure ground system dominance.
- Provide world class functional engineering expertise to our PAE partners.
- Provide world class sustaining engineering expertise to our TACOM partners.
- Recruit and develop the engineering talent to achieve the above.



CRADA COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENT

WHAT IS A CRADA?

A Cooperative Research and Development Agreement (CRADA) is a Technology Transfer (T2) mechanism that **establishes a cooperative relationship between a federal laboratory and its collaborator(s).**

GVSC does not provide funding under a CRADA.

AUTHORITY

Army Regulation 70 – 57, **Army technology transfer enables Army modernization through management of intellectual property (Army Directive 2018-16)**

WHEN IS A CRADA APPROPRIATE?

- CRADAs are appropriate when both parties wish to collaborate by exchanging ideas, personnel, materials, or equipment over an extended period, with the goal of advancing research and development.
- CRADAs enable GVSC researchers to exchange technical expertise with non-federal partners and protect the rights of both parties to inventions that may result from the collaboration.
- CRADAs allow GVSC and external partners to share resources and expertise to help advance the development of an idea or technology that helps meet research goals and objectives consistent with their mission.
- CRADAs may be used to assist in the further development and commercialization of GVSC Technologies that have been licensed.

BENEFITS OF USING A CRADA

CRADAs provide GVSC and CRADA partners the opportunity to easily engage and collaborate on joint R&D efforts, while offering the following benefits:

- **Identify, generate, protect and exploit IP to modernize defense systems.**
- **Accelerate the commercialization of federally-developed technology and defray partner's R&D costs.**
- **Offer real world operation feedback and user perspective to help tailor partner's technology.**
- **Keep research resulting from the CRADA confidential and free from disclosure through the Freedom of Information Act for up to 5 years.**
- **Protect any proprietary information brought to the CRADA by either partner.**

HOW TO START A CRADA

Go to our website, review the GVSC Laboratory Capabilities Brochure to see if our labs fit your needs.

https://gvsc.devcom.army.mil/home/partner-with-us/

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DEVCOM GROUND VEHICLE SYSTEMS CENTER

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TSA TEST SERVICES AGREEMENT

The Ground Vehicle Systems Center (GVSC), located in Warren, MI on the Detroit Arsenal, is the U.S. Army's laboratory for developing advanced military ground vehicle technologies. GVSC offers industry partners access to unique laboratory and testing capabilities, supported by the expertise of our technicians, scientists, and engineers - helping you accelerate your product development and validation

Benefits of using GVSC Laboratory for Testing

1. Purchase testing "at cost" (Laboratories do not make a profit).
2. Government does not derive any right in or to the purchaser's Intellectual Property.
3. Test Results are confidential and may not be disclosed outside of the Federal Government without the consent of the persons for whom the test are performed.

AUTHORITY

Test Services Agreements (TSAs) are authorized by 10 USC 4892. The law authorizes the directors or commanders of government laboratories, centers or other facilities to make available to any person or entity, at a prescribed fee, the services of the government facility for the testing of materials, equipment, models, computer software and other items.

WHEN A TSA IS APPROPRIATE

TSAs must involve a "unique" government capability and should be used if the service is to be provided by the laboratory with no technical collaboration by the partner. The service performed must legitimately be the "testing of materials, equipment, models, computer software or other items." A TSA is not appropriate for research studies or investigations. Neither does it authorize the sale of products – just services. The entity requesting the laboratory's services must establish in writing that provision of the services will not constitute undue competition with the private sector and that the service requested does not involve expansion of laboratory capabilities or facilities, even if the requesting entity offers to finance the expansion.

WHO MAY PARTICIPATE IN A TSA

- **Private Industry (U.S. or foreign)**
- **State, local, or tribal governments (U.S.)**
- **Nonprofits (U.S.)**
- **Academic institutions (U.S. or foreign)**

HOW TO START A TSA

Go to our website, review the GVSC Laboratory Capabilities Brochure to see if our labs fit your needs.

https://gvsc.devcom.army.mil/home/partner-with-us/

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DURABILITY TEST LABORATORY (DTL)

The Durability Test Lab (DTL) provides a one-of-a-kind ability to introduce real world environmental loads into test specimens while utilizing the controlled, repeatable environment of a laboratory. Rapid, cost-effective testing is utilized to make validated engineering decisions for the integration of any Army ground system technology. As an ISO 17025 Accredited Lab the quality and utility of the data generated can be trusted to make informed engineering decisions.

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DURABILITY TEST LAB (DTL)

ELECTRO-DYNAMIC SHAKER TABLE

These shaker tables provide the capability to perform high frequency, multi-axis (via 1 axis at a time) testing to Military Vibration Standards Tests. They are also capable of producing simulated road vibration and shock. This supports multiple tracked and wheeled vehicle military programs, Urgent Operational Needs (UONs), and fleet modernization initiatives.

CAPABILITIES

These electro-dynamic shakers use a slip table to provide the capability to test 3 orthogonal axes of vibration from 5-2000hz. This type of testing is the standard for high frequency component testing. It is very repeatable and controlled, which makes comparisons of different component options very easy. The addition of the thermal chamber allows for the inclusion of temperature cycles (-60F to 160F) while the parts are undergoing vibration, which has been shown to be critical in some materials such as plastics.

BENEFITS

Lab testing of components and subsystems save significant time and money compared to running traditional proving ground testing. This equipment provides a growing capability of high frequency vibration and shock for large payloads. Testing in a lab allows for replications of test profiles in a controlled, repeatable environment.

RIG STATISTICS

- Max Actuation Force: 55,000lbf Random
- Control Bandwidth: 5 to 2,000hz
- Max Payload: 12,000lb
- Table Area: up to 5 ft x 5 ft
- Number of Data Acquisition Channels : 32



T5500 ED shaker with test component



ETS 748 ED Shaker with Environmental Chamber



ETS 748 Shaker

POC
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DURABILITY TEST LAB (DTL)

FULL VEHICLE ENVIRONMENTAL CHAMBER (VEC)

This test rig is used to evaluate vehicles in extreme ambient temperatures, representing the most severe conditions that a vehicle may be exposed to during use. The chamber may be used for static or dynamic temperature and humidity-controlled tests.

CAPABILITIES

This rig can accommodate most Army wheeled vehicles. The operating range of the VEC is -60°F to 185°F with full humidity control up to 149°F. Shake testing at temperature is also available with height restrictions on the vehicle. Frequently used for cold weather kit evaluations and cold start tests.

BENEFITS

- Reduced test duration via 24/7 testing options.
- Controlled environment for repeatability of previous test conditions.
- Ability to conduct thermal vibration tests.

RIG STATISTICS

- Minimum Temperature: -60°F
- Max Temperature: 185°F
- Full humidity control from 20% to 95%
- Humidity Limitations: -40°F dew point at maximum dry-bulb temperature of 149°F
- Internal Dimensions
  - Length: 371”
  - Width: 186”
  - Height: 180”



MMPV II inside VEC



M-ATV inside VEC



VEC

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DURABILITY TEST LAB (DTL)

MISSION EQUIPMENT VIBRATION TABLE (MEVT)

The Mission Equipment Vibration Table (MEVT) delivers an extensive array of testing applications providing rapid, flexible and reliable analysis for large ground vehicle components and subassemblies.

CAPABILITIES

The MEVT is a 3 degree of freedom design capable of providing simultaneous application of force and motion in the vertical, roll, and pitch directions. The system is able to model correlations of frequencies up to 50 Hz with a maximum payload at 15,000lb, using MIL-STD 810H vibration methods, or Road Load Data Acquisition (RLDA) data captured from field/test events. The MEVT system is design to offer high-fidelity of vibration events.

BENEFITS

Lab testing of components and subsystems save significant time and money compared to running traditional proving ground testing. This equipment provides a growing capability of high frequency vibration and shock for large payloads. Testing in a lab allows for replications of test profiles in a controlled, repeatable environment.

RIG STATISTICS

- Table Size: 101” x 119.5”, 6” rectangular grid spaced ¾” x 10 mounting holes
- Vertical Displacement: ± 3 in
- Rotational Roll: ± 3.5 degrees
- Rotational Pitch: ± 2.4 degrees
- Vertical Velocity: 20 in/s
- Control Bandwidth: 50 Hz @ 15,000lb
- Max Payload: 15,000lb



MEVT Test Rig



FMTV Cab on MEVT



Prototype Armor on MEVT

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DURABILITY TEST LAB (DTL)

FULL VEHICLE SHAKERS (N-POST)

The Full Vehicle Shaker, or n-Post Test Rig, is capable of testing some of the largest wheeled vehicles in the Army's fleet. This tried-and-true technology is a valuable addition to any evaluation effort.

CAPABILITIES

This test rig is a tire coupled roadway system capable of testing most Army wheeled ground systems. The actuators can be configured in several ways to accommodate various axle or wheel spacing configurations. It can input most loads seen while exercising to the vehicle Operational Mode Summary on Army Test Courses.

BENEFITS

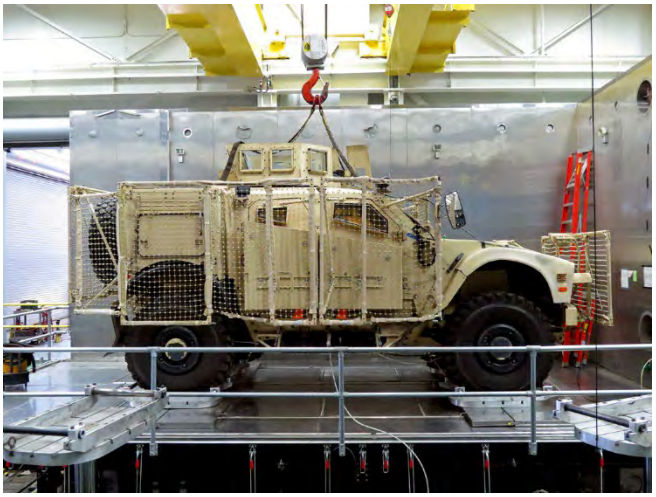
- Reduced test duration via data editing, correlation, and 24/7 test option.
- Observation of test specimens in motion allows the test engineer to evaluate the vehicle negotiating difficult or problem-causing terrain.
- Controlled environment for repeatability of previous test conditions, eliminating changes in motion due to time, the driver, and weather or test parameters.

RIG STATISTICS

- Max Force Rating: 38,000lbf.
- Max Displacement: +/- 20 in.
- Up to 5 axles tested concurrently
- GVW up to 80,000 lbs.
- Up to 96 channels recording
- 8 actuators, 38,000lbf. 20 in. stroke
- 8 actuators 25,000lbf. 20 in. stroke
- 5 actuators 11,000lbf. 14 in. stroke
- 4 actuators 11,000lbf. 12 in. stroke



JLTV being installed on simulator



M-ATV on simulator



Commercial electric truck on simulator

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DURABILITY TEST LAB (DTL)

SUSPENSION TEST ANALYSIS RIG (STAR)

The heavy suspension tester can validate the integration of new components quicker than traditional full vehicle testing at a proving ground. Testing on this rig is especially advantageous where large sample sizes, iterative component design changes, or comparative design analyses are needed. The tabletop above the vertical actuator allows for complex test setups and large fixtures to be installed. The test controller allows for multiple degrees of freedom for complex test kinematics.

CAPABILITIES

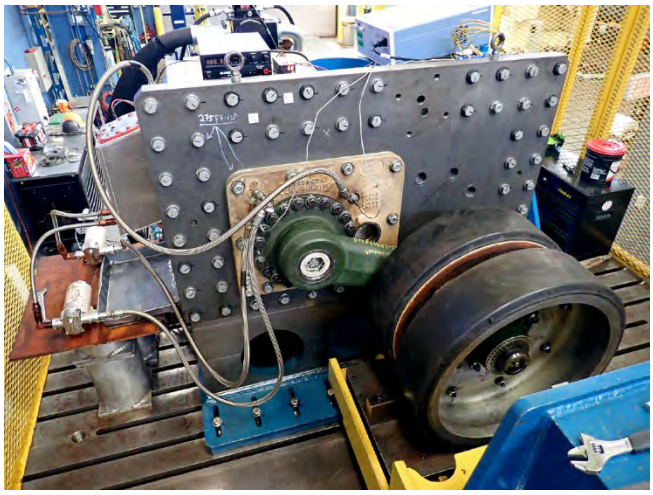
The test rig is referred to as the Suspension Test Analysis Rig (STAR). The STAR can conduct durability testing of suspension systems, including road arms for tracked vehicles. It is capable of extreme velocity and can simulate shock events in line with MIL-STD 810. Utilizing a head expander, or the integrated t-bed, the STAR can perform tests on a wide range of test items and systems. The multi-degree of freedom control system allows for actuation of suspension components in all the directions they would be loaded in the field.

BENEFITS

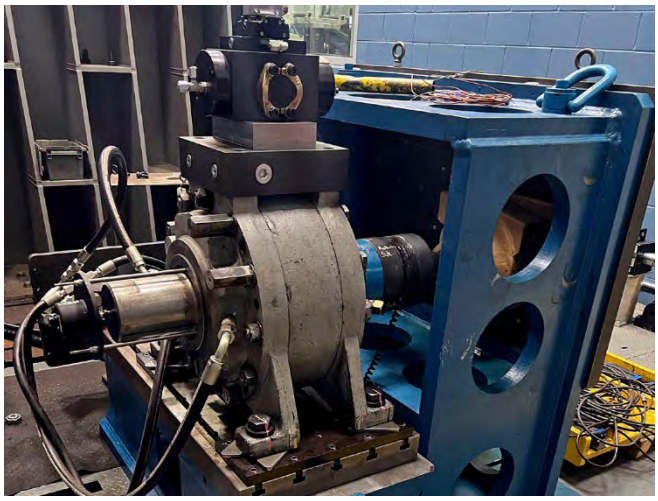
- Reduced test duration via data editing and 24/7 testing operations.
- Multiple Degree of Freedom allows for targeted failure modes and faster test times.
- Reconfigurable table and fixtures allows for multiple components to be tested sequentially and very quickly

RIG STATISTICS

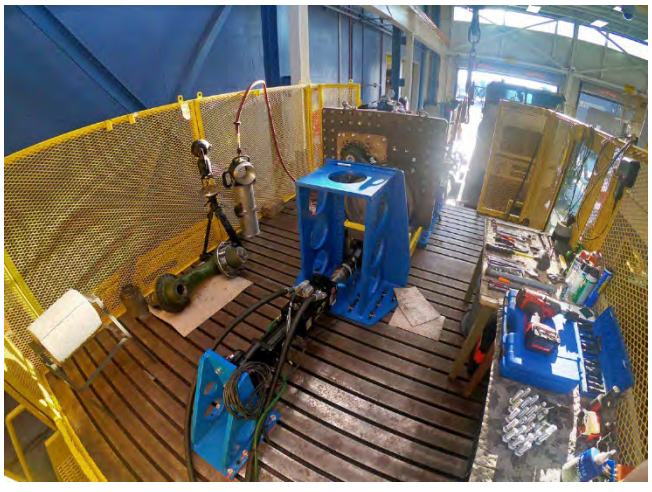
- Force Rating: 72,000lb
- Max Displacement: +/- 9 in
- Max Velocity: 400 in/s
- Test item Dimensions: 120 x 174 in
- Head Expander Size: 50.5 x 50.5 in



Track Suspension Components on STAR



Rotary Actuator



Lateral Actuator

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DURABILITY TEST LAB (DTL)

MULTI-AXIS SHAKER TABLE (MAST)

This shaker table provides capability to perform multi-axis testing in six concurrent degrees of freedom while controlling temperature to replicate simulated road vibration and environmental loads. This supports multiple tracked and wheeled vehicle military programs, Urgent Operational Needs (UONs), and fleet modernization initiatives.

CAPABILITIES

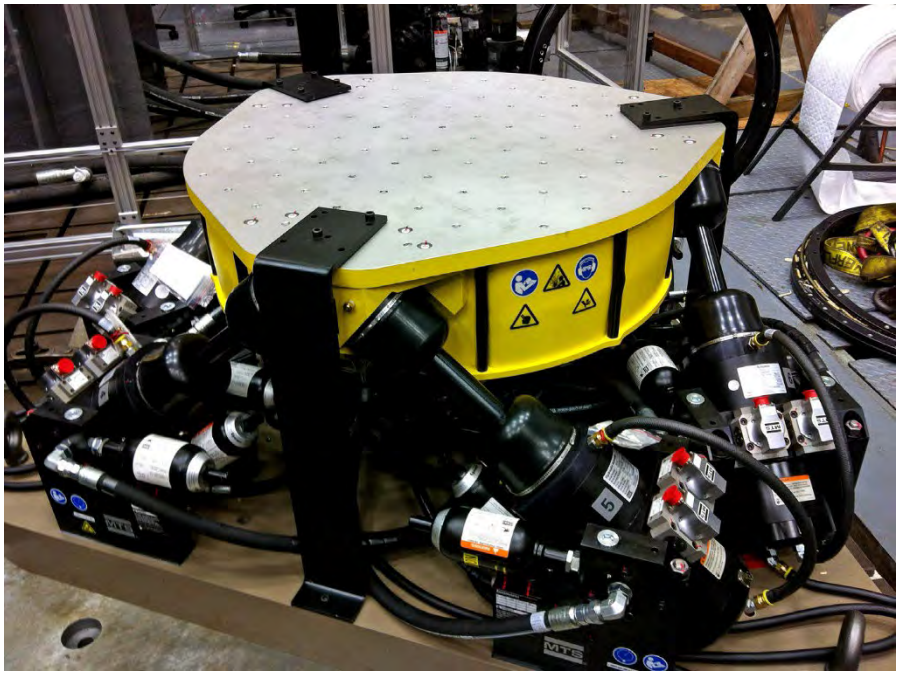
This test rig is a 6 degree of freedom, multi-axis shaker capable of testing any Army ground or air systems to a vibration profile. It can precisely replicate most component vibration input loads seen while exercising to the vehicle Operational Mode Summary, Mission Profile (OMS/MP) on Army Test Courses. Vibration testing on a component level can be utilized as a valuable design tool to discover durability issues and accelerate redesign for a ruggedized product. First Article Test (FAT) and product acceptance testing can also be performed. If the customer requires, Units Under Test (UUT) often can be tested in an operational state, UUT function testing, or be combined with an environmental chamber.

BENEFITS

Lab testing of components and subsystems saves significant time and money compared to running testing on full vehicles. This equipment provides a unique capability of high-frequency multi-axis vibration. The lab controls allow for replication of test profiles in a controlled, repeatable environment.

RIG STATISTICS

- Max Displacement: +/- 1.2” in X / Y / Z
- Max Velocity: +/- 30”/s in X / Y / Z
- Max Acceleration: +/- 20g in X / Y / Z (empty table)
- Control Bandwidth: 0 to 500hz
- Temperature Range -60oF to 160oF
- Max Payload: 1,000lb
- Table Area: up to 3 ft x 3 ft



MAST

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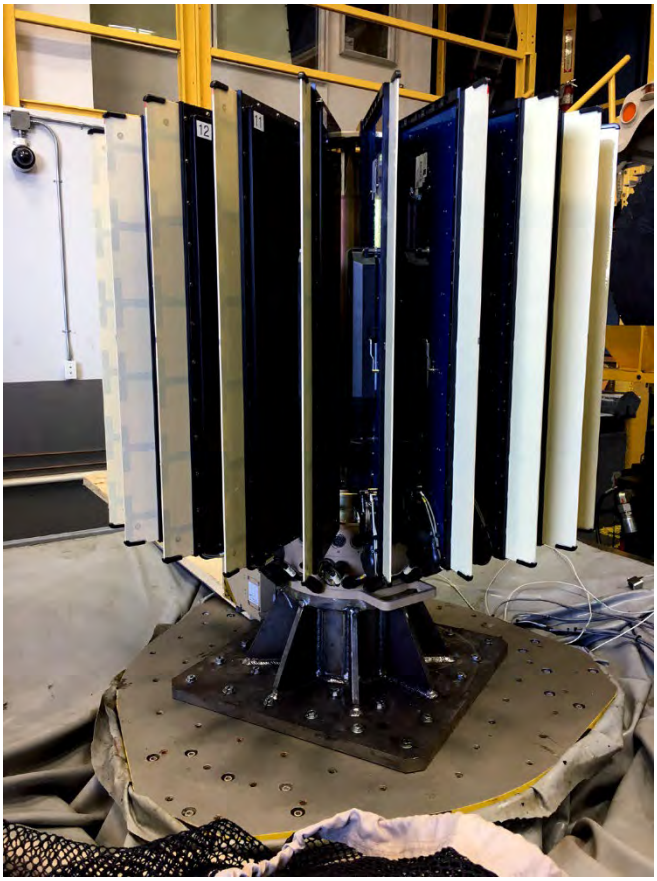
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DURABILITY TEST LAB (DTL)

MULTI-AXIS SHAKER TABLE (MAST)



MAST with environmental chamber



Electronic components on MAST

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DURABILITY TEST LAB (DTL)

NOISE AND VIBRATION DATA ACQUISITION AND ANALYSIS

The DTL team has high-frequency and high-channel count data acquisition capabilities for most measurement types. In addition, the GVSC team has expertise in the analysis of the data that includes acoustics, vibration, durability, and sound quality.

CAPABILITIES

GVSC has 100-plus channels of Siemens Scadas data acquisition that can be configured to collect data from any type of measurement including vibration, forces, strain, displacement, temperature, sound, torsion, pressure, CAN-bus, and GPS. The system can be configured to collect data at multiple sampling rates from 0.5 Hz up to 100 kHz, allowing GVSC to collect a wide range of measurements on large systems such as a full vehicles. With this capability the team has a better understanding of what is happening on a system as it is used in the field and is able to collect relevant data to feed both the internal testing capabilities and feed data to other test centers. GVSC has 28 channels of Bruel & Kjaer LAN-XI data acquisition that can be configured to collect noise and vibration data. Although the system was built to conduct MIL-STD-1474E aural non-detectability data collection and analysis, an additional benefit over conventional MIL-STD- 1474E data collection is that all 24 measurement points are recorded simultaneously, which means the environmental conditions are identical for each measurement point. Simultaneous measurements allow evaluation of moving vehicles using MIL-STD- 1474E.

BENEFITS

The Scada system is expandable and has been used to collect vehicle level data that totaled 484 channels of measurements. This program involved the determination of forces in the Abrams running gear, but given the large dataset, the data is also being used by other customers.

This capability allowed the team to:

- Set and evaluate S-MET vehicle acoustic requirements;
- Set, develop, and evaluate the requirements for the Abrams ECP1 Auxiliary Power Unit (APU);
- Quickly react to a request for vehicle acoustics improvements on the JLTV, resulting in an exhaust muffler being added to support the initial design.



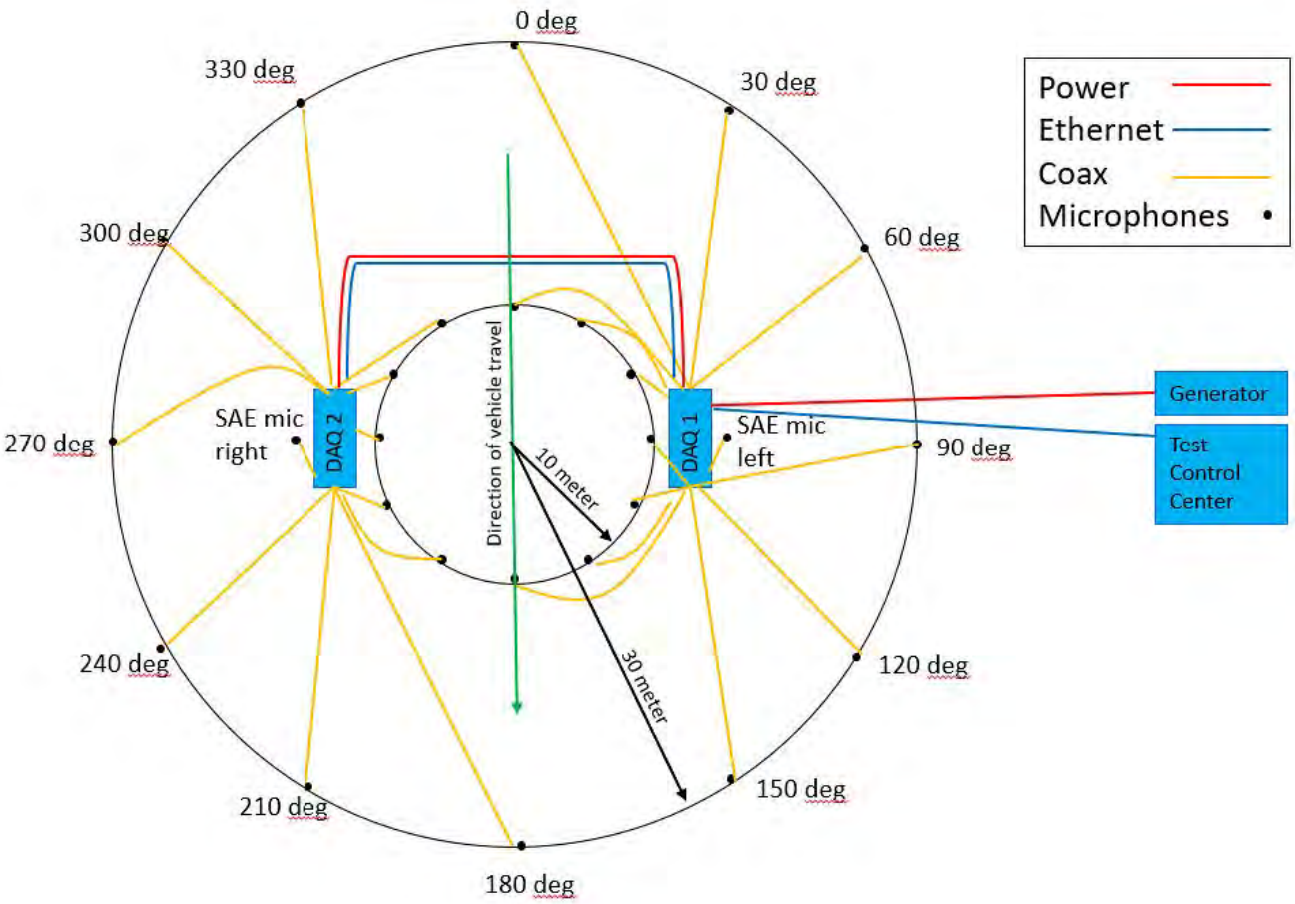
Full vehicle test using the Scada system

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Continued on next page…

DURABILITY TEST LAB (DTL)

NOISE AND VIBRATION DATA ACQUISITION AND ANALYSIS



MIL-STD-1474E data acquisition setup grid

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DURABILITY TEST LAB (DTL)

COMPONENT TEST RIG (CTR)

This test rig is a multiple actuator, reconfigurable test table. The actuators are hydraulically based, and can be powered simultaneously, or one at a time. There is capacity with the controller and hydraulic hookups to run four actuators at once. The intent of the rig is to run smaller components to either ultimate strength or fatigue loads.

CAPABILITIES

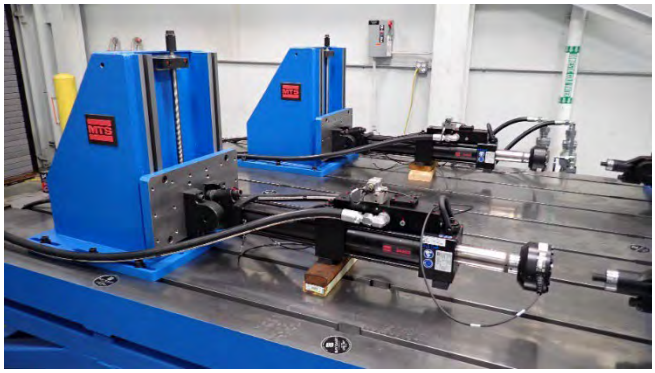
These electro-dynamic shakers use a slip table to provide the capability to test 3 orthogonal axes of vibration from 5-2000hz. This type of testing is the standard for high frequency component testing. It is very repeatable and controlled, which makes comparisons of different component options very easy. The addition of the thermal chamber allows for the inclusion of temperature cycles (-60F to 160F) while the parts are undergoing vibration, which has been shown to be critical in some materials such as plastics.

BENEFITS

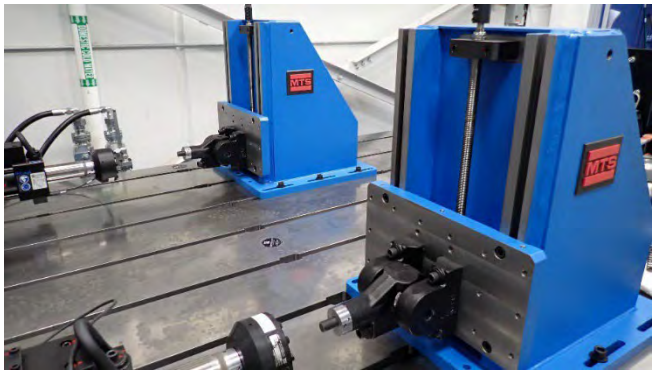
Lab testing of components and subsystems save significant time and money compared to running traditional proving ground testing. This equipment provides a growing capability of high frequency vibration and shock for large payloads. Testing in a lab allows for replications of test profiles in a controlled, repeatable environment.

RIG STATISTICS

- Max Actuation Force: 55,000lbf Random
- Control Bandwidth: 5 to 2,000hz
- Max Payload: 12,000lb
- Table Area: up to 5 ft x 5 ft
- Number of Data Acquisition Channels : 32



Multiple Actuators



Adjustable Multi-Purpose Fixtures



Multiple Hydraulic Hookups

POC
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DURABILITY TEST LAB (DTL)

TRAILER SHAKER, PINTLE MOTION BASED SIMULATOR (PMBS)

This piece of testing equipment can test trailers within a lab environment. It is capable of replicating loads and inputs that simulate connection to a towing vehicle.

