

MERC

An operating unit of Mercer University

Capability Overview



CMMIDEV/3
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Overview

Mercer Engineering Research Center (MERC) is a non-profit applied research engineering unit of Mercer University, a private university founded

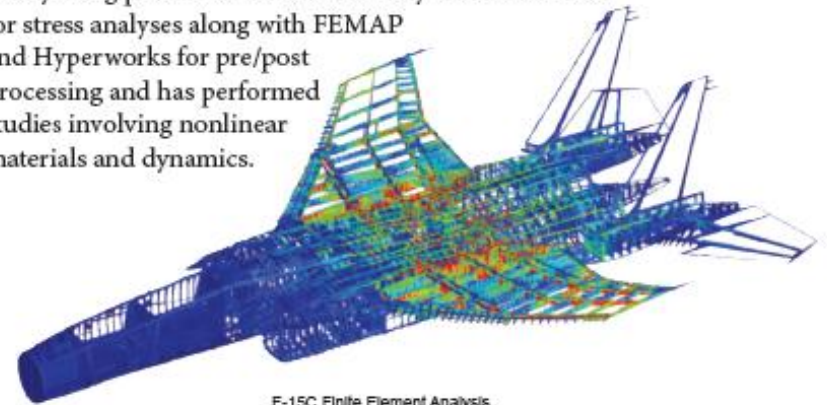
in 1833. MERC was established in 1987 under the Mercer University School of Engineering to provide engineering and scientific services and specialized technical skills to Robins AFB. MERC's core competencies include electronic combat systems engineering, advanced algorithm development, modeling and simulation, information systems technology, structures analysis and technology, mechanical and electronic systems design and reverse engineering, industrial engineering, materials technology, human factors and biomechanics, and cybersecurity.



Mercer Engineering Research Center

Finite Element Analysis (FEA)

MERC is a nationally recognized center of excellence in finite element analysis of military aircraft with extensive experience in static, modal, dynamic transient, and nonlinear methods. This experience base spans high performance fighter jets, military cargo aircraft, and multiple rotary-wing platforms. MERC routinely uses NASTRAN for stress analyses along with FEMAP and Hyperworks for pre/post processing and has performed studies involving nonlinear materials and dynamics.



F-15C Finite Element Analysis

Structural Integrity

MERC personnel are experts in structural analysis and modification design of both fixed and rotary wing military aircraft. MERC supports the Aircraft Structural Integrity Programs (ASIP) of H-1 and H-60 helicopters, as well as C-130, C-5, and F-15 aircraft. MERC instruments and conducts flight data analysis on many aircraft via Health and Usage Monitoring Systems (HUMS) and Loads/Environment Spectra Survey (L/ESS) systems.



Instrumenting an HH-60G 308 Beam

Mechanical Testing

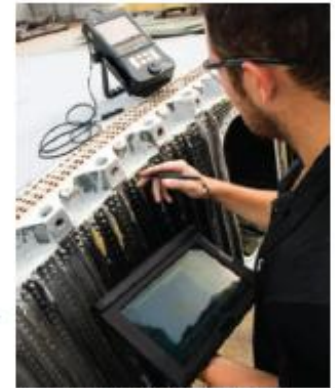
MERC's mechanical testing laboratory consists of a custom built 265,000-lb load frame, 110,000-lb load frame, and two 22,000-lb load frames. These load frames can be used for static, fatigue, and dynamic testing using additional specialized equipment. Components from small coupons up to complex 15-foot assemblies can be tested across this family of load frames. MERC can characterize composite layouts to include sandwich panels using a combination of tensile, direct shear, and flexural beam tests to ASTM standards and perform crack growth fatigue testing.



265,000-lb Load Frame

Non-Destructive Inspection (NDI)

MERC maintains both advanced NDI technology and Level III certification in support of critical and routine customer requirements. MERC has extensive experience with eddy current, magnetic particle, liquid penetration, radiographic, and ultrasonic testing methods to accelerate inspection processes, collect/analyze data, and provide actionable information for engineers and maintenance personnel.



NDI Testing and Certification

Rapid Prototyping

MERC personnel are experienced in 3D modeling on several CAD software platforms and reverse engineering through the use of coordinate measuring machines. With an in-house 3D printer, 3-Axis CNC Milling Center, machining and fabrication resources, and materials test equipment, MERC can build, test, and qualify prototypes to a variety of customer specifications. MERC utilizes 3D printing to provide low-cost, rapid validation of design concepts. The use of a rapid prototyping machine allows customers to visualize, inspect, and in some cases, test-fit an ABS plastic version of components without the costly investment of large quantities of raw materials or machine tooling. Scaled models for larger components and assemblies provide proof-of-concept while full-size prototypes allow for form, fit, and function checks.



