



# A HIGHER STANDARD

TESTING | INSPECTION | CERTIFICATION



## SPEAKERS



### **Joe Shiver, Strategic Accounts Manager**

Joe has served as Strategic Accounts Manager for NTS over the past 3 years developing innovative, cost effective testing solutions for Aerospace. Joe is a retired Executive from UTC where he spent 38 years. The last 15 of those responsible for Operations in US, Singapore, Puerto Rico and Germany. Joe holds a BA form Northern Illinois University and an Executive MBA form Darden School of Business, University of Virginia.

### **Kevin Coke, EMC Department Manager**

Kevin D Coke has been in the EMC industry for 20 years. Kevin's expertise is in aerospace, defense, and commercial industries with a focus on HIRF and Lightning testing. Kevin holds a Bachelor's degree in Business and Communications from Liberty University.

## WEBINAR AGENDA



- PMA Approval Pathways
- Product Testing to RTCA DO-160
- When is Testing Required?
- Test Lab Options

# WHAT IS A PMA?



- Used for replacement or modification articles
- Governing regulations found in USC 49, Title 14, Part 21, Subpart K
  - Governing rule for a PMA's design/application is 14 CFR 21.303
  - PMAs must be produced under an approved Quality System
  - PMAs have the same production requirements as Production Certificate holders who produce engines and aircraft
    - Production oversight is scalable depending on criticality and complexity
- Combined design and production approval
  - Aircraft Certification Offices (ACO) find design compliance
  - Manufacturing Inspection District Offices (MIDO) approve the production
- PMA Includes Installation Eligibility on specific Make/Model Products

# PMA APPROVAL TYPES

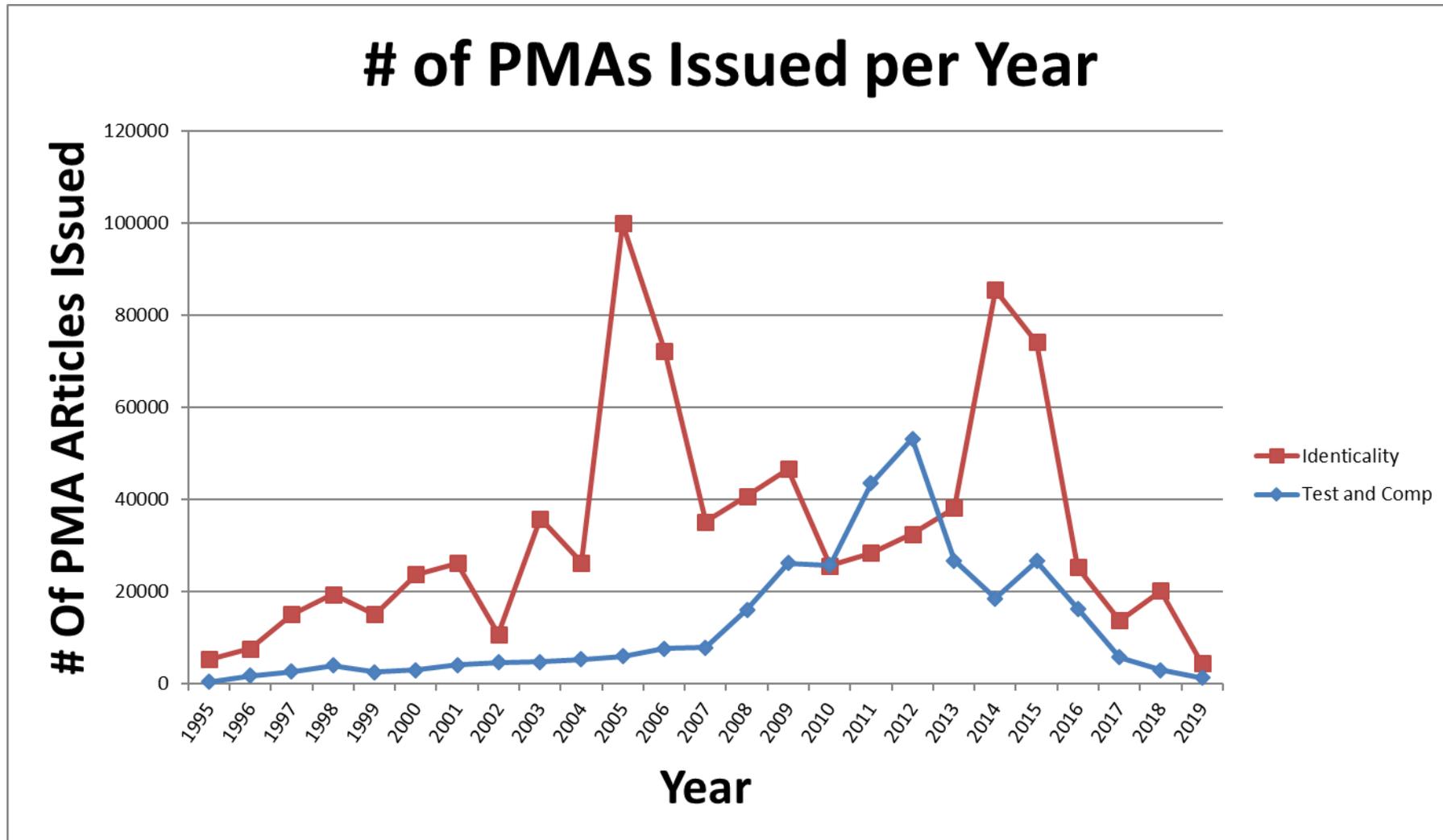


- 4 PMA Methods
  - Identity with a Licensing Agreement
    - The design is licensed to the PMA manufacturer by the TC or STC holder
    - The TC or STC holder is still the design approval holder and are responsible for approving minor changes
  - Supplemental Type Certificate (STC)
    - A method for STC holders to produce their STC parts instead of obtaining a Production Certificate (PC)
  - Identity without a Licensing Agreement
    - Applicant shows their parts design is exactly the same as TC or STC holders design
    - Typically needs to have the TC or STC design to show every aspect is the same
    - Order 8110.42 and AC 21.303 provide policy and guidance
    - Only cosmetic minor changes allowed
  - Test Reports and Computations (T&C)
    - Typically reverse engineered design
    - Must comply with applicable airworthiness regulations
    - Order 8110.42 and AC 21.303 provide policy and guidance
    - Can make minor design changes with proper substantiation

# WHY DOES THE FAA SUPPORT PMA?

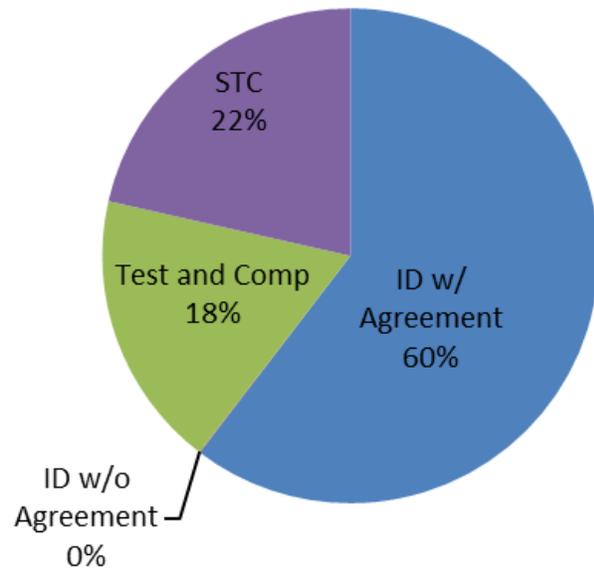


- Confidence in FAA PMA
  - Long history of successful and safe approvals dating back to the 1950's
  - Often fills a need within the industry for timely and airworthy replacement articles
    - Many PMAs are on articles no longer produced or supported by the OEMs
    - Almost 75% of all PMAs are Licensing Agreements or STCs
  - Robust and mature process
    - Studied and vetted on multiple occasions since the 1980's
    - Order 8110.42 originally released in 1995
    - Operational safety supports our position



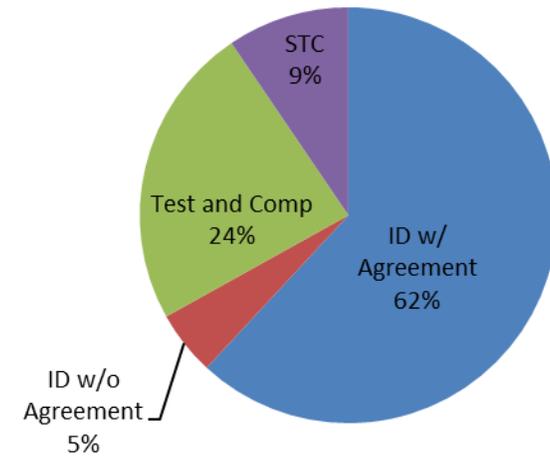
### Parts Manufacturer Approval - Totals