CAPABILITIES

This test rig is used to conduct durability and performance tests on trailers. It provides motion and force inputs to the test trailer's tires and lunette to reproduce dynamic conditions in a representative driving environment. It can input most loads seen while exercising to the vehicle Op Mode Summary on Army Test Courses.

BENEFITS

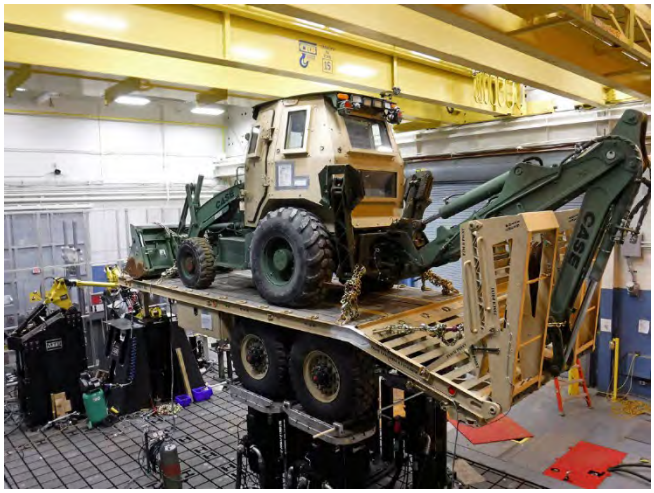
Laboratory trailer testing offers the repeatability of dynamic events, and can eliminate performance variables such as weather conditions, driver variability and course maintenance.

RIG STATISTICS

- Axial Displacement Lunette
  - Vertical = ± 8 in
  - Lateral = ± 5 in
  - Longitudinal = ± 5 in
  - Tires-Vertical: = ± 10 in

- Forces Lunette
  - Vertical = ± 18,000lbs
  - Lateral = ± 11,700lbs
  - Longitudinal = ± 27,300lbs
  - Tires-Vertical: = ± 25,000lbs

- Maximum Payload = 20,000lbs



PMBS with test trailer and mission payload



PMBS with test trailer and mission payload

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DURABILITY TEST LAB (DTL)

UNIAXIAL TENSION/COMPRESSION TESTERS

The DTL houses a hydraulic Instron load frame, an MTS load frame and an electric screw driven Riehle machine all capable of performing quasi-static testing, including tensile, compression, bend, peel, tear, shear, friction, puncture and other mechanical tests. The two load frames can also run in dynamic mode. All three rigs have adjustable crossheads to accommodate larger test items.

CAPABILITIES

- Accepts all forms of coupons or subcomponents
- Conducts low velocity and high force tests
- Used for development of Material Characterization Data

BENEFITS

Laboratory testing offers the repeatability of dynamic events, and can eliminate performance variables such as weather conditions, driver variability and course maintenance.

RIG STATISTICS

- Instron Statistics Force Rating: 115,000 lb
  - Dynamic Displacement: 6 in
  - Velocity: 1118 in/min (0.5 m/s)
  - Dynamic Stiffness
  - Storage Stiffness
  - Loss Stiffness
  - Phase
  - Dampening
  - Tan Delta

- Riehle Statistics Force Rating: 300,000 lb
  - Static Displacement: 48 in
  - Velocity: 0.5 in/min (0.0002 m/s)
  - Force versus Displacement Characteristics
  - Force versus Velocity Characteristics
  - Peak Force versus Peak Velocity Characteristics
  - Ultimate Strength Testing
  - Durability Testing
  - Material Properties



Instron Load Frame



Riehle Load Frame

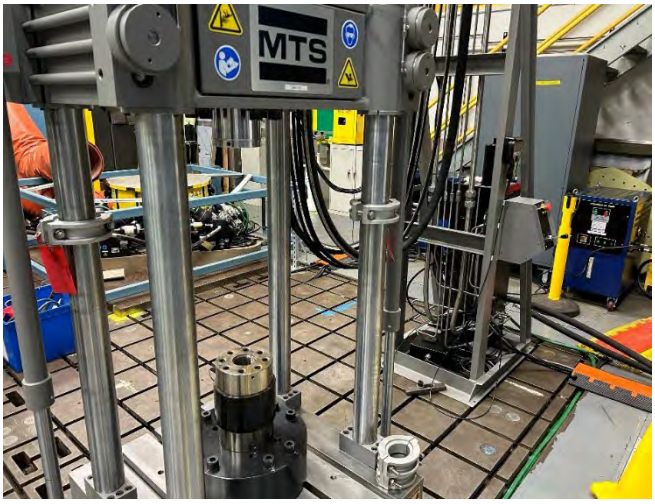
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DURABILITY TEST LAB (DTL)

UNIAXIAL TENSION/COMPRESSION TESTERS

- MTS Force Rating: 220,000lb
  - Dynamic Displacement: 6 in
  - Velocity: 138 in/min (0.06 m/s)
  - Stiffness
  - Dampening
  - Fatigue
  - Ultimate Strength
  - Durability Testing
  - Material Properties



MTS Load Frame

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DURABILITY TEST LAB (DTL)

VEHICLE INERTIAL PROPERTIES EVALUATION RIG (VIPER)

This system is used to accurately measure system and subsystem inertial characteristics and center of gravity (CG) for vehicles, trailers, and turrets. These measured parameters include mass moments of inertia in roll, pitch, and yaw, as well as roll/yaw mass product of inertia.

CAPABILITIES

The VIPER is capable of testing almost all of the Army's wheeled ground systems and some of its tracked ground systems as well. The rig can also test other objects such as turrets and shipping containers.

BENEFITS

The mass property measurements made are an essential component for developing realistic dynamics models when solid modeling is not an option due to cost or availability. This information directly impacts vehicle design trade-off, rollover analysis/prediction, vehicle stability/handling/ride, turret drive/control, transportability assessments, suspension tuning/ design, and vehicle data plate information and analysis.

RIG STATISTICS

- Vehicle Width: up to 150in
- Vehicle Length: up to 600in
- Vehicle Weight: 3,000 to 100,000lbs



Empty VIPER Test Rig



HET Under Test



Abrams Turret in Stand

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DURABILITY TEST LAB (DTL)

SUSPENSION TEST EVALUATION MACHINE (STEM)

This test system is used to test components at high velocity. The intended purpose of the rig is to test suspension components like springs and shocks, but via a head expander mounted to the actuator head other components can be tested as well. The large displacement and force rating allows for testing of any of the military suspension shocks or springs currently in use. The rig is also capable of testing anything smaller such as industry components for baselining, comparison, or customer research.

CAPABILITIES

The test rig is referred to as the Suspension Test Evaluation Machine (STEM). The rig is capable of characterizing and conducting durability testing of vehicle dampers and springs, as well as quarter suspension systems from wheeled vehicles. It accepts all forms of dampener systems in use on Army ground vehicles today and from commercial vendors. It is capable of high velocity and can simulate impact and shock events in line with MIL-STD 810. Utilizing a head expander, the rig can perform tests on a wide range of test items and systems.

BENEFITS

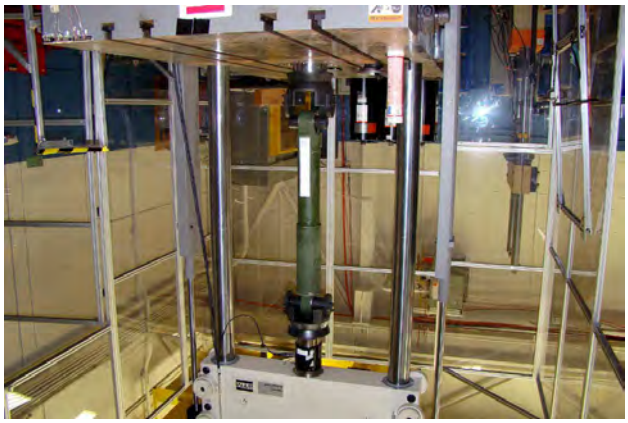
The damper dynamometer can test components faster with less financial and logistical burden than placing the component on a vehicle and running a full vehicle test. Testing on this rig is especially advantageous where large sample sizes, iterative component design changes, or comparative design analyses are needed.

RIG STATISTICS

- Force Rating: 42,000lbf
- Max Displacement: +/- 7 in
- Max Velocity: 300 in/s
- Max Test item Dimensions: 29.75 x 80 in
- Head Expander Size: 28.5 x 28.5 in
- Damping Coefficients
- Component Fatigue Testing
- Damper Performance Characterization
- Quarter Car Testing
- Seat Shock Characterization
- Armor Shock Characterization
- Blast Mat Characterization



STEM with JLTV Shock Absorber Front Sub- Assembly



STEM with Bradley Strut



Empty Load Frame

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DURABILITY TEST LAB (DTL)

ROAD LOAD DATA ACQUISITION & ANALYSIS (RLDA&A)

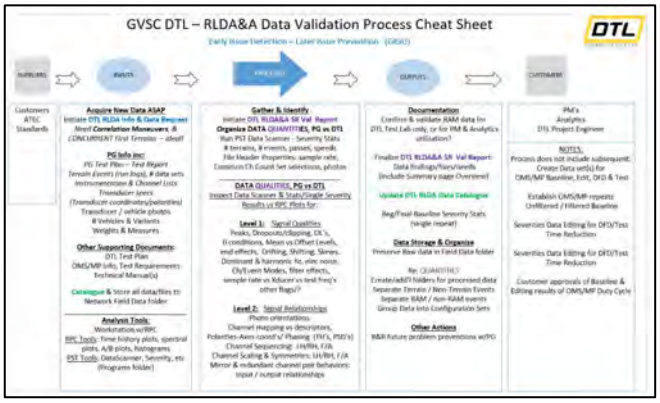
The DTL retrieves/requests and receives vehicle system, sub-system, and component data from the proving ground for all PM needs. The DTL can review, refine and release for use once the data information and data signal qualities have been validated by internal engineers.

CAPABILITIES

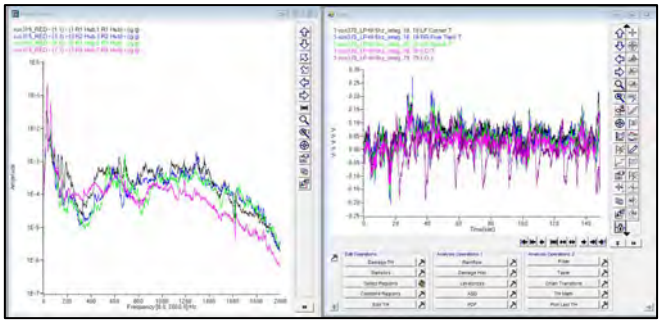
The DTL can help prescribe and acquire data at the lab, proving ground, the field, or anywhere in between. The DTL can specify transducers and locations for measurement and varying vehicle configurations. Data analysis including review of time histories, spectral densities, statistics, damage, pseudo damage ("Severity"), energy/power, pseudo energy/power, data validation with manipulation and reformatting are all part of what the DTL offers. Duty cycle creation & baselining, data editing & reduction, while utilizing both industry standard and custom in-house process tools can all be done within the DTL. The DTL can provide customer direction and guidance regarding a broad spectrum of data concerns.

BENEFITS

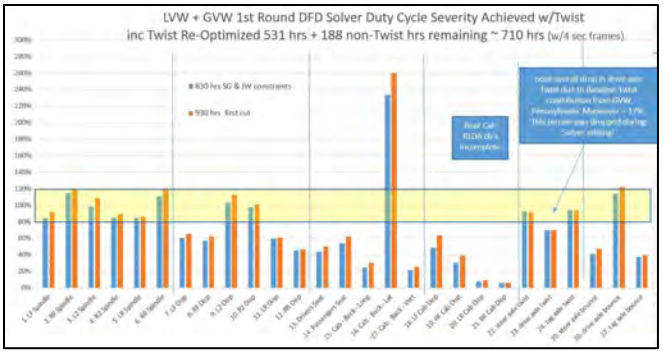
The DTL has proactive involvement at the inception of a road load data acquisition event (RLDA). The DTL can facilitate data needs between the Proving Grounds (PG) and/or the PM, establishing positive communication between the PG and GVSC to assure information is coordinated and maximized. DTL coordinates channels and terrains selected to ensure they meet needs for lab test, analysis, and design. Real time involvement in data review can be arranged as it is measured. DTL can assure final data is ready to use once validated.



RLDA&A Flow Chart



Spectral Density & Time History Analysis



Duty Cycle Data Baseline, Editing, & Test Severity Correlation

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FORCE PROJECTION TECHNOLOGY (FPT)

Force Projection Technology provides mission lifecycle engineering for Army Combat Support and Combat Service Support equipment for gap crossing, petroleum & water systems, combat engineering, material handling, and fluid and petroleum quality surveillance. Its laboratories facilitate research, development, and engineering services to support fuels, fluids, water, wastewater and military bridging systems to keep the US Army in motion anytime, anywhere.

ARMY PETROLEUM LABORATORY (APL) **26-27**

FUEL AND LUBRICANTS LABORATORY (FLL) **28-29**

BRIDGE TECHNOLOGY LABORATORY (BTL) **30-31**

FUEL AND WATER EQUIPMENT BRANCH LABORATORIES **32-34**



FORCE PROJECTION TECHNOLOGY (FPT)

ARMY PETROLEUM LABORATORY (APL)

The Army Petroleum Laboratory (APL) is a tenant organization at the Defense Depot Susquehanna. APL provides quality surveillance testing of bulk fuels including jet fuel, aviation (AV) gas, automotive gasoline, diesel fuel, burner fuel, kerosene, E-85 and bio-diesels in accordance with Military Standard (MIL-STD) 3004. APL is DoW certified to extend the shelf life of packaged petroleum products and chemicals. The lab also conducts first-article testing on products such as lubricating oils and greases, hydraulic fluids, brake fluids, gear oils, engine coolants and select chemicals.

APL tests approximately 10,000 petroleum samples for the military, in addition to over 18,000 tests for over 200 active customers, including aviation and ground customers, CONUS and OCONUS.

PURPOSE

Provide efficient quality surveillance of U.S. government-owned petroleum products worldwide and quality customer support to all our customers.

TECHNICAL AUTHORITY

- Responsible for quality surveillance testing mission for Army petroleum products per AR710-2 and DA-PAM-710-2
- Only Army laboratory certified by the DoW Shelf-Life Program to test package POL. Certified to test multiple Petroleum, Oil and Lubricant items in Federal Supply classes 9150/6850/6810
- Only Army fuel laboratory capable to test at a full B-2 level of testing, which is required to ensure the product is not deteriorating due to age, environmental or storage conditions

BENEFITS

- Quick testing turnaround
- Cost-effective, continuous tests
- Skilled lab associates operating equipment
- Single-point testing to easily send samples
- Test results are maintained electronically

TESTING CATEGORIES

- Quality Surveillance of bulk petroleum products/fuels
- Includes performing filter effectiveness tests to check filter separators efficiency on Army-owned equipment
- Petroleum Shelf-Life Extension for DoW-Owned packaged products:
- Installation owned and war reserve product
- Random testing on manufacturers first lot runs
- Petroleum Shelf-Life Extension
- Filter Effectiveness Testing
- Tests recycled engine coolants received from various army activities to ensure that they meet specifications.



Bulk Fuel Testing



Bulk Petroleum Testing

Continued on next page…

FORCE PROJECTION TECHNOLOGY (FPT)

ARMY PETROLEUM LABORATORY (APL)

QUALITY SURVEILLANCE PROGRAM

- Ensures quality of the product supplied from commercial sources to the Army activities and the Army National Guard
- Maintains quality of Army-owned petroleum products used in equipment such as tanks, trucks, HMMWVs, MRAPS, tactical and non-tactical, equipment, etc.
- Tests fuel associated with aviation crashes
- Supports laboratory certification and correlation programs of fixed and deployable Army petroleum laboratories
- Analyzes products for new Environmental Protection Agency (EPA) requirements
- Evaluates the day-to-day operational issues associated with POL products

The Army Petroleum Laboratory maintains unique capabilities within GVSC's Force Projection Technology team, whose mission is to provide equipment lifecycle engineering support for the missions of gap crossing, petroleum and water systems, combat engineering, material handling and fluid quality surveillance.

ISO 17025 Accreditation
Accredited to perform 45 ASTM test methods on fuel and packaged petroleum products Filter Effectiveness Testing Bulk Petroleum



Fuels Laboratory

FORCE PROJECTION TECHNOLOGY (FPT)

FUELS & LUBRICANTS LABORATORY (FLL)

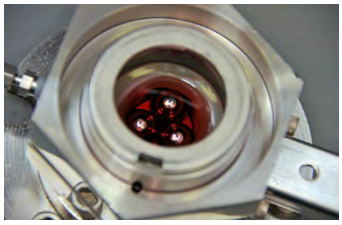
GVSC Fuels and Lubricants (F&L) Branch operates and maintains the Fuels and Lubricants Laboratory (FLL). The FLL has the ability to conduct research, development, testing, analysis, and investigation of Army ground system fuels, lubricants, and fluids. Laboratory experts adhere to standardized testing methodology as published by ASTM International, SAE International, and Federal Test Method 791.

MISSION
Fuel. Cool. Lubricate.

VISION
To modernize military mobility with fuel, lubricant, & thermal management technologies.



Qualification



Research & Investigation

F&L serves as the Department of War's responsible agent for all ground fuels and lubricants specifications: AR70-12 – Fuels and Lubricants Standardization Policy for Equipment Design, Operation, and Logistic Support.

GVSC's Fuels and Lubricants Laboratory comprises 7,075 square feet with an additional 1,600 square feet of space for Petroleum, Oil and Lubricants (POL) storage. FLL's capabilities span from specification and qualification testing, to investigation of field failures or hardware issues, and experimental research in tribology, nanotechnology, corrosion, and fuel efficiency improvement of products. Testing capabilities cover necessary powertrain products for ground vehicles and equipment, including coolants, hydraulic fluids, and other fluids & solvents.

CAPABILITIES
- Combustion and Volatility
- Physical Properties
- Elemental Properties
- Stability and Cleanliness
- Flow/Rheology
- Tribology
- Elastomer Compatibility
- Corrosion Prevention
- Chemical reaction/interface modeling and simulation

BENEFITS
- Independent government analysis, testing and interpretation of results
- Government and industry interface
- Prompt testing supports in-house GVSC projects, especially in conjunction with GVPM testing
- Historical background on products
- Development of custom products and associated specifications and documentation for procurement
- Hardware evaluations consist of utilizing physical and optical profilometry techniques to perform materials, tribofilm, and failure analysis on a wide variety of vehicle parts
- Expertise to modernize Army lubricants while remaining cognizant of the impact to the supply chain
- Leverage industry partners to identify critical new technologies for the Army such as electric vehicle thermal management fluids and lubricants
- Achieving technical authority in basic research related to computational and experimental methodologies

F&L Chemical Engineer examining particulate contamination in fuel.



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FORCE PROJECTION TECHNOLOGY (FPT)

FUELS & LUBRICANTS LABORATORY (FLL)

The GVSC Fuels and Lubricants Branch maintains the government owned, contractor operated research facility in San Antonio, TX. The GVSC Fuels and Lubricants Research Facility (GFLRF) provides research, development, and engineering services via component rig & engine testing and analytical chemistry.



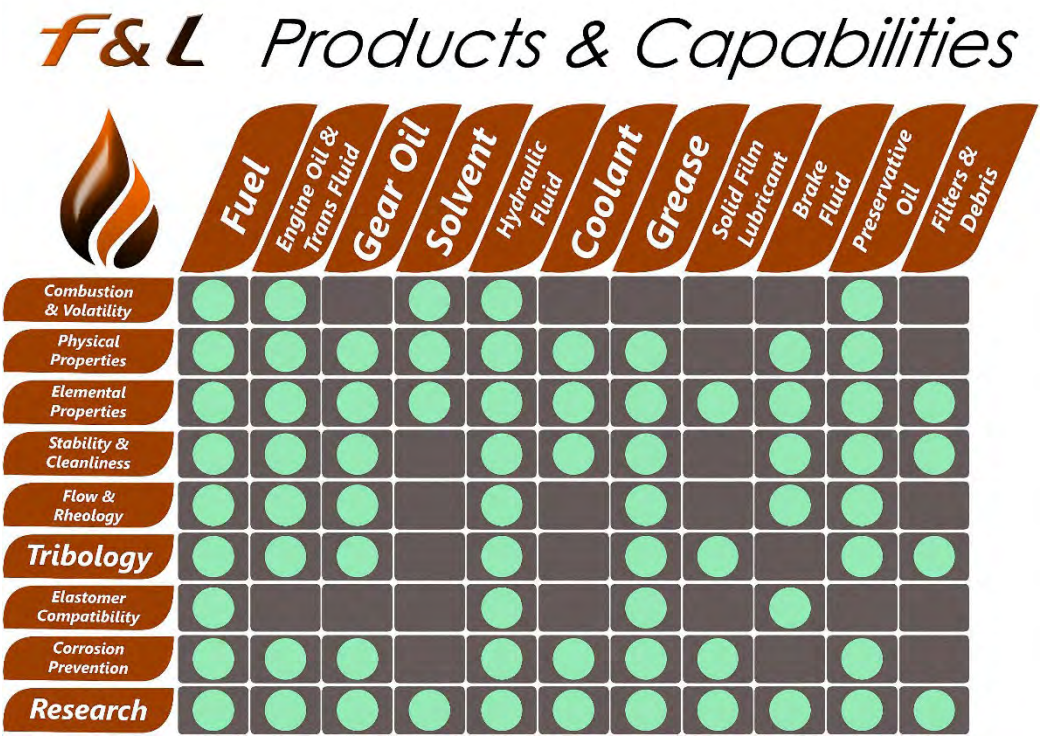
F&L Research Engineer preparing steel panels for solid film lubricant testing.

CAPABILITIES

- Fuel Bladder Testing
- Light-Duty Vehicle Emissions Testing
- Heavy-Duty Vehicle Chassis Testing
- Mileage Accumulation Dynamometers
- Engine Dynamometer Cold Testing
- Temperature-Controlled Vehicle Testing Chambers
- Temperature-Controlled Emissions Enclosure, On-Site Test Track
- Analytical Fuel Analysis Laboratory

The F&L Laboratory maintains unique capabilities within the GVSC's Force Projection Technology team, whose mission is to provide equipment lifecycle engineering support for the missions of gap crossing, petroleum and water systems, combat engineering, material handling and fluid quality surveillance.

ISO 17025 Accreditation
Accredited to perform 31 ASTM test methods on fuel and oil



FORCE PROJECTION TECHNOLOGY (FPT)

BRIDGE TECHNOLOGY LABORATORY (BTL)

GVSC's Bridge Technology Laboratory (BTL) is a 10,000 sq. ft., ISO 17025-accredited facility strategically located at Selfridge Air National Guard Base (SANGB) in Michigan. We specialize in comprehensive strength and durability testing of military bridges and structural components – ensuring the systems meet the highest standards of performance and safety. **Further testing capabilities and specialized services are detailed on page 2.**

UNPARALLELED TESTING CAPABILITIES

The BTL can evaluate complete bridges, structural components, and subassemblies in realistic, simulated environments. It offers:

- Testing structures up to 210 ft. long, 32 ft. wide, and 23 ft. high.
- Simulation of vehicle crossings and loads up to 1 million lbs. using 10 hydraulic actuators.
- Precise data acquisition and analysis to measure and record critical performance data.
- Vertical compression loading of structures

INDUSTRY-LEADING CERTIFICATIONS & STANDARDS

The BTL provides Military Load Classification (MLC) ratings, ensuring bridges meet critical safety requirements. MLC ratings are conducted in full compliance with:

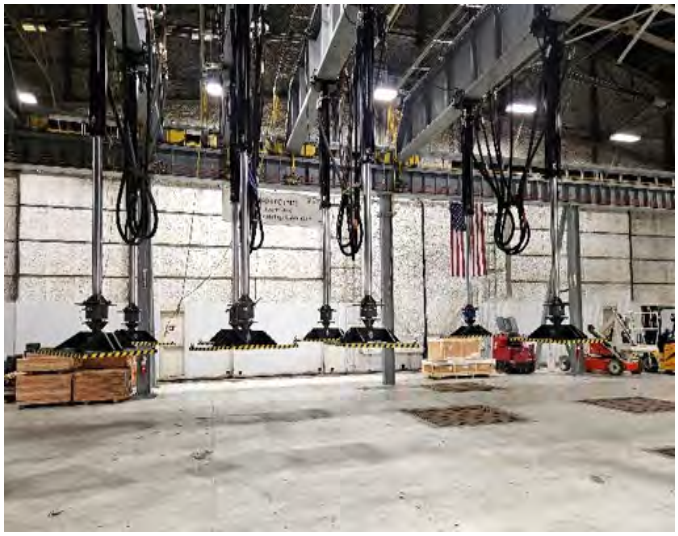
- NATO Standardization Recommendation, STANREC 4865
- NATO Standardization Agreement, STANAG 2021



Tactical Bridge Under Test



Connector Load Sharing Using Strain Gages



Vertical Compression Actuators

Continued on next page…

FORCE PROJECTION TECHNOLOGY (FPT)

BRIDGE TECHNOLOGY LABORATORY (BTL)

The BTL's capabilities extend beyond military bridge testing to support a wide range of structural engineering needs. We specialize in high-resolution data acquisition, advanced data analysis, and precise vertical compression loading of structures, offering comprehensive testing solutions for diverse applications.

PRIMARY CAPABILITY - VERTICAL COMPRESSION LOADING

- 10 Hydraulic Actuators
- 100 kips Each
- 72-inch Stroke
- 2,500 psi Pressure
- 100 gpm Flow

DATA COLLECTION

- 152 Channels
- 2,048 Samples per Second
- Portable and DC-powered for flexible deployment

ANAB
ANSI National Accreditation Board
Certificate # AT-3163.05

ISO 17025 ACCREDITATION

- Accredited to perform Structural Strength and Durability Testing
- Loads up to 1 million lbs.
- Displacement up to 50 in.
- Dimensional outside diameter up to 6 in. and inside diameter between 0.7 in. – 6 in.

SENSOR CAPABILITIES

- Strain Gages
- Load Cells
- Displacement Lasers
- Thermocouples
- Inclinometers
- Accelerometers
- Pressure Transducers

ADDITIONAL CAPABILITIES

- Tilt Testing
- System Troubleshooting
- Safety Factor Evaluation
- Tie Down Provision Testing
- Durability Testing
- Roof Crush Testing
- Vehicle Weighing and MLC Calculations
- Large MHE Support (30k lbs. Capacity)
- On-Site Fabrication



Water Tank Tilt Test

The Bridge Technology Laboratory maintains unique capabilities within the U.S. Army DEVCOM GVSC's Force Projection Technology team, whose mission is to provide equipment lifecycle engineering support for the missions of gap crossing, petroleum and water systems, combat engineering, material handling and fluid quality surveillance.

FOR FURTHER INFORMATION:
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FORCE PROJECTION TECHNOLOGY (FPT)

Fresh Water Treatment Test Facility (FWTTF)

The Fresh Water Treatment Test Facility (FWTTF) in Southeast Michigan provides water and wastewater related products and technical services which capitalize on emerging technologies to ensure the best products are available for the soldier to perform current and future missions. This U.S. Army Combat Capabilities Development Command (DEVCOM) Ground Vehicle Systems Center's (GVSC) Fuel and Water Equipment Branch (FWEB) facility has the ability to test and evaluate water and wastewater treatment, storage and distribution, and quality analysis technologies from bench-scale to full-scale and at the component to the integrated system levels.

PURPOSE

Provide research, development and engineering services for the Army's tactical equipment engaged in water and wastewater treatment and the storage, distribution and quality analysis of water on the battlefield.

In addition to researching emerging technologies, FWTTF experts conduct military-specific water treatment testing to resolve field issues, as well as evaluate new components and methods. The FWTTF offers realistic environments to evaluate water treatment and handling equipment, ranging from individual components to large, integrated systems.

GVSC also has access to the Seawater Desalination Test Facility, located at and operated by the Naval Facilities Center (NAVFAC), Port Hueneme, CA. The Seawater Desalination Test Facility capabilities are comparable to the WTTF facilities but use natural seawater as the test water.

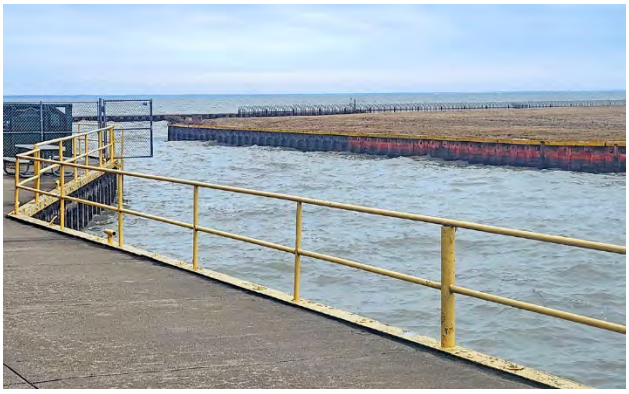
CAPABILITIES

- Water purification equipment testing from bench-scale and individual components to large, integrated systems
- Water packaging and handling equipment testing
- Water quality analysis equipment testing
- Membrane testing: Reverse Osmosis (RO), Nanofiltration, Ultrafiltration, Microfiltration
- Greywater re-use technology testing

DoW Lead Laboratory for Ground Water Supply & Wastewater Treatment per DoW **4705.01 and AR 700-136**



RO Membrane Swatch Test Stand



Lake St. Clair Provides Natural Fresh Water



Reverse Osmosis (RO)

Continued on next page…

FORCE PROJECTION TECHNOLOGY (FPT)

Fresh Water Treatment Test Facility (FWTTF)

BENEFITS

- Facility provides a year-round, relevant test environment
- Direct access to a large, natural fresh water source
- Ability to prepare large volumes of simulated source waters:
- NSF 350 greywater, seawater, etc.
- Staff experienced in water/wastewater treatment technologies and systems:
  - Design
  - Operation
  - Maintenance
  - Testing
  - Training



Pretreatment Test Stands



Water Quality Test Stand



FWTTF Classroom

FEATURES AND EQUIPMENT

- Heated indoor boat well which allows year-round operation on a natural fresh water source
- National Pollutant Discharge Elimination System (NPDES) permit for discharge of up to 500,000 gallons per day
- Military Water Purification Equipment includes:
  - Lightweight Water Purifier (LWP)
  - 600 GPH Reverse Osmosis Water Purification Unit (ROWPU)
  - 1500 GPH Tactical Water Purification System (TWPS)
  - 3000 GPH ROWPU
- Test skids for RO and Pretreatment evaluations
- Water Quality Analysis
  - Analytical Lab
  - Access to EPA certified, water quality analysis laboratory
  - In-line instrumentation, e.g., flow meters, pressure gauges, turbidity & conductivity meters
- Facilities for large systems
- Material Handling equipment to include 4K and 20K forklifts
- Compressed Air: 140 psi, -65 °F dew point
- Electrical
  - 125 kVA multi-tap transformers deliver 440/460/480V 3 phase power
  - Multiple 208V single and 3-phase power disconnects
  - Exterior concrete pad at water's edge
- Conference room seating for up to 25

The Fresh Water Treatment Test Facility maintains unique capabilities within the U.S. Army DEVCOM GVSC's Force Projection Technology team, whose mission is to provide equipment lifecycle engineering support for the missions of gap crossing, petroleum and water systems, combat engineering, material handling and fluid quality surveillance.

