



MOOG OVERVIEW

EXECUTIVE SUMMARY

MOOG



Moog – When Performance Really Matters ®

- Founded in 1951 by Bill Moog
- Headquarters in East Aurora, NY
- Multi-national Company
 - Over 100 locations in 28 Countries
- Over 11,500 Employees Worldwide
- \$2.7 Billion in Revenue (FY 2018)
- Aerospace, Defense, Industrial, Medical
- Precision Control System Provider
- Traded on the New York Stock Exchange (MOG.A and MOG.B)
- People-oriented environment with emphasis on individual responsibility

Our Values

- Customer intimacy
 - ▶ Anticipating the needs and wants of our customers
 - ▶ Mutual trust between our employees, customers and suppliers
 - ▶ Fostering open dialogue
- World Class Support
 - ▶ Empowering our employees to do what's best for our customers
 - ▶ Striving for the highest levels of quality and turn-around time
- Performance excellency
 - ▶ Breadth of technology and solutions to solve difficult challenges



Worldwide Presence



Argentina
Australia
Brazil
Canada
Costa Rica

Finland
France
Germany
India
Ireland

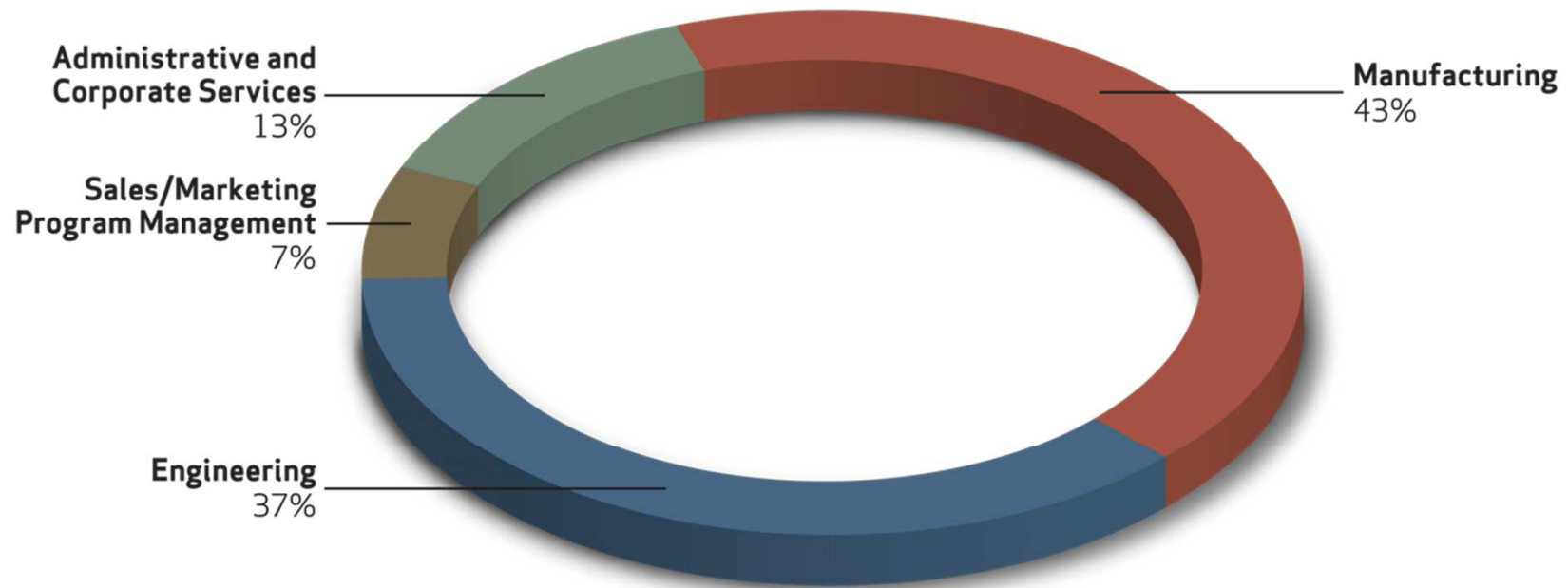
Italy
Japan
Lithuania
Luxembourg
Netherlands

Norway
Philippines
Singapore
South Africa
South Korea

Spain
Sweden
Switzerland
United Kingdom
United States

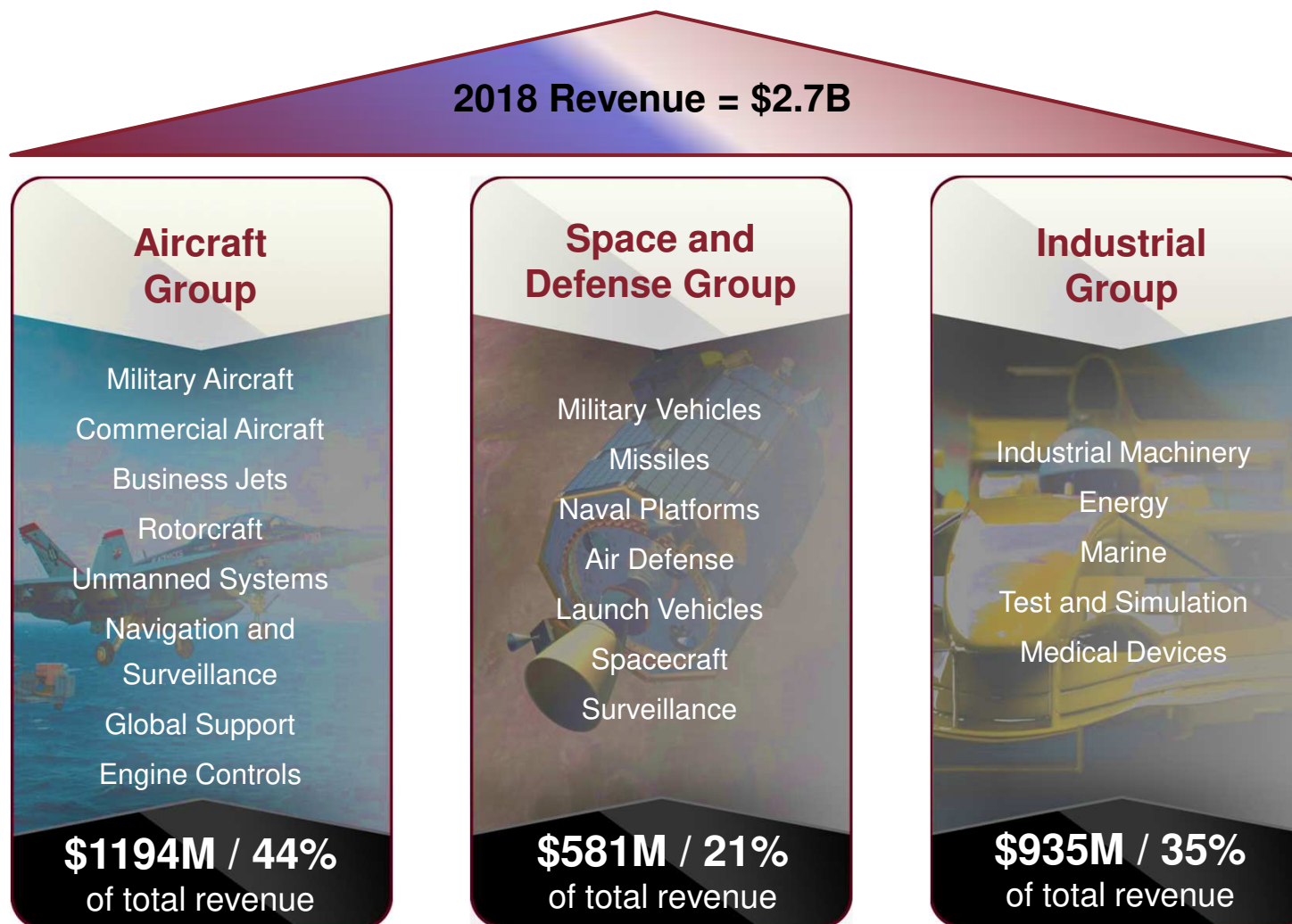
Headquarters in East Aurora, NY | Multi-national Company | Over 100 locations in 28 Countries | Over 11,500 Employees Worldwide