7,139 PMA articles in 2019

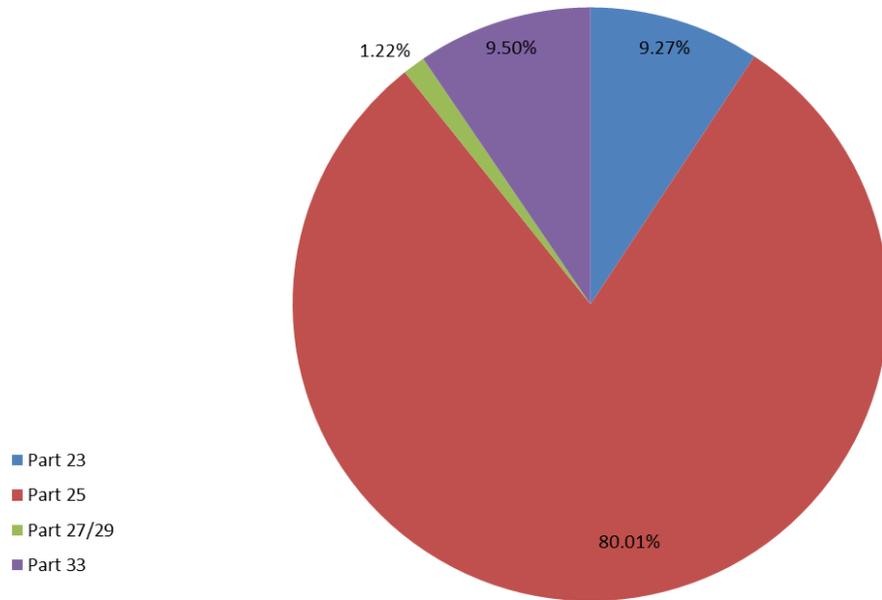


### Parts Manufacturer Approval - Totals

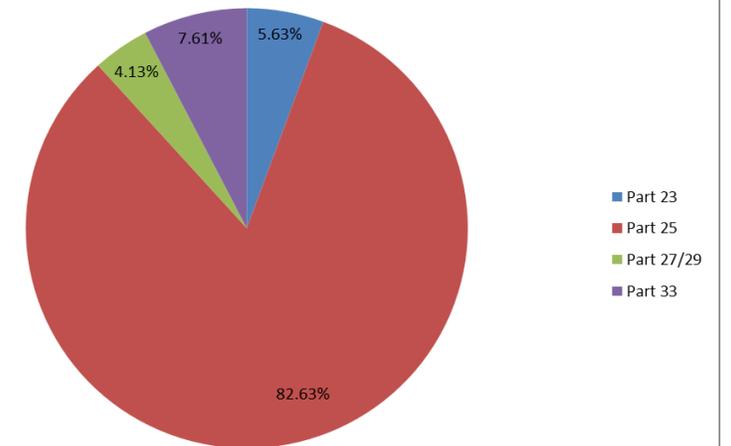
1,363,402 PMA articles as of 12-2019



### % of PMAs Issued by Product Type 7,139 Total PMAs in 2019

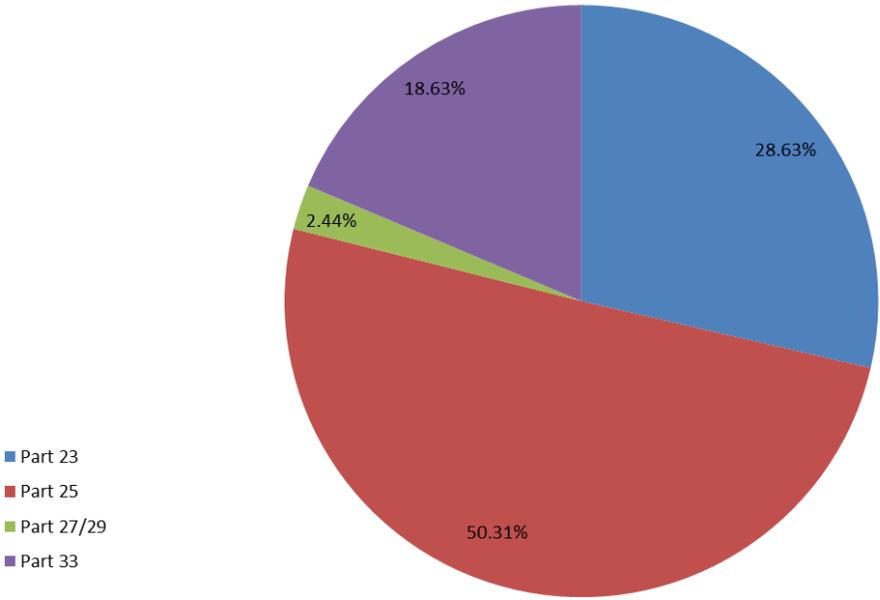


### % of PMAs Issued by Product Type 1,363,402 Total PMAs as of 12-2019



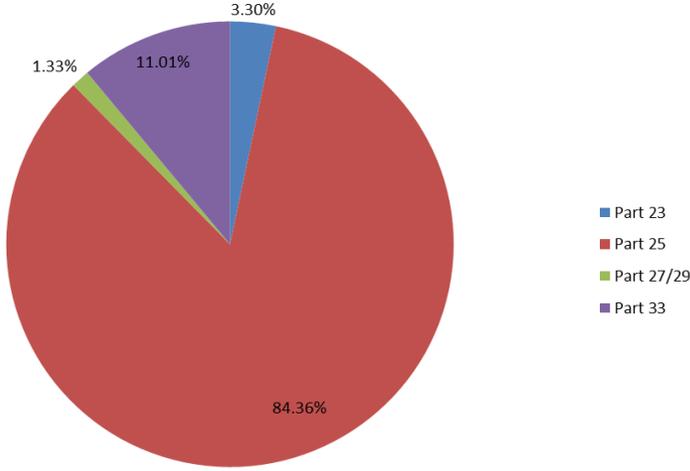
### % of PMAs Issued by Product Type

1,310 Total T&C PMAs in 2019



### % of PMAs Issued by Product Type

320,413 Total T&C PMAs as of 12-2019



## COMMONLY TESTED SYSTEMS & SUBSYSTEMS

- Refuel control panels
- Fuel Quantity Data Concentrator
- Aft Pylon Fairing
- PECS Pump Pack
- Flight Controls/Instrumentation
- Proximity Sensors
- Rate/Velocity Fuses
- CSS Components
- Aluminum Door Frame Assembly
- Oxygen Cylinders
- Hydraulic Snubbers
- CAC Inlet Housing
- Windshields
- Butterfly Valves
- Anti-collision light
- APU
- LCS Pumps
- Brake Control & Monitoring System
- Wireless Emergency Lightning (WELS)
- Wheel Speed Transducers
- Mandrels
- Hose Assembly
- Generators and Control Units
- Power Supply Controls
- Wingtip Lights
- Actuators

## WHAT IS RTCA?

- Was formerly known as (**Radio Technical Commission for Aeronautics**)
- Over 200 committees and overall acts as an advisory body to the FAA

## WHAT IS RTCA/DO-160?

- RTCA/DO-160 (or its precursor, RTCA/DO-138) has been used as a standard for environmental testing since 1958. It defines standard environmental test conditions (categories) and applicable test procedures for airborne equipment.
- The tests in RTCA/DO-160 provide a laboratory means of demonstrating the performance characteristics of airborne equipment in environmental conditions that may be encountered in operation of the equipment in aircraft.

# RTCA/DO-160 (REV G – 2011) TABLE OF CONTENTS



- Sect 4 – Temperature and Altitude
- Sect 5 – Temperature Variation
- Sect 6 – Humidity
- Sect 7 – Operational Shocks and Crash Safety
- Sect 8 – Vibration
- Sect 9 – Explosion Proofness
- Sect 10 – Waterproofness
- Sect 11 – Fluids Susceptibility
- Sect 12 – Sand and Dust
- Sect 13 – Fungus Resistance
- Sect 14 – Salt Spray
- Sect 15 – Magnetic Effect
- Sect 16 – Power Input
- Sect 17 – Voltage Spike
- Sect 18 – Audio Frequency Conducted Susceptibility (Power Inputs)
- Sect 19 – Induced Signal Susceptibility
- Sect 20.0 – Radio Frequency Susceptibility (Radiated and Conducted)
- Sect 21.0 – Emission of Radio Frequency Energy
- Sect 22.0 – Lightning Induced Transient Susceptibility
- Sect 23.0 – Lightning Direct Effects
- Sect 24.0 – Icing
- Sect 25.0 – Electrostatic Discharge
- Sect 26.0 – Fire, Flammability

# TEST SECTIONS



Section	Name	Description
	<b>Standard conditions</b>	
4.0	<b>Temperature</b>	This checks the effects of temperature on the system. Condensation also can be a factor coming from cold temperatures.
	<b>Altitude</b>	These tests check the effects (in terms of performance) of altitude, including loss of cabin pressure on the device/system/equipment. Factors tested include <b>dielectric strength</b> , cooling under low pressure, and resilience to rapid change in air pressure. The norm defines the different <b>temperature profiles</b> under which the equipment must be tested. Due to the variety of aircraft, the equipment are classified in categories.
5.0	<b>Temperature Variation</b>	These tests exercise the assemblies capability of surviving extreme temperature changes and the effects of differing coefficients of thermal expansion.
6.0	<b>Humidity</b>	These tests under humidity check the effects of high concentrations of humidity and the articles ability to withstand moisture effects. Typically moisture sensitive devices have issues with this test and require conformal coat or other types of protection.
7.0	<b>Shock &amp; Crash safety</b>	This aircraft type dependent test checks the effects of mechanical shock. Crash safety test insures the item does not become a projectile in a crash. The norm describes the test procedure for airborne equipment.
8.0	<b>Vibration</b>	Aircraft type dependent test checks the effects of vibration and the equipment's ability to operate during all vibration scenarios.
9.0	<b>Explosion proofness</b>	These tests subject the test article to an environment under vacuum, with a gaseous mixture of combustibles. The unit must operate and be subjected to any actuation including knob turns and button pushes and not ignite the environment.
10.0	<b>Water proofness</b>	These tests subject the test article to various scenarios of dripping water or pooled water to verify the unit will fully operate in the given condition.
11.0	<b>Fluids susceptibility</b>	Aviation related fluids susceptibility including a variety of fluids ranging from carbonated sugared beverage to various cleaners and solvents.
12.0	<b>Sand &amp; Dust</b>	These tests subject the unit to an environment of blowing sand and dust of specific particle sizes in which the unit must operate at the end of exposures.
13.0	<b>Fungus Resistance</b>	This tests determine whether equipment material is adversely affected by fungi under conditions favorable for their development, namely, high humidity, warm atmosphere and presence of inorganic salts.
14.0	<b>Salt &amp; Fog</b>	This test verifies the test articles ability to survive multiple exposures of salt fog and drying and the environment's ability to cause accelerated corrosion.

