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MISSION CRITICAL SOLUTIONS FOR DEFENCE

MOOG

WORLD CLASS MOTION CONTROL

Moog is a leading global supplier delivering motion control and electronic solutions to the military. With a heritage in defence dating back to the early 1950s, Moog customers recognise us for accurate weapon systems, fast ammunition handling, precise steering control of missiles, and near silent actuation for submarines.

Moog addresses needs by delivering battle proven solutions and innovative technologies allowing you to create more efficient systems with lower operations and maintenance costs. In Europe and Australia, we have a heritage spanning more than 60 years and have fielded nearly 10,000 axes of high performance motion control.

KMW PZH-2000

General Dynamics LAV-25

Lockheed Martin AC-130

Patria AMOS

Rheinmetall MLG27

BAE Systems CV9035

COMPREHENSIVE DEFENCE SOLUTIONS

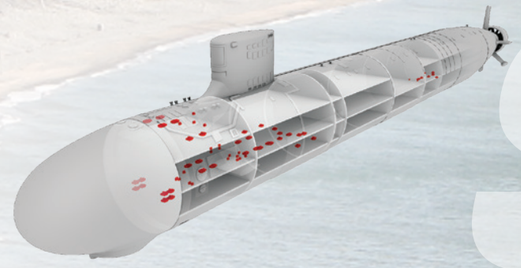
Moog meets the demands of today's military operations with motion control products, integrated subsystems and full systems. Military forces around the globe trust Moog with speed of delivery, absolute reliability and lasting performance. Engineering expertise, rapid prototyping, modelling, and complex integration are some of the capabilities that allow Moog to create design solutions to meet your exacting specifications.

AIR

- Multi-Platform Weaponisation Systems
- Precision Missile Steering
- Divert and Attitude Control
- Guidance and Navigation Control
- Gun Turret Control Systems
- Precision Stabilisation of Electro-Optical Sight Systems

LAND

- Weapon Systems Integration
- Stabilised Motion Control for Turrets, Expeditionary Radar and Sighting Systems
- Remote Weapon Operation and Fire Control
- Non-Lethal Stand-Off Systems
- Conversions and Upgrades
- High Performance Rotary Joints and Actuators
- High Bandwidth Communication Electronics



SEA

- Ammunition Loaders
- Naval Gun Motion Control Systems
- Quiet Actuation Control
- Multi-Platform Weaponisation Systems
- Weapons Stabilisation Platforms
- Non-Lethal Stand-Off Systems