FOR FURTHER INFORMATION:
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FUEL CELL LABORATORY (FCL)

The Fuel Cell Laboratory (FCL) is part of GVSC and located in the GSPEL building. This lab mainly supports the Fuel Cell Technologies Branch as part of GVPM but also supports other DOW, DOE, and commercial efforts. Lab focus is on various research, development, integration, and testing of both hydrogen and JP-8 based fuel cell projects and has a flexible working space layout to accommodate and enable this work.

OVERVIEW

The Fuel Cell Laboratory is part of GVSC and located in the GSPEL building. This lab mainly supports the Fuel Cell Technologies Branch as part of GVPM, but also supports other DOW, DOE and commercial efforts. Lab focus is on various research, development, integration, and testing projects and has a flexible working space

4 FUME HOODS

- Accommodate small components to full size systems
- Hydrogen, JP-8, steam, cooling water supplied to each
- Capable of up testing 500W - 50 kW in a single fume hood
- Solid Oxide Fuel Cell (SOFC) stack test capability

RESEARCH AND ANALYSIS

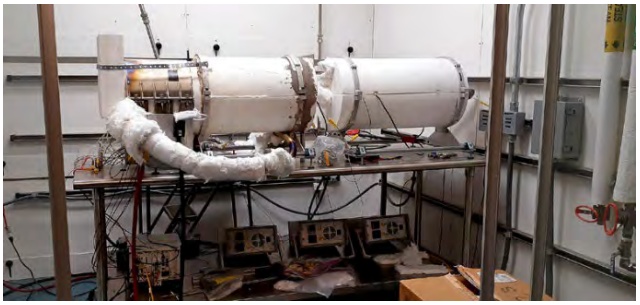
- Full chemical analysis using Gas Chromatograph / Mass Spectrometer (GC/MS)
- SOFC stack initial and sustained performance characterization using laboratory hotbox, fuel/air heaters
- Fuel cell electrode and membrane performance characterization using Electrochemical Impedance Spectroscopy (EIS)
- SOFC catalyst fuel contamination characterization
- Fuel cell surface characterization for cracking and contamination deposition using Optical Microscopy

FLEXIBLE LAB SPACE

- Vehicle and/or equipment integration space and tools
- 3D print capability for small parts
- Electrical and mechanical capabilities



Large Walk-In Fume Hood



Solid Oxide Fuel Cell Stack Test Stand



Flexible Floor Space for Integration Work



Walk-In & Bench Top Fume Hoods



Gas Chromatograph / Mass Spectrometer

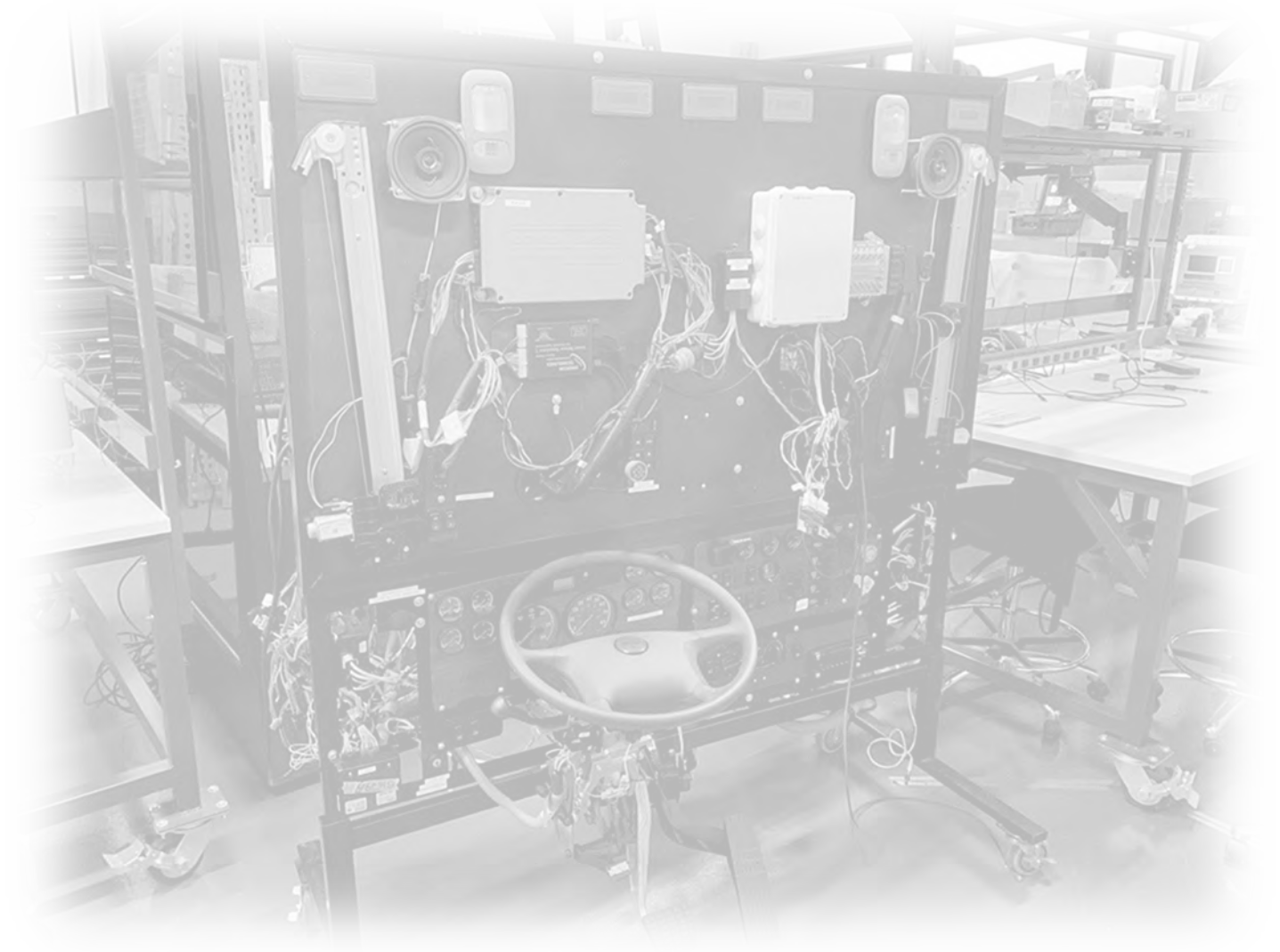
GROUND SYSTEMS CYBER ENGINEERING (GSCE) LABORATORIES

The Ground Systems Cyber Engineering (GSCE) Laboratory analyzes electronic systems consisting of both hardware and software to uncover cybersecurity vulnerabilities that may be used to degrade the performance of the system in operation. The lab can perform full-spectrum vulnerability scans and cyber penetration tests to uncover previously unknown vulnerabilities and provide an independent assessment of a full vehicle system or targeted sub-systems and components. GVSC's lab provides a confidential environment capable of housing multiple large vehicles and provides infrastructure for connecting with testing teams across the nation.

COMPACT CUSTOM DEVELOPMENT LABORATORY (CCDL) **36**

GROUND SYSTEMS CYBER ENGINEERING LABORATORY **37**

HEAVY TRUCK SYSTEMS INTEGRATION LABORATORY (SIL) **38**



GROUND SYSTEMS CYBER ENGINEERING (GSCE)

COMPACT CUSTOM DEVELOPMENT LABORATORY (CCDL)

Ground Systems Cyber Engineering (GSCE) Vehicle and Support Systems Cybersecurity (VS2C) engineers have the capability to develop, implement, and document procedures to produce Compact Custom Development Lab (CCDL) for military ground systems. Similar to a System Integration Lab (SIL), the CCDLs are used to support efforts which require logical or limited use of an overall systems information technology (IT) information system (IS) but on a smaller scale. The CCDL provides the potential for substantial, immediate, and long-term cost savings to adopters in all applicable work efforts related to the overall system IS as the need to send assets, both personnel and equipment/vehicles, are drastically reduced.

The service provided ensures the CCDL is a holistic package wherein everything required to construct, deploy and complete required related tasks is included in one portable kit.

Typical use cases would be systems and networks capable of being virtualized, or standalone systems that cannot efficiently be virtualized (ARM/embedded systems) that also do not require the complexity and cost incurred with use of a traditional SIL.

CAPABILITIES

- Requirements/capability analysis
- Hardware and software system design
- Holistic planning and procedure authoring

AVAILABLE SYSTEM DEPLOYMENTS

- FMTV A2 Variant Greyhill Drivers Display Unit Vulnerability scan and system shell level access provided



Sample Compact Custom Development Lab

POC
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GROUND SYSTEMS CYBER ENGINEERING (GSCE)

GROUND SYSTEMS CYBER ENGINEERING LABORATORY (GSCE)

The GVSC Ground Systems Cyber Engineering Lab capability produces information about the cybersecurity risks inherent in ground vehicle systems. This information is used to prioritize resources to address readiness, security, and financial risks from cyberattack.

The Ground Systems Cyber Engineering Lab analyzes embedded electronic systems consisting of both hardware and software to uncover cybersecurity vulnerabilities that may be used to degrade the performance of the system in operation. The lab can perform full-spectrum vulnerability scans and cyber penetration tests to uncover previously unknown vulnerabilities and provide an independent assessment of a full vehicle system or targeted sub-systems and components. GVSC's lab provides a confidential environment capable of housing multiple large vehicles and provides infrastructure for connecting with testing teams across the nation.

The GSCE Lab also provides Cyber Reconnaissance Services which focus on periodic and scheduled vulnerability assessment of program systems using a variety of cyber assessment tools. Recurring assessment scans evaluate potential vulnerabilities and weak configurations that will create compliance issues. Schedules and deliverables can be tailored to a partner's program needs or for the needs of a specific point in an accreditation or testing process.

CAPABILITIES

- Vulnerability discovery
- Cyber effects on vehicle dynamics
- Input validation and fuzzing
- Data anthropology
- Electronics reverse engineering
- Wired and wireless network protocol analysis
- Static and dynamic software analysis
- Assured Compliance Assessment Solution (ACAS) scanning

CYBER RECONNAISSANCE SERVICES

- Program / system vulnerability assessment with a variety of tool options
- Controlled assessment environment
- Detailed reports with all findings provided in a timely fashion and on schedule per mission partner agreement
- Flexible options for custom tailored solutions
- All assessments, reports, and procedures are DISA compliant



M113 Inside RF Shielded Enclosure

POC
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GROUND SYSTEMS CYBER ENGINEERING (GSCE)

HEAVY TRUCK SYSTEMS INTEGRATION LABORATORY (SIL)

The Heavy Truck Systems Integration Laboratory (SIL) is a full-scale electronic twin of the M915 line-haul tractor, serving as a dedicated, risk-free research testbed designed to develop, test, and validate advanced cyber intrusion detection and cyber resilience technologies for tactical logistics vehicles. By replicating the truck's entire electronic architecture, including high-fidelity engine and transmission simulations, the lab enables cybersecurity analysts to safely execute vulnerability assessments, simulate adversarial network intrusions, and observe how cyber anomalies affect physical mobility systems without risking valuable hardware or human safety. This integration is supported by robust hardware-in-the-loop instrumentation, utilizing Vehicle Spy for real-time CAN bus network monitoring, a PEAK PCAN USB interface for precise traffic injection and node emulation, and signal generators to simulate physical engine sensor anomalies. Ultimately, the Heavy Truck SIL bridges the gap between digital cyber defense and heavy vehicle engineering, ensuring that deployed military transportation platforms can actively detect and withstand sophisticated cyberattacks on their electronic control networks.

To facilitate rigorous cyber vulnerability testing and defensive engineering, the SIL is equipped with specialized automotive network analysis tools

NETWORK MONITORING AND ANALYSIS

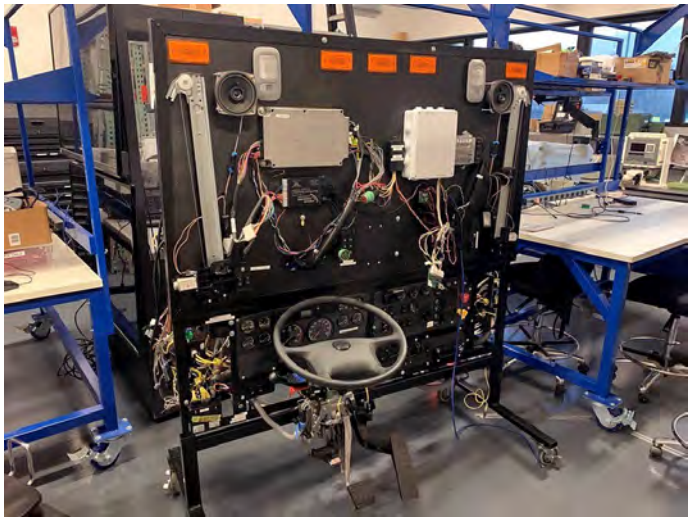
The integration of **Vehicle Spy** software provides analysts with the ability to monitor, reverse-engineer, and analyze in-vehicle network traffic (such as SAE J1939 or standard CAN bus traffic). This visibility is essential for establishing baseline network behavior and developing the algorithms required for effective intrusion detection.

TRAFFIC INJECTION AND NODE EMULATION

The facility utilizes the **PEAK PCAN USB interface** to provide a reliable hardware bridge between the test engineers' workstations and the simulated vehicle networks. This interface allows Red Teams to inject crafted malicious network traffic, emulate compromised network nodes, and interact directly with the vehicle's digital architecture to test defensive thresholds.

HARDWARE-IN-THE-LOOP (HIL) SPOOFING

The SIL employs advanced **signal generators** to simulate physical engine sensors. By manipulating these analog or digital sensor inputs, testers can execute sensor spoofing attacks (e.g., feeding false engine temperature or speed data) to evaluate how the ECUs respond to degraded or manipulated signals, and whether the intrusion detection system can flag the physical anomalies.



Heavy Truck SIL

POC
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GROUND SYSTEMS POWER AND ENERGY LABORATORY (GSPEL)

GVSC's Ground Systems Power and Energy Laboratory (GSPEL) is the Army centerpiece for mobility, power and energy R&D, integration, and testing of current and emerging ground vehicles, providing enhanced capabilities for delivering the best, most advanced ground vehicle technology to our warfighters. It is a centralized, integrated, one-of-a-kind facility to provide steady-state and transient (mission profile) test capability with state-of-the-art test parameter/ environmental control and data acquisition.

AIR FLOW LABORATORY (AFL) **40-41**

ELECTRIC COMPONENT LABORATORY (ECL) **42-43**

ENERGY STORAGE LABORATORY (ESL) **44-45**

POWER & ENERGY VEHICLE ENVIRONMENTAL LABORATORY (PEVEL) **46-47**

ROBOTIC – POWER & ENERGY VEHICLE ENVIRONMENTAL LABORATORY (R-PEVEL) **48-49**



GROUND SYSTEMS POWER AND ENERGY LABORATORY (GSPEL)

AIR FLOW LABORATORY (AFL)

GVSC's Ground Systems Power and Energy Laboratory (GSPEL) Team operates the Air Flow Laboratory (AFL) which supports the execution of component level testing on several critical mobility systems on a variety of military vehicles by use of Calorimeter and Air Filtration Testing.

CALORIMETER TESTING BENEFITS

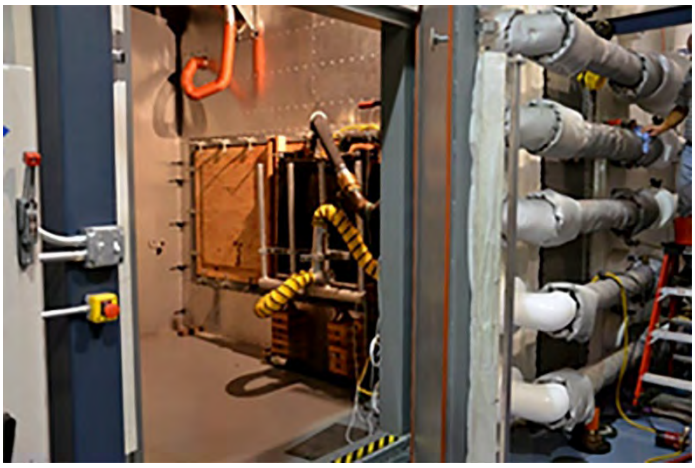
- Evaluate new heat exchangers and ballistic grilles
- Repeatable simulate field environmental conditions
- Test up to three heat exchangers as a pack
- Unique Army testing capability
- Unbiased first-article test and production quality

FILTRATION TESTING BENEFITS

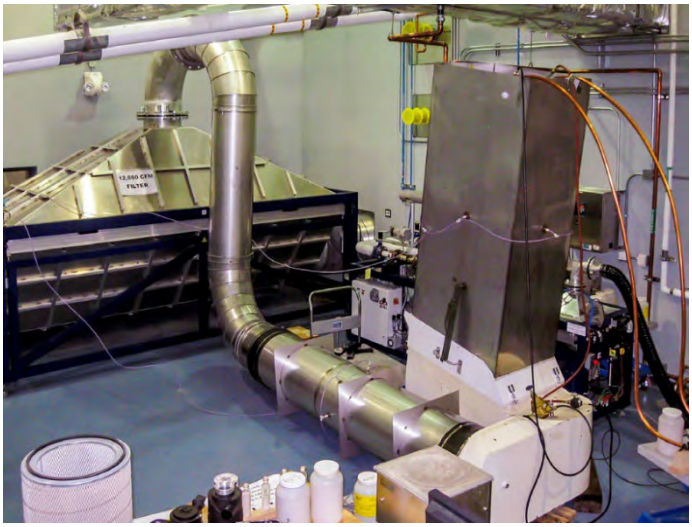
- Evaluate new air cleaner systems
- Replicate field failures
- Assess impact of add-on parts to air cleaner system
- Assess maintenance efficiency
- Unique Army testing capability
- Unbiased first-article test and production quality surveillance

COMPONENTS TESTED

- Air cleaner systems
- Add-on components to air cleaner system



AFL Calorimeter Test



AFL Filtration Test

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GROUND SYSTEMS POWER AND ENERGY LABORATORY (GSPEL)

AIR FLOW LABORATORY (AFL)

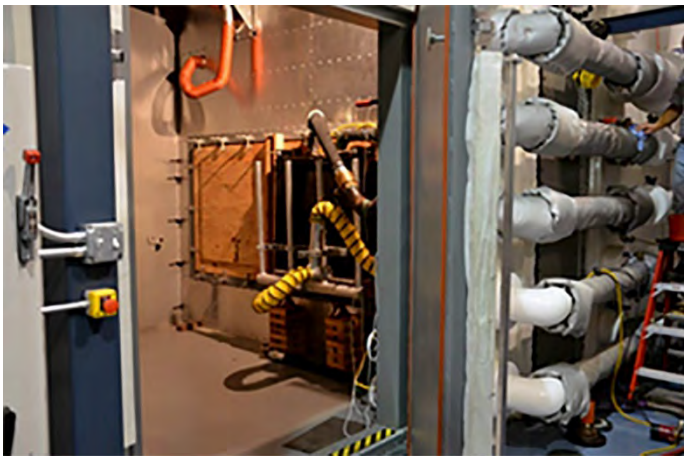
CALORIMETER CAPABILITIES

- Cooling Air
  - Air Flow Rate: 800 to 60000 CFM
  - Air Flow Velocity: 3000 to 7000 ft/min
  - Inlet Air Temperatures: up to 250 °F

- Radiator Loop
  - Coolant Flow Rate: 10 to 300 gal/min
  - Coolant Inlet Temperature: 125 to 350 °F
  - Coolant Inlet Pressure: 0 to 125psig

- Oil Cooler Loop
  - Oil Flow Rate: 10 to 150 gal/min
  - Oil Inlet Temperature: 175 to 350 °F
  - Oil Inlet Pressure: 0 to 300psig

- Charge Air Cooler Loop
  - Charge Air Flow Rate: 30 to 150lb/min
  - Charge Air Temperature: 150 to 650 °F
  - Charge Air Inlet Pressure: 15 to 90psig

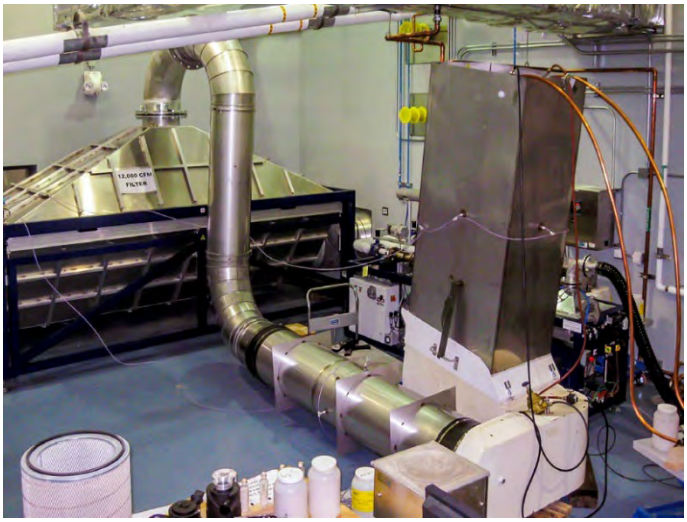


AFL Calorimeter Test

AIR FILTRATION CAPABILITIES

Ambient air conditions are controlled in the Air Filtration laboratory. In addition to controlling temperature, the relative humidity can be set to the desired level.

- 250 CFM Bench
  - Air Flow Rate: 8 to 250 SCFM
- 2000 CFM Bench
  - Air Flow Rate: 80 to 2000 SCFM
- 5000 CFM Bench
  - Air Flow Rate: 320 to 5000 SCFM
- 12000 CFM Bench
  - Air Flow Rate: 800 to 12000 SCFM



AFL Filtration Test

POC
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GROUND SYSTEMS POWER AND ENERGY LABORATORY (GSPEL)

ELECTRIC COMPONENT LABORATORY (ECL)

GVSC's Ground System Power and Energy Laboratory (GSPEL) Team operates the Electric Component Laboratory (ECL) which supports research, development, characterization and testing of high-voltage, high power components necessary for military vehicle electrification and hybrid-electric technology. This lab's research extends to a testing cell in the Propulsion Laboratory that has programmable power absorption and supply capabilities with voltage, current and power, and controls a 350-horsepower AC dynamometer. Component testing on vehicle is also available. The ECL provides temperature and humidity-controlled environments, as well as 346kW and 373kW AC dynamometers to fully test various components.

BENEFITS

The ECL offers several benefits:

- Testing of high voltage, high power components
- Analyze future electrical power generation and control technologies for the Army
- Provides power quality, transients, and harmonic distortion
- Variable coolant temperature and flow rate over a large range
- (Future) Certified and accredited testing to ISO17025
- Thermal chamber for component level testing
- MIL-PRF-GCS600 testing
- Resistive and Capacitive load banks to simulate a wide variety of load types
- Pressure testing of coolant cooled components using high sensitivity pressure transducers

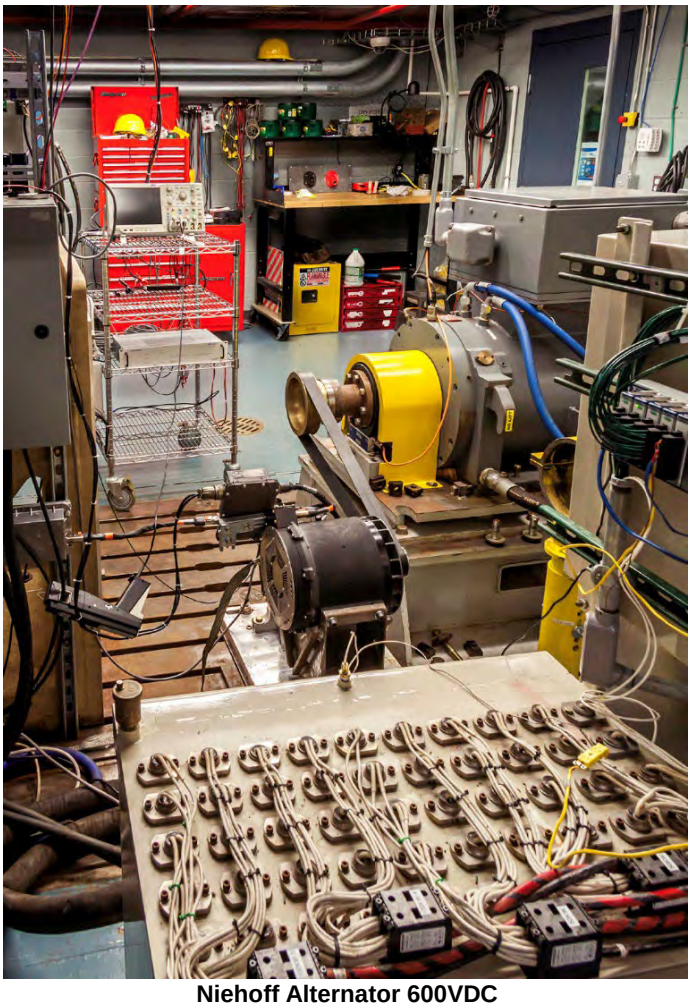
COMPONENTS TESTED

The ECL can test multiple types of components:

- Advanced Electric Machines
- High Voltage Alternators
- Motor controllers
- Power Inverters
- DC/DC Converters



G40-2B ISG



Niehoff Alternator 600VDC

Continued on next page…

GROUND SYSTEMS POWER AND ENERGY LABORATORY (GSPEL)

ELECTRIC COMPONENT LABORATORY (ECL)

CAPABILITIES

ECL Dynamometer

- 373kW 4Q AC Dynamometer
- 3,321 Nm torque from 0-1000rpm
- 0 – 12,000 rpm speed range

CELL 10 Dynamometer

- 346kW 4Q AC Dynamometer
- 1,245Nm torque from 0-2000rpm
- 0 – 12,000 rpm speed range

Thermal Chamber

- Temperature range of -30 to +177 C
- Humidity range of 10% to 95% RH, 85C Max temp and 4C minimum dewpoint
- 439 Liter capacity

AV-900 250kW Dual Power Supply

- Voltage: 8 to 900V
- Current: +/- 1000 ADC
- Power: +/- 250kW

Acquisition of mechanical and electrical parameters

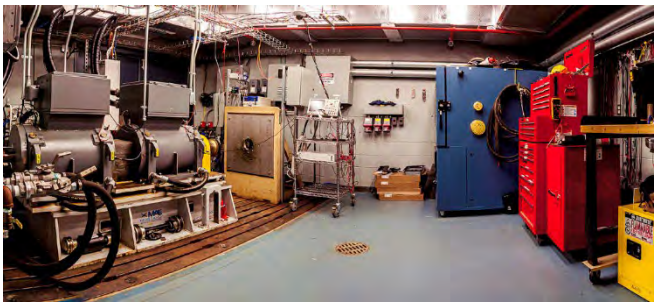
- Phase to Phase measurements
- Active, apparent and reactive power
- Mechanical power
- Power factor and efficiency
- Fundamental frequency
- Total Harmonic Distortion
- Voltage & Current Transients
- Cooling characteristics; Thermal, pressure, flow rate



AC Dynamometer



Power Cycling Station





ECL & Cell 10

POC
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GROUND SYSTEMS POWER AND ENERGY LABORATORY (GSPEL)

ENERGY STORAGE LABORATORY (ESL)

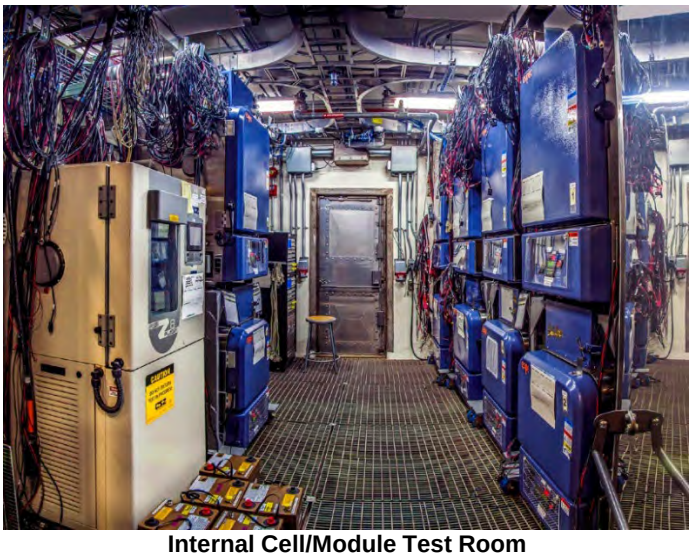
GVSC's Ground Systems Power and Energy Laboratory (GSPEL) Team operates the Energy Storage Laboratory (ESL), an ISO/IEC 17025 accredited laboratory, which supports testing and evaluation of batteries and electrochemical technologies at cell, module and battery pack level.