# TEST SECTIONS



15.0	<b>Magnetic effect</b>	This ensures that the aircraft's compass is not affected.
16.0	<b>Power input</b>	Input power conducted emissions and susceptibility, transients, drop-outs and hold-up. The power input tests simulate conditions of aircraft power from before engine start to after landing including emergencies.
17.0	<b>Voltage spike</b>	This test determines whether equipment can withstand the effects of voltage spikes arriving at the equipment on its power leads, either AC or DC.
18.0	<b>Audio Frequency Conducted Susceptibility</b>	This test determines whether the equipment will accept frequency components of a magnitude normally expected when the equipment is installed in the A/C. These frequency components are normally harmonically related to the power source fundamental frequency.
19.0	<b>Induced Signal Susceptibility</b>	This test determines whether the equipment interconnect circuit configuration will accept a level of induced voltages caused by the installation environment. This section relates specifically to interfering signals related to the power frequency and its harmonics, audio frequency signals, and electrical transients that are generated by other on-board equipment or systems and coupled to sensitive circuits within the EUT through its interconnecting wiring.
20.0 and 21.0	<b>RF emission and susceptibility</b>	Radio frequency energy: -- radiated emissions and radiated susceptibility (HIRF) via an (Electromagnetic reverberation chamber).
22.0 and 23.0	<b>Lightning susceptibility</b>	Direct and indirect effects depending on mounting location; includes induced transients into the airframe or wire bundle.
24.0	<b>Icing</b>	This test determine performance characteristics for equipment that must operate when exposed to icing conditions that would be encountered under conditions of rapid changes in temperature, altitude and humidity.
25.0	<b>ESD</b>	This checks for resilience vs ESD in handling and operation.
26.0	<b>Flammability</b>	This analysis and test verifies the assembly will not provide a source to fire.

## WHEN IS TESTING REQUIRED (TEST REPORT AND COMPUTATION ROUTE)?

### Product Redesign

- New Materials
- Change of Physical Design
  - Enclosure
  - Electrical System
- Technology Upgrade
  - Analog > Digital
- Change of Supplier



**Advanced commercial and government aviation and aerospace testing for aircraft, airframes, systems, and components.**

- A Full Range of RTCA DO-160 Testing Requirements, FAA Fire, MIL-STD-810, and MIL-STD-461.
- Dynamic, Environmental, EMI/EMC, Fuel Icing, Fuel Contamination, Fire, Direct Strike Lightning, and More.
- FAA and Private Aircraft Industry Development and Evaluation Programs
- Insight to Regulatory, Safety, and Service Considerations Early in the Design Process
- Up Front Review Services to Identify Potential Problems and Reduce Delays in the Product Development and Release Process

## KEY TESTING CAPABILITIES

- Airborne Components & Systems
- Airborne Structures
- Materials Analysis
- Explosives/Ballistics/Survivability
- Aircraft Direct and Indirect Effects Lightning and HIRF
- FAA Fire Testing
- RTCA DO-160 Full Suite
- MIL-STD-810
- MIL-STD-461
- SAE ARP 1401 Fuel Contamination Testing
- Hi/Lo Pressure, Flow, Temperature
- Lifecycle Testing for Fuel, Air, Oil and Hydraulics Systems

***28 LABS IN US AND CANADA – YOUR CUSTOMERS AND SUPPLIERS HAVE BEEN TESTING WITH NTS SINCE 1961.***

***THE FAA KNOWS OUR WORK AND OUR REPUTATION.***



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# A HIGHER STANDARD

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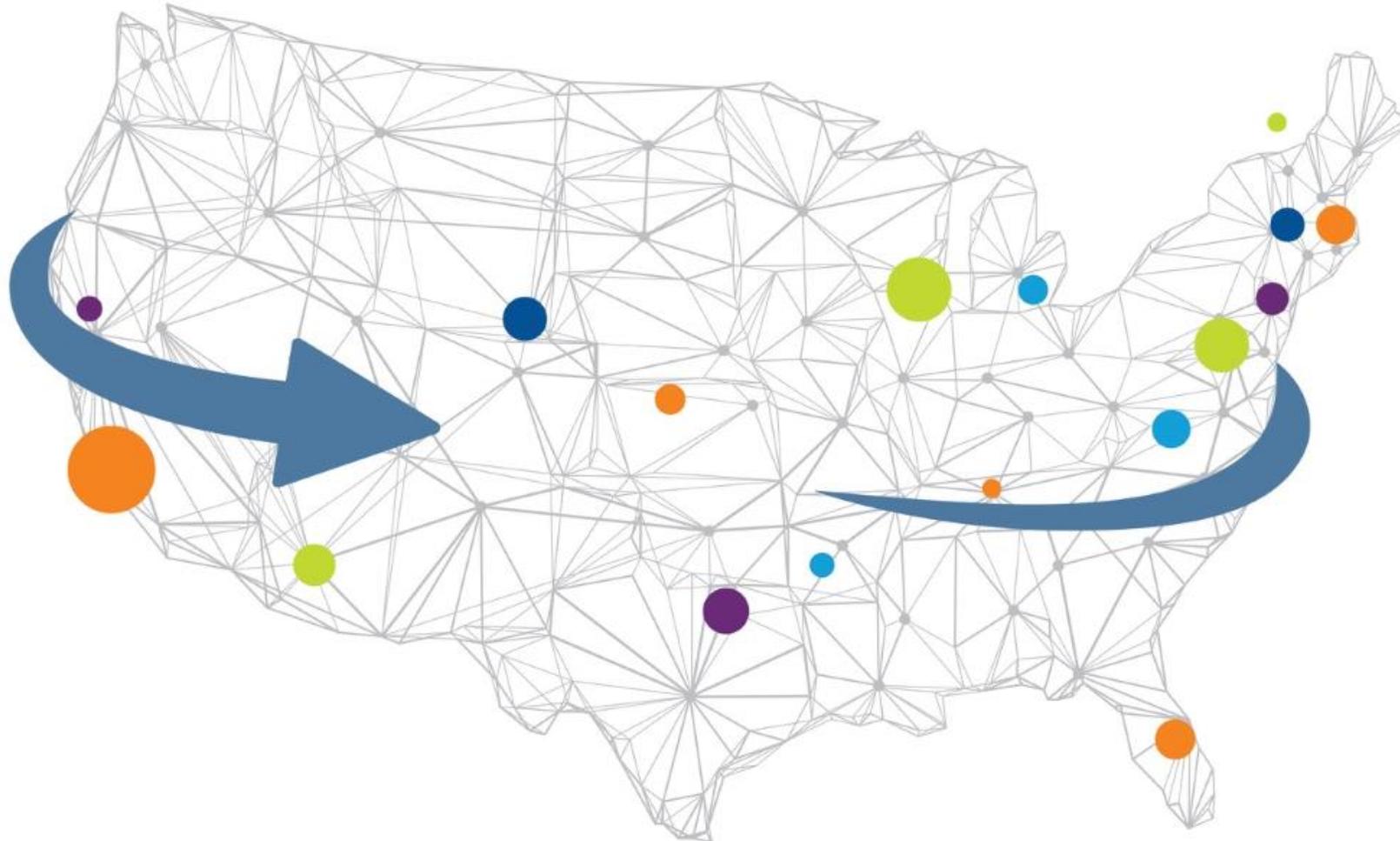


2019 Space Flight Awareness Supplier Award Winner

*"The qualification and testing of hardware for human-rated space flight systems is unique and extensive; and is a critical step in delivering to NASA the safest and most reliable systems for human space exploration."* Lockheed Martin



