World Leader in the Design and Integration of Flight Control and Utility Actuation Systems

Moog is a worldwide designer, manufacturer and integrator of precision motion control products and systems for the aerospace and defense industry. Over the past 60 years, we have developed a reputation for delivering innovative and reliable solutions for the most challenging motion control applications. As a result, we have become a key supplier to the world’s leading aerospace manufacturers and are positioned on virtually every platform in the marketplace – supplying reliable products and systems that are highly supportable and add significant value for our customers.

A key element of our success is our corporate culture, which embraces strong customer focus, process and product innovation. Our superior products and services directly reflect the creativity, work ethic and remarkable attention to purpose of our people. Through Moog’s aftermarket services business, we provide the same highly responsive, customer-focused support to commercial and military operators around the world.

With aircraft staying in service far beyond their intended life, Moog continually strives to develop enhanced repair processes and reliability improvements to keep products on wing longer, increase fleet availability and lower life cycle costs. In addition to providing world-class MRO services, we offer technical support and training, product modification and upgrades, reliability enhancements and technology insertion, obsolescence management, logistics services and public-private partnerships.

Moog Provides A350 Entry Into Service Support

Moog is the designer, manufacturer and integrator for the A350 Primary Flight Control and Flap Drive Actuation. As the aircraft approaches entry into service, Moog is prepared to provide the airlines with industry leading support including expert training from our OEM technical team, first class responsiveness and global spares availability. This includes a team of field service engineers, inventory located in all major world regions, and a variety of spares provisioning and maintenance options.

Moog is working closely with the airlines to customize support packages that meet their exacting needs ranging from initial provisioning buy or lease, access to pool options and flight hour maintenance programs.

Moog Receives Approval for Advanced Corrosion Repair Techniques by the US Army

Moog has been working with industry experts to develop and qualify Cold Spray, an additive manufacturing process, to restore metal parts damaged by corrosion or wear. This repair technique is ideally suited for aerospace parts made from magnesium, titanium and aluminum, which due to their composition, make conventional repairs impractical. Moog has been working with the Army Research Laboratory (ARL) to develop specific repair techniques and most recently received formal approval from the AMRDEC-Aviation Engineering Directory for the repair of UH-60 magnesium castings.

Cold Spray can be effectively used to repair corroded parts, worn parts or parts with surface defects created during production. The pictures to the left show a magnesium casting with manufacturing defects (severe pitting) that were created during the casting process, and the repaired part following Cold Spray application. The approach salvaged an expensive part that otherwise would have been scrapped.

The picture to the right shows a magnesium casting with severe corrosion and the same part after it was restored using Cold Spray. In this instance, Cold Spray was used to salvage a part that is in high demand with long lead time.

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Moog Wins Contract Award with Embraer for Flight Control System on Second Generation of E-Jets

Moog was selected by Embraer S.A. to supply the Primary Flight Control System for Embraer’s second-generation E-Jet family. Under the contract, Moog will provide design, qualification and certification support for a three-axis integrated Primary Flight Control System including Moog proprietary flight control computers and software, flight control actuators and related control electronics.

Provisionally outlined with 78 to 122 seats, the new aircraft will succeed the current E-170 and E-190 lines and is scheduled to enter service in 2018. The new family will be reconfigured with an all-new wing, full fly-by-wire flight control systems and extended main landing gear to provide more clearance for new, higher bypass engines.

Moog Supplying Primary Flight Control Actuation and Trailing Edge Actuation Systems for Airbus A350 XWB

Moog was selected by Airbus to provide design, integration and certification support for the Primary Flight Control Actuation on the A350 XWB. Moog is providing 29 discrete actuators and associated control electronics on this program. This system includes a mix of electrohydraulic (EH) and advanced electrohydrostatic (EHA) actuators to control the aileron, elevator, rudder and spoiler flight surfaces. Moog’s products feature:

- More electric actuation technology
- On-board electronics for actuator power and control
- Highly integrated assemblies to meet challenging envelope constraints

Moog was also selected to supply the Trailing Edge Actuation System for the A350 XWB including the power control unit, inboard and outboard geared rotary actuators, gearboxes, wing tip brakes and other miscellaneous components.