Competent Workforce



As of 11/02/2018

Three Operating Groups, Multiple Markets



FY'18 Sales / % of Total

Balanced Revenue Stream by Segment

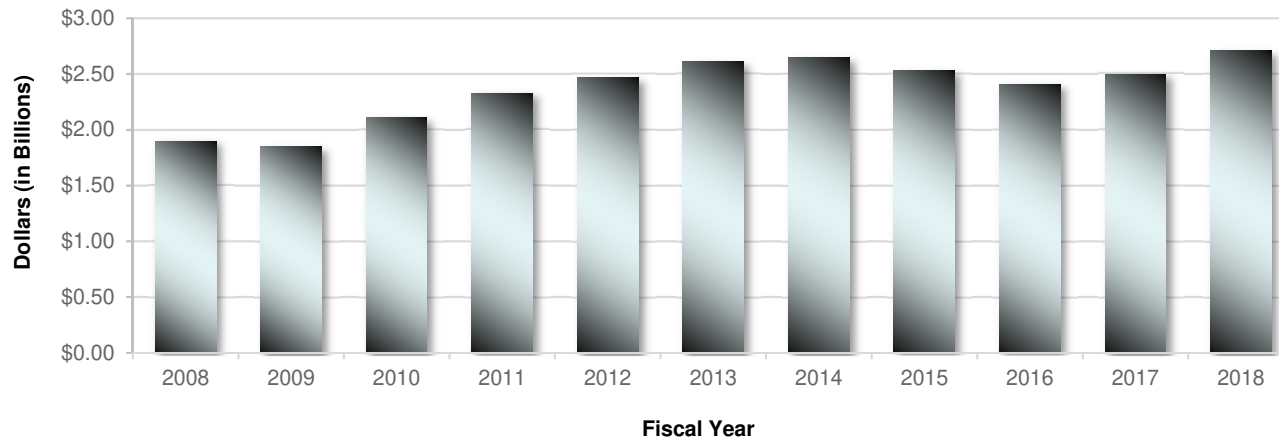


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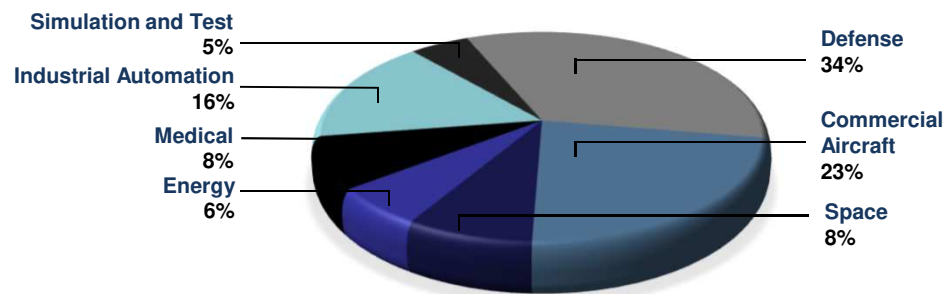
MOOG

Moog Financial Performance

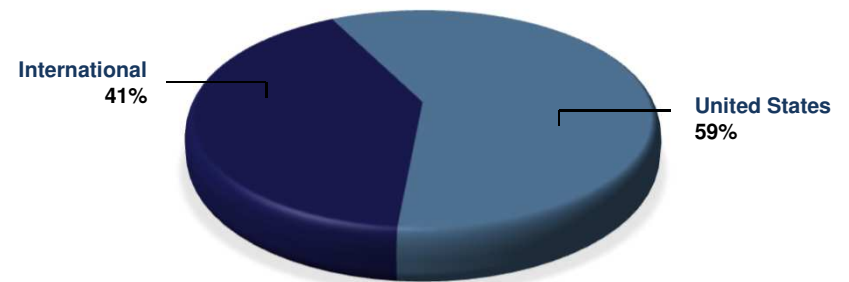
SALES PERFORMANCE



REVENUE BY MARKET



GEOGRAPHIC DISTRIBUTION



Moog Inc. Executive Organization



JOHN SCANNELL
CEO



DON FISHBACK
VP and CFO



PAUL WILKINSON
VP and
Chief HR Officer



MARK TRABERT
VP and President
Aircraft Group



ERIC BURGHARDT
VP and President
Aircraft Group



MAUREEN ATHOE
VP and President
Space and Defense Group



PAT ROCHE
VP and President
Industrial Group

Aircraft Group

- Integrated Flight Control Systems
- Critical Control Applications
- Aftermarket Services & Support



Aircraft Group Presence



USA

East Aurora, NY
Torrance, CA
 Fargo, ND
 Milwaukee, WI
Oklahoma City, OK
Ogden, UT
Salt Lake City, UT
Seattle, WA
Webster, MA