## 28 LABS IN NORTH AMERICA



# WE'VE GOT YOU COVERED



**CONSUMER**



**AUTOMOTIVE**



**SPACE**



**AVIATION**



**DEFENSE**



**TELECOM**



**ENERGY**



**MEDICAL**

EVERYTHING YOU NEED



MATERIALS  
EMI/EMC  
DYNAMICS

LIGHTNING FAILURE ANALYSIS

ENVIRONMENTAL

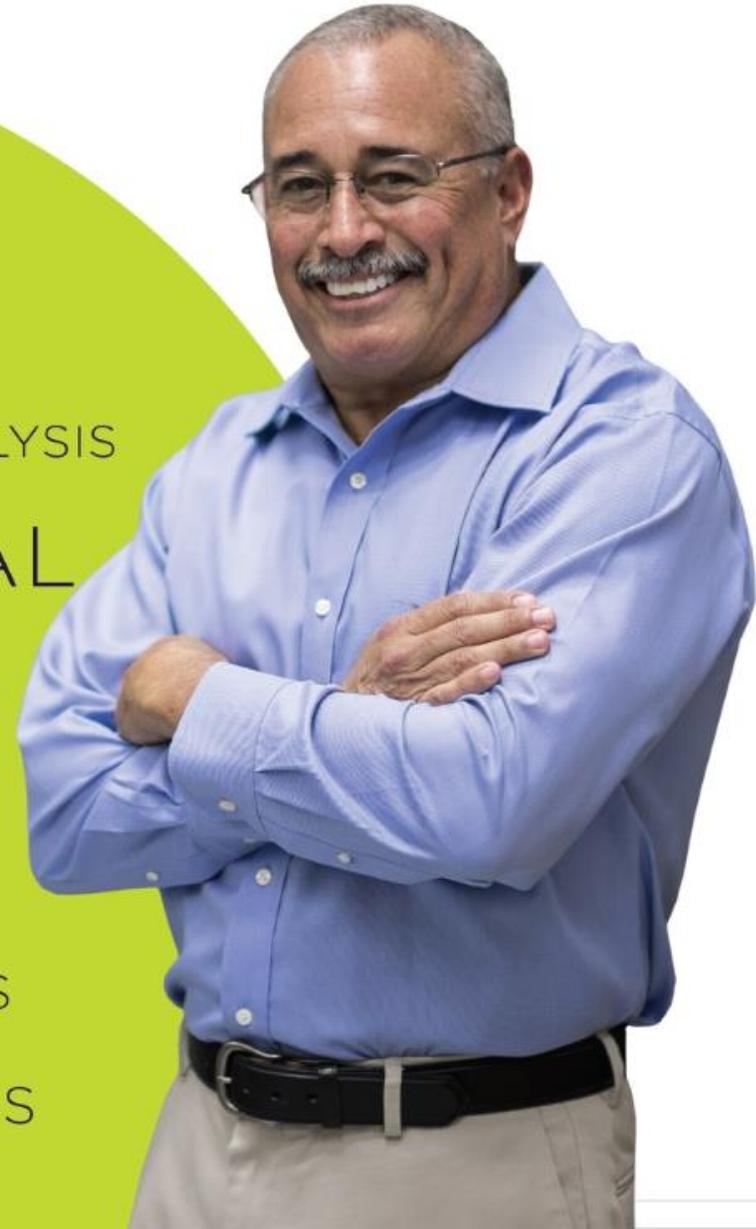
PRECISION CLEANING

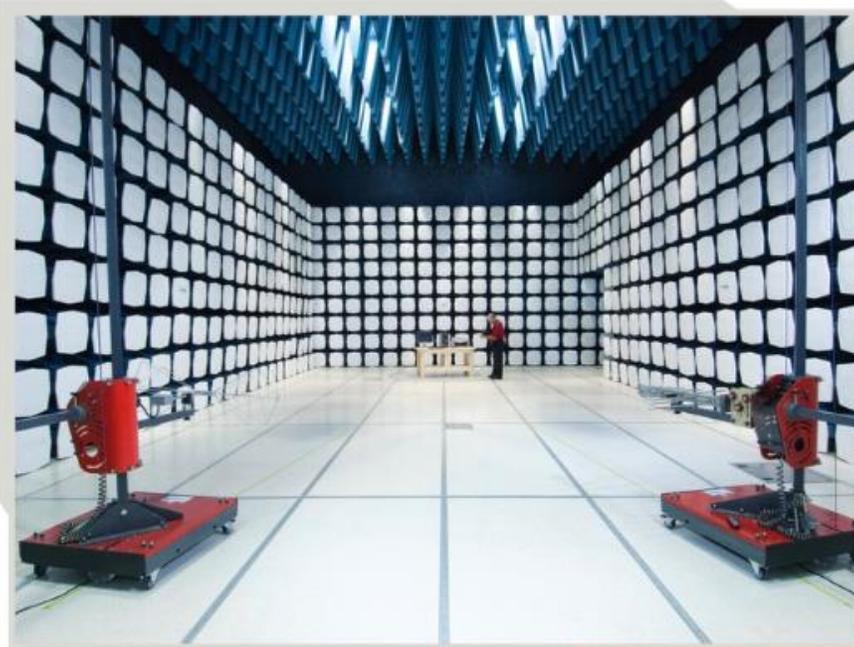
BALLISTICS NEBS

GLOBAL MARKET ACCESS

MANAGED ENGINEERING SERVICES

HYDRAULICS/PNEUMATICS





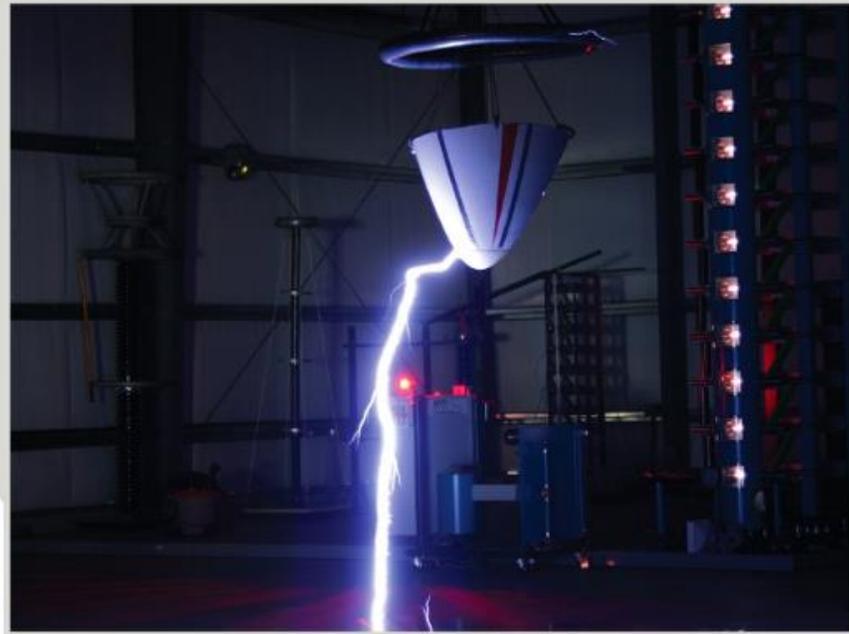
## THE LARGEST NETWORK OF EMC LABS IN NORTH AMERICA

- Large Chambers Up to 40 x 40 x 20
- Semi and Fully Anechoic Chambers
- Electromagnetic Reverberation Chambers
- Radiated Susceptibility up to 200V/m, 10kHz to 40GHz
- Lightning-Multiple Stroke, Multiple Burst, and Single Stroke
- HIRF Testing 400 Mhz to 18 GHz
- Magnetic Susceptibility dc to 10kHz
- Electrostatic Discharge (DO-160, Section 25)



## PUSHING YOUR PRODUCT TO THE BRINK

- HALT/HASS/HATS
- Shock – Pyrotechnic, Thermal, Impact, Drop
- Vibration – Seismic, Triaxial, Biaxial, Combined
- Acceleration, Impact, Corrosion, Mechanical
- Acoustic Noise Reverberation Chamber



## WITNESS THE TRUE POWER OF LIGHTNING

- Indirect Effects (DO-160, Section 22)
- Direct Effects (DO-160, Section 23)
- Near Strike (MIL-STD-464)
- Electrostatic Discharge (DO-160, Section 25)
- Precipitation-Static
- Modeling and Simulation
- DER Services
- Full Vehicle Testing



## NTS CAN SIMULATE ANY CONDITION ON EARTH—AND IN SPACE

- Wind, Ice, Rain, Sand, and Dust
- Salt Fog and Salt Spray Corrosion
- Solar Radiation & Actinic Testing
- Temperature, Humidity, and Altitude
- Highly Accelerated Life Testing
- Highly Accelerated Thermal Shock
- Space Simulation & Thermal Vacuum



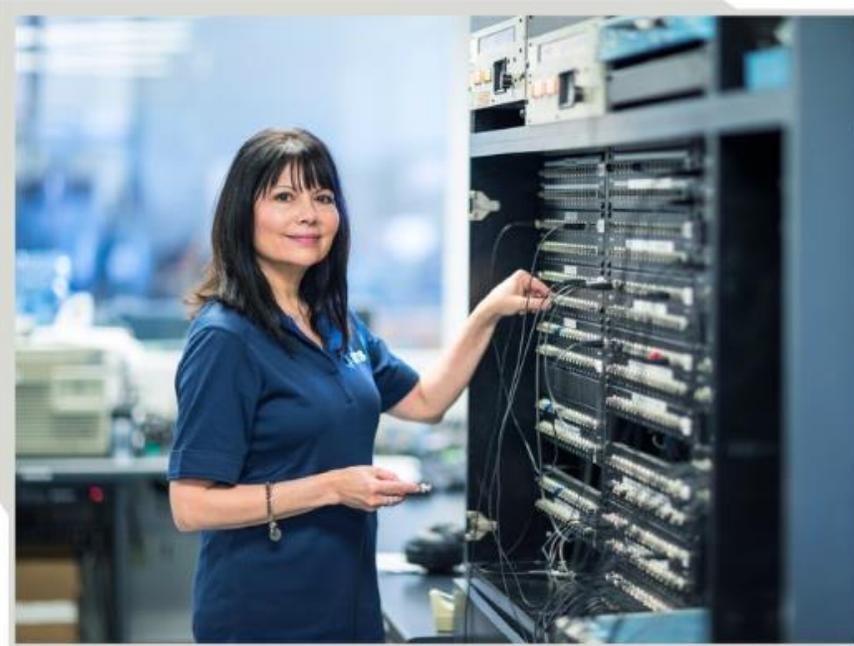
## A SUREFIRE WAY TO MANAGE RISK AND IMPROVE SAFETY

- Ammunition and Firearms
- Arena Testing
- Armor and Ballistic Materials
- Forced Entry
- Insensitive Munitions
- Ordnance Science



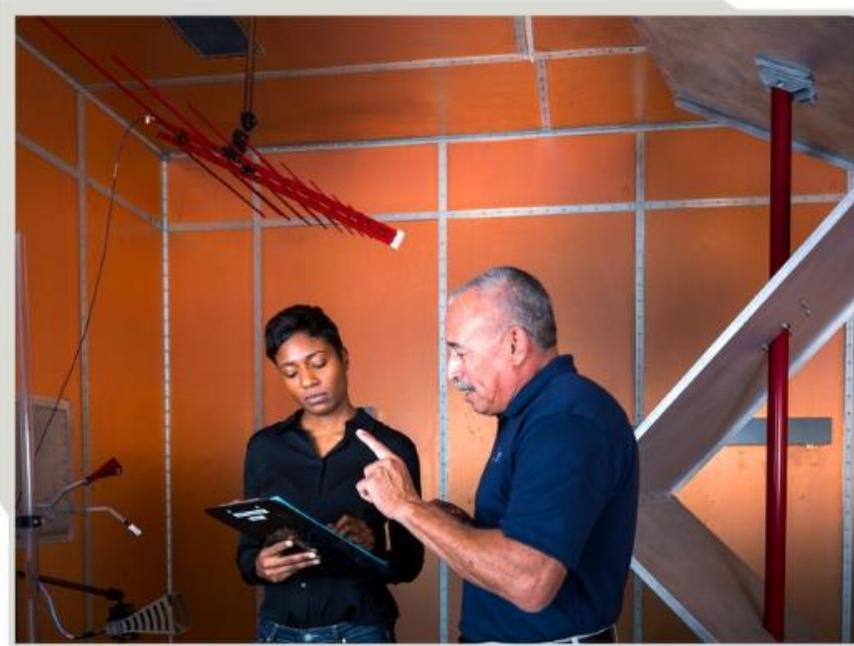
## A SCIENTIFIC APPROACH TO PRECISION CLEANING

Expertise includes cryogenic testing, pickle and passivation, deoxidation, etching, helium leak testing, vacuum bake-out, pressure testing and a range of other ancillary specialized services.