AIR

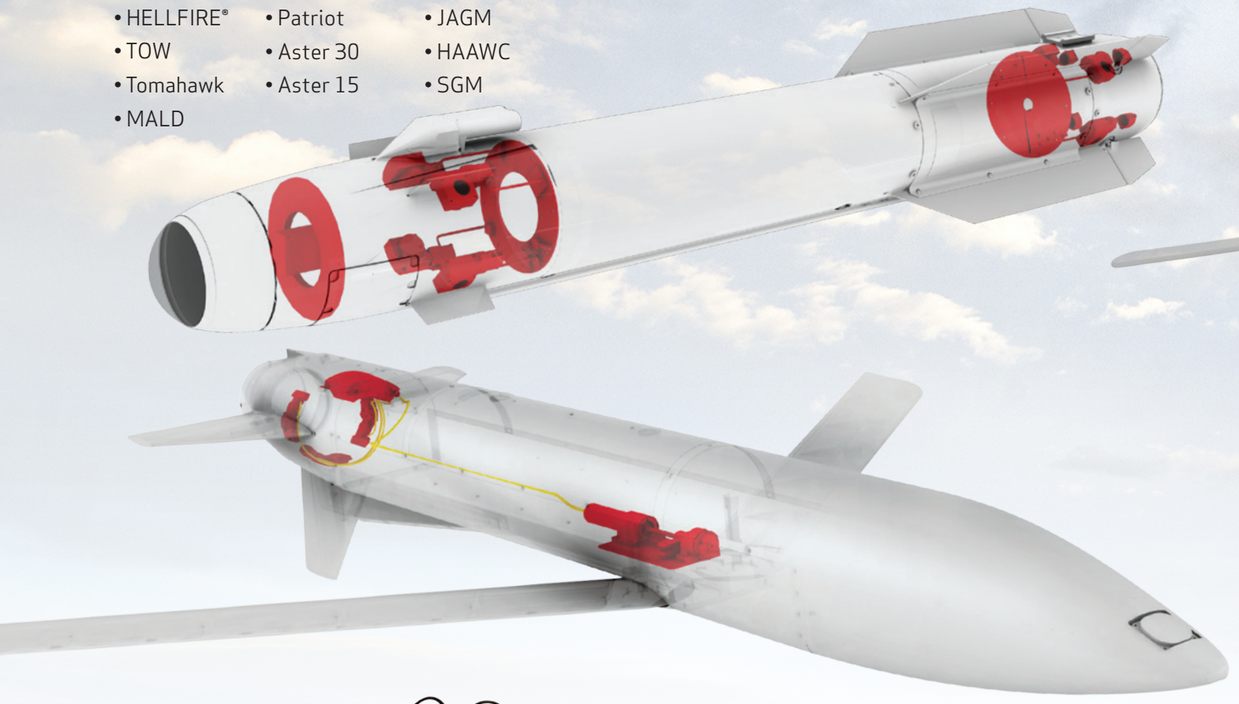
MISSILES

Moog provides innovative fluid and steering controls for missiles and munitions. As a leader in flight control systems, we have delivered hundreds of thousands of fin actuation systems. Integrated solutions include cold and warm gas divert and attitude control thrusters, low-cost fin control actuation, fin deployment systems and thrust vector control systems. Complete systems include:

- Fin Control Actuation Systems
- Flight Control Computers
- Wing Deploy Actuation
- Seeker Motors

MAJOR MISSILE PLATFORMS

- HELLFIRE®
- TOW
- Tomahawk
- MALD
- Patriot
- Aster 30
- Aster 15
- JAGM
- HAAWC
- SGM



TACTICAL CONTROL ACTUATION SYSTEM

LONG RANGE FIN AND WING DEPLOY ACTUATION

SUPERSONIC CONTROL ACTUATION SYSTEM

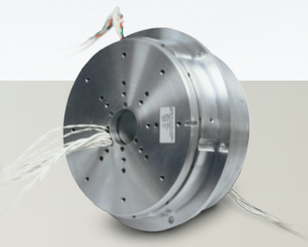
HYPERSONIC CONTROL ACTUATION SYSTEM

HELICOPTER SLIP RINGS

Rotorcraft place tough demands on slip ring technology because of equipment requirements and environmental conditions. From de-ice applications (high rotational speed, exposure to weather conditions and high vibration) to weapon stations and electro-optic sensor systems (high bandwidth signal transmission), helicopter slip rings must perform reliably and consistent with latest product advancements.

Employing a combination of precious metal fibre and brush technology for signal and power transfer, we are qualified to meet the most demanding applications effectively and economically. Customers really value Moog's heritage and we have been recognised as the leader in slip ring technology for rotorcraft applications.

DE-ICING SLIP RING



EO/IR GIMBAL ASSEMBLY

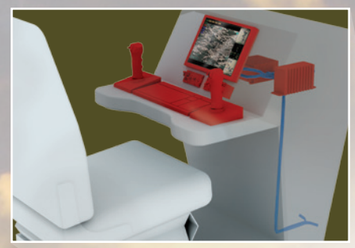
AIR (CONTINUED)

WEAPON STORES MANAGEMENT SYSTEMS (SMS)

The Third Generation Weaponisation System is a digital Weapon SMS controller that interfaces with targeting sensors, operator stations and command-and-control systems to ensure seamless communication from input commands through target acquisition and weapon fire or release.

This proven, lightweight rugged system is an affordable solution to stores management on air, land, and sea platforms. The SMS leverages Moog's extensive experience in systems integration, internal software development, weapons technology, and fire control solutions.

The flexible modular design of the SMS enables fast delivery, rapid integration and future upgrades to the sensors, avionics, and weapons ensuring the SMS's scalability for future mission requirements and weapons expansion. The SMS is a COTS product sold as a customised kit from simple guns and rockets to smart weapons with mixed stores.