UK

Wolverhampton
Tewkesbury
Luton



India

Bengaluru



France

Toulouse



Philippines

Baguio City



Singapore



Brazil

San Jose
dos Campos



Worldwide Locations and
Global Workforce

Aircraft Group Global Facilities



East Aurora, NY



Torrance, CA



Wolverhampton, UK



Tewkesbury, UK



Baguio City, PH



Bengaluru, IN



Fargo, ND



Luton, UK



Milwaukee, WI



Ogden, UT



Oklahoma City, OK



Salt Lake City, UT



Singapore



Seattle, WA



Toulouse, FR



Webster, MA

Manufacturing/Operating Sites



East Aurora, NY

1,300 Employees



Torrance, CA

600 Employees



Wolverhampton, UK

440 Employees



Tewkesbury, UK

350 Employees



Baguio City, PH

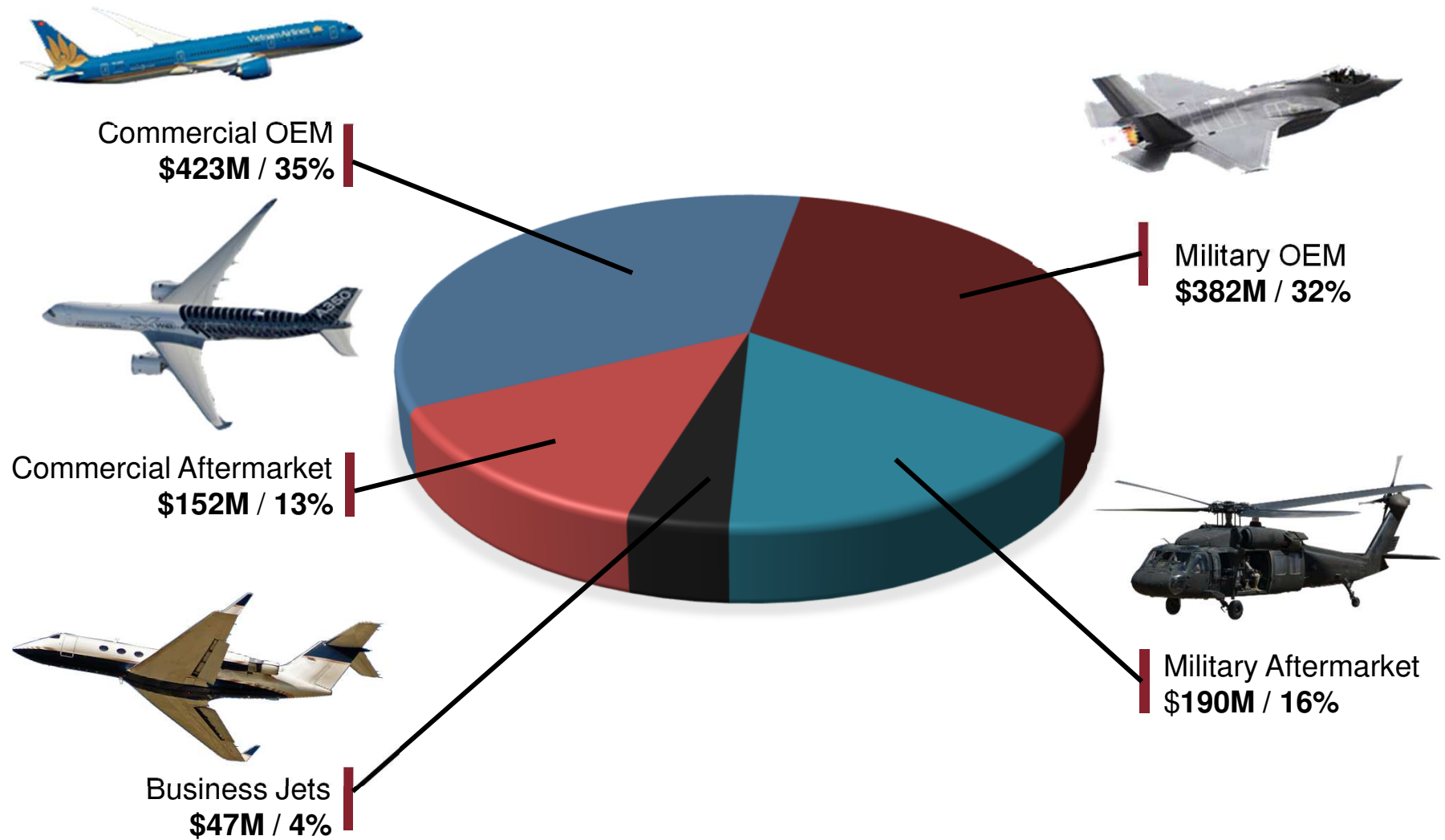
1,300 Employees

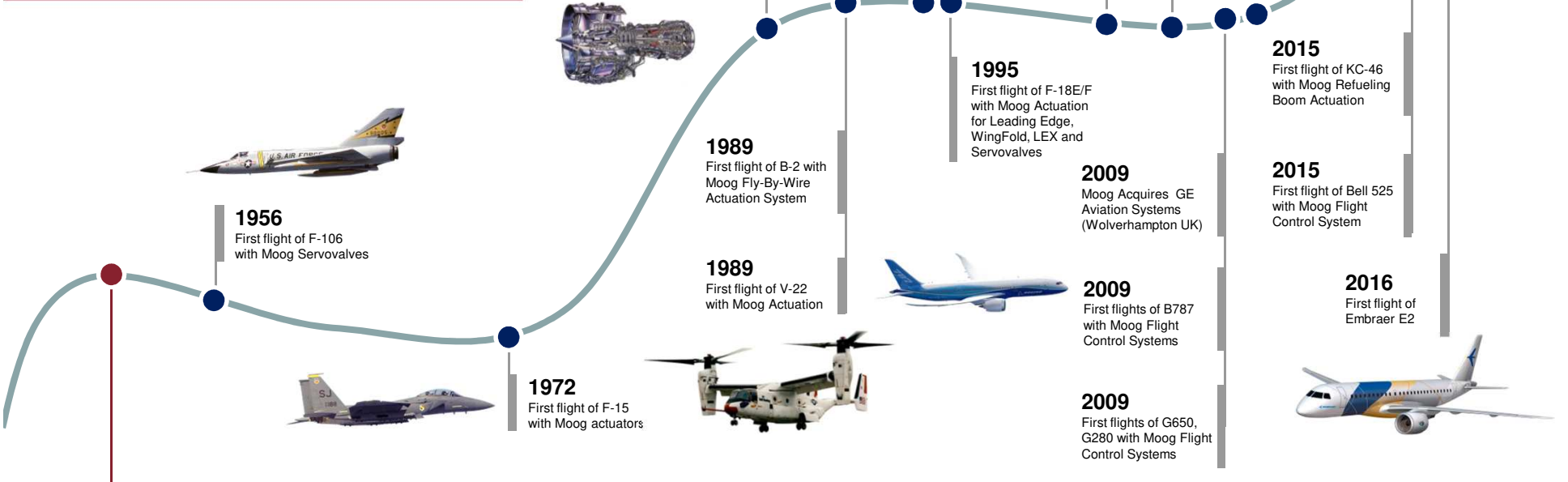


Bengaluru, IN

240 Employees

2018 Major Markets Served





Moog Valve Company Formed

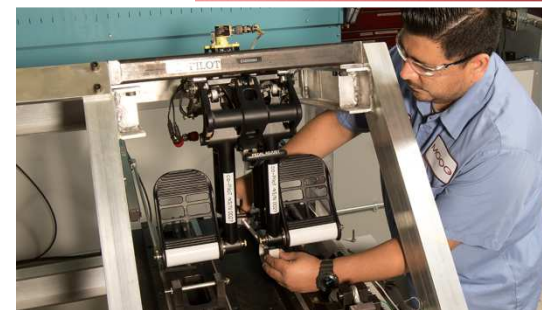
Aircraft Group Offerings

- Integrated Flight Control Systems
 - Military – Rotary Wing – Commercial
 - Business Jets
- Critical Control Applications
 - Engine Controls – Active Vibration Control –
 - Weapon Bay Door Drives –
 - Specialty Control Actuation -
 - Wingfold Actuation
- Critical Control Products
 - Flight Control Computers – Cockpit Controls – Navigation Aids
- Platform Integration
 - Qualification – Certification
- Manufacturing
 - Global Sourcing, Worldwide Manufacturing
- Aftermarket Services
 - R&O – Advanced Repair Technologies – Public Private Partnerships - Power By Hour



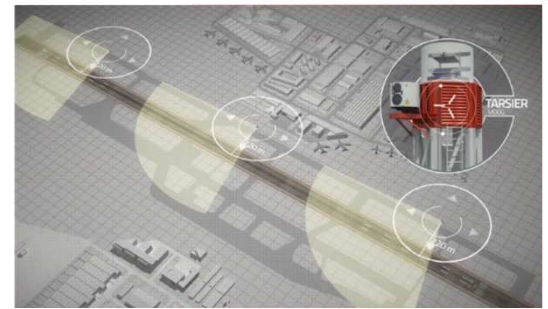
Aircraft Group Services

- Advanced Manufacturing and Repair
 - Traditional
 - 3D Additive Manufacturing
 - Design, production, inspection and post processing
 - Cold Spray
 - Corrosion, wear and damage repair
- Sustaining Engineering
 - Lab testing, analysis, fabrication/manufacturing, environmental and assembly testing, etc.
 - 3rd Party Repair and Overhaul Services
 - Mods and Upgrades
 - Obsolescence Management
- Commercial and Military Aftermarket
 - Power by hour
 - Technical support
 - Environmental and other testing capabilities
 - Lab services
 - Extensive repair development
 - Prognostics health management
- Integrated Logistics Services
 - Turnkey MRO, supply chain management, warehousing and inventory management
 - Import/export control and compliance