## SEAMLESSLY INTEGRATE INDUSTRY EXPERTS INTO YOUR WORKFORCE

- Facility and Lab Planning
- Talent, Resource Sharing and Management
- Risk Management
- Lab Accreditation
- Quality Systems and Procedures
- Life Cycle Integration



## THE MOST EFFICIENT ROUTE FOR CERTIFICATION

- A single-point-of-contact in 180 countries
- A path for taking down barriers and accelerating product entry
- Unrivalled industry knowledge and customer service



## REDEFINING INNOVATION IN HYDRAULIC TESTING

- Burst and Proof Pressure Testing to 60,000 psi
- Cracking and Reseat Pressure Testing to 8,000 psi
- Continuous Flow & Pressure Drop Testing
- Impulse Testing (9,500 psi Hydrocarbon; 7,500 psi Phosphate Ester)
- Fluid Immersion and Susceptibility
- Combined Environments (Hydraulic, Temperature, Humidity, Vibration)



## THE INTERSECTION OF SPEED AND PRECISION

Evaluation and analysis of material properties and composition and their resistance to chemical, mechanical, and environmental conditions, including:

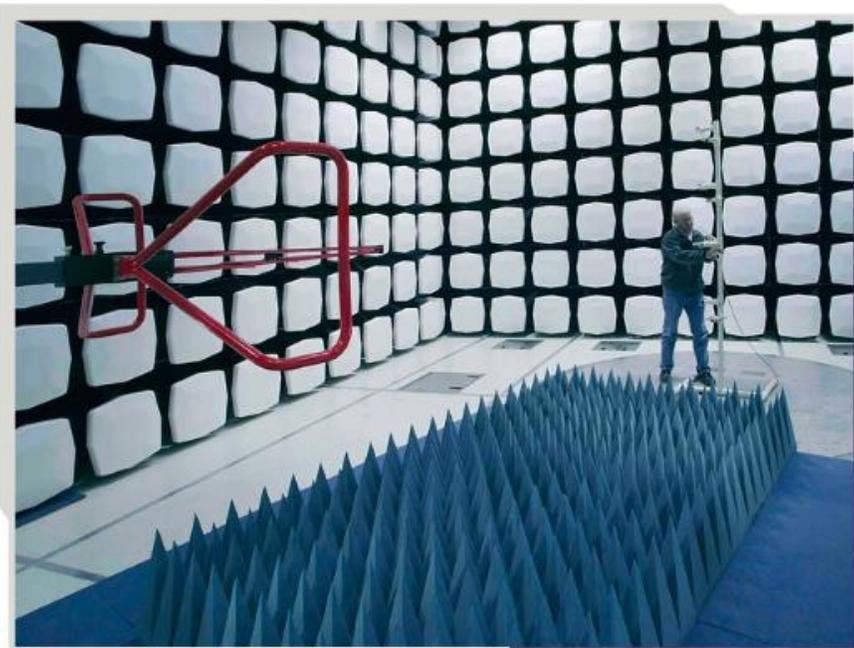
- Composition, Corrosion, Shear, Impact
- Thermal Resistance & Flammability
- Flexure & Fatigue
- Ozone & Gas Exposure
- Tensile/Compression
- Thermo Mechanical Analysis



## ROOT CAUSE ANALYSIS FOR BETTER INSIGHTS

- X-Ray Fluorescence Spectroscopy
- Scanning Acoustic Microscopy
- Optical Microscopy
- Contamination Analysis
- Visual Examination

- 2D/3DX-Ray Radiography
- Curve Trace/Electrical Inspection
- Destructive Physical Analysis (DPA)
- Cross-section Analysis
- Thermal Analysis



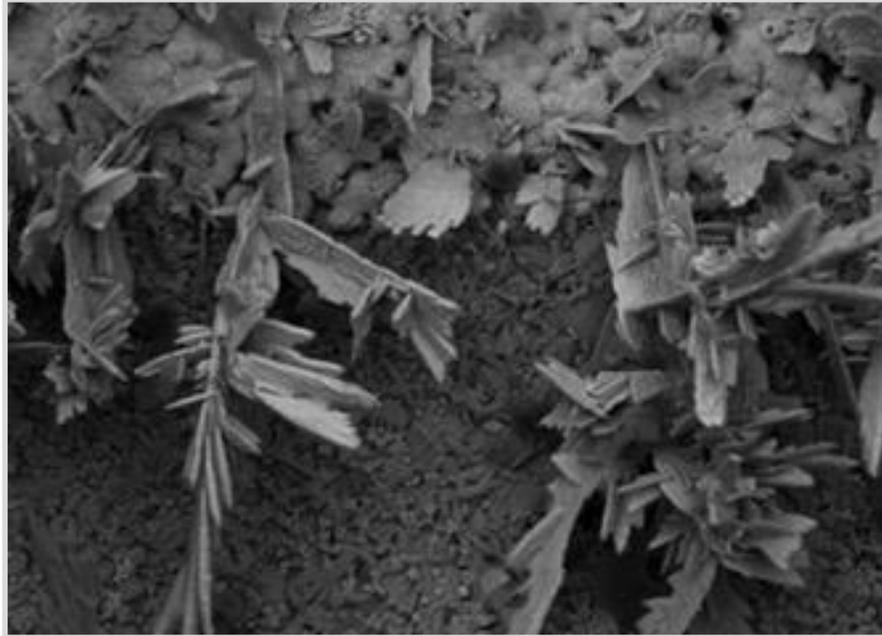
**NTS OPERATES THE LARGEST GROUP OF VERIZON-CERTIFIED INDEPENDENT TEST LABORATORIES IN THE WORLD**

- A full suite of environmental and dynamics tests to simulate extreme conditions
- Accreditation to NEBS standards and GR, ETSI, VZ-TPR, and AT&T requirements
- Semi-anechoic chambers and immunity ground planes for international markets



**A MATERIALS ANALYSIS LAB WITH EXPERTISE IN MILITARY, AEROSPACE, COMMERCIAL, MEDICAL, AND AUTOMOTIVE SECTORS**

- Printed Circuit Board Testing
- Failure Analysis
- Root Cause Analysis
- Electronic, Electrical, & Mechanical Testing
- UL & Product Safety Testing
- Micro-Sectional Analysis
- Research & Development



A WORLD-RENOWNED MATERIALS ANALYSIS LAB  
WITH EXPERTISE IN ELECTRONIC AND MECHANICAL  
PRODUCT FAILURE MODES ACROSS NUMEROUS  
INDUSTRIES

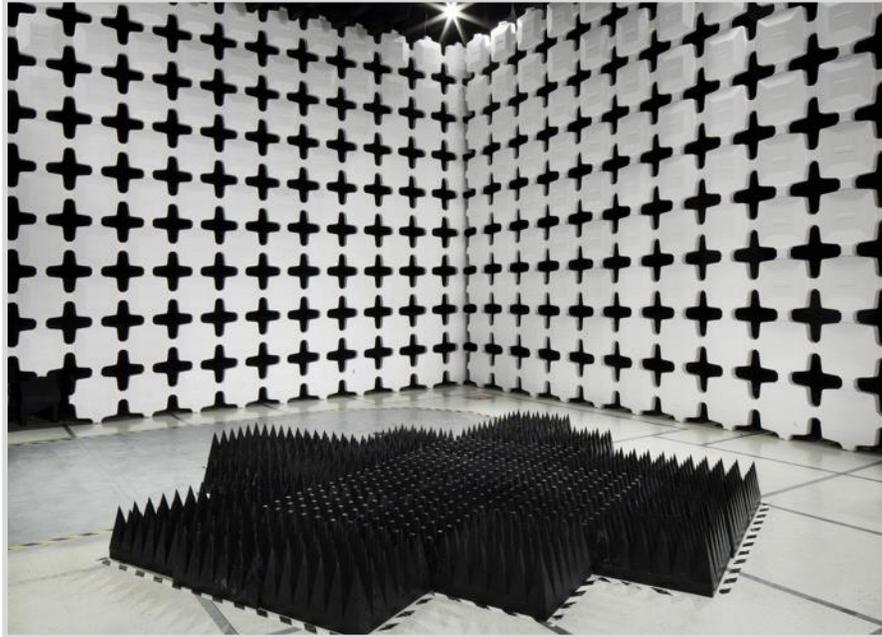
- Chemical Testing
- Electrical Testing
- Environmental Testing
- Mechanical Testing
- Printed Circuit Board/Assembly Analysis



## A STATE-OF-THE-ART LAB FOR BALLISTIC EXPERIMENTATION AND NON-DESTRUCTIVE TESTING OF MUNITIONS AND PROTECTION SYSTEMS.

- Ballistic Resistant Material Impact Testing
- CT Scanning in Conjunction with Advanced Digital X-Ray
- Firearm Safety & Device Testing
- Helmet Impact Testing
- NIJ Ballistic Testing & Stab Testing
- Environmental & Mechanical Testing Services
- NOCSAE Sporting/Athletic Equipment Testing

# BOXBOROUGH, MASSACHUSETTS



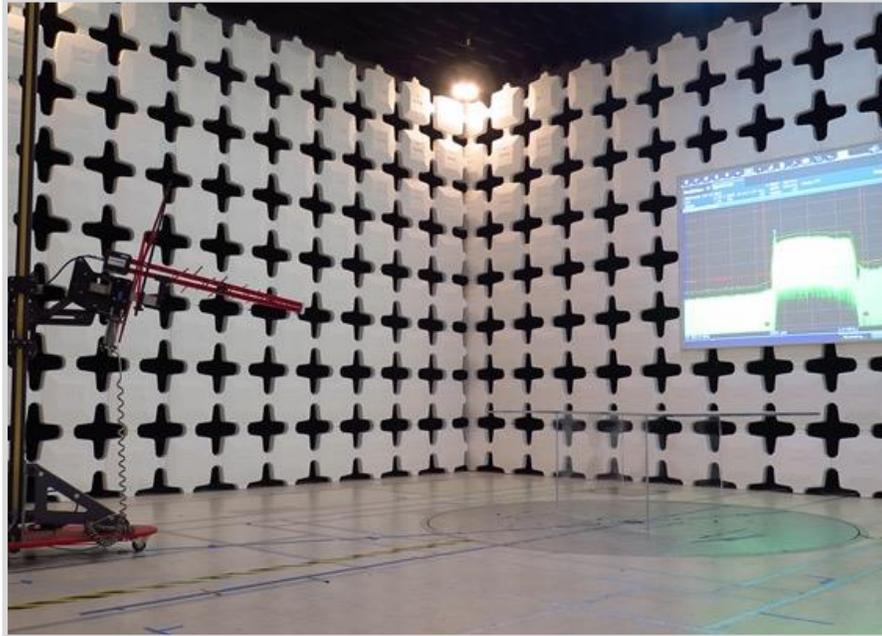
**A FULL SERVICE TESTING FACILITY SERVING COMMERCIAL, MILITARY, DEFENSE, MEDICAL, TELECOM, AND AUTOMOTIVE MARKETS.**