Ammunition Loader Gearing Prototype

Electronics Engineering

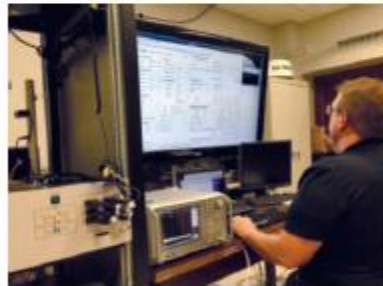
Using advanced tools, MERC engineers execute projects integrating electronic hardware, software, firmware, FPGA and mechanical design to provide a complete electromechanical development capability. Our capability extends to the development and delivery of technical data packages suitable for follow-on competitive procurement. MERC possesses expertise in designing for robust aircraft mechanical and electrical environments, including experience in MIL-STD-810/461/704 qualification testing. Our development process incorporates the use of advanced 3D solid modeling to create component level models of the electromechanical assembly design. Our experience across the entire electronic/avionics lifecycle includes development of requirements, obsolescence mitigation, technology insertion, integration, and qualification testing.



H-1 Health and Usage Monitoring System

EW and Embedded Software

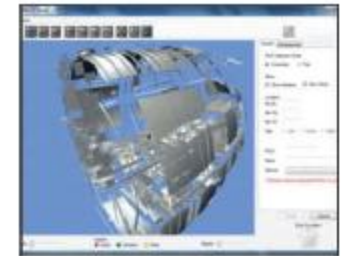
Through our broad EW systems experience, MERC can provide one-stop shopping for many EW requirements to include operational flight program design, mission data threat analysis, hardware technology insertion, diagnostic system hardware/software, training system software, and modeling/simulation tool sets. MERC is a recognized industry expert in advanced RF pulse train deinterleaving and real-time geolocation. MERC has extensive expertise in the development of complex FPGA applications, such as Radar signal processing, DRFM kernels, and waveform generation. MERC has current experience with the ALR-46/69/69A and the ALQ-161/172/155/122.



EW Demonstration Lab

Custom Software Development

MERC provides custom software tools to capture critical weapon system information, thoroughly analyze that information, and then present the results in an actionable format for key decision makers. One such tool ICARR-3D, a point-of-maintenance data collection application that uses 3-D technology to accurately record inspection results and repairs made to a weapon system. It also provides reporting capability to analyze data across a variety of operational variables such as mission, location, or inspection type. MERC uses Agile software processes to ensure requirements are understood and test cases are executed to ensure product quality prior to fielding. Specific software expertise includes .NET, JAVA, and Oracle, to include Oracle Certified Professionals, SQL Server, database development, hardware control interfaces, mobile application development, networking, and system administration.



C-130 3D Visualization Tool

Energy Management

ISO 50001 is the global standard for establishing, implementing, maintaining and improving an Energy Management System (EnMS). This standard is used as the framework for solutions offered to MERC's Energy Practice customers. ISO 50001 provides a mature methodology by which energy systems are analyzed, improvements planned, and performance goals achieved. MERC's Energy Practice is built on decades of experience of MERC team members with experience in HVAC, building control systems, energy metering, secure wireless metering communication systems, and energy data information systems. Combining expertise in both the mechanical and electrical domains of the energy field allows MERC to offer a unique and comprehensive set of services to support the effective management of an organization's energy supply and use.



Energy Metering

Computational Fluid Dynamics

For computational fluid dynamics (CFD) problems, MERC uses Kestrel, the DoD/High Performance Computing advanced Navier-



C-130 Flow Field Analysis

Stokes equation solver. MERC runs the solver in-house on an advanced Linux-based multi-node server complex. The memory and switching hardware provide rapid convergence for large, whole-aircraft problems. As an example, the C-130 model shown has approximately 58 million cells and executes in a 28-hour time frame. The CFD capabilities are used to evaluate pressure distribution and drag for various airframe configurations and flight conditions. The results support decisions regarding external modifications and placements, and can be used for load estimation for structural models.

Cybersecurity for Mission Assurance

MERC is well versed in network design, monitoring, and response for ensuring data security and integrity. Experience includes the development and deployment of network monitoring “command centers” to allow quick identification and response to potential cyber threats. Additionally, MERC is advancing our capabilities in cybersecurity areas such as risk assessment and mission assurance, secure coding techniques, and system penetration testing. MERC also has extensive experience with Government Information Assurance/ cybersecurity processes to obtain and maintain authority for systems to operate on Government networks, including the new Risk Management Framework.



Risk Assessment and Mission Assurance

Human Factors and Biomechanics

MERC's biomedical engineers use our advanced biomechanics laboratory to perform a range of complex biomechanical testing and analysis. The laboratory is equipped with an array of sensing systems and simulation software, including: 3D motion capture, floor load, muscle testing, digital human modeling, and inverse kinematic biomechanical simulation. MERC collaborates with healthcare professionals in areas such as injury prevention, sports medicine, and occupational rehabilitation to improve function and productivity and reduce costs.



Biomechanics Lab

MERC Contract Vehicles

Prime

- Robins AFB BOA FA8509-12-G-0001
- SeaPort Enhanced (SeaPort-e)
- GSA Professional Services Schedule (PSS)
- C5 Other Transaction Authority

With Partners

- One Acquisition Solution for Integrated Services (OASIS)
- Defense Systems Technical Area Tasks (DS TAT)
- GSA Alliant Government Wide Acquisition Contract (Alliant)
- Advanced Expeditionary Warfare Development (AEWD)
- Design/Engineering Support Program (DESP III)
- Army Prototype Integration Facility II (PIF II)

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