SMS THIRD PARTY INTERFACE WITH L3 FORCEX WIDOW® MISSION MANAGEMENT SYSTEM

BLACK HAWK PLATFORM SMS INTEGRATION

CARAVAN PLATFORM SMS INTEGRATION

DUAL RAIL LAUNCHER WITH HELLFIRE INTERFACE UNIT (DRL)

DIGITAL SMS COMPONENTS

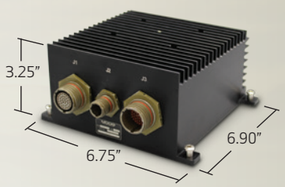
STORES CONTROL PANEL (SCP)
WIDTH (NOT SHOWN IN PIC): 5.85"

ENHANCED STORES MANAGEMENT COMPUTER (E-SMC)

ENHANCED STORES INTERFACE UNIT (E-SIU)

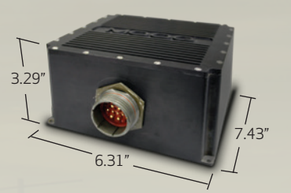
GUN ROCKET UNIT (GRU)

STORES CONTROL PANEL (SCP)



ENHANCED STORES MANAGEMENT COMPUTER (E-SMC)

STORES INTERFACE UNIT (SIU)



REMOTE POWER UNIT (RPU-6)

LAND

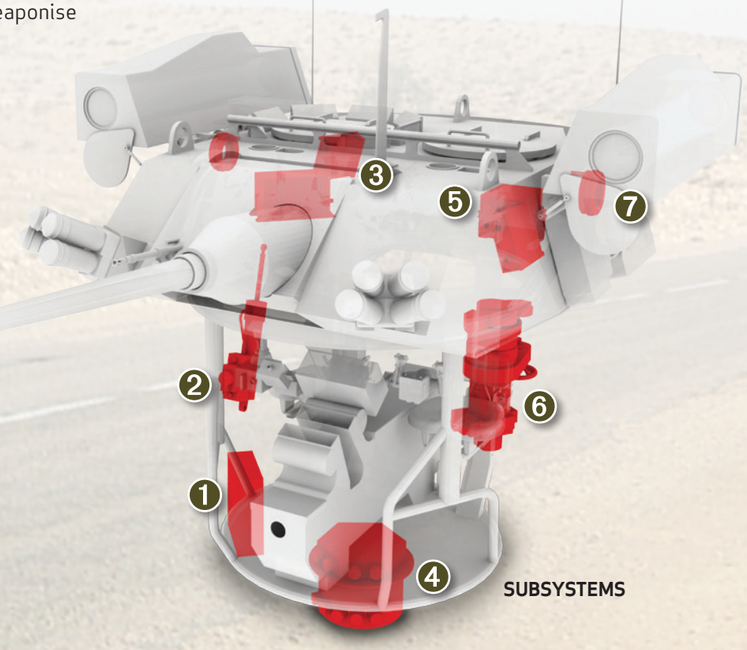
FLEXIBLE MISSILE PLATFORM (FMP)

Meeting an increased demand for ground launched anti-tank/anti-air weaponisation, Moog has applied key technologies of launch control, aiming and platform stabilisation to the mechanical integration required to achieve reliable and consistent launch parameters.

Global MODs already trust and rely on Moog's expertise in stabilisation, fire control, power distribution and management, and weapon stations. The FMP exploits multiple Moog technologies and these are a foundation for anti-tank/anti-air missions required by today's dynamic military forces. Flexible in both mission and missile, the FMP is an affordable way to weaponise a variety of vehicles.

TURRETED WEAPON SYSTEMS

Moog designs, manufactures and integrates weapon systems, sub-systems and products for a variety of global military vehicle platforms. You can gain access to the expertise in fire control, gun control, weapon stabilisation, and weapons integration found on over 30 of the world's leading military vehicle platforms including manned and unmanned turrets and remote weapon stations. Small, medium and large calibre weapons are equally supported by Moog technology.



SUBSYSTEMS

1. DIGITAL DUAL AXIS CONTROLLER
2. ELEVATION ACTUATOR
3. GUN CONTROL UNIT (GCU)
4. SLIP RING
5. FIRE CONTROL COMPUTER
6. AZIMUTH ACTUATOR
7. TORQUE MOTORS

RIwP (RECONFIGURABLE INTEGRATED-WEAPONS PLATFORM)