CAPABILITIES/FACILITIES

- Three (3) large Battery Test Rooms, two (2) Pack Test Chambers, an Electrochemical Research Lab, and a Battery Management System Lab
- Multiple cell/battery Cyclers on a centralized control system
- Thermal Chambers (1.5ft3 – 69.3ft3)

CAPABILITIES/BENEFITS

- Cradle-to-grave R&D and surveillance testing support for all DoW ground vehicle energy storage systems
  - Performance to specification
  - Cycles to Failure (Service Life)
  - Cold Cranking
- Assess TRL levels and understand new technology/chemistry
- Assess performance of fielded storage systems
- Test new solutions for fielded and future vehicle systems



Internal Cell/Module Test Room



Cell, Module & Battery Cycling Equipment

Continued on next page…

GROUND SYSTEMS POWER AND ENERGY LABORATORY (GSPEL)

ENERGY STORAGE LABORATORY (ESL)

Battery Cyclers

Brand	Model	Quantity of units	# of Channels per unit*	# Thermocouples Channels per unit	Voltage		Current		Temperature	
					Range	Tolerance	Range	Tolerance	Range	Tolerance
Bitrode	LCV3-100-36	1	3	7	±54VDC	±.05VDC	±100ADC	±.1ADC	-40 to 190°C	±2.5°C
Bitrode	MCV48-50-5	2	48	48	±5VDC	±.005VDC	±50ADC	±.05ADC	-40 to 190°C	±2.5°C
Bitrode	LCV12-50-24	2	12	16	±32VDC	±.036VDC	±50ADC	±.05ADC	-40 to 190°C	±2.5°C
Bitrode	LCV4-100-36	1	3	8	±54VDC	±.05VDC	±100ADC	±.1ADC	-40 to 190°C	±2.5°C
Bitrode	LCV4-100-60	8	4	8	±60VDC	±.06VDC	±100ADC	±.1ADC	-40 to 190°C	±2.5°C
Bitrode	DTV1-2000-24**	1	1	1	-24VDC	±.024VDC	-2000ADC	±2.0ADC	-40 to 190°C	±2.5°C
Bitrode	LCV8-100-60	3	8	12	±60VDC	±.06VDC	±100ADC	±.1ADC	-40 to 190°C	±2.5°C
Bitrode	LCV2-1000-48	1	2	4	±72VDC	±.07VDC	±1000ADC	±1.0ADC	-40 to 190°C	±2.5°C
Aero-Vironment	AV900	3	2	-	±900VDC	±1.35VDC	±300A	±1.13ADC	-	-

*Channels within unit may be placed in parallel for higher currents
**Discharge only

Temperature Conditioners

Brand	Model	Quantity of units	Temperature		Internal Volume	Cooling Change Rate	Heating Change Rate
			Range	Tolerance			
ESPEC	BTZ-175	5	-65 to 150ºC	±.5ºC	1.5 ft^3	5°C/min	5°C/min
ESPEC	BTZ-475	20	-65 to 150ºC	±.5ºC	4 ft^3	2.5°C/min	2.75°C/min
Cincinnati Sub-Zero	ZPHS-8-1.5-1-H/AC	1	-65 to 150ºC	±.5ºC	8 ft^3	14°C/min	17°C/min
Tenney	T10RC-1.5	2	-65 to 150ºC	±.3ºC	10 ft^3	4°C/min	5.5°C/min
Russells	GD-64-5-5-AC-EP	2	-65 to 150ºC	±1ºC	64 ft^3	3°C/min	3.8°C/min
Thermotron	SE-2000-6-6	1	-65 to 150ºC	±.7ºC	69.3 ft^3	3.4°C/min	5.3°C/min
Test Equity	1007-C	1	-65 to 150ºC	±.5ºC	7 ft^3	3.3°C/min	7.3°C/min



Outdoor Pack Test Chambers

POC
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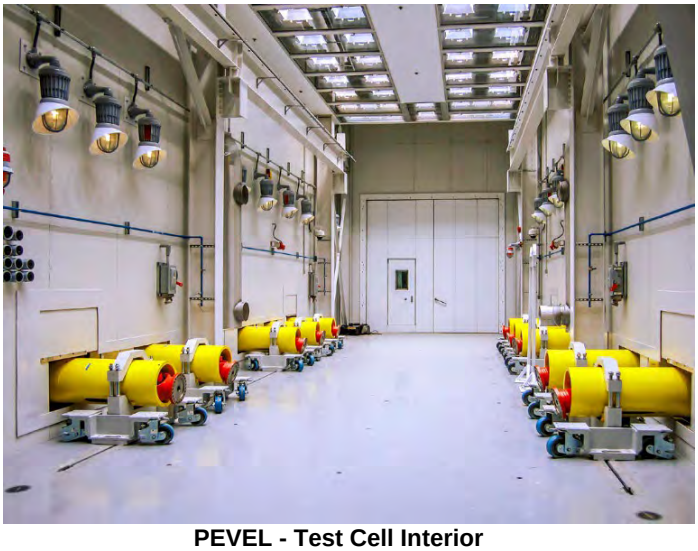
GROUND SYSTEMS POWER AND ENERGY LABORATORY (GSPEL)

POWER & ENERGY VEHICLE ENVIRONMENTAL LABORATORY (PEVEL)

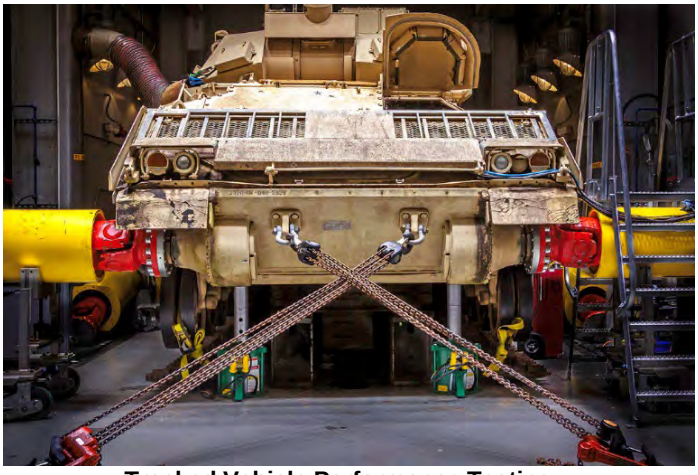
GVSC's Ground Systems Power and Energy Laboratory (GSPEL) Team operates the Power & Energy Vehicle Environmental Laboratory (PEVEL) which enables GVSC to perform vehicle-level performance and durability testing on both wheeled and tracked vehicles. The PEVEL's reconfigurable dynamometers can support up to a 5-axle wheeled vehicle with 34,000lbf·ft (per wheel) and tracked vehicles up to 42,000lbf·ft (per side). The PEVEL offers controlled environmental conditions with temperatures ranging from -60 to 160 °F, humidity levels from 0 to 95 %Rh, wind speeds up to 60 mph, and solar load up to 1,200 W/m^2

PEVEL TESTING CAPABILITIES

- Transient Road-Load Profiles
- Vehicle Acceleration
- Fuel Economy
- Full-Load Cooling
- Speed on Grade
- HVAC Validation
- Engine Cold-Start Evaluation
- Alternator Load Testing



PEVEL - Test Cell Interior



Tracked Vehicle Performance Testing



Wheeled Vehicle Performance Testing

Continued on next page…

GROUND SYSTEMS POWER AND ENERGY LABORATORY (GSPEL)

POWER & ENERGY VEHICLE ENVIRONMENTAL LABORATORY (PEVEL)

TEST CHAMBER OVERVIEW

Powertrain Specifications

- Wheeled Vehicle Dynamometers Speed: 0-1,000 RPM
  - Torque: 0-34,000lbf-ft (per wheel)
  - Power: 0-160 hp (per wheel)
  - Wheel Stations: up to 10 wheels (5 axle)

- Tracked Vehicle Dynamometers
  - Speed: 0-1,250 RPM
  - Torque: 0-42,000lbf-ft (per side)
  - Power: 0-800 hp (per side)

Environmental Control

- Temperature: -60 to 160°F
- Wind: 0-60 mph
- Solar: 0-1,200 W/m2
- Humidity: up to 95% RH

General Information

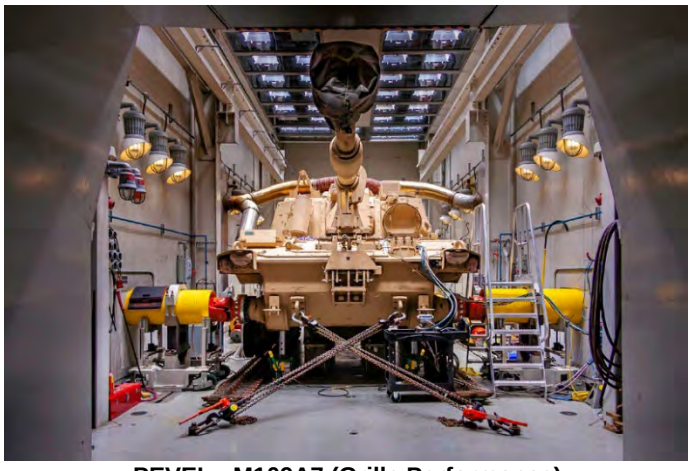
- Chamber Door: 14 ft (W) x 14 ft (T)
- Dimensions: 20ft (W) x 20ft (T) x 75ft (L)
- Floor Capacity: up to 100 tons
- Crane: 25 tons
- Multiple Vehicle Build-up Bays



PEVEL - JLTV (Full Load Cooling Test)



PEVEL - PLS (Transmission Calibration)



PEVEL - M109A7 (Grille Performance)

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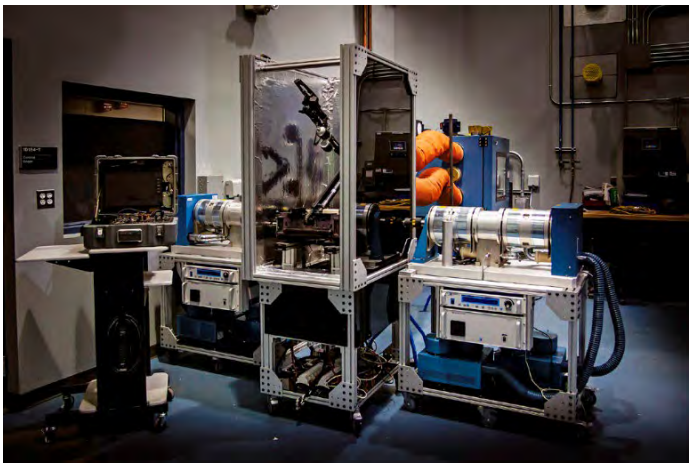
GROUND SYSTEMS POWER AND ENERGY LABORATORY (GSPEL)

ROBOTIC - POWER ENERGY VEHICLE ENVIRONMENTAL LABORATORY (R-PEVEL)

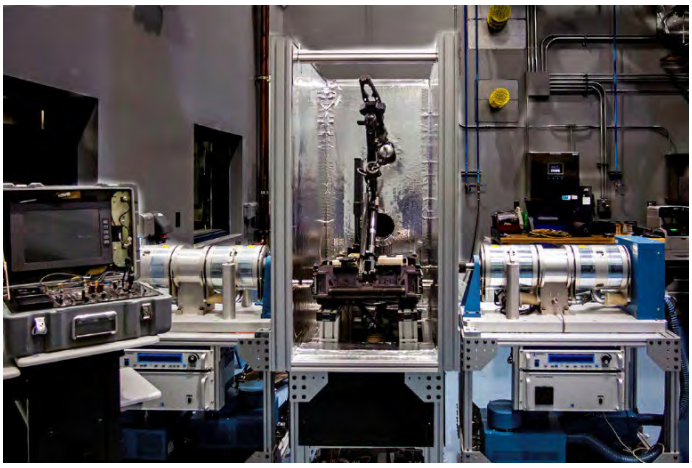
GVSC's Ground Systems Power and Energy Laboratory (GSPEL) Team operates the Robotic - Power & Energy Vehicle Environmental Laboratory (R-PEVEL) which enables GVSC to perform robot platform-level performance and durability testing on both wheeled and tracked robotic platforms. The R-PEVEL's 2 quadrant dynamometers can support up to a Common Robotic System – Intermediate (CRS-I) sized robotic platform,
and up to 56.5 Newton- Meters at up to 8,000 RPM. The R-PEVEL offers controlled environmental conditions with temperatures ranging from -60 to 160 °C.

R-PEVEL TESTING CAPABILITIES

- Mobility and Performance testing of small robotic platforms
- Motors and Drives power measurement
- Performance Characteristics of low to medium power range motors
- Load simulation for duty cycle and life testing
- Testing in extreme climates under various loads
- Powertrain development and prototype system/ component evaluation



R-PEVEL System View



R-PEVEL Test Chamber View



R-PEVEL System View with Thermal

Continued on next page…

GROUND SYSTEMS POWER AND ENERGY LABORATORY (GSPEL)

ROBOTIC - POWER ENERGY VEHICLE ENVIRONMENTAL LABORATORY (R-PEVEL)

TEST CHAMBER OVERVIEW

Dynamometer Specifications

- 14 kW 2Q Hysteresis Dynamometer x2
- 56.5 Nm torque rating
- 0-8,000 RPM speed range
- Magtrol LabView based controller

Data Collection System

- National Instruments cDAQ chassis
- SMBus collection and sampling
- National Instruments LabView-based control
- Veri-volt voltage isolation
- Current shunt current sense

Environmental Control

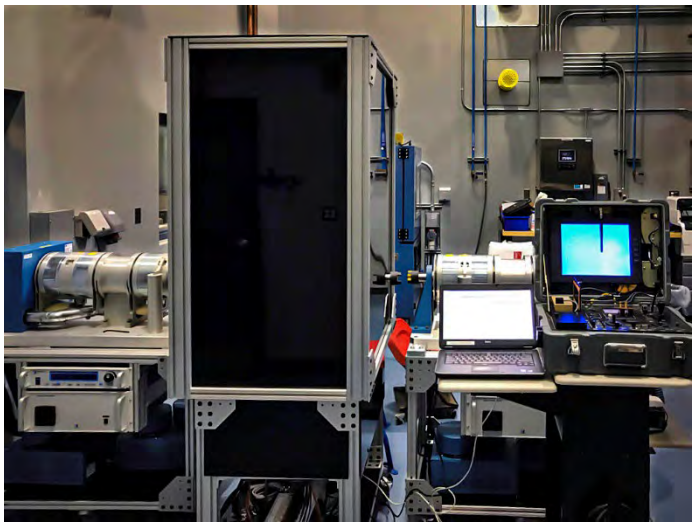
- Temperature: -60 to 160°C
- External Russels Thermal Products system
- Multipoint thermocouple/RTD monitoring
- Humidity: up to 95% RH

General Information

- Thermal test chamber sized to MTRS Inc II and smaller robotic platforms
- Thermal test chamber and dynamometers are mobile
- CRS-I ready with minimal modification
- Remote Operation ready
- Large Robotic Assembly area



R-PEVEL - TALON (Cold Mobility Test)



R-PEVEL - Battery Performance Test

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GROUND VEHICLE MATERIALS ENGINEERING (GVME)

Ground Vehicles Materials Engineering (GVME) provides technical expertise in materials engineering for the weapon system lifecycle from research to acquisition to sustainment. Technical competencies include lightweight materials maturation and integration; design optimization/weight reduction; materials testing (characterization and failure analysis); joining technologies (welding, adhesives, mechanical fastening); additive manufacturing application; corrosion prevention and control; coatings (paint, surface finishing); and environmental and hazardous materials management. GVME operates the Material Characterization Lab (MCL) an ISO 17025 accredited lab that performs material characterization, failure analysis, research, and testing to provide innovative solutions and recommendations to customers.

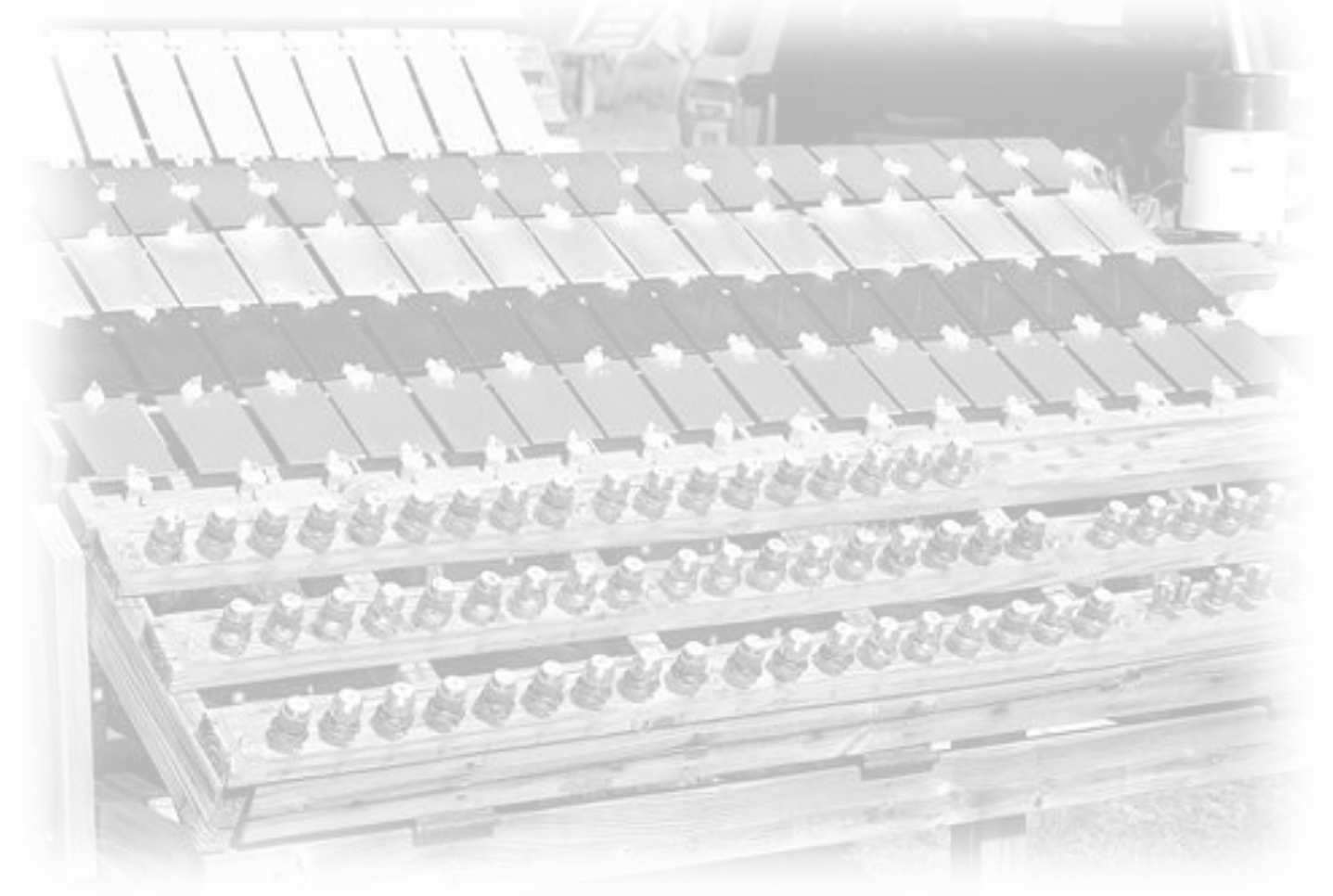
ADVANCED MANUFACTURING COMMERCIALIZATION CENTER (AMCC) **51**

MATERIAL CHARACTERIZATION LABORATORY (MCL) **52**

MATERIAL CHARACTERIZATION LABORATORY (MCL) NON-METALLIC & POLYMER CHARACTERIZATION **53**

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GROUND VEHICLE MATERIALS ENGINEERING (GVME)

ADVANCED MANUFACTURING COMMERCIALIZATION CENTER (AMCC)

AMCC BACKGROUND

Located in Sterling Heights, the Advanced Manufacturing Commercialization Center (AMCC) operates under the Ground Vehicle Materials Engineering (GVME) directorate, utilizing metal-based Additive Manufacturing (AM) to produce components for a diverse range of customers

CAPABILITIES

The Army utilizes Additive Manufacturing (AM) to optimize product manufacturability and streamline critical supply chain timelines. To support this mission, the AMCC leverages this technology to produce components more efficiently, reducing equipment weight, lowering costs, and enhancing long term sustainment. Specifically, the center utilizes this technology to support the Defense Organic Industrial Base (DOIB) in producing critical readiness parts. This targeted support ensures that military installations, such as RIA JMTC, can rapidly bypass supply chain disruptions to keep essential combat systems operational.

The AMCC completed significant facility upgrades in early 2026, with most of the new equipment fully commissioned by late spring 2026. The primary metal AM capabilities include Laser Powder Bed Fusion (LPBF), Additive Friction Stir Deposition (AFSD), Arc Wire Direct Energy Deposition (AW DED), and eventually Binder Jetting (BJAM). To support these complex printing operations, the AMCC features extensive post processing capabilities such as cleaning, cutting, and precision machining, alongside advanced 3D scanning technology used to reverse engineer physical geometry or validate newly printed parts against baseline CAD data.



JH-SST system and example part

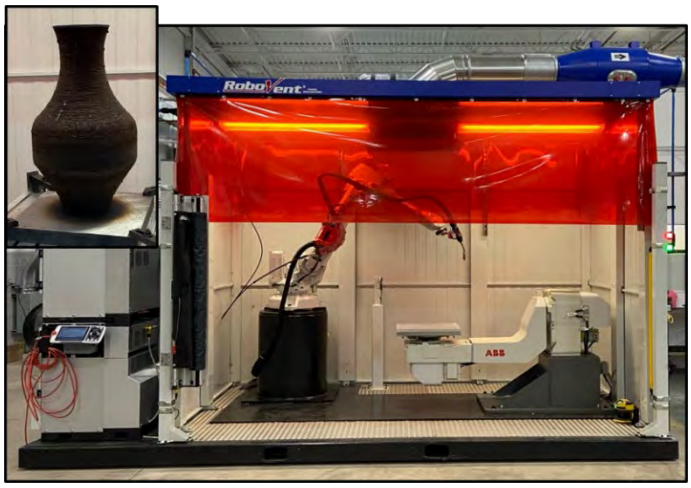


ABB AW-DED system and example part

EQUIPMENT

POST-PROCESSING

- HAAS UMC 500SS (CNC Vertical Mill)
  - Work Area: 30 x 12 x 10(H) in
- EDMMAX 656W Fast Wire (EDM)
  - Work Area: 24.8 x 19.7 x 24.6 in
- Superior WDC8000 (Downdraft Table)
  - Work Area: 38″ W x 38″ D x 38″ H
- TITAN 3838 (Blast Cabinet)
  - Work Area: 38″ W x 38″ D x 38″ H
- Hexagon - Portable (3D Scanner)
  - 3D scan blue & white light (accuracy 43µm)

ADDITIVE MANUFACUTINRG

- EOS M290
  - Materials (Powder): 316L, 17-4PH, MS1, & Ti64
  - Build Area: 9.85 x 9.85 x 12.80 in
- 3D SYSTEMS DMP-FLEX 350
  - Materials (Powder): AlSi10Mg, Ni718, & 316L
  - Build Area: 10.82 x 10.82 x 14.96 in
- DESKTOP METAL X25Pro (Summer 2026)
  - Materials (Powder): Aluminum.
  - Build Area: 9.84 x 9.84 x 15.75 in
- ABB AW-DED
  - Materials (Wire): Steel, & Aluminum
  - Build Area: 13 x 10.6 x 8 in
- JH-SST
  - Materials (Bar Stock): Aluminum
  - Build Area: 5 x 4 x 3 ft

POC

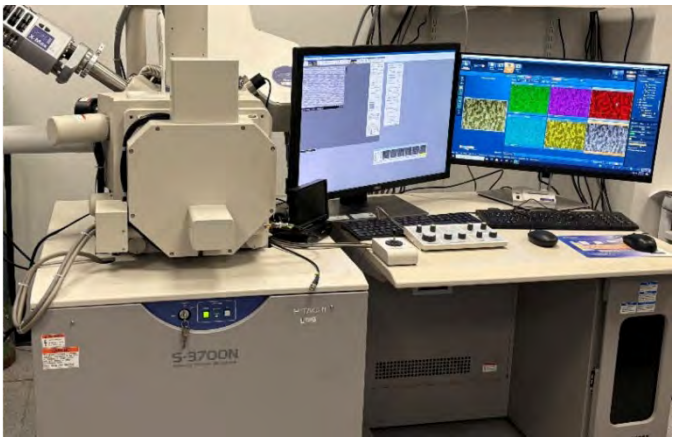
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GROUND VEHICLE MATERIALS ENGINEERING (GVME)

MATERIAL CHARACTERIZATION LABORATORY (MCL)

An ISO 17025 Accredited Facility for DoW Material Solutions ANAB Cert – AT-3163.01

The Material Characterization Laboratory (MCL) solves the DoW's most complex material challenges. Through root-cause failure analysis and applied research, we deliver authoritative data and actionable recommendations to ensure warfighter safety and operational readiness across all military ground vehicle systems.



Scanning Electron Microscope (SEM): Provides high-magnification imaging and elemental analysis to identify microscopic defects, crack initiation sites, and material composition.

PROVEN MISSION IMPACT (SUCCESS STORIES)

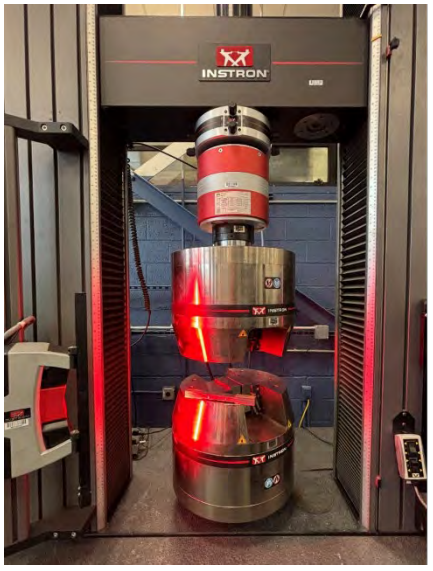
The MCL is the primary authority for solving critical material and structural failures across the fleet, directly saving millions of dollars and preventing vehicle downtime.

Target Area	Challenge / Failure Mode	MCL Scientific Solution & Impact
Driveline System	Transmission Mount Failures	Conducted structural and mechanical analysis to identify stress-concentration weaknesses, resulting in a revised design that eliminated field failures.
Powertrain Systems	Engine Oil Consumption	Diagnosed critical engine wear and varying oil consumption rates through advanced oil chemistry, piston-ring metallurgy, and surface wear analysis.
Legacy Systems	Material Obsolescence	Application of deep production specification knowledge, material characterizations, and engineering principles.

STRATEGIC VALUE & LAB EXPERTISE

As Subject Matter Experts for TACOM and DoW partners, the MCL provides distinct advantages over commercial labs by translating data into direct mission impact.

Strategic Advantage	Our Targeted Solutions
Military-Specific Rigor	Executing specialized testing protocols that directly satisfy unique, extreme DoW operational requirements.
Standards Modernization	Leveraging quantitative data to author and refine Military Standards (MIL-SPEC) for enhanced performance.
Advanced Manufacturing	Providing complete validation, defect scanning, and verification for parts produced via Additive Manufacturing (AM).
Reverse Engineering	Identifying material compositions and manufacturing methods to support legacy systems and overcome parts obsolescence.
Root-Cause Failure Analysis	Conducting rapid forensic-level analysis on structural, mechanical, and chemical material failures in the field.



600kN Tensile Tester: Performs high-capacity mechanical testing to determine the strength and deformation limits of advanced alloys.

GROUND VEHICLE MATERIALS ENGINEERING (GVME)

MATERIAL CHARACTERIZATION LABORATORY (MCL) NON-METALLIC & POLYMER CHARACTERIZATION

An ISO 17025 Accredited Facility for DoW Material Solutions

POLYMER, ELASTOMER & THERMAL CAPABILITIES

Non-metallic materials - such as trackpads, road wheels, seals, plastics, and composites - endure severe environmental and frictional stress. The MCL provides specialized thermal, mechanical, chemical, and durability testing to ensure polymer resilience.

ANALYTICAL DOMAIN	TECHNICAL CAPABILITIES & INSTRUMENTATION
Chemical & Thermal Analysis	• Polymer Chemical Composition (FTIR) • Thermal Analysis (DSC) • Dynamic Mechanical Analysis (DMA) • High-Temperature Characterization
Elastomer Durability & Wear	• Trackpad Wear & Abrasion testing • Elastomer Durability (HBU - Heat Build Up & Compression Set) • Low-Load Tensile & Compression (Starting at 100 N for soft materials)

FORENSIC ENGINEERING (NON-METALLIC SYSTEMS)

SERVICE AREA	ENGINEERING ACTION & IMPACT
Polymer Degradation Analysis	Investigating elastomer failures, thermal degradation of seals, and accelerated wear on track and suspension components.
Characterization & Reverse Engineering	Validating new rubber/polymer compounds, along with identifying and assisting with material obsolescence, to extend the lifecycle of combat vehicle trackpads and environmental seals.



Instron 68TM-50 Tensile System: Configured with an environmental chamber for non-ambient testing and an advanced video extensometer for high-precision, non-contact strain analysis.



VMI LAT-100 Rubber Tester: Evaluates abrasion resistance and friction of rubber compounds across ambient, elevated, and sub-ambient temperatures, including simulated wet and icy surface conditions.



TGA-FTIR Evolved Gas Analysis: An integrated system connecting a Thermogravimetric Analyzer (right) to an FTIR Spectrometer (left) via a heated line, enabling real-time chemical identification of gases released during material heating.

POC
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GROUND VEHICLE MATERIALS ENGINEERING (GVME)

MATERIALS JOINING & MANUFACTURING LAB

The Joining Lab specializes in advanced materials joining solutions. We provide deep technical expertise across the entire life cycle of military ground vehicles and support systems, ensuring that vehicle structures and components are safe, reliable, and a benefit to the warfighter.