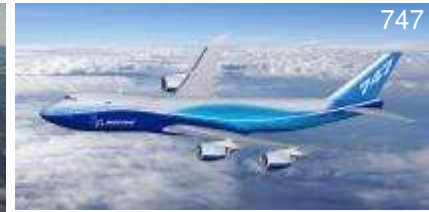


Aircraft Group Products & Systems

- Critical Control Applications in Airborne Environments
 - Engine Controls
 - Active Vibration Control
 - Weapon Bay Door Drives
 - Specialty Control Actuation
 - Wingfold Actuation
- Critical Control Products for Aerospace
 - Flight Control Computers
 - Cockpit Controls
 - Navigation Aids
 - Rotary and linear EM/Hydraulic/Hybrid Actuation technologies
- System Integration Systems
 - Hardware/software integration
 - Verification and validation
 - Sub-system qualification
 - Iron bird testing



Flight Controls for Commercial Aircraft



Military Aircraft

- High Performance Systems
 - ▶ Primary and Secondary Flight Control
 - ▶ Maneuvering Leading Edge
 - ▶ Weapons Bay Door Drive
 - ▶ Engine Control
 - ▶ Lift Fan Actuation
 - ▶ Wingfold and Specialty Controls
- Advanced Technology
 - ▶ Actuation and Control Electronics



F-35



F/A-18E/F



**Eurofighter
Typhoon**



KC-46

Increased Customer Value

Core Technologies



Moog Enabling Capabilities

- Systems Design, Integration & Analysis
- Software
- Test Facilities
- Qualification

Applications

- Primary Flight Controls
- Secondary Flight Controls
- Weapons Bays Door Systems
- Utility Systems

Platforms

- Fighters/Trainers
- UAVs
- Tankers/Transports
- Strategic Aircraft
- Rotorcraft

Systems Integration

PLUS

Proven Experience

- JSF F-35
- X-47B
- KC-46
- V-280

Enabled Adjacent Growth

- Power Management
- Vehicle Health Monitoring (CBM)
- Vehicle Management Computers
- Air Data Sensors and Systems

Control of Multiple Sub-systems

- Primaries
- WBDDS
- Nose Wheel Steering



Leveraging Systems Capability & Product Depth to Offer Our Customers Innovative Solutions

Flight Controls for Military Aircraft

F-35



V-22



F/A-18 E/F



X-47B



B-2



F-15E



F-16



Typhoon



Tejas



T-50



F-2



Hawk AJT



M-346



A400M



C-27



KC-46



UH-60



AW-129



IDF



CX/PX



Unmanned Air Systems (UAS)

- Systems, Products and Components
 - Primary and Secondary Flight Control
 - Maneuvering Leading Edge
 - Weapons Bay Door Drive
 - Wingfold, Nosewheel Steering and Utility Controls
- Wide Range of Capabilities
 - Fractional to Integral HP Actuators
 - Simplex and Redundant Designs
 - Hydraulic, Electromechanical and Electrohydrostatic Actuation Technology
- Mix of Catalog and Semi-Custom Products for Accelerated Demonstration Programs



X-47B



**BAE
Mantis**

Rotorcraft

- Flight Control Solutions
 - Main and Tail Rotor Actuation
 - Fly-by-Wire and Mechanical Input
 - Ballistically Tolerant Designs
 - Flight Control Electronics and Software
 - Cockpit Controls
- Active Vibration Control
- Specialty Actuation
 - Blade Fold, Weapons Stabilization and Utility Actuation
- Systems, Products and Components



V-22



AW129 ATAK



UH-60



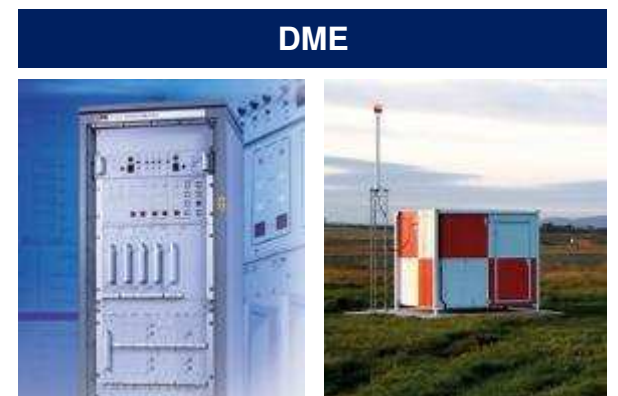
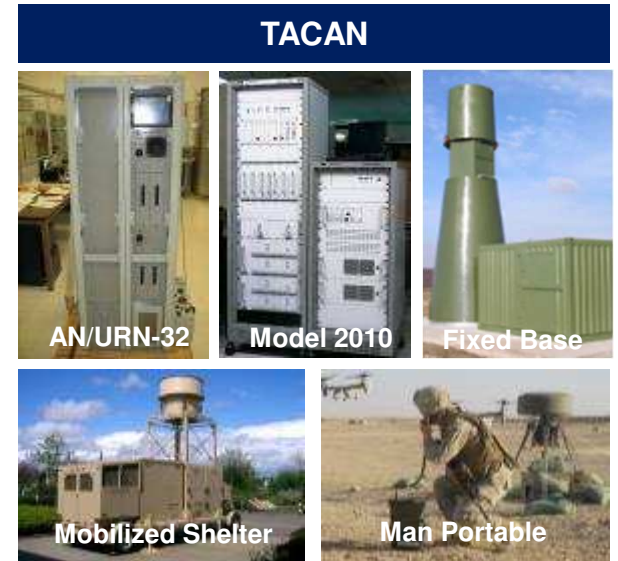
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Navigation Aids and Surveillance Systems (NASS)

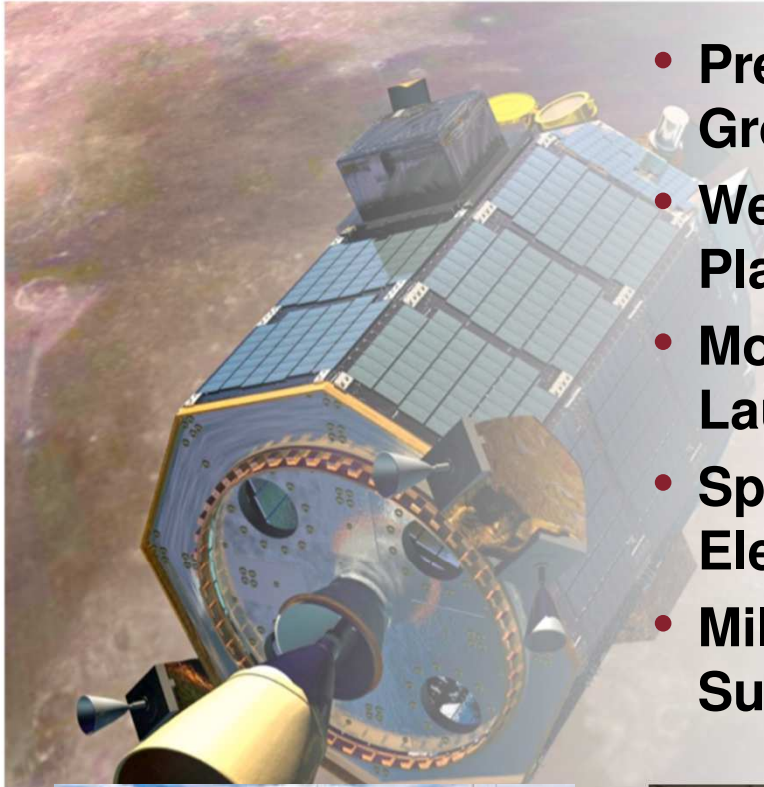


Navigation and Surveillance Systems

- Navigation Aids for Civil and Military Aviation
- Surveillance Systems and Products for Aviation and Maritime Needs
- Design and Manufacturing in US and EU
- Market Leader in TACAN Systems
- Several Major Active Programs
- Key Products:
 - TACAN
 - DME
 - DF Systems
 - Tarsier® Runway FOD Detection
 - Antennas