Moog Providing Flight Control Computer and Software for 747-8

Moog is supplying Boeing with the lateral control electronics (LCE) for the new Boeing 747-8. The Boeing 747-8 Intercontinental and the 747-8 Freighter are the new high-capacity 747’s, which recently entered revenue operations.

As part of the program, Moog designed, manufactured, qualified and provided certification support for the LCE. The function of the LCE is the control of fly-by-wire aileron and spoiler actuators.

The system leverages Moog’s proprietary dual redundant, triplex dissimilar architecture and builds upon expertise gained designing and certifying flight control systems on other civil programs.
Moog Introduces Total Support for Commercial Aircraft

Moog recently launched Moog Total Support (MTS), a comprehensive support program for its flight control systems. By combining asset pooling, maintenance, technical support and logistics, Moog can provide a highly-customized support package that unites its OEM expertise with decades of experience as a world-class MRO provider.

MTS provides airlines with an unrivaled one stop solution tailored specifically to individual needs. This helps to reduce cost, inventory levels, AOG risk and exposure to obsolescence. These flexible life cycle cost solutions include:

- 24/7 access to spares with regional pooling locations around the world
- Guaranteed availability of replacement components
- On-site consignment
- 24/7 customer support
- Lease, loan and exchange options
- Reliability monitoring and maintenance recommendations

Moog Acquires Flight Control Actuation Business from GE Aviation Systems

The business, located in Wolverhampton, U.K., designs and manufactures primary and secondary flight control actuation for a number of commercial and military programs. Key commercial products that have been added to Moog’s support capabilities include:

- 737 – Primary Flight Actuation
- 777 & 767 – High Lift Actuation
- 787 – High Lift Actuation
- A300-600 – Primary Flight Actuation
- A330/A340 – High Lift Actuation
- A380 – High Lift Actuation
- BAE 146 – Primary and High Lift Flight Actuation

The General Electric Company acquired this business as part of its acquisition of Smiths Aerospace in May of 2007. The acquisition is now part of Moog’s Aircraft Group.

Moog Wins Contract with Hainan Airlines for Long Term Support for 787 Fleet

Moog Inc. and Hainan Airlines signed a 10 year exclusive contract for comprehensive support of the Moog Flight Control Systems on Hainan Airlines’ fleet of Boeing 787 aircraft. The program will include maintenance and inventory support via Moog’s strategically selected worldwide stocking locations, giving Hainan 24/7 access to spares no matter where their aircraft are located.

Moog, the provider of both primary and high lift flight control systems on the 787, recently launched an entirely new suite of aftermarket support solutions. The Moog Total Support program is aimed at providing airlines with a comprehensive range of services for Moog products, including inventory support.

Enhanced Services for Commercial Aircraft Operators

Moog recently launched its 24/7 centralized customer service center for our MRO services. The customer center’s dedicated support team provides a single point of contact for all your product support needs.

In addition, Moog recently selected Aeroturbine to provide global logistics support for its Total Support and Asset Support programs. The agreement includes 24/7/365 warehousing for Moog’s global pool support customers. Locations include Miami, Los Angeles, Singapore, Beijing, Tokyo, London and Dubai, with more locations established as required.
Moog is providing the design, manufacture and integration of 19 primary flight control actuators including main rotor swashplate, flaperon, rudder and elevator.

In addition, Moog is providing the active vibration control system, blade fold actuation, nose-wheel steering servovalves, main prop rotor slip ring, hydraulic fluid compensation module and engine fuel control servovalves. Key attributes of the flight control system include a 5000 psi operating pressure, duplex hydraulic – triplex electrical redundancy on the swashplate actuators and ballistic tolerant elevator and swashplate actuators.
CRITICAL CONTROL PRODUCTS FOR AEROSPACE

Rotary and Linear Electromechanical Actuators and Controls

Moog leads the industry by designing and producing high performance linear and rotary electromechanical actuators (EMA) for aerospace applications. Our actuation products are used to control flight surfaces and position sensors on aircraft and space vehicles; steer antennas in high bandwidth communication systems; and provide control for various utility applications.