CORE CAPABILITIES & MULTIDISCIPLINARY ENGINEERING

Virtually every segment of ground vehicle systems relies on advanced joining technologies. Welding is a highly complex engineering discipline, and our specialized team integrates multiple competencies to solve critical fabrication challenges.



Friction Stir Welding (FSW) System: Enabling high-strength, solid-state joining of thick-section aluminum and advanced lightweight alloys to improve combat vehicle survivability and structural integrity.

ENGINEERING DISCIPLINES	OUR TARGETED SOLUTIONS
Multidisciplinary Integration	Expertise spanning Materials Science, Metallurgy, Electrical & Mechanical Engineering, Design, Inspection, and Automation.
Advanced Fabrication	Proven solutions for metallics, composites, and dissimilar material combinations.
Rigorous Standards	Application of deep production specification knowledge, material characterizations, and engineering principles.

KEY RESEARCH AREAS

Our active research portfolio spans traditional fusion methods, cutting-edge solid-state techniques, and advanced durability testing to modernize the ground fleet.

RESEARCH DOMAIN	SPECIFIC FOCUS & TECHNOLOGIES
Fusion-Based Welding	Gas Metal Arc Welding (GMAW), Gas Tungsten Arc Welding (GTAW), and Shielded Metal Arc Welding (SMAW).
Solid-State Processing	Friction Stir (FS) Welding (FSW), Processing (FSP), Additive Manufacturing (FSAM) and Ultrasonic Welding.
Dissimilar Materials	Adhesives, hybrid joining solutions, and high-strain-rate adhesive evaluation.
Materials Characterization	Hydrogen embrittlement, weldability, and filler material development.
Mechanical Fastening	Fastener evaluation, precise torque schedules, and mechanical testing.
Environmental Durability	Environmental exposure effects and long-term joint degradation testing.





Torque-Tension Testing System: Evaluates torque-tension relationships and clamp load retention to establish precise fastening schedules for critical ground vehicle structures.

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GROUND VEHICLE MATERIALS ENGINEERING (GVME)

MATERIALS JOINING & MANUFACTURING LAB

CORE COMPETENCIES (QUALITY & ENGINEERING SUPPORT)

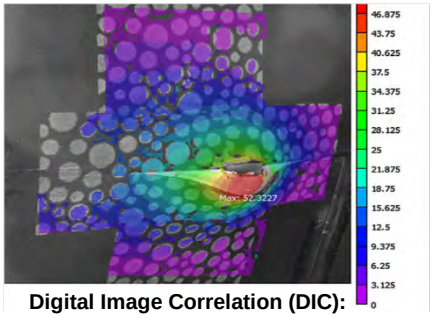
We provide direct engineering support, quality assurance, and failure analysis to ensure acquisition programs and manufacturing partners meet rigorous military standards.

CORE TECHNICAL SERVICES	AREA OF SUPPORT & IMPACT
Standards & Compliance	Validation, verification, and engineering audits of complex weld requirements.
Quality Assurance	Comprehensive weld audits, quality inspections, and contract language formulation for weld requirements.
Testing & Evaluation	Complete destructive and non-destructive testing (NDT) & evaluations.
Novel Materials	Advanced fastening and joining methods specifically tailored for novel, lightweight, or armor materials.
Failure Analysis	Rapid root cause analysis and mitigation strategies for structural or joint failures.

LABORATORY & TESTING CAPABILITIES

Our state-of-the-art facilities allow us to physically test, certify, and validate joining technologies under simulated combat and environmental conditions.

CAPABILITY	TECHNICAL FOCUS
Advanced Welding Methods	Production-scale Fusion Welding and Friction Stir Welding & Processing.
Ballistic Certification	Official ballistic weld certification and survivability testing.
Advanced Diagnostics	Joint characterization and Digital Image Correlation (DIC) for real-time strain mapping.
Extreme Evaluation	High-strain-rate evaluation and environmental exposure testing.



Digital Image Correlation (DIC): Non-contact optical mapping used to measure real-time strain, deformation, and displacement across weld joints during structural testing.



Wire Arc Additive Manufacturing (WAAM): Utilizing advanced 3D metal printing to fabricate high-strength prototype components and rapid repair solutions



Collaborative Robotic (Cobot) Welding: Automated GMAW system used to evaluate robotic path planning, precision welding parameters, and advanced manufacturing integration

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GROUND VEHICLE MATERIALS ENGINEERING (GVME)

RAPID PROTOTYPING LAB

The Rapid Prototyping Lab (RPL) falls within the Ground Vehicle Materials Engineering (GVME) Directorate and utilizes polymer 3D Printing/Additive Manufacturing to produce parts for various customers. The usage of these parts includes fit-check, temporary field repairs, and permanent vehicle use.

The primary capabilities used within the RPL are polymer 3D printers. These machines range from small desktop machines (identical to fielded systems) to industrial machines capable of producing parts that can withstand a lifetime in the engine bay of a vehicle. The RPL also has multiple 3D scanners that are used to either generate geometry from existing parts or to validate as-printed geometry against existing CAD data. These 3D scanners are portable and can be brought to the point of need.

EXAMPLE RAPID PROTOTYPING PROJECTS



Low Velocity Air Drop (LVAD) Support block: 3 design iterations tested over a 2-week period, final design prevented critical parts failing during LVAD testing.



Temporary Camera Cover: Designed and tested a temporary cover for 2 different weapon system cameras to prevent damage while the unit waited to receive OEM replacements. Covers were made from a rubber like material.



Suspension Position Sensor Arm temporary replacement: Tested several machines/materials to validate this temporary repair piece for expeditionary manufacturing/use.

- **Manufactured forming tools** that enabled our composites team to make custom geometries from carbon fiber sheets.
- Travelled to a coastal Army facility with a scanning arm and worked with soldiers **to scan large pump components** on Army Watercraft Systems.
- **Designed and built electrical covers** located in an engine bay to prevent water ingress, ultimately replaced the OEM design.
- **HMMWV Door Handle** temporary replacement: Tested several machines/materials to validate this temporary repair piece for expeditionary manufacturing/use.

EQUIPMENT

- Stratasys 450mc
  - Materials: ASA, PC, ULTEM, etc.
  - Build Area: 16 x 14 x 16 in
- HP4200
  - Materials: PA11 Nylon
  - Build Area: 15 x 11 x 15 in
- Formlabs Fuse 1+
  - Materials: PA11 Nylon, TPU
  - Build Area: 6.5 x 6.5 x 12 in
- Formlabs Form 3L
  - Materials: Tough 200, Flexible 80A, etc.
  - Build Area: 13 x 8 x 12 in
- Formlabs Form 4
  - Materials: Tough 200, Flexible 80A, etc.
  - Build Area: 8 x 5 x 8.3 in
- Markforged X7
  - Materials: Onyx, ESD Safe Onyx, FR Onyx + continuous reinforcement fibers
  - Build Area: 13 x 10.6 x 8 in
- Lulzbot Machines
  - Materials: PLA, ABS, Nylon (fielded materials)
  - Build Area: 11 x 11 x 10 in
- Makergear Ultra 1
  - Materials: PLA, ABS, Nylon (fielded materials)
  - Build Area: 16 x 14 x 13 in
- VisionMiner 22 IDEX
  - Materials: PLA, ABS, Nylon (fielded materials)
  - Build Area: 14 x 14 x 18 in
- Prusa XL
  - Materials: PLA, ABS, Nylon (fielded materials)
  - Build Area: 14 x 14 x 14 in
  - 5 tool-heads enable multi-material printing
- BigRep Studio G2
  - Materials: PLA, ABS, Nylon (fielded materials)
  - Build Area: 40 x 20 x 20 in
  - 5 tool-heads enable multi-material printing
- 3D Scanning
  - Hexagon RA8725 2.5m spherical measurement volume
  - Hexagon RA8740 4.0m spherical measurement volume
  - Contact Touch Probe - accuracy up to 6µm
  - 3D Laser (blue wavelength) Scanner - accuracy within 43µm
  - Area Scanner 3D white light scanning - accuracy within 43µm

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GROUND VEHICLE ROBOTICS (GVR)

Ground Vehicle Robotics' mission is to develop, experiment, demonstrate and transition autonomy enabled ground systems capabilities and technologies to meet and shape Army requirements. GVR wants to be the first choice of technology and engineering expertise for ground vehicle systems and support equipment - today and tomorrow.

CAPABILITIES

Detroit Arsenal offers four full high bays capable of housing full size tactical and combat systems so that integration work can be performed. Lab bench SIL's and HIL's allow synchronous work in vehicles while adjacent technology is proven on bench. On site there is an approximate 13-acre open area with grass, trees, and an asphalt loop allowing field testing of systems without requiring shipment to a full test range until they are mature enough.

Selfridge ANG Base offers two high bays, several SIL areas, a general work and maintenance building and a four-acre test area consisting of an asphalt loop as well as off road area with stone, sand and turf surfaces. Performs electrical and mechanical hardware design, fabricates and integrates modifications to existing base platforms based on user requirements. Modeling/simulation of vehicles large and small, this includes hardware-in-the-loop simulations and testing/development of systems and vehicles from 30-pound robots to Strykers Interoperability Profiles (IOP) and Conformance Verification Tools (CVT). CVT provides the capability to verify vendor conformance against government-defined IOP profiles Including a Warfighter Machine Interface (WMI) SIL where personnel can physically interact with upcoming operational control systems and configurations

The facilities support customer efforts such as; Common Robotic System (Individual), Combat Vehicle Robotics (CoVeR), Autonomous Tactical Vehicle Systems (ATVS), Robotic Combat Vehicle (RCV) and small Dismounted Systems such as GVRBot, Project 10X, and SMET.

BENEFITS

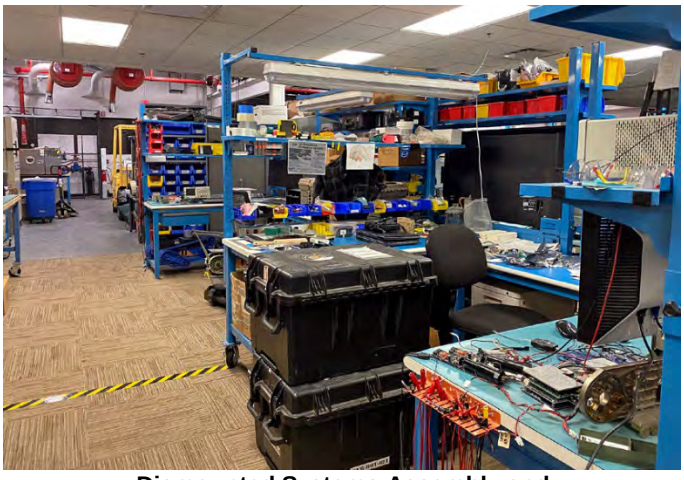
The benefits of small test areas adjacent to Bays and SIL's is the capability to do rapid prototype and revision then test prior to deploying for full scale testing at a range or base.



RCV-L Staged for Local Testing



ATVS Simulator



Dismounted Systems Assembly and Troubleshooting SIL

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GROUND VEHICLE SIMULATION LABORATORY (GVSL)

GVSC's Immersive Simulation (IS) Directorate develops and executes state-of-the-art, Soldier-centric simulations in support of virtual experimentation, immersive visualization, and in-the-loop technology development. These immersive simulation capabilities provide stakeholders key data and information to develop early on system requirements/Tactics, Techniques, and Procedures (TTPs), explore novel crew station technologies, visualize/review ground vehicle system concepts, and more quickly/efficiently develop and test the latest Robotic/Autonomous System (RAS) solutions. The Ground Vehicle Simulation Laboratory (GVSL), within IS, boasts two unique motion-based simulator assets that provide both Soldier and system-in-the-loop simulation capabilities to look at a myriad of vehicle and vehicle crew station challenges.

CREW STATION/TURRET MOTION BASE SIMULATOR (CS/TMBS) **59**

RIDE MOTION SIMULATOR (RMS) **60**

VIRTUAL EXPERIMENTATION **61**



GROUND VEHICLE SIMULATION LABORATORY (GVSL)

CREW STATION/TURRET MOTION BASE SIMULATOR (CS/TMBS)

OVERVIEW

- Accommodates “Active” Combat Vehicle Turret Systems
  Highly repeatable to test gun/turret drive, weapon stabilization and ammunition handling systems.
- Reconfigurable cab can accommodate entire crew.
  Can replicate current vehicle layout or concept vehicle crew configuration.
- Hexapod configuration (Stewart Platform)
- 6 Degrees of Freedom (6-DOF: Lat, Long, Vertical
- (Heave), Roll, Pitch and Yaw)
- Hydraulically Actuated
- Replicates the “ride” of military ground systems over several terrain types, including field collected data or analytical models
- Human-in-the-loop, real-time vehicle dynamics and virtual mission scenarios available.

CS/TMBS Performance Specs	
Payload	25+ tons
Acceleration Bandwidth	10-20Hz
Displacement	
Linear (vert., lat., long.)	± 1m
Angular (roll, pitch, yaw)	± 20°
Acceleration	
Linear (vert., lat., long.)	4g
Angular (roll, pitch, yaw)	30 rad/sec^2
Accuracy	
Linear	> 97%
Angular	> 97%



M1A2 Turret on CS/TMBS



Reconfigurable Mission Module on CS/TMBS



Mission Module Interior

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GROUND VEHICLE SIMULATION LABORATORY (GVSL)

RIDE MOTION SIMULATOR (RMS)

OVERVIEW

- Single occupant reconfigurable cab
- Designed for crew station and soldier-in-the-loop virtual experimentation
- Capability to test new seating for current systems.
- Hexapod configuration (Stewart Platform)
- 6 Degrees of Freedom (6-DOF: Lat, Long, Vertical (Heave), Roll, Pitch and Yaw)
- Hydraulically Actuated
- Replicates the “ride” of military ground systems over several terrain types, including field collected data or analytical models
- Human-in-the-loop, real-time vehicle dynamics and virtual mission scenarios available.

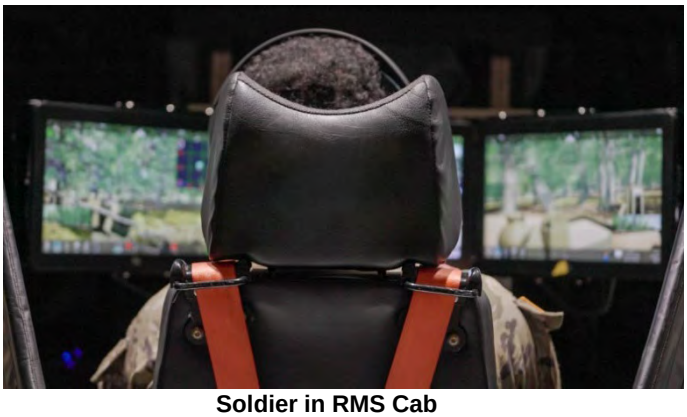
RMS PERFORMANCE SPECS	
Maximum Payload	1500lb
Acceleration Bandwidth	40 Hz
Axes Displacement • Linear (long, lat, vert) • Angular	 ±0.5m ±20°
Max Accel w/ Max Payload • Linear • Angular	 2g 20 rad/sec^2
Accuracy • Linear • Angular	 > 97% > 97%



Soldier Riding on RMS



Crew Station Mockup in RMS Cab



Soldier in RMS Cab

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GROUND VEHICLE SIMULATION LABORATORY (GVSL)

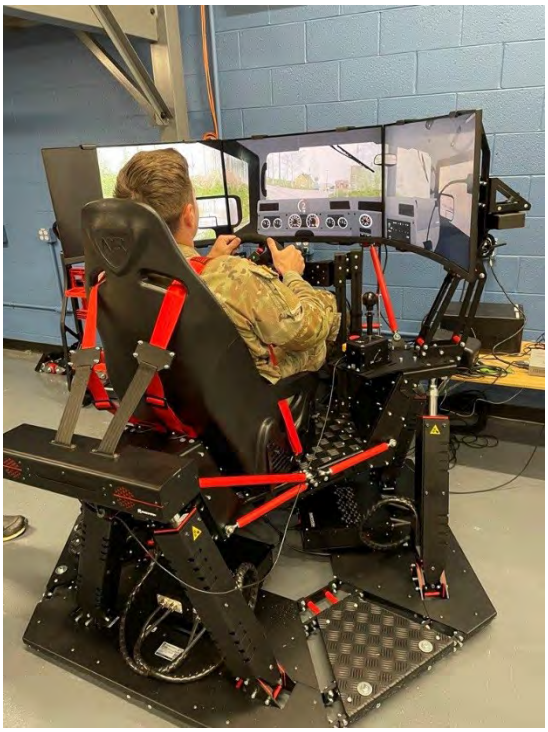
SIMULATION PLATFORM FOR IMMERSIVE KINETIC ENGAGEMENT (SPIKE)

OVERVIEW

Commercial Entertainment Simulator (COTS)

Lower Cost Alternative for:

- Training
- Virtual Fielding
- Experimentation
- Hexapod configuration (Stewart Platform)
- 6 Degrees of Freedom (6-DOF: Lat, Long, Vertical (Heave), Roll, Pitch and Yaw
- Electrically Actuated
- Replicates the “ride” of military ground systems over several terrain types in IS’ Project GL simulation Environment
- Human-in-the-loop, real-time vehicle dynamics and virtual mission scenarios available





SPIKE PERFORMANCE SPECS	
Payload	250kg
Bandwidth	100 Hz
Displacement	
Linear (vert., lat., long.)	± 5.3, 114 & 120 cm
Angular (roll, pitch, yaw)	± 5, 5 & 9 deg
Velocity	
Linear (vert., lat., long.)	± 35, 100 & 125 cm/sec
Angular (roll, pitch, yaw)	± 40, 40 & 100 deg/sec
Acceleration	
Linear (vert., lat., long.)	0.5g, 1g, & 1g
Angular (roll, pitch, yaw)	500, 500 & 1000 deg/sec^2

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

Ground Vehicle Survivability & Protection (GVSP) is responsible for holistic ground vehicle layered survivability and protection to ensure Soldiers maintain an operational capability against a peer advisory within a contested battlespace. Primary competencies emphasize interoperability with Vehicle Protection System Vehicle Base Kit (VPS VBK) MAF compliance for a layered protection including obscuration, ballistic armor, blast mitigating technologies, plus soft/hard kill avoidance initiatives that include LASER and unmanned aerial system (UAS) mitigation for the Department of War ground vehicles including internal power, environmental controls and fire protection. Specialty areas cover the utilization of specialized test fixtures, test rigs, instrumentation systems (including Anthropomorphic Test Devices) and live-fire ranges for testing and evaluation of protection technologies for an overall integrated system designed to accommodate the Soldiers' operational environment within the platform and protect them from hazards encountered within combat and tactical wheeled vehicles. GVSP uses its unique in-house laboratories and off-site ranges for subject matter experts to reinforce its reputation as the Army's technical authority on survivability.

FIRE PROTECTION TECHNOLOGY INTEGRATION LABORATORY (FP TIL) **63-64**

OCCUPANT PROTECTION LABORATORY OFF-SITE TESTING SUPPORT (OPL) **65**

- **CREW COMPARTMENT UNDERBODY BLAST SIMULATOR (CCUBS)** **66**
- **SUB-SYSTEM DROP TOWER (SSDT)** **67**
- **COMPONENT IMPACT SIMULATOR (CIS)** **68**
- **FLOOR INTERFACE TECHNOLOGY ACCELERATOR (FITA)** **69**
- **HEAD IMPACT LABORATORY (HIL)** **70**
- **RAPID EVALUATION CAPABILITY (REC)** **71-72**
- **SPECIAL SYSTEMS AND COMPONENT ENGINEERING LABORATORY** **73**
- **ANTHROPOMORPHIC TEST DEVICE (ATD) CERTIFICATION LABORATORY** **74-75**

SURVIVABILITY AND BALLISTICS LABORATORY (SABL) **76**

VEHICLE ARMOR LABORATORY (VAL) **77**

VEHICLE PROTECTION INTEGRATION LABORATORY (VPIL) **78-79**



GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

FIRE PROTECTION TECHNOLOGY INTEGRATION LABORATORY (FP TIL)

The Fire Protection Technology Integration Laboratory (FP TIL) provides resources that allow for faster and more thorough evaluation of emerging automatic fire extinguishing system (AFES) technologies and agents to support the Army's modernization plans for future and legacy vehicles. It also enables researchers to develop methods to evaluate new fire protection technologies for future applications.

This important lab provides DEVCOM Ground Vehicle Systems Center with integration and testing capabilities to evaluate the performance of existing and emerging extinguishing components and agents.

The lab features a ballistic fireball simulator, reconfigurable test enclosure, and an ability to perform high-speed agent concentration analysis.

This facility can support integration and engineering test and evaluation of AFES designed to protect watercraft, tactical and armored manned/unmanned ground vehicles including:

- Abrams
- MRAP
- BFV
- FAASV
- Stryker
- HEMTT
- M-ATV
- Other current and future military vehicles



FP TIL reconfigurable chamber, used for fire protection research and vehicle integration testing



FP TIL forced ventilation and filtration system

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

FIRE PROTECTION TECHNOLOGY INTEGRATION LABORATORY (FP TIL)

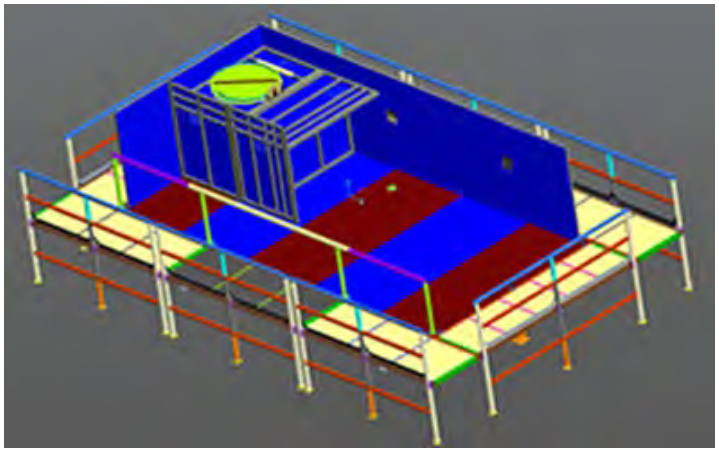
DEVCOM Ground Vehicle Systems Center is researching ways to improve fire resistance and increase vehicle protection by addressing fire vulnerabilities with current and emerging threats.

RESEARCH

- Environmentally friendly agents
- Integration and evaluation of vehicle/crew fire suppression systems
- Development of and conformance to material flammability, smoke and toxicity standards



Fireball Generator: The Fireball Generator creates and ignites a pressurized, heated fuel spray to simulate a ballistic event where a threat has penetrated a vehicle's fuel tank.



Reconfigurable Fire Box: The Reconfigurable Fire Box is able to replicate interior dimensions of all current and future tactical and combat vehicles.

OTHER AREAS OF INTEREST

- External fire protection systems
- Fuel tank vulnerability reduction
- Li-Ion battery fire protection
- Electrical fire protection
- Ammunition fire protection



High Speed Agent Concentration Analyzer: DEVCOM Ground Vehicle Systems Center's unique capability to perform real-time, gaseous agent distribution measurements and assess AFES performance.



FP TIL forced ventilation and filtration system

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

OCCUPANT PROTECTION LABORATORY OFF-SITE TESTING SUPPORT (OPL)

The Occupant Protection Laboratory (OPL) provides existing partnerships and experience to perform the testing with proven providers such as the Engineering Research and Development Center (ERDC), National Ground Intelligence Center (NGIC), and other contractor facilities.

The OPL can assist with the coordination and provide off-site test support for its customers with Data Acquisition Systems (DAS), ATDs, instrumentation, cameras, and test consulting.

CAPABILITIES

OPL Partners offer several scenarios to extend the subsystem performance and integration. OPL technicians instrument the test fixtures and subsystems to compare improvements against the baseline for:

- Dynamic rollover testing
- Generic hull underbody blast testing
- Vehicle born improvised explosive device (VBIED) blast testing

AVAILABLE INSTRUMENTATION

- 5th, 50th, and 95th Hybrid III ATD
- Accelerometers: 7264 style, 2K range or other upon request
- Load Cells: upon request
- High Speed Video: 5,000 fps



Generic Hull Live Fire Test



Generic Hull



Vehicle Live Fire Test

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

CREW COMPARTMENT UNDERBODY BLAST SIMULATOR (CCUBS)

The Crew Compartment Underbody Blast Simulator (CCUBS) is a pneumatically-actuated test device made up of a large platform capable of holding up to four seated occupants and used to evaluate vehicle crew compartments in simulated underbody blast events or material equipment drops. Testing is performed on system and subsystem items such as energy attenuating (EA) seats, bench seats, restraints, EA floors, floor mats, cargo retention devices, and any item that requires dynamic impact testing. CCUBS simulates the independent local and global forces that occur from an underbody explosive event (initial vertical and drop-down forces). This test device evaluates the occupants, occupant protection technologies, and components in a controlled, repeatable, and reproducible environment.

CCUBS is located within the Occupant Protection Laboratory (OPL), a full-service test facility with the resources, capabilities, equipment, and partnerships needed to perform dynamic impact/impulse testing on components, subsystems, or systems within six distinct testing capabilities. CCUBS can utilize Anthropomorphic Test Devices (ATDs), which are certified, repaired, and maintained within the OPL.



Programmers on Bullet Mass

CAPABILITIES

- Testing impulses up to 350g - 5ms on a global level with slam down impulses up to 90g - 20ms
- Total payload is 2,200 lbs
- Platform size 8’ x 8’ (Warrior Injury Assessment Manikin)
- Accelerometers: 7264 style, 2K range or other upon request
- Load Cells: Compression load cells
- High Speed Video: 5,000 fps upon request

AVAILABLE INSTRUMENTATION

- 5th, 50th, 95th Hybrid III ATD
- Sample Rate: 10,000 - 20,000/sec
- Accelerometers: 7264 style, 2K range or other upon request
- Load Cells: lightweight seatbelt load cells
- High Speed Video: 5,000 fps



Readying ATDs on the CCUBS Platform in Preparation for a Test



Nitrogen-charged actuators accelerate the mass on the test fixture to induce the required impulse to simulate an IED

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

SUB-SYSTEM DROP TOWER (SSDT)

The Sub-System Drop Tower (SSDT) is a device used to evaluate technologies that must endure dynamic impact testing. The drop tower consists of a 48” x 48” platform that has the capability to test a variety of system configurations such as floor, wall, or ceiling mounted energy absorbing (EA) seats, floor mat materials, EA floors, cargo retention devices, and data acquisition black boxes. The SSDT is capable of simulating a wide range of impulses and measuring the effects on the technology and/or occupant.

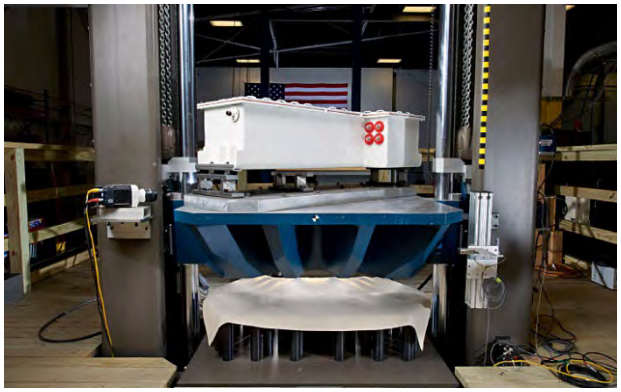
SSDT is located within the Occupant Protection Laboratory (OPL), a full-service test facility with the resources, capabilities, equipment, and partnerships needed to perform dynamic impact/impulse testing on components, subsystems, or systems within six distinct testing capabilities.

CAPABILITIES

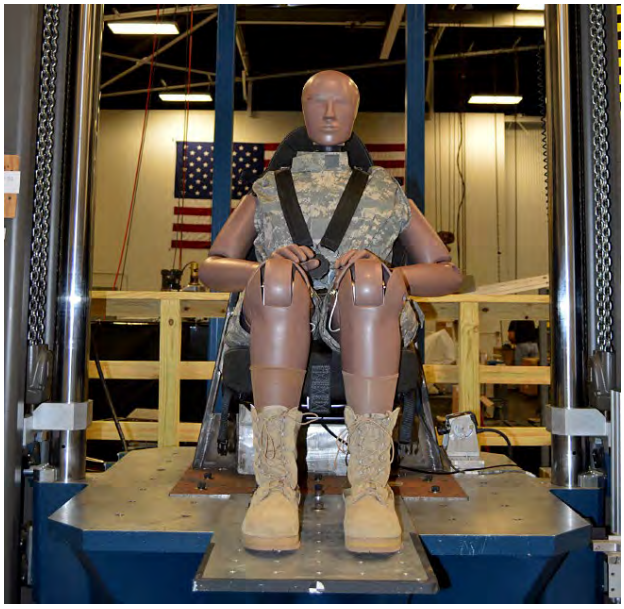
- Impulses up to 1,000g durations from 2-10 msec
- Platform size 48”x48”
- Payloads depending on test configurations
- 1,100lbs to 7,400lbs

AVAILABLE INSTRUMENTATION

- 5th, 50th, 95th Hybrid III ATD
- Accelerometers: 7264 style, 2K range or other upon request
- Load Cells: upon request
- High Speed Video: 5,000 fps



SSDT with Stryker Battery Box



Seat with Hybrid II Anthropomorphic Test Device (ATD) test



Ammo Rack Retention Test

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

COMPONENT IMPACT SIMULATOR (CIS)

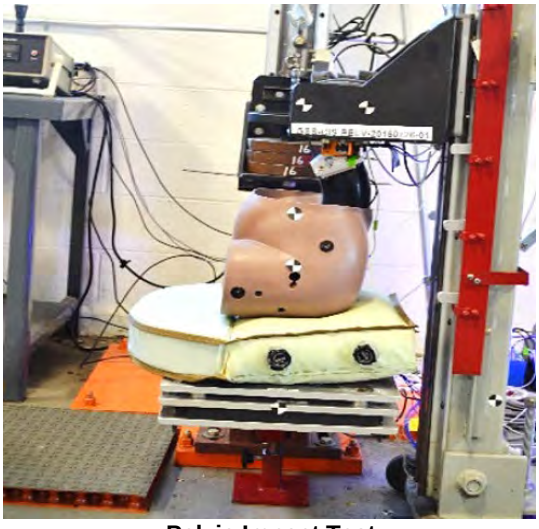
The Component Impact Simulator (CIS) is a multipurpose test fixture used for component and subcomponent shock impulse testing. The test results are used to identify input parameters that are significant to component failure or occupant injury. The CIS provides the data required to generate algorithms that will predict the risk of failure or injury given the input parameters. This is a repeatable, non-destructive test methodology.