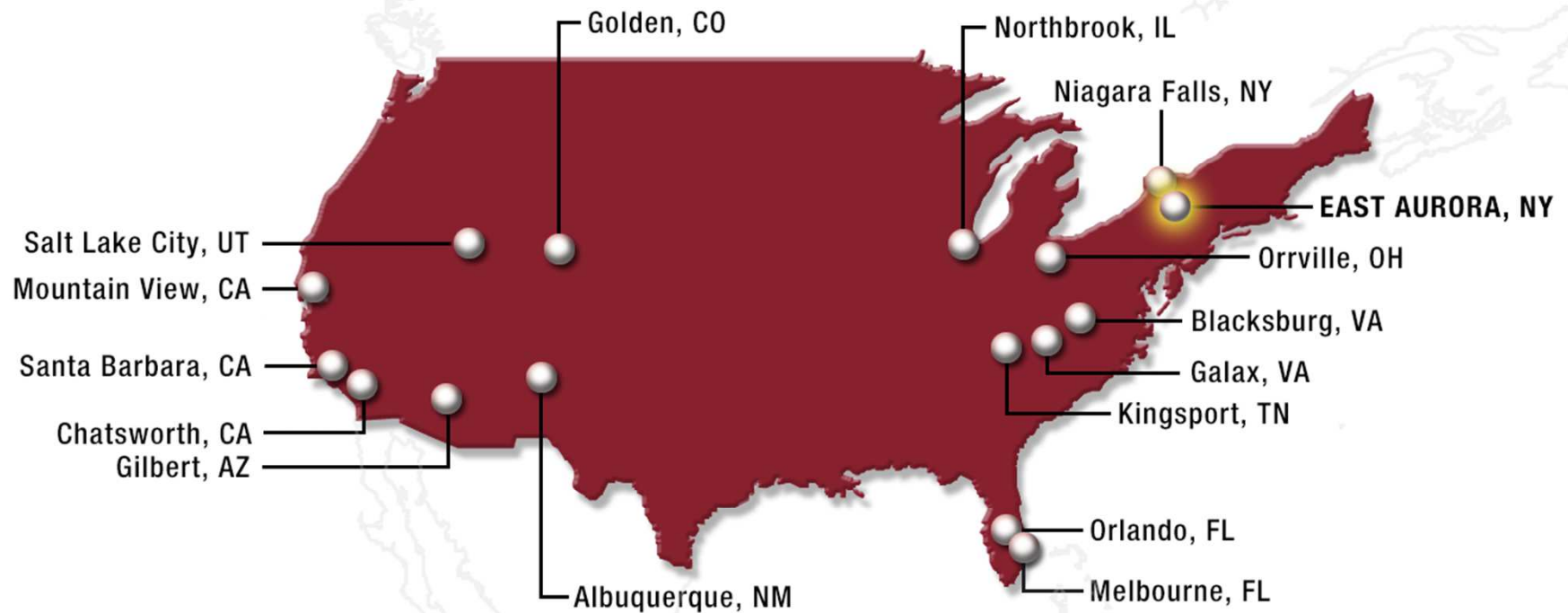
Space and Defense Group



- Precision Motion Control for Military Ground Vehicles, Naval Ships and Missiles
- Weaponization of Air, Land and Sea Platforms
- Motion and Fluid Control Solutions for Launch Vehicles and Spacecraft
- Spacecraft Avionics and Payload Electronics
- Military, Commercial and Industrial Surveillance Systems