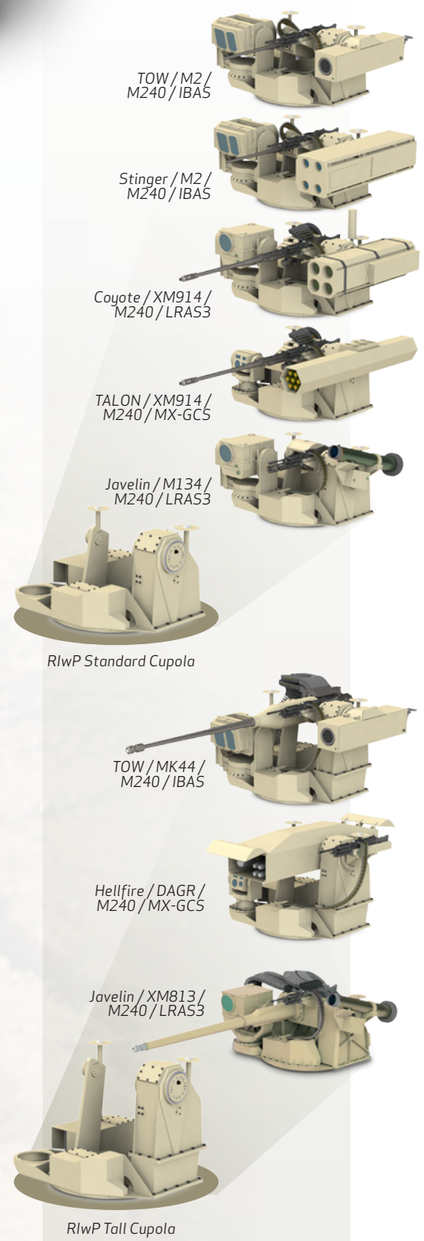
RIwP is an innovative remote weapons platform offering multiple weapon options to guarantee tailored overmatch in every combat situation. Engineered with many advanced features, RIwP includes high-performance target acquisition technology and unmatched pointing/stabilisation accuracy ensuring U.S. and allied forces see first, engage first and achieve mission success. Additionally, the RIwP offers an unprecedented range of platform weapon system interoperability and allows the warfighter both reload under armor and in-field weapon reconfigurability.

Multiple Weapon Options with in-theater user reconfigurability ensures overmatch in every combat situation.

Options include:

- Direct Fire Options: MK44/XM813, M242, M2, M230LF/XM914, Mk19, M240, M249, M134
- Missile Options: TOW, Javelin, HELLFIRE, DAGR, Hydra 70/LGRs, Stinger, Coyote
- Non-lethal Options: Smoke/Projectile Grenades, Acoustic, Laser Dazzler
- Sensors: IBAS, MITAS, LRAS3, MX-GCS

Photo courtesy of U.S. Marine Corps



RIwP Standard Cupola

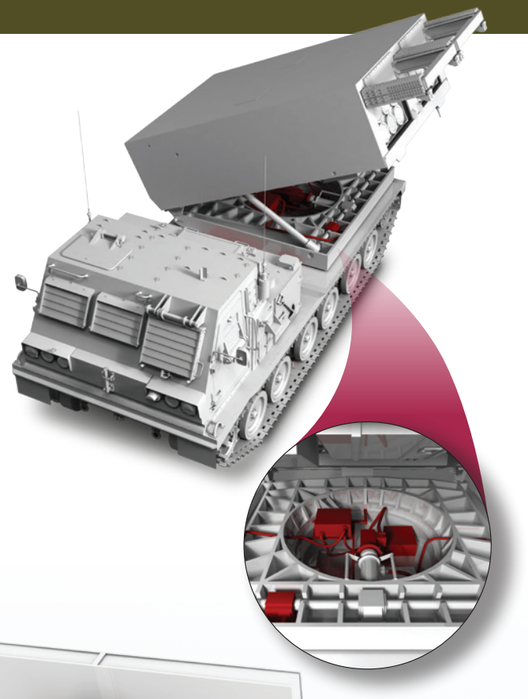
RIwP Tall Cupola

LAND (CONTINUED)

CONVERSIONS AND UPGRADES

Moog works closely with vehicle manufacturers and the armed forces to upgrade, convert, and reset existing assets. Our modeling, hardware, software, mechanical and production engineering teams are experts in both electromechanical (EM) and electrohydraulic (EH) motion control systems and technologies, providing system upgrades to meet strict space, weight, and power constraints.