CIS is located within the Occupant Protection Laboratory (OPL), a full-service test facility with the resources, capabilities, equipment, and partnerships needed to perform dynamic impact/impulse testing on components, subsystems, or systems within six distinct testing capabilities.

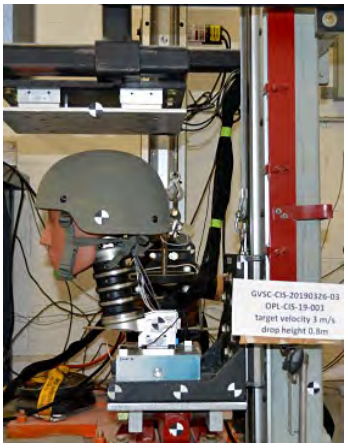
- Testing from 6 -10 m/s
- Head/Neck impact testing (with or without helmet)
- Lower-extremity testing (ATD leg from knee down)
- Pelvis impact testing (pelvis and lumbar)
- Evaluation of flooring, seat padding materials (foams, rubbers), vehicle trim, cargo retention, and electronics

AVAILABLE INSTRUMENTATION

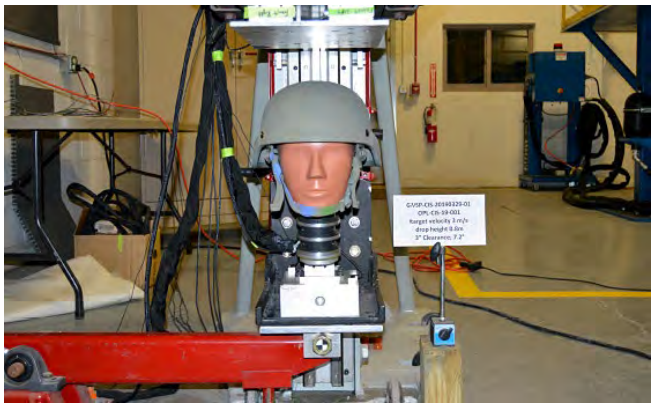
- 5th, 50th, 95th Hybrid III ATD and WIAMan (Warrior Injury Assessment Manikin)
- Accelerometers: 7264 style, 2K range or other upon request
- Load Cells: Compression load cells
- High Speed Video: 5,000 fps upon request
- Load Cells: upon request
- High Speed Video: 5,000 fps



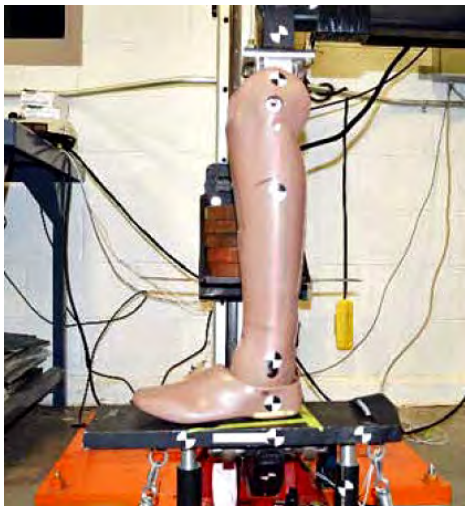
Pelvic Impact Test



Head and Neck Assembly Test



Head and Neck Testing



Lower Leg Testing

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

FLOOR INTERFACE TECHNOLOGY ACCELERATOR (FITA)

The Floor Interface Technology Accelerator (FITA) is a leg impact system used to evaluate the performance of energy absorbing floor materials, simulating an underbody blast. It could be adapted to test any component that requires being subjected to accelerative forces. The FITA consists of a rigidly mounted seat with a pneumatically-actuated piston that pushes against the foot of the occupant or resistive object. This test allows engineers to quickly evaluate the performance of the test item prior to more extensive testing on other Occupant Protection Laboratory (OPL) test fixtures or in live-fire events.

FITA is located within the (OPL), a full-service test facility with the resources, capabilities, equipment, and partnerships needed to perform dynamic impact/ impulse testing on components, subsystems, or systems within six distinct testing capabilities. The OPL provides offsite testing support and coordination for a multitude of different types of survivability testing.

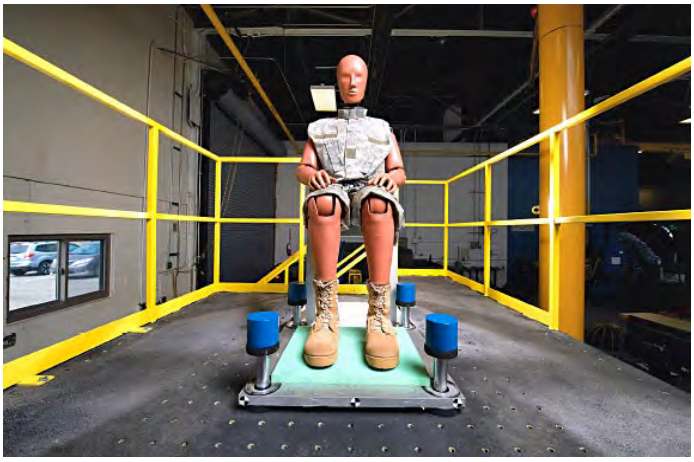
- Impactor velocity at 525 psi is approximately 14m/s
- Impactor velocity at 1,000 psi is approximately 18m/s
- Chair for dummy positioning
- Foot platform size: 2'x 2'

AVAILABLE INSTRUMENTATION

- 5th, 50th, and 95th Hybrid III ATD
- Accelerometers: 7264 style, 2K range or other upon request
- Load Cells: upon request
- High Speed Video: 5,000 fps



Floor Interface Technology Accelerator



ATD Seated In Position

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

HEAD IMPACT LABORATORY (HIL)

The Head Impact Lab (HIL) is an impact test machine used to test vehicle interior impact points that cause injuries to the head and extremities. The data provides information required to develop interior padding solutions that will reduce injuries to the head and extremities of occupants involved in a blast, crash, and rollover event in ground vehicles. The HIL fills a capability gap between component level testing, and system/vehicle level evaluation of occupant protection technologies.

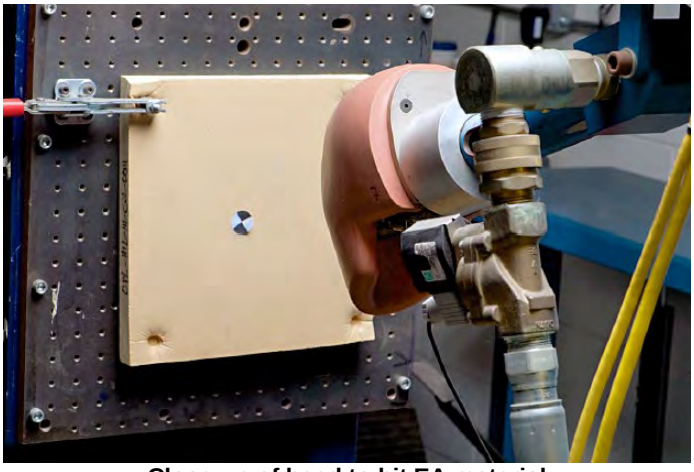
The HIL is located in the Occupant Protection Laboratory (OPL) a full-service test facility with the resources, capabilities, equipment, and partnerships needed to perform dynamic impact/impulse testing on components, subsystems, or systems within six distinct test capabilities. Researchers use the OPL to perform unique "out of the box" impact testing, as well as standardized testing on occupant protection and energy mitigation technologies.

CAPABILITIES

- The HIL is capable of testing speeds up to 24kp/h (15 mph) using Federal Motor Vehicles Safety Standards 201u head form or with the European/ pedestrian head form with a mounted Advanced Combat Helmet
- Dynamic impact testing of energy mitigating materials
- The HIL is ISO/IEC 17025 accredited

AVAILABLE INSTRUMENTATION

- Accelerometers
- Load Cells
- High Speed Video



Close-up of head to hit EA material



Close-up of head to hit inside HMMWV



HIL with use of a HMMWV

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

RAPID EVALUATION CAPABILITY (REC)

The Rapid Evaluation Capability (REC), uses a Mobile Experiment Lab and special equipment to effectively extend the REC's capabilities to remote locations such as Camp Grayling, MI or Fort Irwin, CA and configure a bare field into a high-fidelity live-fire range.

The REC can instrument and monitor an open-field range like the state of Michigan's only high-explosive impact area at Camp Grayling to conduct year-round experiments and evaluations on survivability and protection systems. In coordination with the Michigan National Guard, REC can utilize more than 147,000 acres to develop and assess technologies and system integration on platforms before they undergo validation testing.

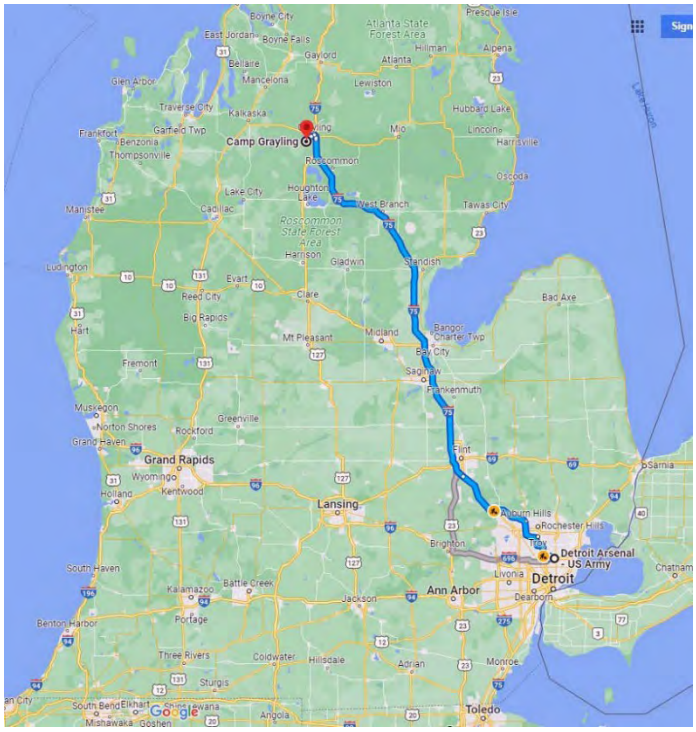
GVSP has developed capabilities to assess a broad suite of vehicle protection systems such as laser detection, Soft Kill, and Hard Kill using foreign threats and advance countermeasures. This also includes newly-established competencies for assessing counter- Uncrewed Aircraft Systems (cUAS). Camp Grayling's vast training areas have also allowed for platforms to conduct mobility performance/shakedown runs, driver enhancements, target recognition demonstrations, communication performance checks, and other technology assessments. Mobility assessments include electric, hybrid electric and hydrogen power systems.

BENEFITS

- Preliminary feasibility assessments are more cost effective than conducting actual tests
- Remote/Isolated location provides for discreet evaluation of technology readiness
- Controlled experiment/evaluation setting allows for repeatable yet rapid reconfiguration as necessary
- Mobile experiment laboratories facilitate immediate data capture, analysis and collaboration --anywhere/anytime



REC range configurations



Continued on next page…

GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

RAPID EVALUATION CAPABILITY (REC)

CAPABILITIES

- Mobile Experiment Lab efficiently extends the REC's capabilities to remote reconfigurable locations
- Real-time experiments and evaluations of emerging technologies against high-explosive threats:
  - Explosively Formed Penetrators (EFPs)
  - Rocket Propelled Grenades (RPGs)
  - Anti-Tank Guided Missiles (ATGMs)
  - Recoilless Rifles
  - Mines
  - Direct-Fire Suppression
- Verifies medium-caliber armor manufacturing processes (i.e. welds) to quickly determine technology maturity
- Utilizes remote firing controls, multiple high-speed video camera angles and mobile experiment labs for real-time data/video capture and analysis
- Large workspaces and collaboration areas to host onsite After-Action Reviews/discussions immediately following experiments



GVSP Expandable Test Trailer deploys to remote Test Range



Large work area inside the GVSP Test Trailer for briefings, meetings and running test operations



Large work area inside the GVSP Test Trailer for briefings, meetings and running test operations

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

SPECIAL SYSTEMS AND COMPONENT ENGINEERING LABORATORY

TESTS

- HVAC System Testing
  - A/C capacity and performance
  - Exchangers and heating system capacity
  - Charge determination and system evaluation
  - Oil circulation measurement
  - Air flow component, system, vehicle level
- Vehicle system power testing
- Alternator bench to vehicle testing

CAPABILITIES

- Five Environmental Chambers
  - Sizes from 4'x4'x4' to 12'x15'x10'
  - Temperatures -80 Deg F to 1000 Deg F
  - Humidity
  - Solar load
  - Thermal shock up to pallet sized items

- Alternator testing
  - Up to ~1500 amps @ 28V
  - -80 Deg F to 225 Deg F

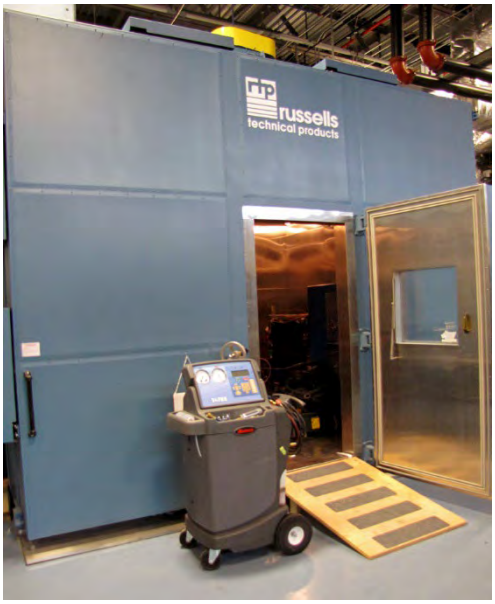
- Airflow5000
  - 20 CFM to 5000 CFM



Alternator Test Inside Environmental Chamber



5000 CFM Airflow Bench



Large Environmental Chamber



Airflow on Vehicle

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

ANTHROPOMORPHIC TEST DEVICE CERTIFICATION LABORATORY (ATD)

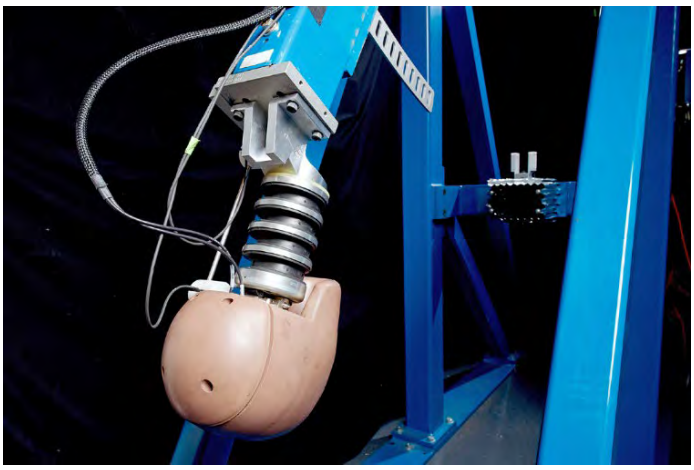
The Anthropomorphic Test Device (ATD) Certification Lab enables GVSC to certify ATDs and the Warrior Injury Assessment Manikin (WIAMan) in-house.

This lab has the experience to record data and test using ATDs and the WIAMan, thanks to subject matter experts who have been on the WIAMan development team from the very beginning. The ATD Lab owns 12 dummies, which they can certify, repair, and maintain after each test. This saves up to 6-8 weeks of time that would be required if they had to be sent out, reducing cost and downtime between testing events.

The ATD Lab is located within the Occupant Protection Laboratory (OPL), a full-service test facility with the resources, capabilities, equipment, and partnerships needed to perform dynamic impact/impulse testing on components, subsystems, or systems within six distinct testing capabilities. ATDs are utilized in multiple labs within the OPL, including the Crew Compartment Underbody Blast Simulator (CCUBS), Sub System Drop Tower (SSDT), Hardware in the Loop (HIL), and Floor Interface Technology Accelerator (FITA) as well as in off-site live fire tests.



Thorax Impact Test Device



Neck Pendulum Test Device

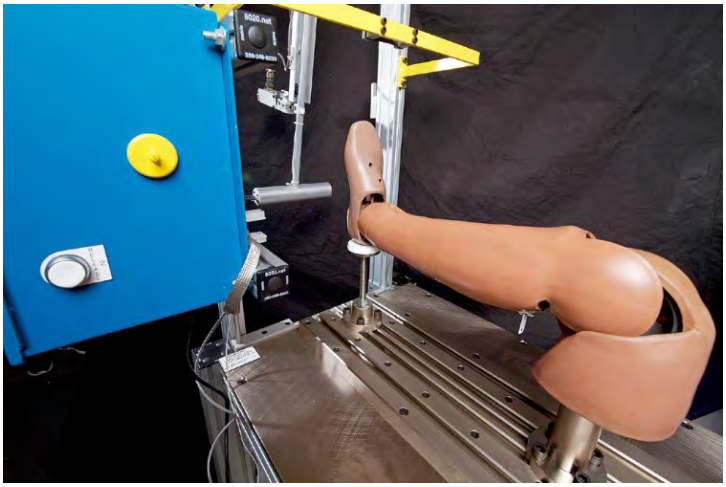
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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

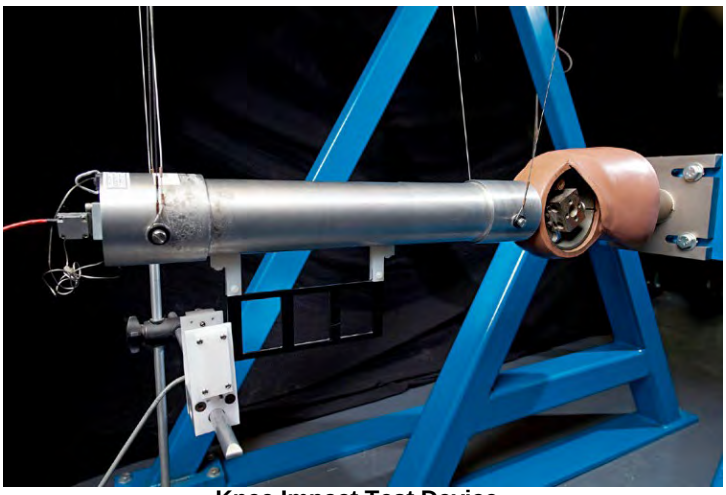
ANTHROPOMORPHIC TEST DEVICE CERTIFICATION LABORATORY (ATD)

KEY CAPABILITIES

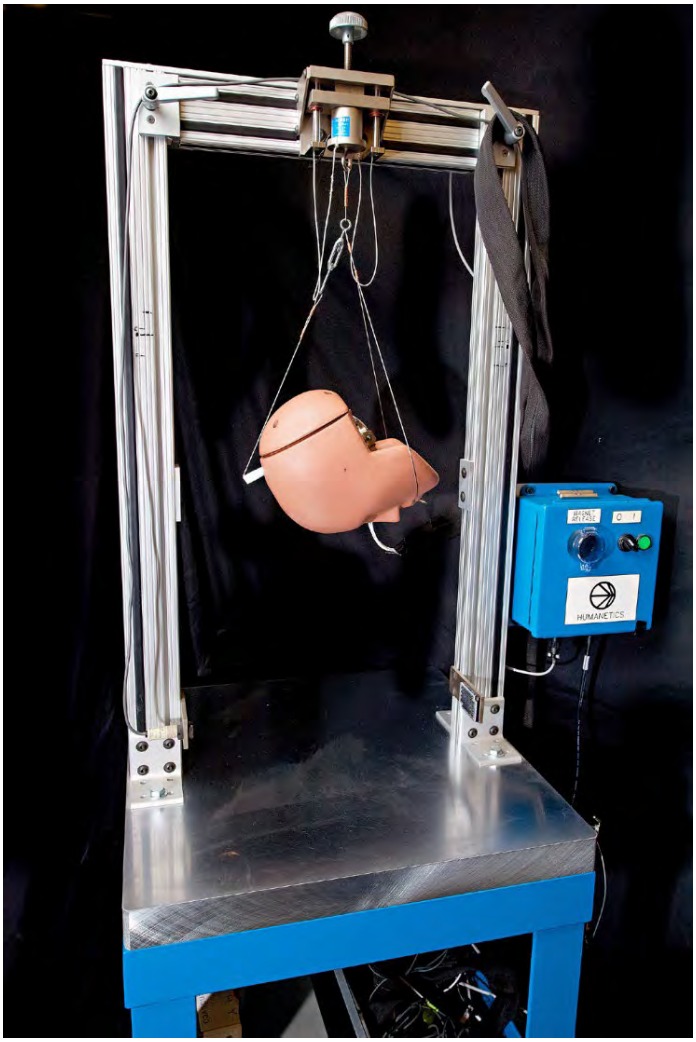
- Test fixtures to certify each body region of an ATD (head, neck, knee, thorax, foot)
- Compliant with CFR 49, Part 572 ATD
- Instrumentation conforms to SAE J211 standards
- 5th, 50th, 95th Hybrid III ATD and WIAMan (Warrior Injury Assessment Manikin)



Foot Impact Test Device



Knee Impact Test Device



Head Drop Test Device

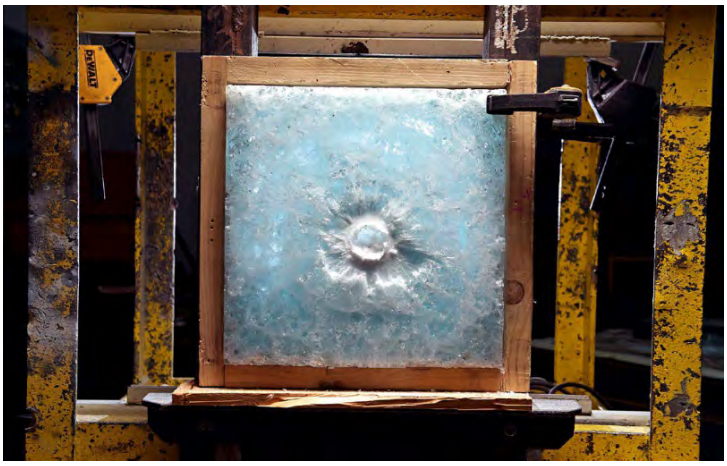
POC
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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

SURVIVABILITY ARMOR BALLISTICS LABORATORY (SABL)

OVERVIEW

The Survivability Armor Ballistics Lab (SABL) provides independent ballistic testing, data collection, data reduction, analysis, and qualification of armors. The lab conducts Automotive Tank Purchase Description (ATPD) 2352 and MIL- STD-3040 and 3057 qualification testing and supports customer-directed armor research and development.



BALLISTIC TESTING OF TRANSPARENT AND OPAQUE ARMOR SOLUTIONS

The SABL performs ballistic tests to multiple specifications including:

- ATPD 2352
- MIL-STD-662F
- STANAG 4569
- MIL-STD-3040
- MIL-STD-3057
- Customer directed test plans

Transparent, metallic, and composite armor coupons as well as vehicle armor components are tested in the SABL for research, first article, and product control purposes.

SABL INVENTORY

The SABL inventory contains more than 30 different projectiles which range
in size from 5.56mm to 105mm and include a variety of ammunition types:

- Ball
- Armor Piercing
- Plate-proofing Projectiles
- Fragment Simulating Projectiles

IMPACT CHAMBER

SABL's 1,440ft3 impact chamber is designed to accommodate large targets and/or system components. The lab has the capability to manufacture and assemble custom fixtures for complex targets as required. The SABL offers a walk-in environmental chamber to allow thermal cycling and testing of targets at hot or cold temperatures.

FIELD TESTING AT CAMP GRAYLING

SABL conducts large caliber ballistic shock evaluations at Camp Grayling's Multipurpose Range Complex
Capabilities include:

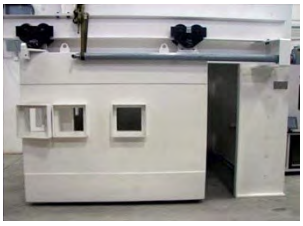
- 37mm, 57mm, and 75mm steel projectiles
- 37mm, 57mm, 75mm, and 105mm aluminum projectiles



Samples of various projectiles available for testing



High speed cameras are used to capture frame-by-frame ballistic impact data on targets



Impact Chamber



Target Setup for Weld Evaluation Testing

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

VEHICLE ARMOR LABORATORY (VAL)

OVERVIEW

The Vehicle Armor Lab (VAL) is a multifunctional facility that focuses on the research, development, fabrication, and integration of vehicle armor systems.

The VAL provides the capability to design and build composite systems for structural, armor, and general vehicle applications. Using computer-aided design (CAD) software and specialized equipment, VAL engineers and technicians can rapidly fabricate custom size and custom shape composite panels.

The VAL's specialized equipment includes an automated glass/panel washing system, Computer Numerical Controlled (CNC) router, automated wet table saw, curing oven, walk-in freezer, 180 psi autoclave, and a Graco XFR Rhino-coating machine for components containing metal, glass, ceramic, or thick section composites. The two Thermotron environmental chambers enable early durability testing.

BENEFITS

Ability to economically design, fabricate, and test prototype composite parts at a coupon, subsystem, and system level to find material issues early in the development stage. In conjunction with the onsite Survivability Armor Ballistic Laboratory (SABL) armor design concepts are rapidly fabricated, evaluated or tested. Fabrication of prototype parts and early testing improves transition to full-scale production.



Above: The VAL is leading Transparent Armor research for the Army with an autoclave capable of adding 180 psi of pressure to a ballistic panel

CAPABILITIES

- Transparent Armor: Capable of fabricating and designing transparent armor coupons.
- Composites: Extensive use of composite materials and cutting-edge fabrication techniques including pre-preg autoclave-cured armor panels.
- Metals: Lightweight metals such as aluminum and titanium can be incorporated into armor designs. Capable of cutting 3" aluminum on the CNC router.

INSTRUMENTATION

- Thermal Cycling: Two Thermotron environmental chambers with humidity control
- Thermocouple data recorder for accurate cure cycle feedback



The VAL is a recognized leader in the Vacuum Assisted Resin Transfer Molding (VARTM) process



Overhead View of the VAL



The VAL has a diamond wet saw capable of cutting through silicon ceramic tiles and composite panels

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GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

VEHICLE PROTECTION INTEGRATION LAB (VPIL)

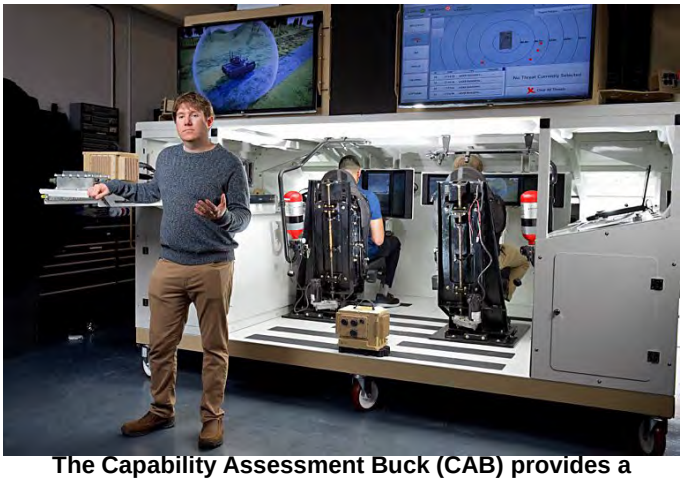
OVERVIEW

The Vehicle Protection Integration Lab (VPIL) is an enduring capability within DEVCOM GVSC that provides the Army with an agile virtual prototyping environment and robust digital engineering services required for PdM Vehicle Protection Suites (VPS) to support technological requirements for both legacy and Capability Program Executive Ground (CPE Ground). GVSC has made continuous investments in the VPIL to ensure state-of-the-art capabilities are provided to DEVCOM, DoW, and close allies, offering the best possible services to our Warfighters.

The VPIL is responsible for certifying system compliance to the Modular APS (MAPS) Framework (MAF), modeling platform configurations for optimization, CONOP / TTP development, and for providing advisory services to evaluate system effectiveness within specific geographic locations of interest. This work is accomplished through the use of multiple capabilities and tool suites, including our hardware-in-the-loop (HWIL) environment and modeling & simulation environment (Virtual Battlespace Environment, or VBE).

HARDWARE-IN-THE-LOOP (HWIL) ENVIRONMENT

- Enables connection of the MAPS Base Kit to APS hardware and software components to evaluate the performance of all devices
- Subsystems stimulated using representative threat data from the VBE or unique hardware stimulation mechanisms
- Analysis tools capture HWIL data exchanges, determine if subsystems are MAF-compliant, and feed data to endgame tools for further performance analysis (e.g. residual armor penetration and collateral hazard characterization)



The Capability Assessment Buck (CAB) provides a representative ground platform crew compartment and allows Soldiers to operate the vehicle in the lab's Virtual Battlespace Environment (VBE) and train in the use of various vehicle protection systems.



Displays inside the CAB replicate those used on various ground vehicle platforms.