Space and Defense Group United States Locations



Space and Defense Revenue

FY 2018 Sales
\$581M



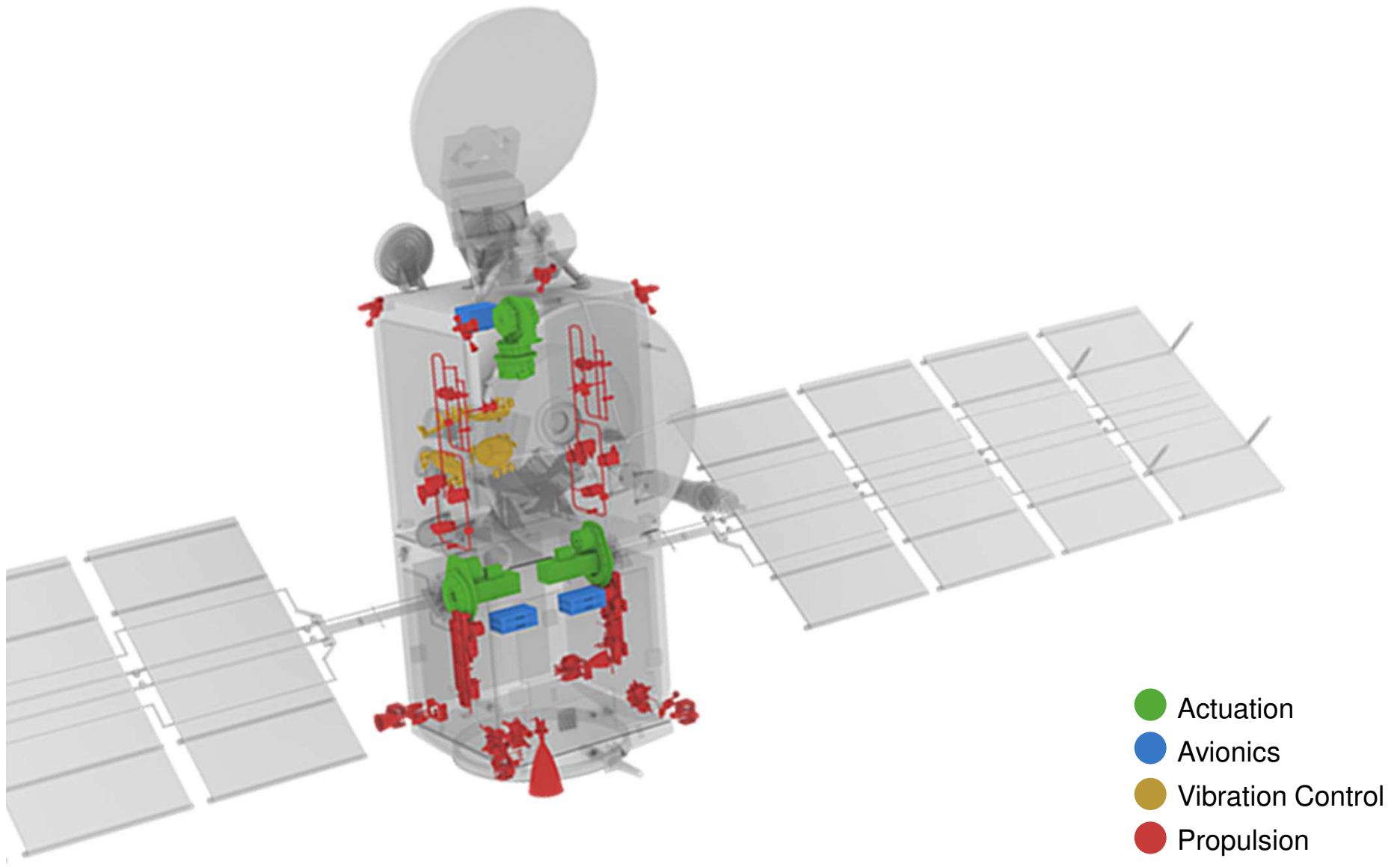
As of 11/02/2018

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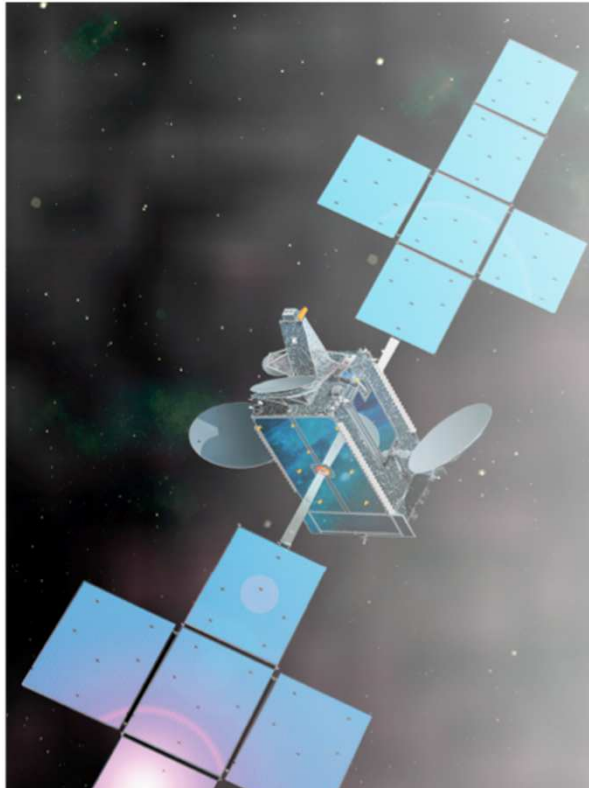


Space

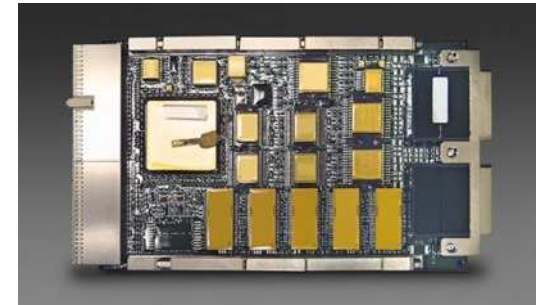
Satellite Controls



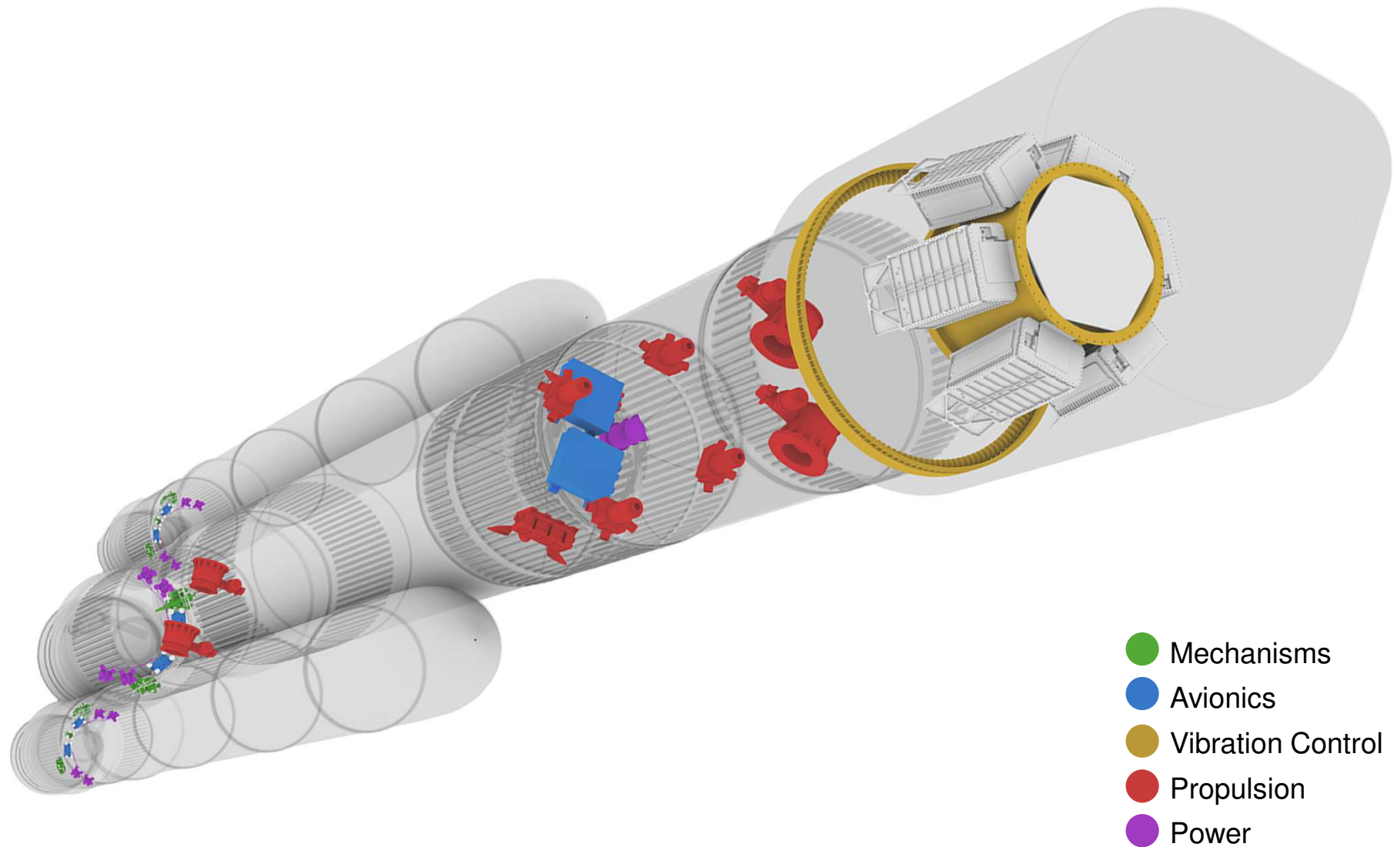
Spacecraft Controls



- **Chemical and Electric Propulsion**
 - Chemical Rocket Engines
 - Valves, Regulators and Flow Controllers
- **Avionics**
 - Command and Data Handling
 - Power Management
 - Motor Controllers
 - GPS Receivers
- **Positioning Mechanisms**
 - Rotary and Linear Actuators
 - Gimbals for Antenna and EP Thrusters
 - Solar Array Drive Assemblies



Launchers



Launchers and Space Vehicles



- Structures and Payload Accommodation
- Avionics, Power and GNC
- Actuation Systems
- Propulsion
- Environmental Control



A photograph of several military soldiers in full combat gear, including helmets and tactical vests, moving across a dry, grassy field under a bright, cloudy sky. The soldiers are seen from behind, moving away from the camera. The word "Defense" is overlaid in the center in a bold, dark red font.