- State-of-the-Art 10-Meter Anechoic Chamber
- EMI/EMC Testing
- Verizon ITL for NEBS Testing
- Extreme Environmental Testing
- Hydraulics & FAA Fire Testing
- Electro-Dynamic Shaker Systems
- Engineering Services



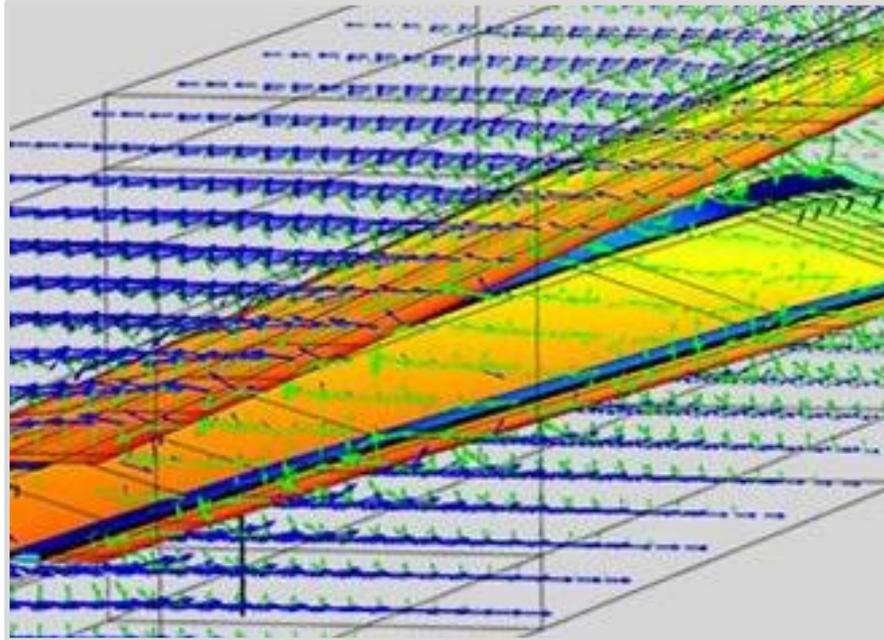
**A NATIONAL ORDNANCE AND BALLISTIC CENTER FOR TESTING WEAPONS SYSTEMS, ORDNANCE, ROCKET MOTORS, HAZARDOUS MATERIALS, AND COMMERCIAL PRODUCTS**

- Small, Medium, Large Caliber Ranges
- Rocket Range with Shoulder Fired Weapons Testing
- Drop Test Facility
- Arena Testing, 7 Test Ranges
- MIL-STD-2105 Insensitive Munitions Testing
- Full Environmental, Dynamics, Shock Facility
- Storage for Explosives and Propellants



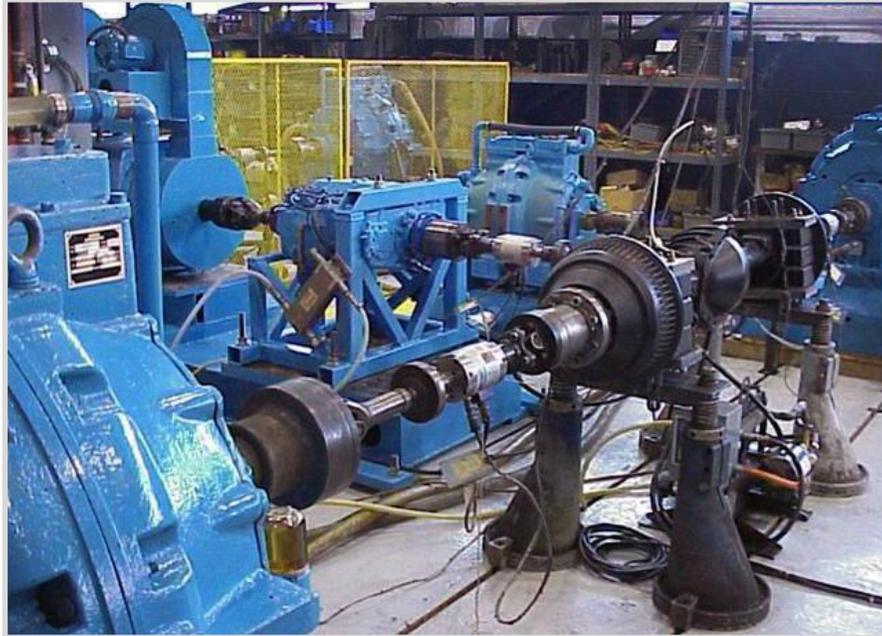
## EXPERT EMI/EMC SERVICES, IN-DEPTH TROUBLESHOOTING AND DESIGN ASSISTANCE ACROSS COMMERCIAL, AUTOMOTIVE, AEROSPACE, AND MILITARY INDUSTRIES

- Chemical Exposure Testing
- Electrical & Environmental Testing
- Mechanical Testing & Mechanical Shock
- HALT/HASS
- Dynamics, Climatic, Electrical, Ingress Protection Testing
- MIL STD UV & Blowing Sand/Dust
- Environmental Stress Screening
- Expertise in Engineering Non-Standard Test Procedures



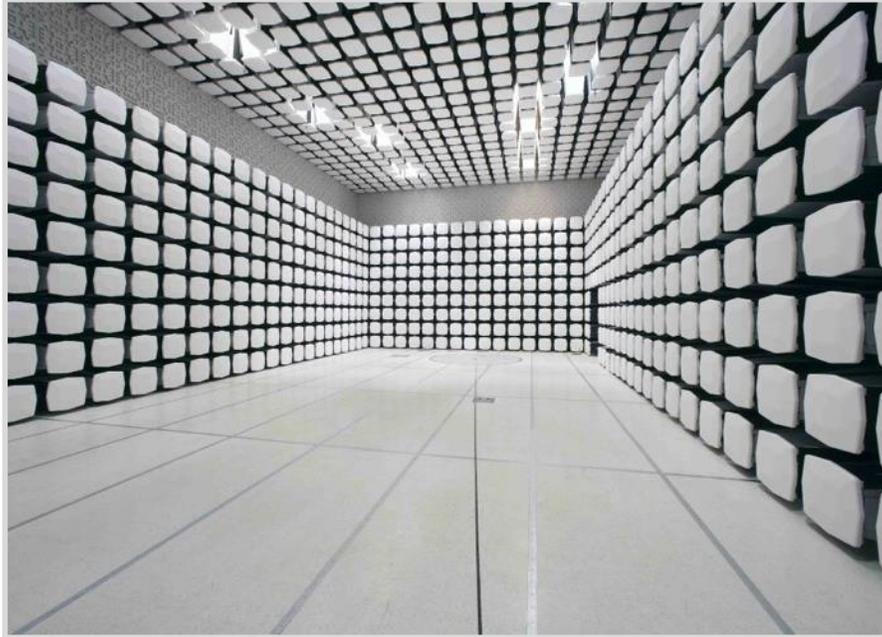
## A DEDICATED CENTER FOR THE DESIGN, ANALYSIS, AND TESTING OF MILITARY AND COMMERCIAL PROGRAMS

- 3D CAD & CAE
- Finite Element Analysis
- Structural & Thermal Analysis
- Computational Fluid Dynamics
- Failure Modes Effects Analysis
- Precision Mechanical Analysis
- Project Engineering of Unique Programs
- Interior & Exterior Ballistics Analysis of Projectiles & Solid Rocket Motors



**AN INDEPENDENT PRODUCT TESTING AND VALIDATION CENTER, WHICH SERVES MEDICAL, AUTOMOTIVE, MEDICAL, DEFENSE, AEROSPACE, ELECTRONICS, AND ENERGY SECTORS**

- Hybrid & Electric Vehicle Systems
- Mechanical & Fluid Dynamics Analysis
- Vibration & Sound Systems
- Dynamometer Powertrain Testing
- Climatic & Electrical Testing



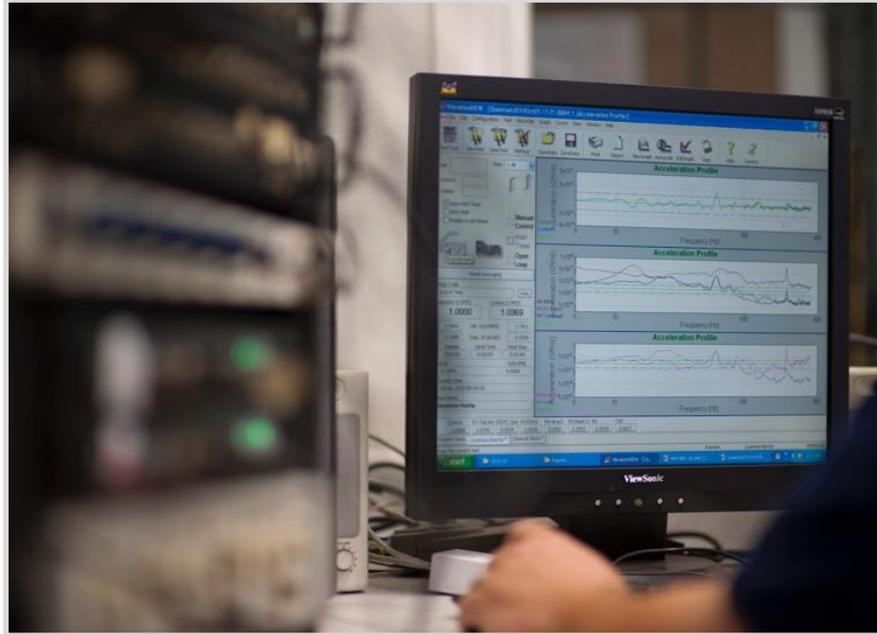
## A WORLD-CLASS PRODUCT COMPLIANCE AND REGULATORY LABORATORY IN SILICON VALLEY

- EMC/EMI with Five and 10 Meter Chambers
- Product Safety
- Verizon ITL for NEBS Testing
- Wireless Certification & Testing
- Over-the-Air (OTA) Testing
- Extreme Environmental Testing
- Robust Dynamics Capabilities
- International Certification Services
- 10 Microphone Acoustic Testing



**A MASSIVE FACILITY WITH ADVANCED ENVIRONMENTAL, MECHANICAL, EMI/EMC, AND DYNAMICS TESTING CAPABILITIES TO SERVE CUSTOMERS ACROSS SEVERAL SECTORS**

- Verizon ITL Approved NEBS and Fiber Optic Testing
- EMI, EMC, and HIRF Testing
- High Powered Single and Dual Shaker Systems
- HALT, Temperature, Altitude, Humidity, Icing, Wind
- Materials Testing
- Salt Fog, Sand/Dust, Solar Radiation, Mix Flowing Gas/Corrosive Atmosphere
- Electromagnetic Reverberation Testing
- Hardware/Software Compatibility, Including ZigBee, IoT, and HAN



AN AUTHORIZED USB, ZIGBEE, AND MoCA TEST LAB WITH EXPERTISE IN CONSUMER, MEDICAL, AEROSPACE, DEFENSE, AUTOMOTIVE, TELECOM, AND ENERGY SECTORS.