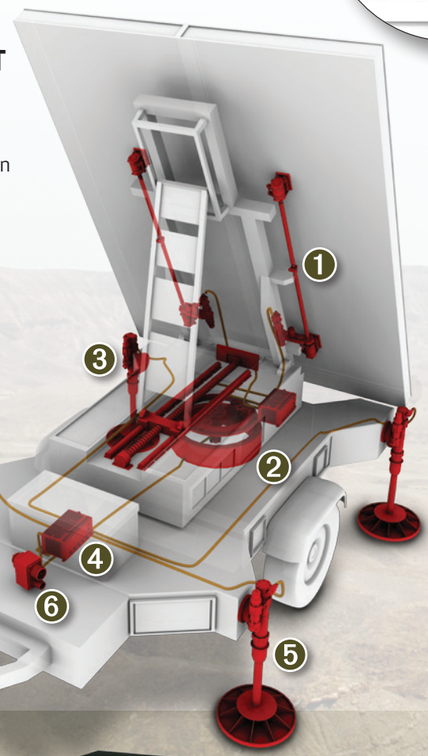
Moog has developed patented high-redundancy, fail-safe, EM actuation systems offering users reassurance in power failure conditions.



EXPEDITIONARY RADAR DEPLOYMENT SYSTEMS

Moog provides motion control products, integrated subsystems, complete single and multi-axis actuation systems for land radar platforms, including:

- Antenna Elevation and Fold Actuation
- Point and Stare Actuation
- Azimuth Drive Motor, Controller and Actuation
- Automatic Levelling Actuation
- Integrated Rotary Joint Assemblies
- Hydraulic to Electric Conversions
- Communication Networking Products

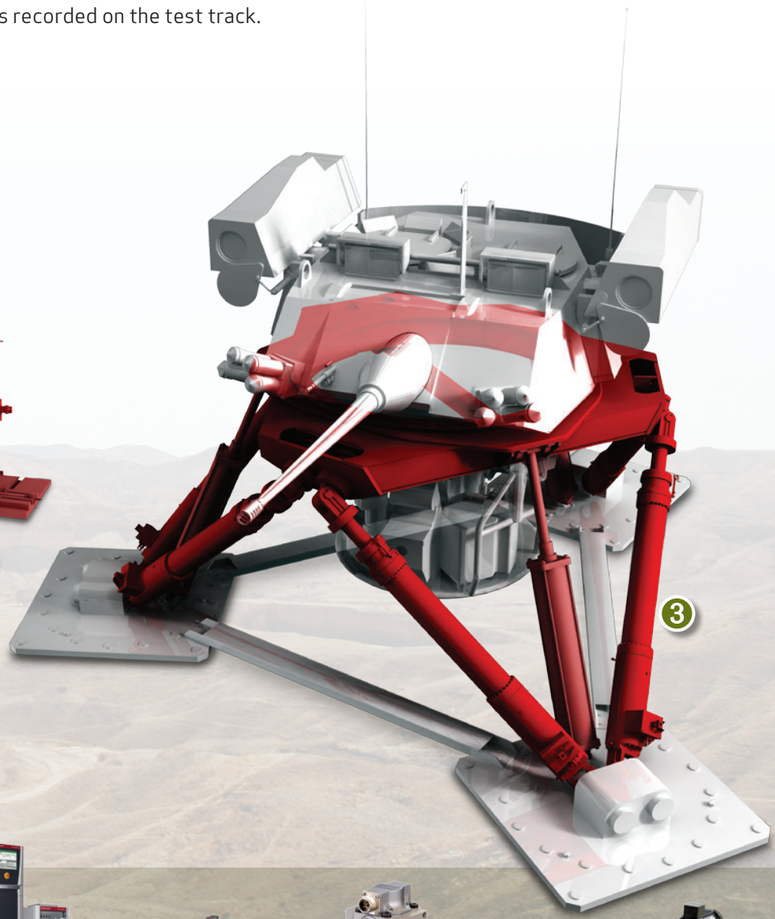


1 ELEVATION ACTUATOR | 2 SLIP RING | 3 AZIMUTH ACTUATOR | 4 CONTROLLERS | 5 LEVELLING ACTUATOR | 6 ETHERNET MEDIA CONVERTER

VEHICLE TEST AND SIMULATION

Moog is a leader in providing world-class test and simulation solutions. Moog designs and manufactures high performance motion control solutions combining electric, hydraulic, and hybrid technologies with expert consultative support in a range of applications including simulation and test equipment.