Defense

Defense – Air



- Precision Missile Steering and Seeker Motors
- Divert and Attitude Control
- Gun Turret Control Systems
- Weapon Stores Management Systems
- Helicopter De-Ice System Slip Rings
- EO/IR Target Acquisition Components



Air Defense Systems



- **Missile Steering and Seeker Controls**



Tactical Control
Actuation System



Hypersonic Control
Actuation System



- **SMS for Guns and Rockets and Weapons**
- **EO/IR and De-ice Slip Rings**



Stores Control Panel



SMS Third Party Interface
with L3 ForceX Widow®

Defense – Land

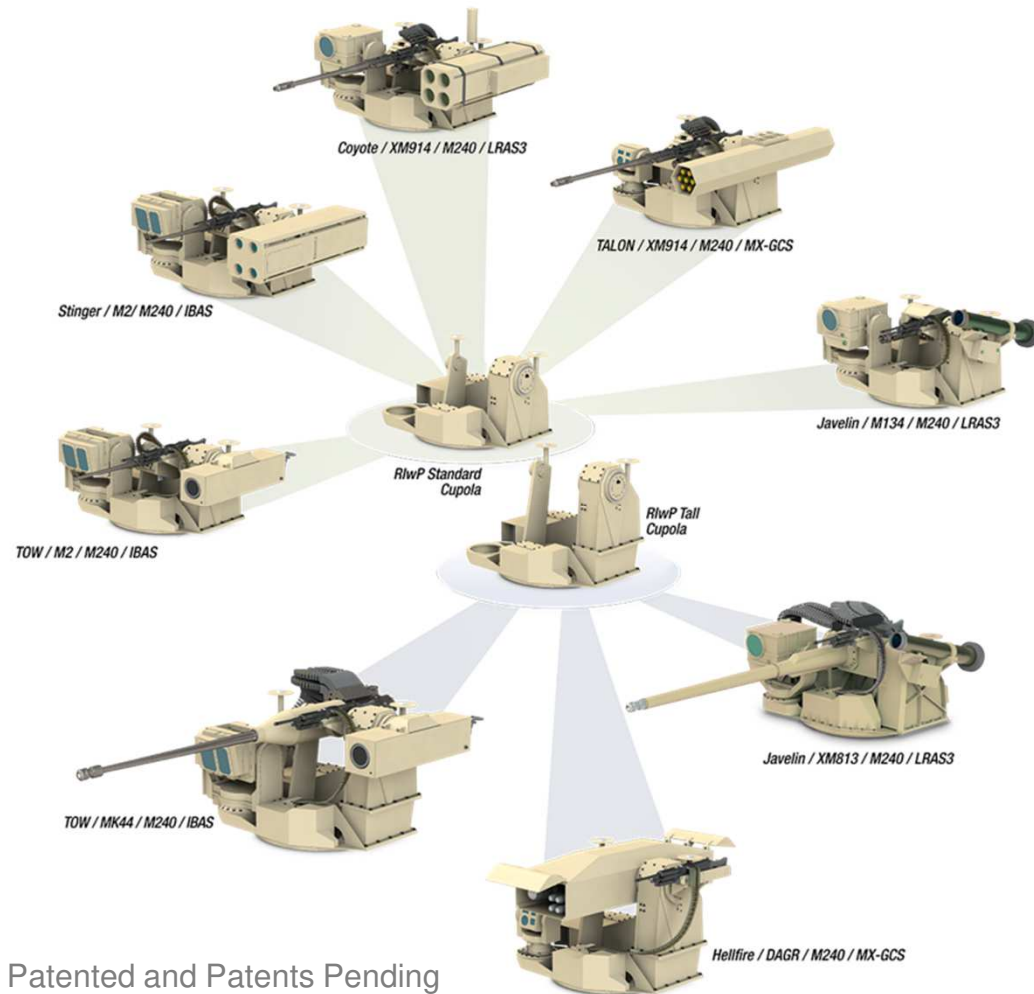


- Turreted Weapon Systems and Integration
- Stabilized Motion Control for Turrets, Launchers, Expeditionary Radar and Sighting Systems
- Remote Weapon Operation and Fire Control
- Conversions and Upgrades
- Turret, Radar and Gimbal Components
- Counter-UAS Solutions



Land Defense Systems

RIP RIwP (Reconfigurable Integrated-weapons Platform)



Patented and Patents Pending



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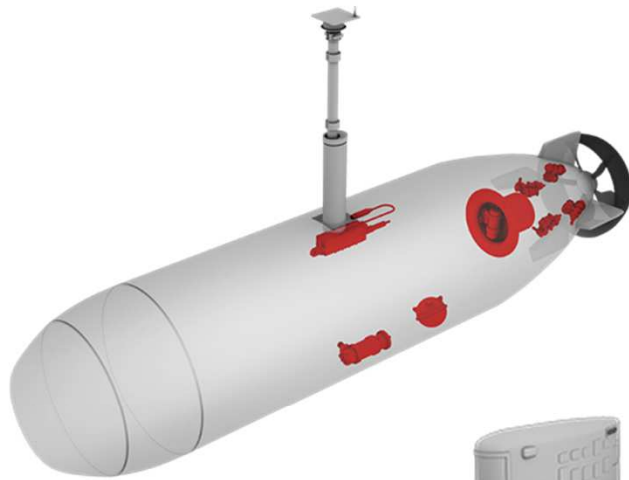
Defense – Sea