Continued on next page…

GROUND VEHICLE SURVIVABILITY & PROTECTION (GVSP)

VEHICLE PROTECTION INTEGRATION LAB (VPIL)

VEHICLE PROTECTION SYSTEM BATTLESPACE (VPSB)

- Direct stimulation of HWIL subsystems and endgame models with real-time data generated by VPSB, as well visualization of resultant HWIL and endgame outputs
- Utilization of threat models generated by various DoW agencies to generate digital threat information for subsystems
- Modeling of theaters or ranges of interest utilizing geo-spatial data from both DoW agencies and open-source communities
- Simulation fidelity is expected to grow as a function of time through use of additional physics-based models as well as the preprocessed results of high-fidelity physics-based tools

RECONFIGURABLE VEHICLE CAB

- Provides representative vehicle frame for performing subsystem integrations and demonstrations, integrated w/ VBE and HWIL
- Opportunity for man-in-the-loop experiments with Soldiers, offering candid feedback on APS configuration and MAPS Base Kit usability

BOTTOM LINE

The Vehicle Protection Integration Lab (VPIL) is an enduring capability within GVSC that directly supports PdM VPS' mission and vision. The mission of the VPIL is to enable the assessment, configuration, and optimization of AP subsystems, as well as compliance verification and validation of future AP subsystems to the MAF.

GVSC's expertise combined with the VPIL's hardware and software tool suites directly supports PdM VPS' mission to advance and rapidly deploy vehicle force protection technologies for legacy and Capability Program Executive Ground.

The VPIL continually evolves to interface with state of-the-art capabilities in the APS M&S spectrum and links technology assessments with current capabilities. Capabilities with additional space for growth include residual fragmentation modeling, probability of defeat estimates, terrain model generation, associated infrared, and radio frequency material modeling, and development of additional physics-based threat models.

GVSC is open to all sources of data and collaborations as required to advance the APS M&S capabilities for the US Army. This includes partnerships with DoW organizations, industry, bilateral engagements with foreign partners, and live-fire test results/data that can be integrated into the VPIL.

GVSC integrates all technologies and capabilities onto the fleet of ground combat platforms. With the support of the VPIL, GVSC acts as an honest broker for the US Army
and other DoW allies in validating the performance of MAF-compliant AP subsystems and system configurations.

POC
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PROTOTYPE INTEGRATION FACILITY (PIF)

Detroit Arsenal Prototype Integration Facility (PIF) is the Arsenal's rapid response center established to engineer, fabricate & integrate technology, and develop experimental prototypes for Army watercraft, DoW ground combat & combat support systems.

ENGINEERING – DETROIT ARSENAL PROTOTYPE INTEGRATION FACILITY (DTA PIF) **81**

PROTOTYPE FABRICATION - DETROIT ARSENAL PROTOTYPE INTEGRATION FACILITY (DTA PIF) **82-86**



PROTOTYPE INTEGRATION FACILITY (PIF)

ENGINEERING - DETROIT ARSENAL PROTOTYPE INTEGRATION FACILITY (DTA PIF)

MISSION

Provide the mechanical & electrical engineering expertise to the entire Detroit Arsenal, necessary for full system development or product integration onto watercraft, ground combat systems, combat service support vehicle, or logistics platforms.

OVERVIEW

The PIF has highly experienced associates capable of designing anything from individual components such as armor kits, hull structures, interiors, weapon mounts, C5ISR integration, powertrain & suspension integration, crew station integration, advanced technology integration, circuit boards, wiring harnesses, electrical cables, embedded software, as well as complete vehicle systems.

MECHANICAL ENGINEERING CORE CAPABILITIES

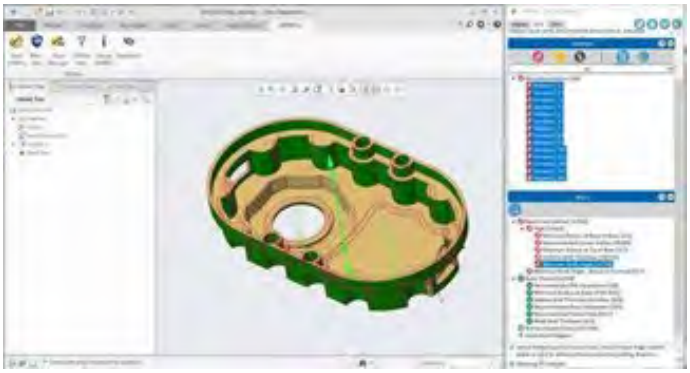
- 3D Solid Modeling (CREO Parametric), finite element analysis and mechanical failure analysis.
- 3D portable laser surface scanning (Handy Scan) for high measurement rates and accuracy necessary in product development and quality control.
- Concept, Developmental, and Product level drawings.
- Design for Manufacturing (DFM).
- Technical Data Packages (TDP) including engineering drawings, Bill of Materials (BOM), and user manuals.



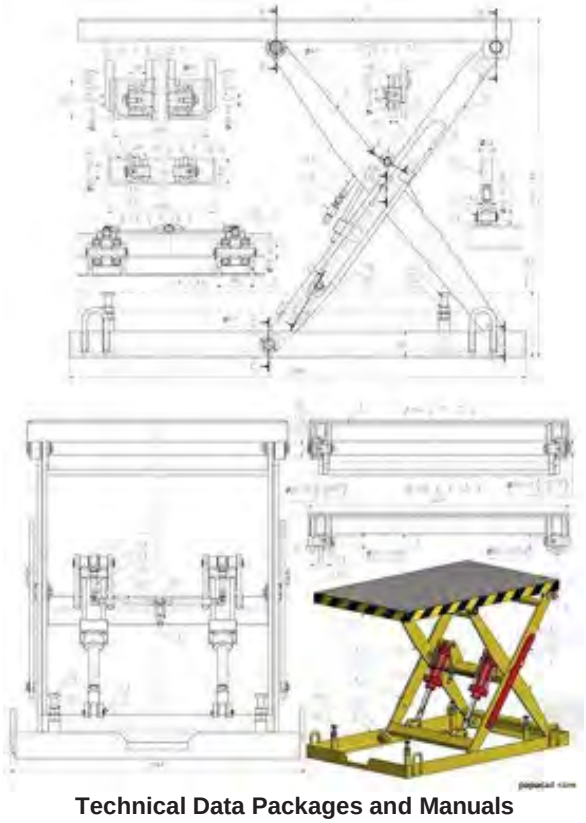
3D CAD Modeling & Analysis



3D Laser Surface Scanning



Design for Manufacturing Analysis



Technical Data Packages and Manuals

PROTOTYPE INTEGRATION FACILITY (PIF)

PROTOTYPE FABRICATION - DETROIT ARSENAL PROTOTYPE INTEGRATION FACILITY (DTA PIF)

MISSION

Fabricate ground system prototypes, subsystems, and components in support of modernization and readiness.

VISION

Apply advanced manufacturing techniques and “hands on” high-skill craftsmanship to ensure durable, cost-effective military ground system prototypes on time and on budget.

OVERVIEW

Prototype Fabrication is where engineering solutions are realized in physical form for evaluation and delivery to customers. The highly skilled associates plan, procure and execute fabrication, integration and kitting. The integrators have experience with various Army systems. In addition, Prototype Fabrication manages a Quality Lab where parts are inspected and gages verified and calibrated.

CORE CAPABILITIES

- 20 fully customizable Integration bays; with multiple overhead rail cranes that allow for physical integration of engineered systems and subsystems onto ground platforms
- Manufacturing process routings
- Laser and water jet cutting
- Computer numerical control (CNC) machining – Lathes and Mills
- Press Brakes
- Ballistic certified welding and training
- Chemical Agent Resistant Coating (CARC) painting
- Kitting and Packaging
- Quality Lab with full set gages, granite slab, Romer and Faro Arm
- Printed Circuit Board Laboratory
- Cable and Harness Fabrication Laboratory



DTA-PIF Boasts Over 140,000sqft of Fabrication, Assembly & Integration Space



Laser & Waterjet Cutting



CNC Press Brake Forming



Laser & Waterjet Cutting

PROTOTYPE INTEGRATION FACILITY (PIF)

PROTOTYPE FABRICATION - DETROIT ARSENAL
PROTOTYPE INTEGRATION FACILITY (DTA PIF)







CNC Press Brake Forming



Ballistic-Certified Welding



Full Vehicle & Component CARC Painting





Kitting and Packaging

PROTOTYPE INTEGRATION FACILITY (PIF)

ELECTRICAL FABRICATION CORE CAPABILITIES - CABLE & HARNESS FABRICATION LABORATORY

The Cable Lab contains specialty equipment to support the design/reverse engineering, fabrication, and quality inspection of DoW grade custom designed Cables and Wiring Harnesses. The Cable Lab contains the necessary production machines to support; precise conductor wire cutting and labeling, custom sheathing and protection coatings and looms. The laboratory is an IPC J-STD-001 and IPC/WHMA-A-620 compliant fabrication facility for military cables and wiring harnesses. The laboratory routinely performs activities to support quality assurance inspections, troubleshooting, and reverse engineering.



MIL-STD Cable Design, Fabrication and Testing

BENEFITS

- Reduced developmental and production lead times for experimental/prototype cables and wiring harnesses
- Custom designs to meet military specific requirements
- Continuous certification to industry standards
- Reduced costs and lead times for external inspection sources

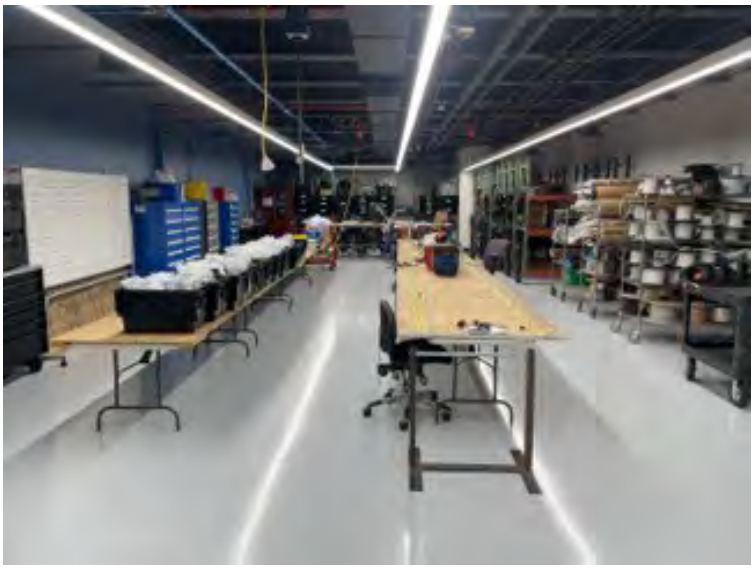




Cirris Automated Cable Testing Equipment

SPECIALTY EQUIPMENT

- Automated Wire Processing and Labeling Machine
- Heat Shrink Oven
- Polyethylene Loom/Braiding Machine
- Coaxial Cable Stripping Machine
- Cirris Automated Cable Tester
- Low Pressure Over-Mold Machine



5000+ sq. ft. of Cable Fabrication Space



Electrical Panel Design, Fabrication and Assembly

PROTOTYPE INTEGRATION FACILITY (PIF)

ELECTRICAL FABRICATION CORE CAPABILITIES - CABLE & HARNESS FABRICATION LABORATORY





Wire Processing, Marking, Cutting and Stripping



Automated Cable Braiding Machine



Coaxial Cable Stripping Machine



Low Pressure Over-Mold Machine

PROTOTYPE INTEGRATION FACILITY (PIF)

ELECTRICAL FABRICATION CORE CAPABILITIES – PRINTED CURCUIT BOARD LABORATORY

The PCB Lab contains specialty equipment to support the fabrication of DoW grade custom prototype and production representative Printed Circuit Boards (PCBs) and Circuit Card Assemblies (CCA). The PCB Lab contains the necessary production machines to support; precise solder and flux deposition, surface mount and through-hole component placement, reflow soldering oven, solder removal, and conformal coating applications. In addition, the PCB Lab is capable of microscopic inspections and three-dimensional X-Ray inspections to support quality assurance, troubleshooting, and reverse engineering activities.

BENEFITS

- Reduced developmental and production lead times for experimental/prototype PCBs and CCAs
- Custom designs and components to meet specific requirements
- Integration of Nuclear Event Detection (NED) and protection circuitry
- Reduced costs and lead times for external inspection sources

SPECIALTY EQUIPMENT

- Nikon X-Ray Inspection Machine
- Selective Solder Machine
- Pick & Place Machine
- Reflow Oven
- Component Remove and Replace Fixture with Microscopic Camera Assistance
- Selective Conformal Coating Machine



Selective Conformal Coating Machine



Selective Solder Machine



PCB Component Pick & Place Machine



PCB Reflow Oven



3D PCB X-Ray Machine

PROPULSION SYSTEMS LABORATORY (PSL)

GVSC's Propulsion Systems Laboratory (PSL) hosts nine dynamometer test cells which are all ISO 17025 accredited. The lab can perform multiple tests that cover engine, transmission, powertrain component, full powertrains, and vehicle-level testing. Eddy current, water brake, and AC dynamometers are used to test engines/transmissions/power packs to full vehicles ranging from 50 HP up to 3000 HP. All nine test cells offer various simulated field test conditions heat (from ambient temperature up to 160 °F), wind (speeds up to 20 mph,) and solar load conditions up to 1120 W/m2 in controlled/repeatable laboratory environments.

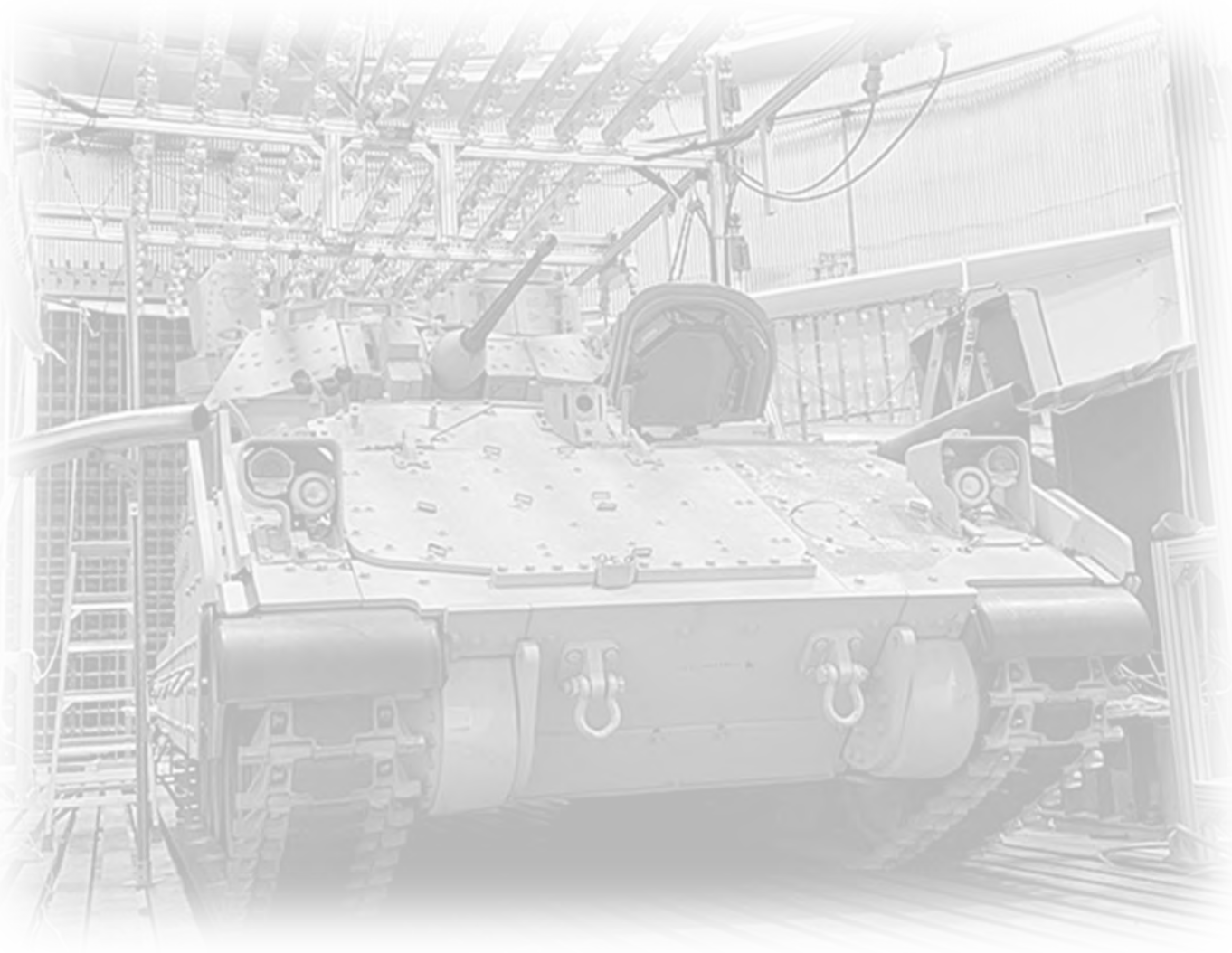
COMBAT VEHICLE ENVIRONMENTAL CHAMBER (CVEC) **90**

COMBAT VEHICLE POWERTRAIN LABORATORY (CVPL) **91**

ENGINE RESEARCH AND DEVELOPMENT **92**

ENGINE TESTING AND DEVELOPMENT **93**

POWER & INERTIA SIMULATOR (PAISI) **94**



PROPULSION SYSTEMS LABORATORY (PSL)

PROPULSION SYSTEMS LABORATORY (PSL)

TESTING CAPABILITIES

- 9 Cells
- Controlled Environmental Temperatures
- NATO 400hr Testing
- Full-Load Cooling Testing
- Road Load Simulation
- HVAC Validation
- Electrical Powertrain Testing
- Powertrain Testing
- Project Research Development



Vehicle Testing



Engine Development



Engine Research Testing

Continued on next page…

PROPULSION SYSTEMS LABORATORY (PSL)

COMBAT VEHICLE ENVIRONMENTAL CHAMBER

Test Cell 9 is a climatic chamber with wind and dynamometer capability equipped to evaluate continuous vehicle performance in extreme climates under full load conditions. The lab controls multiple aspects of environmental conditions to enable repeatable testing and vehicle cooling diagnostics.

CAPABILITIES

- Absorption 2500 HP per side
- Replicates tracked vehicle loading up to 88,000lb-ft per side and 128,000lb-ft per side at stall
- Air Temperature Range: Ambient to 160°F
- Airflow Velocity: 5 to 20 mph
- Water Flow: 900 GPM @ Pressure 50Psig
- Electrical Service: 440VAC @ 60/100 amps, 100 @ 20 amps, 24VDC @ 200 amps
- Solar loading up to 1120 W/m2
- Exhaust capacity commensurate with turbine air flow performance requirements
- Data collection channels up to 300 analog and digital channels.
- Room Size: Diameter 80ft, height 35ft
- Door Size: 20ftx20ft
- Crane: 5 Ton

COMPETENCE

- Full Load Cooling Testing
- Speed on Grade Testing
- Top Speed Testing
- HVAC Testing & Development



Combat Vehicle Environmental Chamber

POC
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PROPULSION SYSTEMS LABORATORY (PSL)

COMBAT VEHICLE POWERTRAIN LABORATORY (CVPL)

Test Cell 5 has regenerative AC dynamometers, control, and test data acquisition systems, for up to 80 ton and 2000 HP tracked vehicles/powertrains. The test cell is supporting the Army's combat vehicle fleet modernization initiatives, future combat vehicle powertrains, and customer requests for the evaluation of legacy engines, transmissions, and vehicle systems under simulated road loading and transient operating conditions.

CAPABILITIES

- Loading up to 140,000 ft-lb per side
- Air Temperature Range: Ambient to 160°F
- Airflow Velocity: 5mph
- Water Flow: 900 GPM @ Pressure 50Psig
- Electrical Service: 440VAC @ 60/100 amps, 100 @ 20 amps, 24VDC @ 200 amps
- Solar loading up to 1120 W/m2
- Data collection channels up to 150 temperature, 90 analog and CAN communication capability
- Room Size: Width 25ft X Length 50ft X Height 20ft
- Door Size: Width 14ft X Height 20ft
- Crane: 15 Ton

COMPETENCE

- Vehicle Powertrain Road Course Simulation
- Cross Drive Transmission Efficiency Assessment and Shift Calibration Development
- Cross Drive Powertrain Performance and Drivability Development
- Propulsion Assist and Silent Mobility System Assessment and Development
- Full Load Cooling Testing
- Speed on Grade
- Top Speed



Combat Vehicle Powertrain Laboratory (CVPL)



Combat Vehicle Powertrain Laboratory (CVPL)

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PROPULSION SYSTEMS LABORATORY (PSL)

ENGINE RESEARCH AND DEVELOPMENT

Test Cell 7 is a single cylinder diesel engine research facility resource dedicated to fundamental diesel engine combustion research using a precisely controlled engine system and environmental operating conditions. Cell 7 can support basic and applied research that include high temperature piton alloy development, low heat rejection component development, and assessment of new/alternative fuels for Army ground vehicles.

CAPABILITIES

- Single cylinder research engine highly instrumented for high and low speed measurements of in-cylinder pressure, start of injection, and injection rate
- Standalone compressor provides air to simulate turbocharging
- Independently controlled lubrication and coolant subsystems to enable isolation of combustion affecting phenomena
- Research engine includes high firing pressure capability for high power density engine research
- Flexible engine controller for choosing desired injection timing and frequency

COMPETENCE

- Combustion Research (exhaust emissions and heat release rate)
- In-Cylinder Pressure Measurement
- Piston temperature measurement during operation
- Turbo Charger Simulation
- Intake and Exhaust System Temperature and Restriction Control
- High Speed Data Acquisition System
- Precise Fuel Consumption Data Harvesting



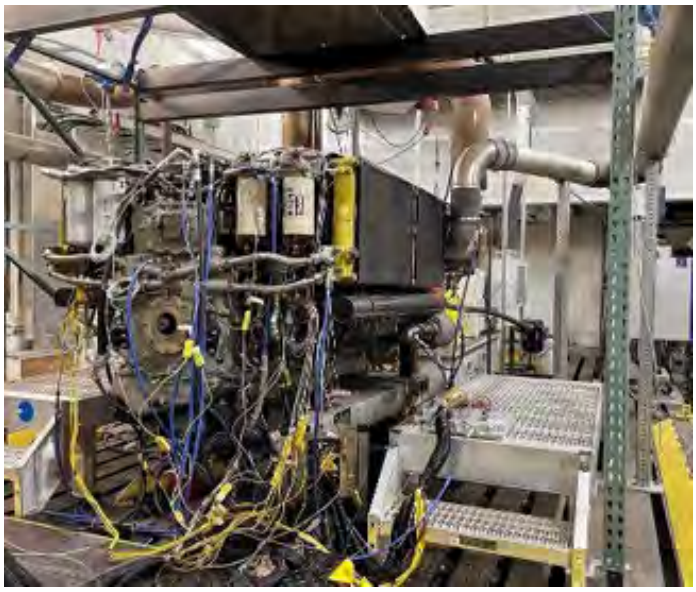
Engine Research Testing

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PROPULSION SYSTEMS LABORATORY (PSL)

ENGINGE TESTING AND DEVELOPMENT

Engine Test Cells can support engine and/or transmission to complete power pack testing rated from 50 to 2000 HP. These test cells provide enhanced developmental testing in support of Army's ground vehicle fleet. Two of the test cells offer 1000 HP AC dynamometers that offer both absorption and motoring capability.



Engine Test Cells

CAPABILITIES

- Absorption from 175 to 3000 HP
- Air Temperature Range: Ambient to 160°F
- Airflow Velocity: 5mph
- Water Flow: 900 GPM @ Pressure 50Psig
- Electrical Service: 440VAC @ 60/100 amps, 100 @ 20 amps, 24VDC @ 200 amps
- Data collection channels up to 150 temperature, 90 analog and CAN communication capability
- Room Size: Width 25ft X Length 40ft X Height 20ft
- Door Size: Width 12ft X Height 12ft
- Crane: 5 Ton

COMPETENCE

- Modified NATO 400-hour Endurance Test
- 2400-hour Simulated YPG Duty-cycle Engine Test (SYDET) Turbine Engine Endurance Test
- Performance Testing
- Fuel Map Testing
- Heat Rejection Testing
- Engine Controls, Calibration and Development

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PROPULSION SYSTEMS LABORATORY (PSL)

POWER & INERTIA SIMULATOR (PAISI)

Test Cell 4 contains the equipment and instrumentation to operate, control and test vehicles with cross-drive type transmissions. The PAISI dynamometer system is designed to operate tracked vehicles up to 850 HP in steady state or simulated road load operational modes. Used for Bradley Fighting Vehicle and transmission performance testing. Test Cell 4 has recently been upgraded with new data acquisition and dynamometer control equipment that will further help in harvesting the critical data used to make programmatic decisions.

CAPABILITIES

- Vehicle Powertrain Road Course Simulation
- Cross Drive Transmission Efficiency Assessment and Shift Calibration Development
- Cross Drive Powertrain Performance and Drivability Development
- Propulsion Assist and Silent Mobility System Assessment and Development
- Full Load Cooling Testing
- Speed on Grade
- Top Speed

COMPETENCE

- Absorption: 850 HP
- Air Temperature Range: Ambient to 160°F
- Airflow Velocity: 5mph
- Water Flow: 900 GPM @ Pressure 50Psig
- Electrical Service: 440VAC @ 60/100 amps, 100 @ 20 amps, 24VDC @ 200 amps
- Solar loading up to 1120 W/m2
- Data collection channels up to 150 temperature, 90 analog and CAN communication capability
- Room Size: Width 50ft X Length 53ft X Height 20ft
- Door Size: Width 14ft X Height 20ft
- Crane Capacity: 15 Ton



Power & Inertia Simulator (PAISI)

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REAL TIME CONTROL SYSTEMS (RTCS) LABORATORY

RTCS LAB BACKGROUND

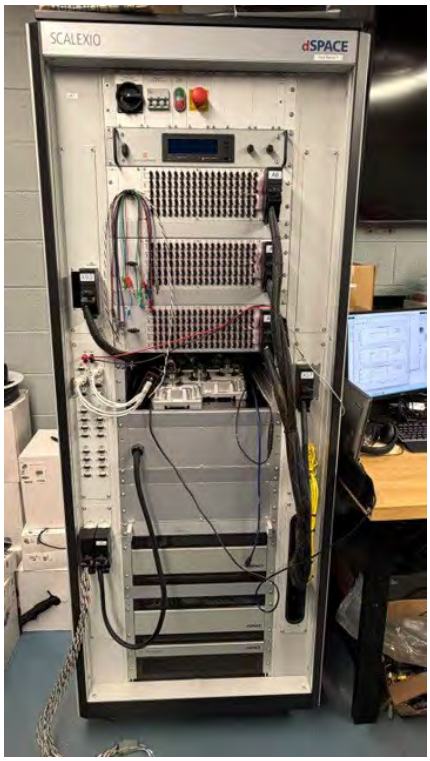
The Real Time Control Systems (RTCS) Laboratory is a specialized developmental test facility, fully operational and equipped with engine, transmission, and powertrain component simulation capabilities for development and test of real-time control systems under low risk, controlled conditions. The RTCS Laboratory houses three hardware-in-the-Loop (HIL) testing where real-time controllers interact with simulated environments to validate performance and safety. This setup allows engineers to test embedded software and hardware as if they were interacting with the real physical system, but in a safe, flexible, and repeatable laboratory environment.

CAPABILITIES

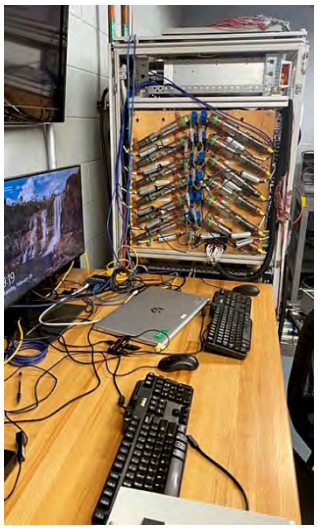
The RTCS Laboratory offers a wide range od capabilities that make it an essential tool for developing, testing, and validating embedded controllers and software. By showing how application software running on an embedded controller responds, in real time, to all relevant signal stimuli, HIL testing provides an important contribution to quality assurance during the development and testing of application software. The HIL test systems have the capability to simulate diesel and turbine engines as well as transmissions that allow engineers to perform a variety of tests in a virtual test environment when prototype parts are available in limited numbers.