- USB Testing
- Performance Testing
- Wireless Testing
- Power Delivery
- FDA Wireless Coexistence
- Smart Home
- Smart Grid



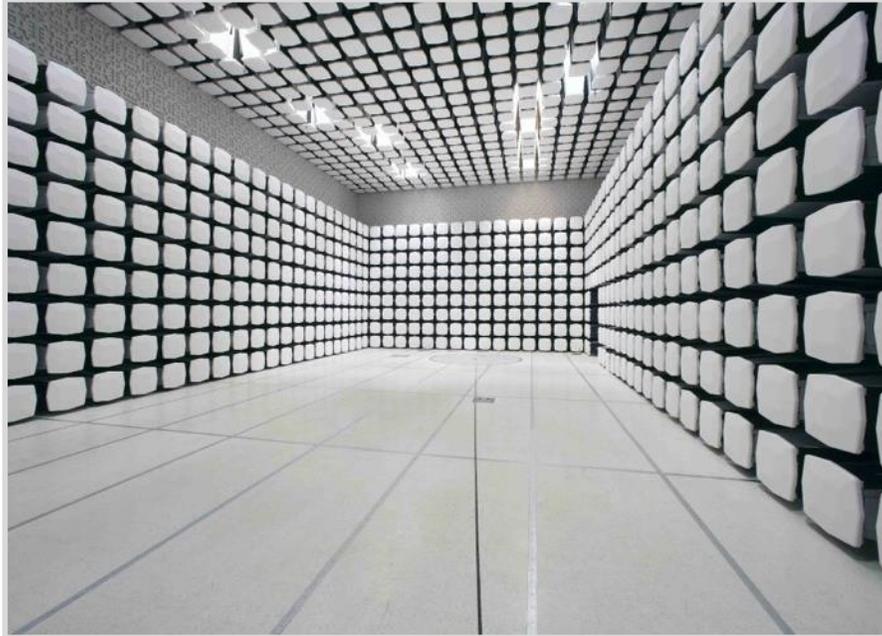
A 238,000 SQUARE FOOT LAB THAT SPECIALIZES IN  
LARGE-SCALE AND CUSTOM TESTING FOR THE DEFENSE,  
COMMERCIAL, NUCLEAR, AND AEROSPACE SECTORS

- Advanced Dynamic & Structural Testing
- EMI/EMC to EPRI, Nuclear Regulatory, FCC & DoD Standards
- 50+ Environmental Simulation Chambers/Systems
- High-Flow Steam & Water Capabilities
- Custom Test Designs for Large-Scale Projects
- Acoustic Noise Chamber Testing, Design, Refurbishment
- Nuclear Center of Excellence



**COMPREHENSIVE FACILITY PERFORMING PRODUCT AND MATERIAL, MECHANICAL, CHEMICAL, DURABILITY, RELIABILITY, AND PERFORMANCE VALIDATIONS.**

- Thermal/Altitude and Corrosion
- Vibration, Shock, HALT, Linear Acceleration
- Solar, Weathering, Dust, and Water Resistance
- Sand and Dust, Altitude, and Explosive Atmosphere
- Robotic Cyclic Engage/Disengage, Open/Close at Temperature
- Organic/Inorganic Characterizations and Failure Analysis
- Screening, Qualification, and Destructive Physical Analysis



## A FULL-SERVICE TESTING LAB WITH ADVANCED EMI/EMC, ENVIRONMENTAL, AND DYNAMICS CAPABILITIES FOR THE COMMERCIAL, MEDICAL, DEFENSE, AND AEROSPACE MARKETS

- Emissions, Immunity, and ESD
- FCC, IEC, Pre-Scan, and Mitigation
- Commercial Medical, Military, and Aerospace
- CBTL Certified Testing
- Fully Accredited 10-Meter Chambers
- Environmental and Dynamics
- Vibration, Shock, and Acceleration
- Multiple Combined Environments, Temperature, Vibration, Humidity, Shock, and Altitude
- ITSA Certified Package Testing
- Drive-in Thermal Chamber



THE PREMIER EXPERTS IN ENGINEERING CUSTOM CHAMBERS AND FIXTURES TO CONDUCT TESTING FOR A COMPLETE RANGE OF SPACE-RELATED PHENOMENA

- Environmental Testing
- Thermal Vacuum Cycling
- Class 10,000 and Class 100 Cleanrooms
- Hydraulic and Cryogenic
- Industrial Cleaning, Precision Cleaning
- Helium Leak
- Pressure Testing
- Vibration and Shock



A COMBINATION OF TWO LABS FOCUSED ON SERVING  
AEROSPACE, DEFENSE, AND TRANSPORTATION SECTORS

- Dynamic & Mechanical Testing
- Mechanical Shock
- HALT/HASS
- EMC/EMI
- Thermal Shock, Humidity, Thermal Cycling
- Salt-Fog Corrosion, Altitude, Vacuum
- Pressure & Fluid Susceptibility



## A CENTER OF EXCELLENCE IN THE HEART OF EUROPE SERVING TELECOM, CONSUMER ELECTRONICS AND AEROSPACE INDUSTRIES

- Verizon ITL for NEBS Testing
- EMC/EMI with Three, Five and 10 Meter Chambers
- Product Safety
- ESD, Surge, Lightning, and EMP
- Telecom and Wireless Certification & Testing
- Medical Technology Testing
- HALT/HASS
- Electrodynamic Shakers, Shock, Random, and Sine Vibration
- Temperature, Humidity, and Altitude Chambers
- Corrosive Effects (Mixed Flowing Gas, Salt Fog)
- International Certification Services (CE, FCC, VCCI, KCC etc.)
- 10 Microphone Acoustic Testing



## EXPERT TESTING FOR AEROSPACE, DEFENSE, MILITARY, MEDICAL, AND COMMERCIAL INDUSTRIES FROM TWO FACILITIES IN ORLANDO

- Hydraulic Testing: Extreme Temperatures & Flow
- High Speed Data Acquisition & Control Up to 1kHz
- MIL-STD 810, RTCA-DO 160, A2LA Accredited
- EMI Testing: Indirect Lightning Effects
- Environmental Testing: Combined Vibration & Flow



**A 20,000 SQUARE FOOT FACILITY WITH GENERATORS CAPABLE OF PRODUCING OVER 200,000 AMPERES AND 2.4 MILLION VOLTS.**

- CAD/FEA Modeling for Direct & Indirect Lightning Effects
- Design, Analysis, Testing of Systems and Subsystems to Determine Optimum Protection
- Multiple Stroke & Multiple Burst
- Training Courses for Lightning, Simulation, Modeling
- Consultation on Lightning Protection Design Projects
- Electrostatic Discharge, Near Strike, Precipitation-Static Simulations
- Customer Facility Lightning Testing



## A STATE-OF-THE-ART LABORATORY SERVING MILITARY, AEROSPACE, COMMERCIAL ELECTRONIC, MEDICAL, AND TELECOM CUSTOMERS

- EMI/EMC, Dynamics, and Environmental Test Services
- Three & 10-Meter Chambers
- ESD, Surge, Lightning, and EMP
- Electromagnetic Reverberation Chamber
- HIRF Radiated Immunity > 7200 V/m
- Seismic Simulation
- Electrodynamic Shakers, Shock, Random, and Sine Vibration
- Temperature, Humidity, and Altitude Chambers
- Acceleration, Sand & Dust, Explosive Atmosphere
- CE Mark, FCC, and Wireless Certification



**AN 83,000 SQUARE FOOT, STATE-OF-THE-ART  
LABORATORY, WHICH SERVES MILITARY, AEROSPACE,  
COMMERCIAL ELECTRONIC, TELECOM, AND MEDICAL  
SECTORS**

- EMI/EMC/ESD Testing
- Extreme Environmental & Dynamics
- Accredited for RTCA/DO-160 Radiated Susceptibility
- Reverberation Chamber
- HIRF Testing
- Indirect Lightning Testing
- Pyrotechnic Shock



## A NAVAL SEA SYSTEMS COMMAND CERTIFIED TEST AND RESEARCH FACILITY

- MIL-DTL-901E and MIL-STD-167 Full Test Capabilities
- Floating Shock Platforms for Test Loads to 125,000+ Pounds
- Deck Simulating Shock Machine (DSSM)
- EMI/EMC Testing
- Temperature and Humidity Testing
- Airborne & Structure Borne Noise Testing



## A SPECIALIZED FLUIDS TESTING LABORATORY WITH HIGH-LEVEL EXPERTISE IN SPACE APPLICATIONS

- Fluid Flow: Hydrogen - 7 lbs/sec (GH<sub>2</sub>), 700 gpm (LH<sub>2</sub>) Oxygen - 3.2 lbs/sec (GOX), 5000 gpm (LOX) Nitrogen - 60 lbs/sec (GN<sub>2</sub>), 5000 gpm (LN<sub>2</sub>)
- Cryogenic to 6000 psi Helium, Hydrogen, Oxygen, Nitrogen, Methane, Carbon Dioxide
- High Temperature at High Pressure (+1500 F at 2500 PSI)
- High Pressure Steam & Water Flow Test Systems (+700 F at 2800 PSI)
- Structure borne & Airborne Noise Measurement Capability
- Data Acquisition, Leak Detection, Life Cycling