The Moog Turret Test System is based on a high performance 6-Degree of Freedom (6-DOF) electric motion system with powerful test software to simulate test tracks and test performance of the turret station. Customers can install an actual turret or remote weapon station on the motion system, up to 24,000 kg or 53,000 lb, to meet specific excursions, velocities, or accelerations. The Moog Replication Software Module has been developed to accurately simulate vehicle movements as recorded on the test track.



TEST CONTROLLERS

1 HYDROSTATIC ACTUATOR

2 VALVE

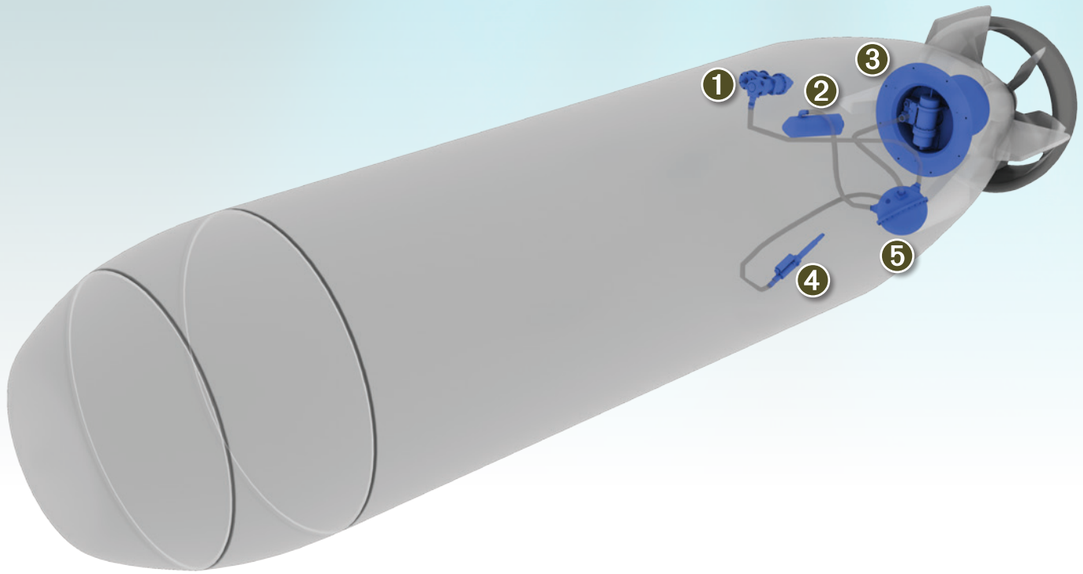
3 ELECTRIC ACTUATOR

SEA

Moog is a major supplier of hydraulic, electromechanical and pneumatic motion control systems for submarines, aircraft carriers and other naval vessels. The company has designed and manufactured hundreds of critical control systems that operate valves, open and lock hatches and provide propulsion for these platforms.

LARGE AUTONOMOUS UNDERSEA VEHICLES

Moog has over 50 years of motion control system design and manufacturing experience in the undersea domain. U.S. Navy submarine programs have relied on Moog for mission critical actuation hardware from the USS GEORGE WASHINGTON class to the USS VIRGINIA class. For ROV and AUV platforms Moog provides motors, controllers, actuators, servovalves, and sonar equipment with continuing investments in future technologies to support these platforms. Moog has facilities in the United States, Canada, United Kingdom, and Germany dedicated to the naval and marine industries. If your application is in a challenging environment where performance really matters, Moog has the reliable, low risk solution to ensure mission success and provide propulsion for these platforms.