BENEFITS

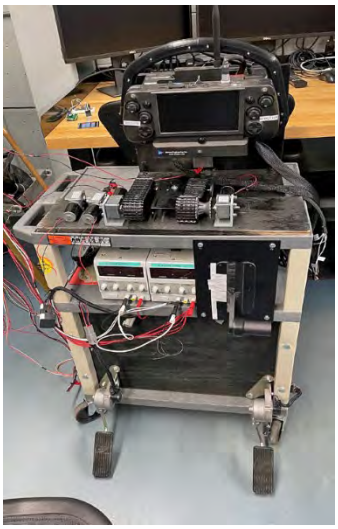
- Supports development, test, evaluation, and validation of state-of-the-art embedded controller software on a system and subsystem level
- Develops advanced control systems to improve efficiency, increase capability and improve survivability of Army ground vehicles
- Aids in understanding existing and proposed control systems to support the PEOs/PMs in making acquisition decisions
- Provides highly efficient digital technologies with capabilities to increase vehicle range, mobility and efficiency



Controls Software Testing



Simulated Engine Testing

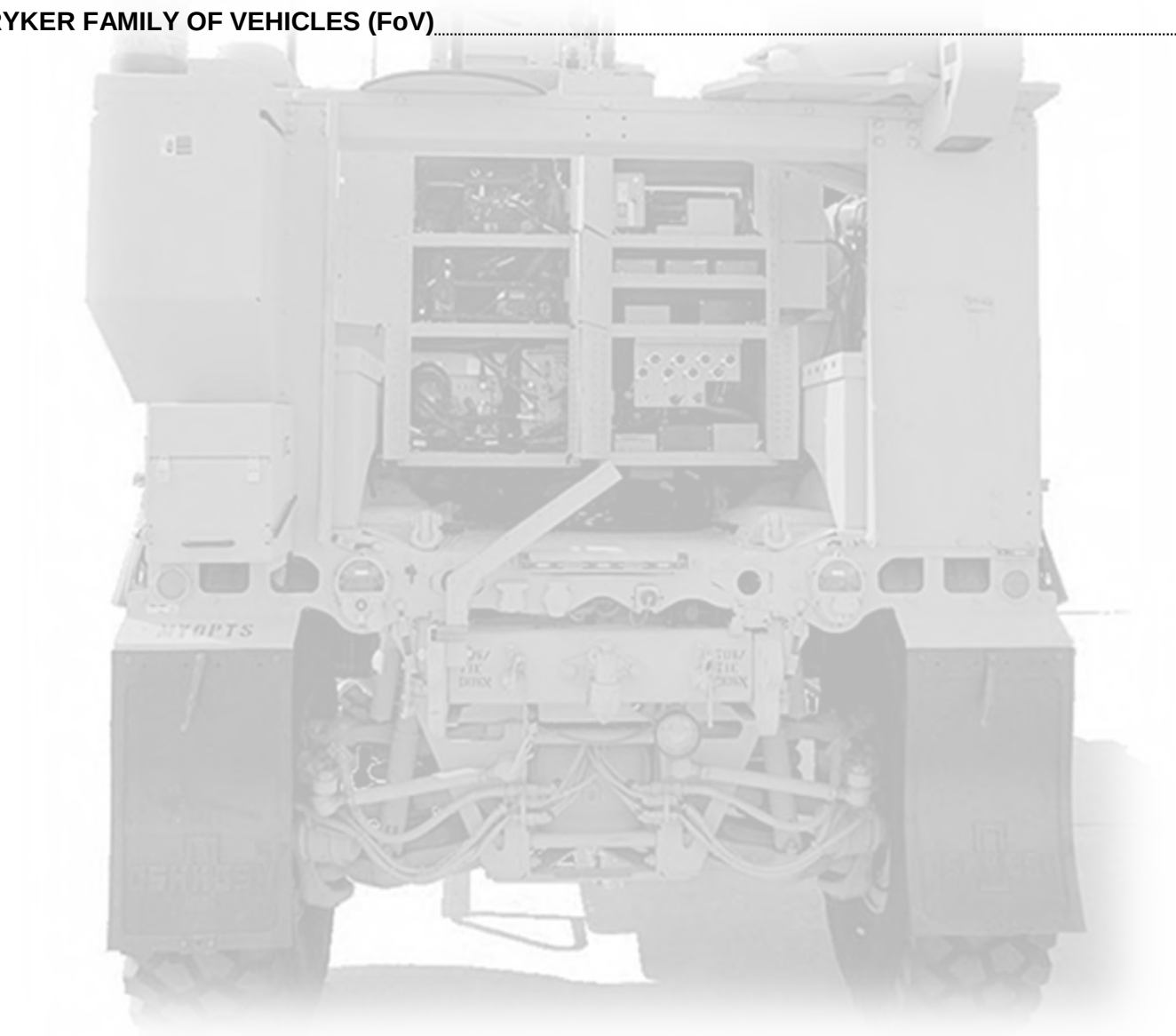


Advanced Control System Development

SOFTWARE ENGINEERING CENTER (SEC) GROUND SYSTEMS SOFTWARE INTEGRATION LABORATORY (GSSIL)

The Ground Systems Software Integration Laboratory (GSSIL) establishes and maintains facilities that support engineering and support activities for various programs while maintaining the associated program system, sub-system software and hardware configurations throughout all phases of the program. This includes production support, fielding, and transition to post-production program activities. GSSIL schedules and budgets are managed through the various engineering projects the GSSIL supports.

ARMORED MULTI-PURPOSE VEHICLE (AMPV) **97**
BRADLEY FIGHTING VEHICLE (BFV) SYSTEMS INTEGRATION LABORATORY (SIL) **100**
MINE-RESISTANT AMBUSH PROTECTED-INTEGRATED BRIDGE (MRAP-IB) **102**
PREDICTIVE LOGISTICS (PL) SYSTEMS INTEGRATION LABORATORY (SIL) **103**
STRYKER FAMILY OF VEHICLES (FoV) **104**



SOFTWARE ENGINEERING CENTER (SEC) GROUND SYSTEMS SOFTWARE INTEGRATION LABORATORY (GSSIL)

ARMORED MULTI-PURPOSE VEHICLE (AMPV) SYSTEMS INTEGRATION LABORATORY (SIL)

Designed to operate fielded hardware, software, and cabling to recreate a vehicle inside a laboratory environment. This lab increases accessibility and adaptability to support Project Manager Mounted Armored Vehicles (PM MAV) in integration of production software. This lab incorporates vehicle Line Replaceable Units (LRUs), system emulation and monitoring, radios, computers, and other equipment. The SIL team maintains a vehicle emulation bench for both Mission Command and Medical Treatment variants.

BENEFITS

The SIL can test and verify vehicle electronics, software packages, and new cabling prior to field deployment. The lab can also support hardware & software development, post-production support, regression testing, system training, and new technology integration & demonstrations.

SIL FEATURES AND EQUIPMENT

- Modular bench construction which can be modified to add/remove sections depending on requirements
- Two Vehicle Emulation Benches
- Utilizes maximum GFE and MILSPEC standards (actual vehicle cabling etc.)
- Siemens Programmable Logic Controller (PLC) HW to monitor/stimulate IO
- Vector CANoE SW to stimulate discrete J1939 CANbus for emulated LRUs
- Supports MFoCS BLK II JBCP and MMCS software with GPS and BFT2 transceivers
- Supports several MEP packages (OSRVT, M96, AFATDS, DVE-W)
- Supports VIC-3 & 5, SINGCARS, PRC-104HF and HMSII
- Support to PM for fielding issues and test procedures



AMPV Exterior – Mission Command



Vehicle Emulation Bench (Mission Command Variant)



Vehicle Emulation Bench (Medical Treatment Variant)

POC
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SOFTWARE ENGINEERING CENTER (SEC) GROUND SYSTEMS SOFTWARE INTEGRATION LABORATORY (GSSIL)

EARLY ENTRY FLUID DISTRIBUTION SYSTEM (E2FDS) SOFTWARE INTEGRATION LABORATORY

The E2FDS software integration bench replicates the hardware and fiber optic networks of the physical pumping stations in a laboratory setting. This system allows the development process to guarantee a dependable and secure software update before being fielded to Soldiers. The bench helps identify and resolve problems early to reduce the risk of failures in active environments. Developers can run the system to simulate fluid flow, track system-level maintenance status, and identify bugs without risking live equipment. This reduces costly in-field failures, increase the systems stability over time, and ensures compliance by military driven standards leading to increased assurance in the software readiness before deployment.

BENEFITS

Virtual simulation uses a Software In-The-Loop (SIL) architecture to simulate real world cases and system performance under battlefield stress.

FEATURES AND EQUIPMENT

- Perform integration testing in simulated environments.
- Coordinate integration of testing schedules with software and hardware teams.
- Develop and validate the E2FDS control software according to specified requirements.
- Validate system performance and safety compliance.
- Data acquisition, monitoring, and control interfaces.
- Safety interlocks and fail-safe mechanisms.
- Verify system readiness for operational deployment.



Fielded Pump Station



Command and Control Module (C2M) with Pump Station Control Panel

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SOFTWARE ENGINEERING CENTER (SEC) GROUND SYSTEMS SOFTWARE INTEGRATION LABORATORY (GSSIL)

SEC ABRAMS SEP V2 FULL SYSTEM TEST BENCH.

The Abrams SEP V2 Full System Bench (FSB) was designed and built by OEM General Dynamics Land Systems and relocated to GVSC SEC labs for enhanced accessibility and use to multiple Abrams PM customers. The bench was designed to simulate a fully functional Abrams SEP V2 main battle tank utilizing vehicle hardware (LRU's and cables) combined with simulation/emulation to perform software development and test.

BENEFITS AND CAPABILITIES

The SEP V2 FSB provides a safe environment to test and evaluate vehicle software builds prior to moving to an actual vehicle environment. The bench also provides a test environment used in conjunction with vehicle platforms to provide test engineers the ability to perform full regression testing on field released software builds.
The bench also provides Program Management the ability to support software development, training, post-production software support and investigate field issues.

SIL FEATURES AND EQUIPMENT

- Full regression test capabilities. This, combined with vehicle testing, enables more efficient and time saving software test cycles.
- Full engine start and idle simulation capabilities along with 1553 and 485 bus monitoring and manipulation. Fault insertion capabilities for generating specific notifications, cautions and warnings.
- Pre-vehicle platform that allows testing of safety critical software functions prior to introduction on a vehicle platform. This helps to ensure personnel and equipment are not put into a dangerous safety situation with the introduction of new software.
- Provides a more user-friendly environment for removing and disconnecting cables and LRU's for test that may be inaccessible on the vehicle.



M1A2 SEP V2 Full System Bench



M1A2 SEP V2 Full System Bench

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SOFTWARE ENGINEERING CENTER (SEC) GROUND SYSTEMS SOFTWARE INTEGRATION LABORATORY (GSSIL)

BRADLEY FIGHTING VEHICLE (BFV) SYSTEMS INTEGRATION LABORATORY (SIL)

Designed to operate fielded and developmental hardware, software, and cabling to recreate a vehicle inside a laboratory environment; increasing accessibility and adaptability for rapid post-production software support and integration. This lab is comprised of full M2A3 and M3A3 BFIST vehicles, as well as a full system Virtual Test Bed (VTB) and Subsystem benches for the Turret Processer Unit (TPU).

BENEFITS

The SIL can test and verify vehicle electronics, software packages, and new cabling prior to field deployment. The lab can also support hardware & software development, post-production support, regression testing, system training, and new technology integration & demonstrations

SIL FEATURES AND EQUIPMENT

- Virtual Test Bed (VTB): Allows for software regression testing in lab environment
- TPU Standalone Test Beds: Allow developers to remotely test developmental software builds
- M2A3, M3A3 BFIST Vehicles: Allow for on vehicle and track testing at GVSC and SANG



Bradley M2A3 and BFIST testing in SIL



Bradley Standalone and subsystem Benches



Bradley Virtual Test Bed

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SOFTWARE ENGINEERING CENTER (SEC) GROUND SYSTEMS SOFTWARE INTEGRATION LABORATORY (GSSIL)

SELF-PROPELLED HOWITZER SYSTEM (SPHS)

PURPOSE

The Self-Propelled Howitzer System (SPHS), located at the GVSC in MI, Is designed to operate fielded hardware and software to create an environment for rapid post-production software support and integration. The lab consists of the production and deployment support systems (PADSS) capable of testing full system of both SPH and CAT configurations.

BENEFITS

The PADSS test bench within the software engineering center, provides an end-to-end component and platform environment for real-time vehicle simulations of system and electrical control behavior. This can be utilized to quickly identify improvements and mitigate risk to fielded vehicles significantly reducing overall project costs.

FEATURES AND EQUIPMENT

The integrated PADSS contains the vehicle configuration for both the CAT and SPH as closely as possible while providing a flexible lab environment with the following capabilities:

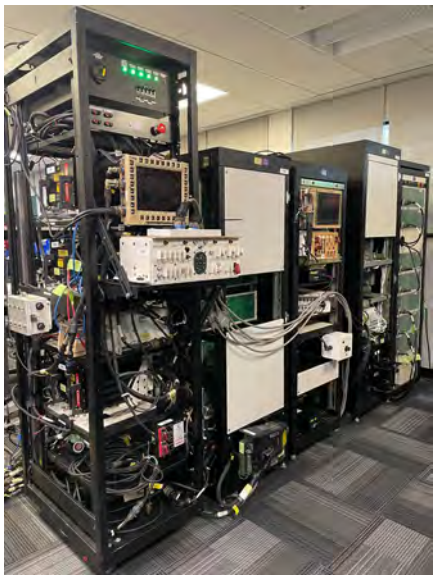
- Full vehicle-system representative network
- All discrete devices on the vehicle (speed sensor fuel gauge, etc.) that are represented physically or emulated
- Fault injection capabilities
- Actual vehicle cabling and harnesses
- Ability to incorporate any objective LRU into testing system
- Automation of test scripts for reducing testing time
- Data analysis and acquisitions for both Ethernet and CAN Bus traffic
- Diagnostic and System Health (DASH) testing



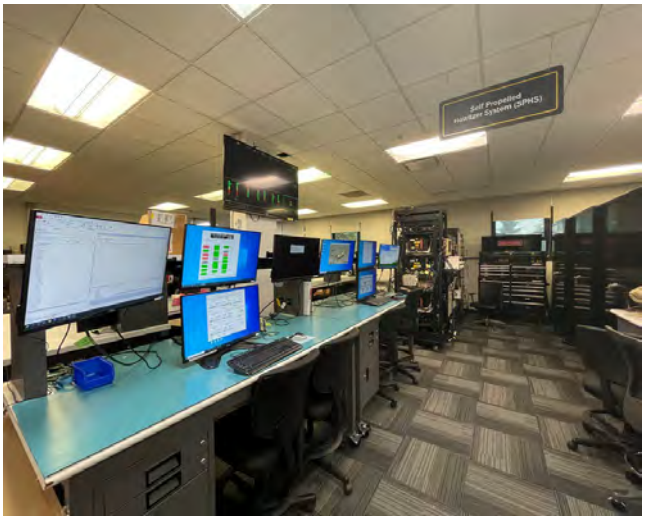




Self-Propelled Howitzer (SPH) and Carrier Ammunition Track (CAT)



PADSS Testing Hardware



PADSS Control System

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SOFTWARE ENGINEERING CENTER (SEC) GROUND SYSTEMS SOFTWARE INTEGRATION LABORATORY (GSSIL)

MINE-RESISTANT AMBUSH PROTECTED-INTEGRATED BRIDGE (MRAP-IB) SYSTEMS INTEGRATION LABORATORY (SIL)

This MRAP-IB SIL is designed to operate fielded hardware, software, and cabling to recreate a vehicle inside a laboratory environment; increasing accessibility and adaptability for rapid post-production software support and integration. This lab incorporates vehicle hardware, system emulation, radios, computers, and other equipment and maintains both full-system and subsystem benches for multiple MRAP variants.

BENEFITS

The MRAP-IB SIL can test and verify vehicle electronics, software packages, and new cabling prior to field deployment.

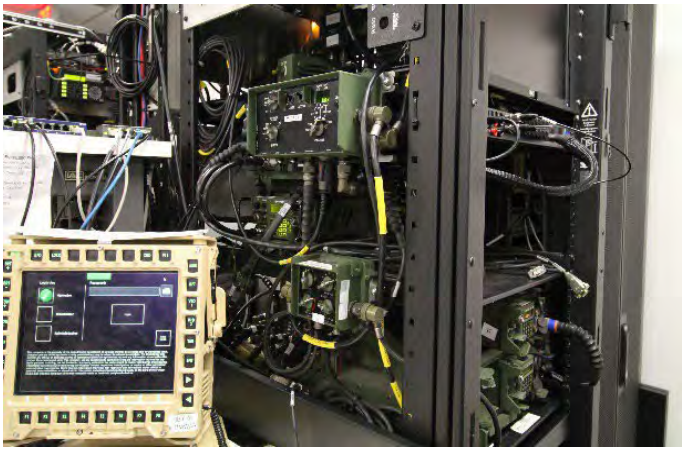
The lab can also support hardware & software development, post-production support, regression testing, system training, and new technology integration & demonstrations.

FEATURES AND EQUIPMENT

- 5 Full System Benches
- Multiple Sub-System Benches for development and debugging
- Test automation, Scripted Test Cases, and Test Logging to reduce total testing time and remove human error
- J1939 vehicle CAN Data emulators
- WinT Inc2 and Next Gen stations
- C5ISR supported with VIC3 systems and BFT2 transceivers
- Supports MFoCS and JBCP software
- Bench configured with HMS GEN II, 117G, SINCGARS, and HF150 and HF160 Radios
- Integrated hardware such as RWS, DVE, and CHK6 cameras
- In lab Hi-Bay doors with 2x M-ATV MRAP vehicles available



MRAP All Terrain Vehicle (M-ATV) Key Leader Vehicle (KLV)



Test Automation and Modernization



MRAP Integrated Bridge Bench

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SOFTWARE ENGINEERING CENTER (SEC) GROUND SYSTEMS SOFTWARE INTEGRATION LABORATORY (GSSIL)

PREDICTIVE LOGISTICS (PL) SYSTEMS INTEGRATION LABORATORY (SIL)

The Predictive Logistics (PL) System Integration Lab (SIL), located onsite at GVSC, specializes in supporting the development, integration, fielding, and sustainment of Army Ground logistics supporting software and hardware. The PL SIL, with its mission-critical role, provides the engineering expertise, robust testing environments, and tactical pilot support that directly improve Army Ground readiness. The lab achieves this by maintaining end-to-end benches, integrating system components, and deploying Soldier-driven pilots to accelerate digitized, AI-ready sustainment.

BENEFITS

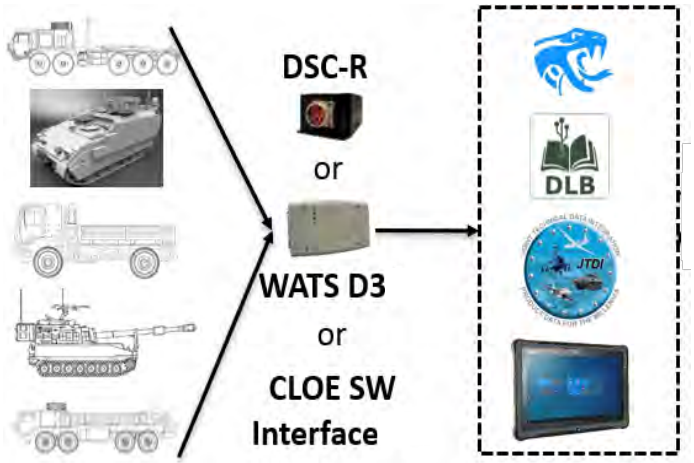
The PL SIL provides an end-to-end organic Army architecture that enables full-system testing and significant risk reduction prior to tactical deployment. Featuring a flexible architecture designed to integrate both Original Equipment Manufacturer (OEM) and Commercial Off-The-Shelf (COTS) PL solutions, the lab serves as a collaborative hub across the DoW. Grounded in comprehensive engineering expertise, the PL SIL supports physical and virtual system demonstrations, cybersecurity compliance, regression testing, and post-production software support (PPSS) across the core Army PL software and hardware ecosystem.

SIL FEATURES AND EQUIPMENT

- Laboratory capable of hosting any platform to test with live vehicles
- Emulation bench capable of broadcasting any interactive electronic technical manual (IETM) fault code and CAN Bus message for Viper-supported platforms
- Hardware-in-the-loop testing
- Fielded mirror bench to test and verify live performance and status of fielded software and hardware
- Secure infrastructure designed to deliver critical software updates and system images across Army tactical and garrison networks
- Enterprise-grade imaging server capable of simultaneously imaging over 30 devices for rapid pilot deployment of software and hardware kits
- Top-tier server racks dual-connected to both NIPR and accredited TDREN networks



The PL SIL's M1083 A1P2, a DLB tablet, vehicle data collectors, and spare CSS VSAT



Software/Hardware integrated to acquire fault and parametric data from any supported platform



Soldiers at National Training Center (NTC), Ft. Irwin show off their DLB tablets

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SOFTWARE ENGINEERING CENTER (SEC) GROUND SYSTEMS SOFTWARE INTEGRATION LABORATORY (GSSIL)

STRYKER SYSTEMS INTEGRATION LABORATORY (SIL)

Equipped with vehicle test beds that utilize a blend of real and simulated Line Replaceable Units (LRUs), this facility offers the Army the ability to emulate real-world electrical environments for their systems. The test beds in the Stryker Lab deliver a comprehensive capacity for validating feature functionality in parallel with software development timelines. By conducting both software and hardware-level testing, Stryker Lab enhances the efficiency of in-vehicle testing, enabling early detection of bugs or faults in the software through the use of its specialized test beds. This ultimately leads to streamlined program lifecycles.

BENEFITS

Our environment allows for testing and development with full access to lab equipment prior to on-vehicle testing while still allowing for vehicle access via our High Bay Lab. Configuring hardware on bench tops allows better access, interchangeability, and modification for high use regression testing and development. Each bench can be configured for specific Stryker Variants or Mission Equipment Packages; benches can also be linked together to form more complete Stryker systems for testing. Most Stryker FoV variants are present in the lab.

FEATURES AND EQUIPMENT

We also have multiple benches that support common vehicle equipment such as:

- Common Chassis – equipment common to all variants such as driver instrument panels, height management units, and gauge cluster units all interconnected to operate as intended on vehicle
- C4ISR equipment – BFT & GPS data communication carts with JV5/MFoCS hardware supported by JCR/JBCP software that can be linked to other benches to replicate vehicle configurations
- Standalone Hardware/Software benches – Designed to isolate a single component for loading and verifying software and firmware



Stryker



Common Chassis Bench connected to C5ISR Cart



Nuclear Biological Chemical Reconnaissance Vehicle Bench

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VEHICLE ELECTRONICS AND ARCHITECTURE LABORATORY (VEA)

The Vehicle Electronics And Architecture (VEA) Laboratory is used for architecture development, high-voltage (HV) power systems development, and electronics integration for tech-based Research & Development (R&D) projects. The lab utilizes several benches to conduct this development and contains a high-bay and crane for final vehicle integration work.

Within the VEA Lab is the Electromagnetic Compatibility (EMC) Laboratory, which is one of nine ISO-17025 accredited labs in GVSC. The EMC Lab performs several of the MIL-STD-461 electromagnetic interference (EMI) tests applicable to electrical and electronic subsystems integrated on Army Ground Platforms.

VEHICLE ELECTRONICS AND ARCHITECHTURE (VEA) SYSTEMS INTEGRATION LABORATORY (SIL) **106**

ELECTROMAGNETIC COMPATIBILITY (EMC) LABORATORY **107**



VEHICLE ELECTRONICS AND ARCHITECTURE (VEA) SYSTEMS INTEGRATION LABORATORY (SIL)

VEHICLE ELECTRONICS AND ARCHITECHTURE (VEA) SYSTEMS INTEGRATION LABORATORY (SIL)

The Vehicle and Electronics Architecture (VEA) Systems Integration Laboratory (SIL) is a premier research, development, and integration hub dedicated to designing, testing, and delivering next-generation vehicle electronic systems and modular open data architectures. By bridging the gap between cutting-edge research and ruggedized military applications, the lab accelerates the transition of advanced technologies into field-ready capabilities.

Through collaboration with industry partners, academia, and government stakeholders, the VEA SIL fosters innovation to ensure decisive operational overmatch for our warfighters.

Our primary strategic pillars include:

- **Modular Open Systems Approach (MOSA):** Advancing open standards to ensure rapid technology insertion, prevent vendor lock-in, and reduce life-cycle costs.
- **Vehicle-to-Vehicle (V2V) Communication:** Developing and testing secure, high-bandwidth communication protocols to enhance situational awareness and collaborative combat capabilities.
- **Next-Generation Architectures:** Designing resilient, scalable, and secure physical and logical data architectures capable of supporting heavy computational loads on the move.
- **Industry Collaboration Space:** Providing physical and virtual bench space where industry partners can integrate, test, and validate their proprietary technologies against military standards.

CAPABILITIES

The VEA SIL provides end-to-end engineering, verification, and validation services for digital network architectures, sub-components, and complete vehicle systems that includes:

- Requirements & Standards Verification
- Deterministic Networking Analysis
- Hardware-in-the-Loop & Bench Top Testing
- Full Vehicle Integration
- Video Latency & Sensor Testing
- Radio Frequency Spectrum Analysis
- MOSA Evaluation

AVAILABLE INSTRUMENTATIONS

- Ethernet analysis tool
- Time Sensitive Network (TSN) analysis tool
- Controller Area Network (CAN) analysis tool
- High Voltage DC Oscilloscopes
- High voltage load banks
- Low voltage load banks
- Radio Frequency Spectrum Analyzer



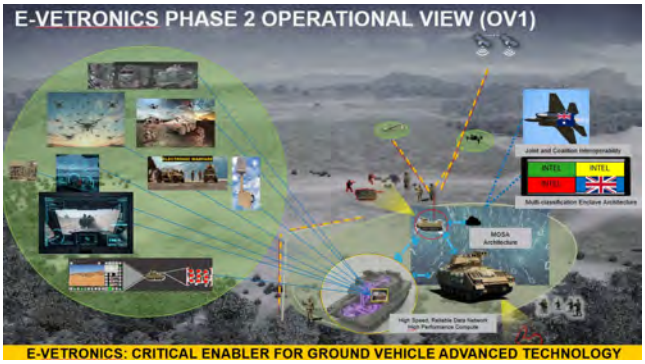
TSN Bench Testing



Network bandwidth/throughput Analysis Testing



Open Integrable Vehicle Demonstrator



Network Architecture

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VEHICLE ELECTRONICS AND ARCHITECTURE (VEA) SYSTEMS INTEGRATION LABORATORY (SIL)

VEHICLE ELECTRONICS AND ARCHITECTURE (VEA) ELECTROMAGNETIC COMPATIBILITY (EMC) LABORATORY

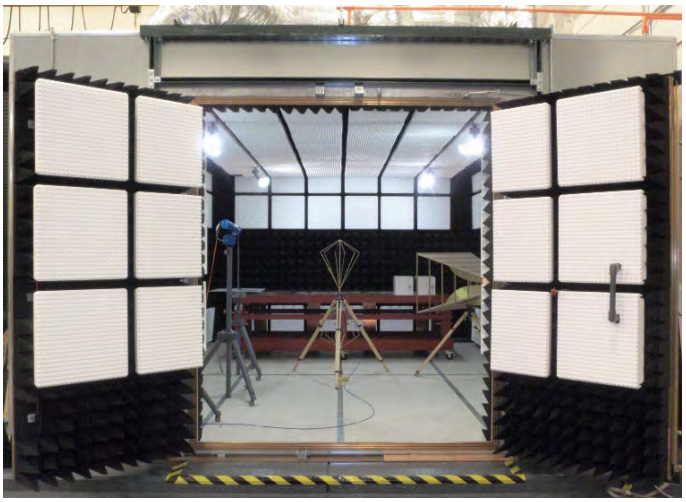
The Vehicle and Electronics Architecture (VEA) EMC Laboratory is one of nine ISO/IEC 17025 accredited laboratories in GVSC. The EMC Laboratory is accredited to ISO/IEC 17025:2017 by ANAB in the field of Testing, Certificate No. AT-3163. The EMC Laboratory can perform all MIL-STD-461 electromagnetic interference (EMI) tests applicable to electrical and electronic subsystems integrated on Army Ground Platforms. The EMI chamber supports electronic component and subsystem testing to MIL-STD-461.

CAPABILITIES

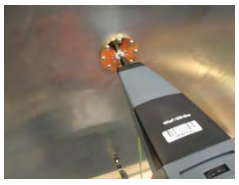
- MIL-STD-461 Testing
  - Conducted Emissions
  - Conducted Susceptibility
  - Radiated Emissions
  - Radiated Susceptibility
- MIL-STD-464 Testing
  - Bonds and Grounds
- Testing of subsystems with 28VDC to 600VDC power.
- Waveguide-below-cutoff coolant loop with thermal conditioning to support EMI/EMC testing of liquid-cooled power electronics.

AVAILABLE INSTRUMENTATION

- Semi-anechoic 16 ft. x 20 ft. x 10. ft. shielded enclosure.
- Fiber-optic closed-circuit TV, SAE J1939 (CAN), 10/100Mbps Ethernet, RS232 monitoring of Equipment Under Test.
- RF network analysis 5 Hz to 40 GHz.
- Spectrum Analyzer/EMI Receivers 20 Hz to 40 GHz with Fast Fourier Transform (FFT) capability.
- MIL-STD-461-compliant monopole, bi-conical, and double-ridged waveguide horn antennas for radiated emissions testing 50 Hz to 40 GHz.
- Personnel-borne electrostatic discharge (ESD) to ±25 kV.



Semi-Anechoic Shielded Enclosure for Conducted/Radiated Emissions and Susceptibility Testing



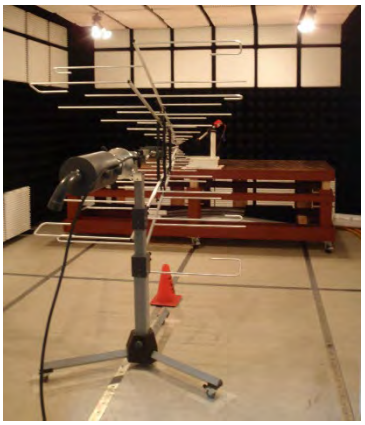
MIL-STD-461G CS118 Electrostatic Discharge Testing



MIL-STD-461G CS115 Impulse Excitation



MIL-STD-461G CS114 Bulk Cable Injection



MIL-STD-461G RS103 Radiated Susceptibility, Electric Field 2 MHz to 18 GHz, up to 200 V/m

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COLLABORATE WITH GVSC

The Ground Vehicle Systems Center (GVSC), located in Warren, Michigan, on the Detroit Arsenal, is the United States Army's laboratory for developing advanced military ground vehicle technologies and providing systems engineering and integration expertise that delivers unmatched ground vehicle solutions. GVSC is part of the U.S. Army Combat Capabilities Development Command (DEVCOM), a major subordinate command of the U.S. Army Transformation and Training Command (T2COM).

If your organization would like to partner with GVSC, we employ several collaborative methods to engage industry, academia and other government agencies, depending upon stakeholder requirements. Some options are: Small Business Innovation Research (SBIR), Small Business Technology Transfer (STTR), Cooperative Research and Development Agreements (CRADAs) and Test Service Agreement (TSA).

To start communications with GVSC go to our website at:
https://gvsc.devcom.army.mil






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