## ONE OF THE LARGEST TEST FACILITIES IN THE U.S. COVERING MORE THAN 120 ACRES

- Airflow Capabilities >350 LBS/Min at 300 PSIG and up to 1500 F
- Custom Solutions, Including Mechanical and Thermal Systems for a Wide Variety of Applications
- Fuel and Hydraulic Component and Systems Testing up to 500 GPM at 250 PSIG
- Temperature Variation of Fuel and Ambient Environment
- Air, Fuel, Hydraulic Pressure, and Flow in Combined Environments



## A ROBUST EMI/EMC, PNEUMATICS, DYNAMICS, AND ENVIRONMENTAL TESTING SOURCE FOR COMMERCIAL AND DEFENSE CUSTOMERS

- Dynamics: Vibration, Shock, SRS, Acceleration
- Climatic/Environmental: Temperature, Humidity, Altitude, Combined Environments
- EMI/EMC: Emissions, Susceptibility, and High Power RF
- Space Simulation/Thermal Vacuum
- Blowing Sand, Blowing Dust, Rain, Wind, Solar Radiation



## EXPERTS IN EMC/EMI, ENVIRONMENTAL, AND DYNAMICS SERVING THE MID-ATLANTIC REGION

- EMI / EMC Testing
- Environmental Testing
- Dynamics Testing
- Approved Verizon ITL for NEBS Testing
- Product Safety
- Fungus Testing
- Hail/Stone Impact



## A LABORATORY DEDICATED TO BALLISTIC EXPERIMENTATION AND NON-DESTRUCTIVE TESTING OF MUNITIONS AND PROTECTION SYSTEMS

- Ballistic Resistant Material Impact Testing
- Firearm Testing
- Firearm Safety Device Testing
- Helmet Impact Testing
- NAVLAP Accredited, Lab Code 200818-0
- HOSDB 2017 Accredited Laboratory



**EXPERTS IN AUTOMOTIVE TESTING TO ENSURE SAFETY,  
RELIABILITY, LONGEVITY, DURABILITY, AND  
FUNCTIONALITY**

- Hybrid/Electric Vehicle Testing
- Transportation Vibration and Shock
- Climatic Testing with Extreme Environments
- Full Vehicle Drive-In Chambers
- Dynamometer Powertrain Testing
- Gravelometer and Gravel Bombardment
- Coatings and Paint Analysis



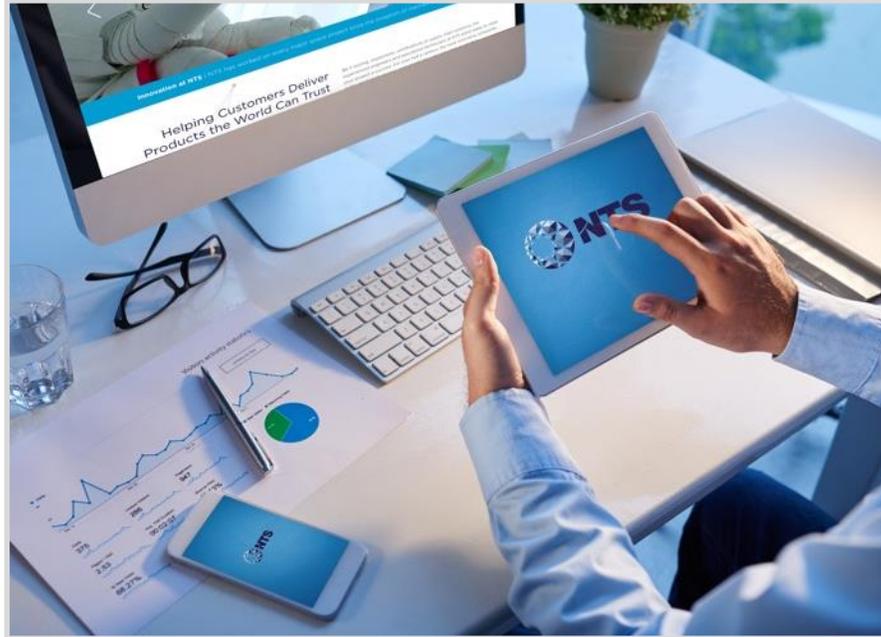
## ADVANCED COMMERCIAL AND GOVERNMENT AVIATION AND AEROSPACE TESTING FOR AIRCRAFT, AIRFRAMES, SYSTEMS, AND COMPONENTS

- A Full Range of RTCA DO-160 Testing Requirements, FAA Fire, MIL-STD-810, and MIL-STD-461.
- Dynamic, Environmental, EMI/EMC, Fuel Icing, Fuel Contamination, Fire, Direct Strike Lightning, and More.
- FAA and Private Aircraft Industry Development and Evaluation Programs
- Insight to Regulatory, Safety, and Service Considerations Early in the Design Process
- Up Front Review Services to Identify Potential Problems and Reduce Delays in the Product Development and Release Process



**NTS IS TRUSTED BY THE U.S. GOVERNMENT AND TOP DEFENSE CONTRACTORS TO SERVE THE DEFENSE INDUSTRY**

- Comprehensive Suite of Ballistic and Warhead Live Fire Testing and Characterization
- Insensitive Munitions and Safety Testing
- Engineering Services Design, FEA, Modeling, and Failure Analysis
- NIJ, MIL-STD, and UL Qualified Body Armor Testing
- All Military Standard Qualification Environmental, Dynamics, and Mechanical Testing
- Complete EMI/EMC Test Capabilities
- State-of-the-Art High Speed Photography, Instrumentation and Data Acquisition



## A SUITE OF ADVANCED TESTING AND CERTIFICATION SERVICES TO BRING PRODUCTS TO MARKET SAFELY AND QUICKLY

- EMC, EMI Testing and Pre-Scanning
- Global Market Access and International Approvals
- Product Safety Testing and CE Marking
- Electronics Reliability and Materials Testing and Evaluation
- Environmental and Durability Testing
- Root Cause Failure Analysis Chemical Exposure Testing
- Technology Certifications, Including DirecTV and MoCA



AN INTERNATIONAL LEADER IN PRODUCT  
QUALIFICATION AND TESTING SERVICES FOR NUCLEAR  
POWER, SMART GRID TESTING, AND  
SOLAR/PHOTOVOLTAIC TESTING

- EMC, EMI Testing and Pre-Scanning
- Electronics Reliability and Materials Testing and Evaluation
- Environmental and Durability Testing



## CUSTOM TESTING TO MEET FDA, PRODUCT SAFETY, AND OTHER ESSENTIAL CERTIFICATIONS TO BRING PRODUCTS TO MARKET QUICKLY

- EMC, EMI Testing and Pre-Scanning
- Global Market Access and International Approvals
- Product Safety Testing and CE Marking
- FDA Coexistence Testing
- Electronics Reliability and Materials Testing and Evaluation
- Environmental and Durability Testing
- Root Cause Failure Analysis Chemical Exposure Testing



## NTS PROVIDES QUALIFICATION AND TESTING FOR THE NEXT GENERATION OF NAVAL SHIPS, SUBMARINES, AND CARRIERS

- Naval Sea Systems Command Certified Full-Spectrum Test and Research
- Multiple Floating Shock Platforms for Shipboard Heavyweight and Pyro-Shock, Covering MIL-DTL-901E
- Pitch and Roll Testing
- DSSM Testing
- EMI/EMC Testing Co-Located with Shipboard Shock
- Hydraulic/Pneumatic Testing



**THE PRIMARY SUPPLIER OF SAFETY-RELATED EQUIPMENT,  
QUALIFICATION TESTING, AND SERVICES FOR NUCLEAR  
POWER PLANTS AND MANUFACTURERS**

- Qualified Equipment and Parts for Third-Party Qualification/Commercial Grade Dedication
- Equipment Qualification Testing: Radiation Aging, Thermal Aging, Cycle Aging, EMI, Seismic, and Accident (LOCA) Simulation
- Safety Relief Valve Testing: ASME OM Code, Set Pressure, Seat Leakage and Operability with Steam/Water/Air, and Repair Support
- Valve Qualification/Flow Testing: ASME QME-1, Hot and Cold Cycle Testing, Flow Interruption, Deflection and Modal Testing, Steam/Water/Air
- Snubber Services: ASME OM Code, Removal, Installation, Inspection, Repair, Refurbishment



## NTS HAS SUPPORTED EVERY MAJOR SPACE PROGRAM SINCE THE INCEPTION OF MANNED SPACE EXPLORATION

- Astronautics and Propulsion Testing
- Rocket Thrust Stand and Exhaust Duct Testing
- Space Simulation/Thermal Vacuum Cycling
- Extreme Environmental Testing, Including Pyroshock, High Intensity Vibration, and Launch Level Acoustics
- Cryogenic Component Tests, LH2, LO2, LN2, LNG
- High Pressure, High Flow Pneumatic Tests at Temperature, GHe, GN2, GH2, GO2, and GNG
- Precision Cleaning
- Advanced EMI/EMC Testing



**A SPORTS DIVISION DEDICATED TO TESTING PERSONAL SAFETY EQUIPMENT, WHICH IS USED BY ATHLETES AND RECREATION ENTHUSIASTS**

- Football, Baseball, Softball, Hockey, Lacrosse, Soccer, Equestrian
- NOCSAE, ASTM, DOT standards
- Twin-Wire Flying Arm Helmet Impact Machine
- Helmet Chin-Strap Testing: Tension and Roll-Off
- Linear Impact Cannon: Fires Baseballs, Softballs, Hockey Pucks, Golf Balls, Lacrosse Balls
- Piston for Impacts on Helmets (Helmet-to-Helmet Contact)
- Bat Testing: NCAA, USSSA and ASTM Bat Testing



**NTS OPERATES THE LARGEST GROUP OF VERIZON-CERTIFIED  
INDEPENDENT TEST LABORATORIES (ITL) IN THE WORLD**

- NEBS Testing, Verizon ITL
- EMC, EMI Testing and Pre-scanning
- Fiber Optics
- Wireless Testing and Certification
- Product Safety Testing and CE Marking
- Global Market Access and International Approvals