❶ FIN CONTROL ACTUATORS

❷ PUMP MOTORS AND CONTROLLERS

❸ MAIN PROPULSION MOTORS

❹ FIN ELECTRO-MECHANICAL ACTUATOR

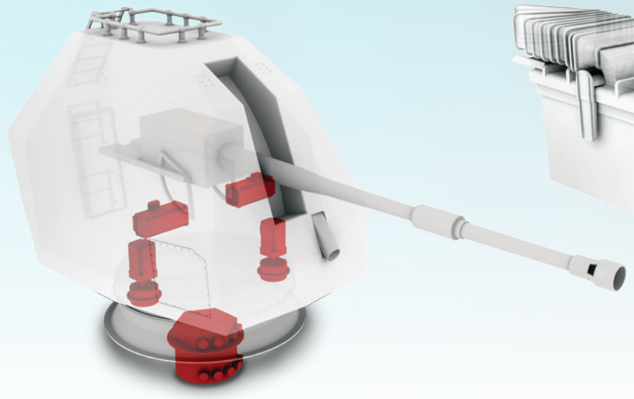
❺ FIN ACTUATOR CONTROL ELECTRONICS

WEAPONISATION SYSTEMS FOR FAST PATROL BOATS

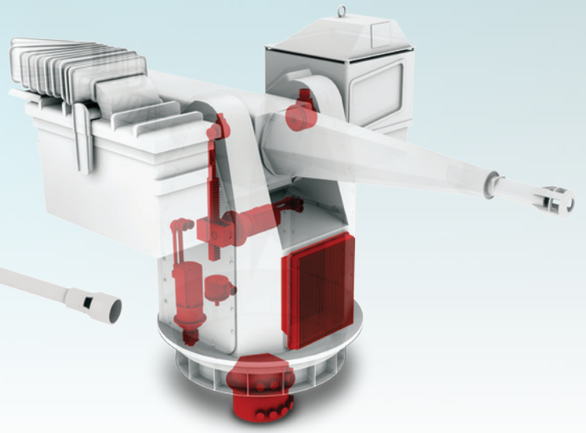
Moog provides weapon stores management (details on Page 6) and pan and tilt systems for on-board weapon stations as well as high performance rotary joints for electro-optical sighting systems.

MULTI-AXIS AMMUNITION HANDLING

Moog heritage is responsible for the design, manufacture and integration of precision ammunition handling systems for a variety of applications including naval gun ammunition. Our ammunition handling systems involve complex mechanical integration, linear and rotary actuation and sophisticated, ruggedised motor control technologies.



BAE Systems' Mark 8 Mod 1 naval gun: Moog provides the high performance motors for aiming stabilisation and ammunition loading. The slip ring transfers power and data.



Rheinmetall's MLG27 naval gun mount: Moog provides the electric gun / turret drives, motion sensors along with the power and stabilisation electronics. The slip ring transfers power and data.

See Moog technology in action. Follow the link below to see multi-axis Ammunition Handling Technology used on the Type 23 Frigate by the UK and Chilean Navies. This ship features the Mk8, Mod 1, 4.5" gun with Moog ammunition handling drives.
www.moog.com/shipweapons

DEFENCE PRODUCTS

ROTARY JOINTS AND SLIP RINGS

These high performance products are used in systems that require unrestrained, continuous rotation while transmitting power, data and media from a stationary device to a rotating structure. High bandwidth options include Ethernet, high definition video and other industry standard formats. Moog also has solutions including fibre optic rotary joints, fluid rotary unions and position encoders.

DIRECT DRIVE DC TORQUE MOTORS AND ALTERNATORS

Frameless torque motors are used in defence applications that require high power density and quick accelerations. The motors are optimised to minimise input power for maximum efficiency. Alternators in the same mechanical configuration can be used for mobile power generation.

POSITION SENSORS

Moog offers several position sensor product lines that provide highly accurate, repeatable absolute position sensing in robust, compact designs. The Rotary Variable Differential Transformer (RVDT) is available in housed and frameless models. Synchros and resolvers are available in both standard servo frame sizes and pancake solutions.

ACTUATORS

Multi-purpose actuators are available in both rotary and linear configurations and are standard building blocks in a variety of systems. These actuators are used on air, ground and unmanned applications.

SOLENOIDS

Moog linear solenoids include simple push/pull applications, latching in energized or power-off applications, position indication feedback and four-position articulating motion.

HIGH SPEED DATA COMMUNICATIONS

Moog provides innovative components and communication sub-systems for both copper and optical fibre based systems used in harsh environments. Moog meets the demanding high speed and secure networking equipment requirements of todays modern defence systems. The product range includes electro-optical transceivers, link extenders, Ethernet media converters and switches, data aggregators and multiplexer/ de-multiplexer solutions.

FIBRE OPTIC ROTARY JOINTS

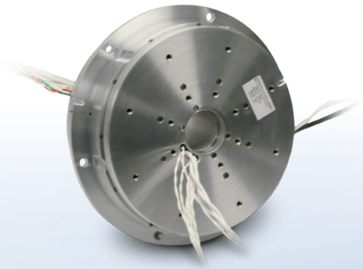
Fibre optic rotary joints are the optical equivalent of an electrical slip ring allowing very high speed data transmitted. Available in single and multi-mode versions with single or multi-channel capability.