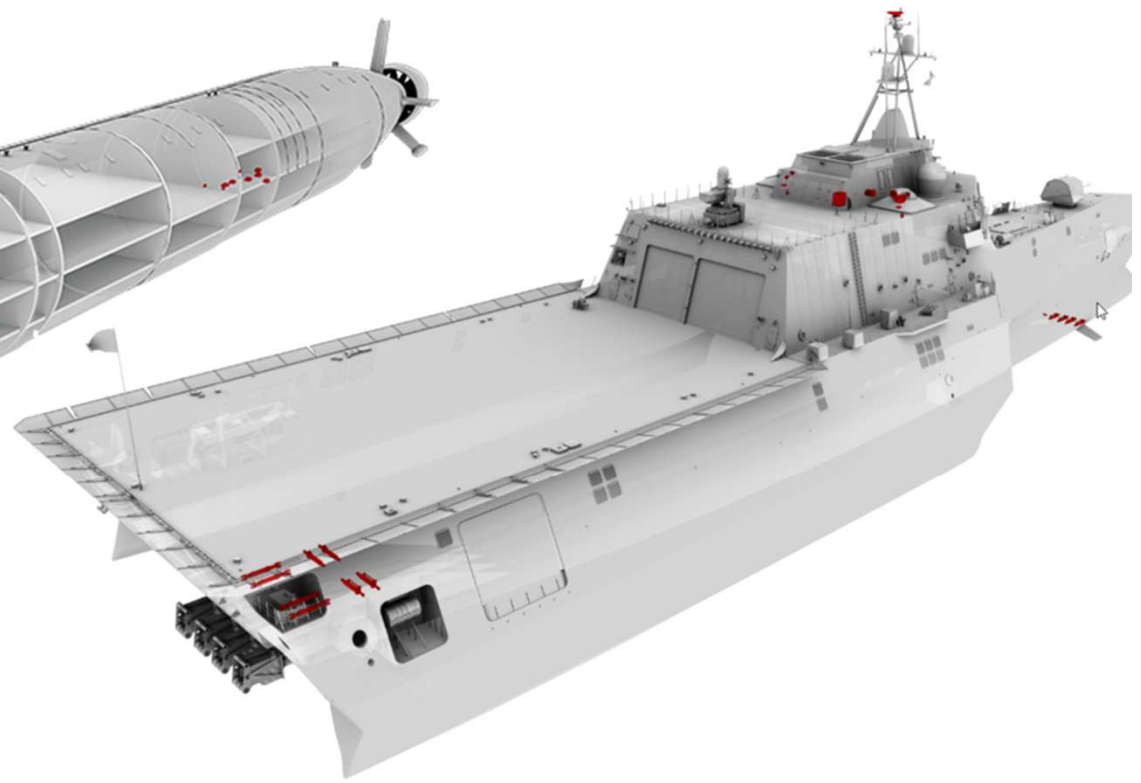
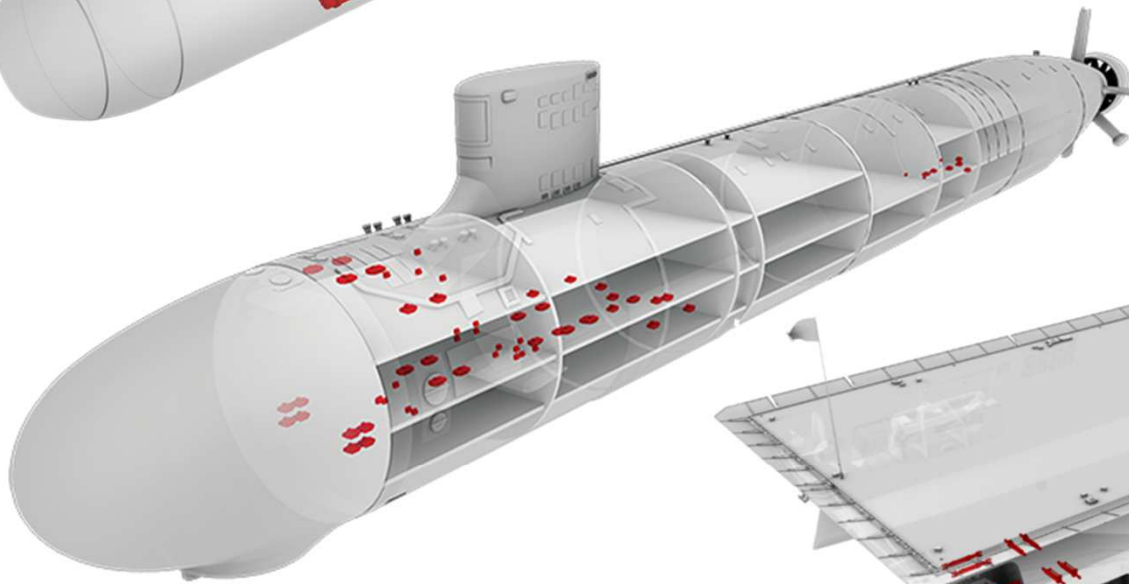
- **Submarine Quiet Actuation Control**
- **Unmanned Undersea Vehicle (UUV) Quiet Propulsion and Actuation**
- **Torpedo Steering Control**
- **Turret Motion Control and Stabilization**
- **Weapon Stores Management Systems**
- **EO/IR, Radar and Turret System Components**



Naval Defense Systems



- **Propulsion and Controls for UUV**
- **Subsea Quiet Actuation for Nuclear Submarines**
- **Surface Ship Weapons and Stabilization**



Surveillance and Sensor Integration



- **System Integration for Military, and Commercial Applications**
- **Camera Systems and Enclosures**
 - Short, Mid and Long Range
 - Thermal and Custom Solutions
- **Pan and Tilt Positioners and Components**
- **Tripods and Poles**
- **Video Tracking Cards and Systems**
- **Counter-UAS Solutions**





Power and Data

Power and Data, Motion Control Components



- **Multi-Component and System Level Solutions for Electro-Optics/Infrared Sensors**
- **Aircraft Servos and Utility Actuators for UAVs**
- **Communication Networking Ethernet Switches, Media Converters, Optical Transceivers**
- **Motors, Resolvers, Slip Rings for Solar Array Drive Assemblies, Armored Vehicle and Remote Weapon Station Turrets**

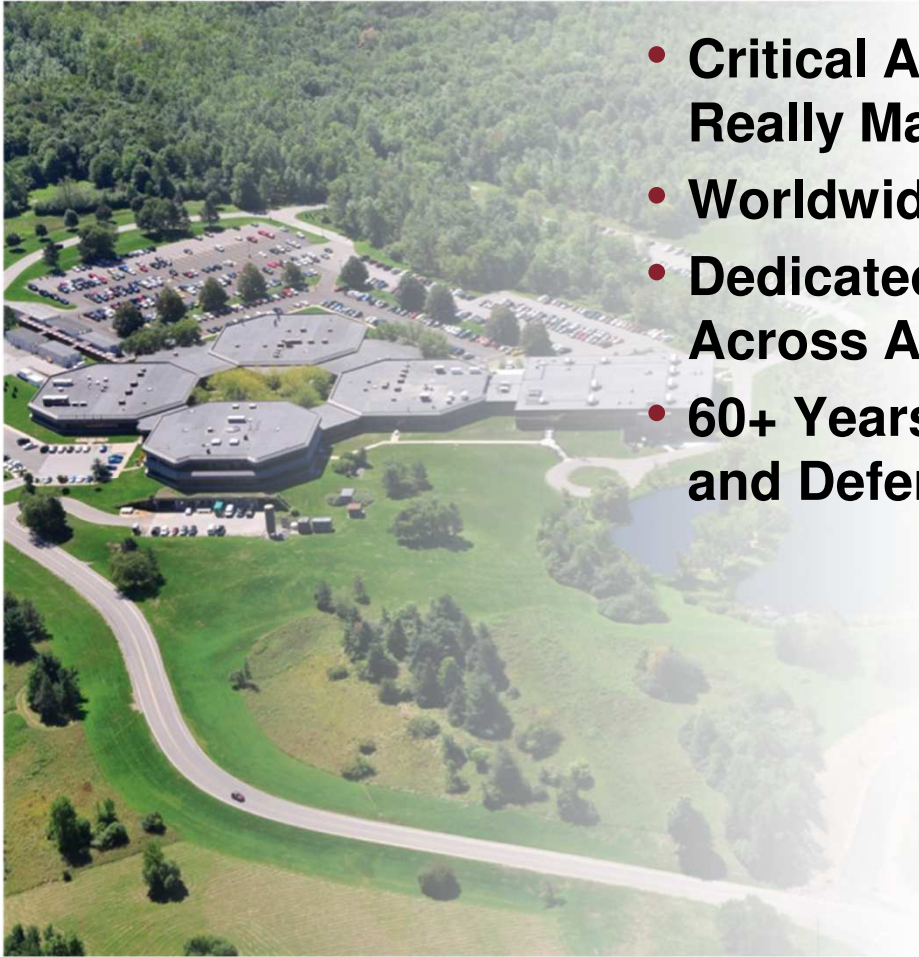


Industrial Group

- **Motion Control Slip Ring & Marine, Products, Solutions and Services**
- **Industrial Machinery**
- **Energy**
- **Test and Simulation**
- **OEM Medical Device Components**



Summary



- **Critical Applications When Performance Really Matters**
- **Worldwide Manufacturer**
- **Dedicated, Talented, Ambitious People Across All Disciplines**
- **60+ Years of Heritage in the Aerospace and Defense Markets**

Commitment to our customers, partners and employees