FLUID ROTARY UNIONS

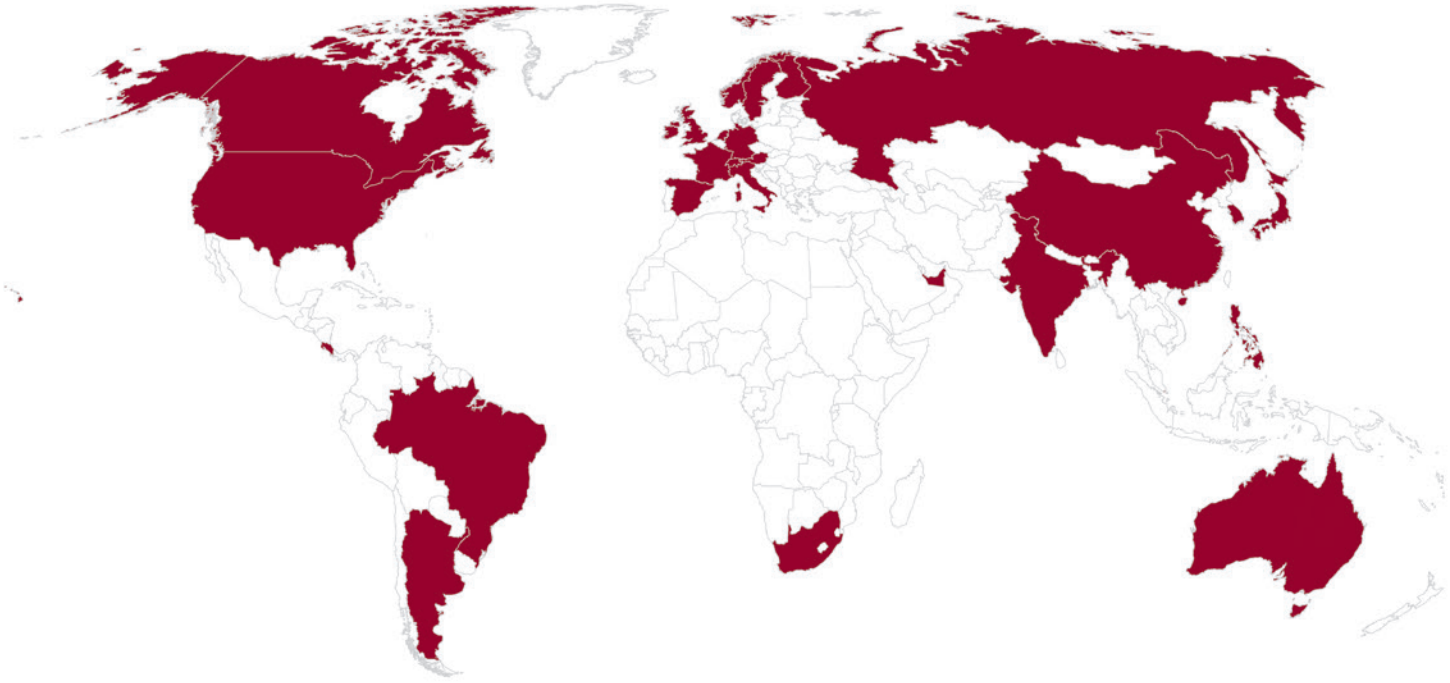
Moog fluid rotary union allows the passage of liquids/gas across a fully rotating interface with hight performance seal to minimise leakage. Fluid rotary unions can be combined with our electrical slip rings and fibre optic rotary joints.

INTEGRATED MOTION ASSEMBLIES

Our higher level solutions range from simple combinations of individual products to sophisticated electromechanical assemblies including the motor, drive electronics, fibre optic rotary joints, fluid/pneumatic swivels and RF rotary joints.



LOCATIONS



Argentina	Germany	Singapore
Australia	India	South Africa
Austria	Ireland	South Korea
Brazil	Italy	Spain
Canada	Japan	Sweden
China	Luxembourg	Switzerland
Costa Rica	The Netherlands	Turkey
Czech Republic	Norway	United Arab Emirates
Finland	Philippines	United Kingdom
France	Russia	United States

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