Moog is able to offer precision actuation solutions with rare earth brushless motors, planetary gears and smart servocontrollers with integral position control or utility actuation solutions with DC motors, spur gears and analog amplifiers with external position control.

A technology initiative currently underway allows us to offer a fiber optic communication interface for our EMA’s. This technology provides many systems advantages, including EMI immunity and weight savings.

Active Vibration Control Systems for Military and Civil Rotorcraft

Moog is supplying its active vibration controls for Sikorsky’s UH-60M Blackhawk helicopter.

Moog’s Vibration Suppression Actuation System (VSAS) includes a DSP-based controller and a pair of counter-rotating force generators per channel. Vibration levels within the air vehicle are monitored and the force generators inject cancellation forces at discrete locations throughout the airframe, dynamically adapting to changes in the vibration environment. By eliminating the need for heavy passive vibration absorbers, the system offers weight savings while providing a number of secondary benefits including enhanced situational awareness, passenger comfort and increased aircraft component life. The system is currently flying aboard the Sikorsky S-92, Bell/Boeing V-22, UH-60 Blackhawk, SH-60 Seahawk and Sikorsky’s X2 technology demonstrator.

Moog Crossbow Introduces Integrated Guidance, Navigation and Control System for Unmanned Aircraft

Moog Crossbow recently introduced the GNC1000, a highly integrated guidance, navigation and control system that includes Autopilot, Flight Control Computer, Actuation Control, Attitude Heading and Reference System and Air Data. While robust in features, the GNC1000 is compact, light-weight and low power; making it ideal for a wide range of unmanned platforms. The system core is based on Moog’s proprietary avionic solutions currently operating aboard large commercial transports and high end business jets. Because of its highly configurable nature, the GNC1000 is easily integrated into a variety of vehicle architectures.

Product Features:

- Autopilot and user-specified flight control laws
- Attitude heading reference system (AHRS)
- Built-in GPS and magnetic references
- Air-data system meeting FAA TSO 106 requirements
- Serial I/O including 10/100 Ethernet (4), RS-485 (8), RS-232 (2) and CAN (2)
- Digital I/O including discrete (8I/4O), PWM (6), and solid state relay
- Analog input +/-10V, OAT
- Ruggedized design complying to DO-160G and MIL-STD-810G and MIL-STD-461F
- Compact, low power (<7W) and light weight (<3lbs)

Displays and Avionics

With over 35 years of experience in cockpit displays, avionics and instrumentation, Moog Components Group has contributed to the success of numerous aerospace platforms. We offer total in-house engineering capabilities for design, manufacture and test of a full range of products. We offer a number of stand-by and utility navigation instruments for the Commercial, Business Jet and Regional Jet community and also provide support to many TSO and STC efforts for retrofit applications. In addition to our traditional electromechanical product line, Moog offers a line of fixed format LCD engine instruments and can accommodate numerous Signal Data Conversion (SDC) needs as well.
Moog Signs Umbrella Corporate Contract with DLA

Moog has recently signed an umbrella contract with DLA - Defense Supply Center Richmond. The corporate contract covers critical component parts and sub-assemblies required to support depot repair activity for all Moog Aircraft Group products. This new contract benefits DLA, the USAF depots and Moog by streamlining the procurement process and providing more cost-effective and timely access to parts required to support legacy aircraft systems.

Defense Supply Center Richmond is the aviation supply and demand chain manager for the Defense Logistics Agency and serves within the Defense Department as the primary source of supply for more than 1.2 million repair parts and operating supply items. DLA recently assumed responsibility for procurement management and related support functions for depot-level repairables at the Oklahoma City, Ogden and Warner Robins Air Logistics Centers. DLA’s mission is to provide best value aviation weapon systems and logistics support to America’s armed forces – on land, at sea and in the air.

USAF Selects Moog to Provide Overhaul Support on B-1B Primary Flight Control Servoactuators

The United States Air Force (USAF) awarded Moog contracts to provide overhaul services for the primary flight control servoactuators on the B-1B weapon system. These 5-year contracts encompass a total of 25 different line items including horizontal stabilizer, pitch roll SCAS, yaw SCAS, forward and aft structural mode controls, lower rudders, inboard and outboard spoilers and the master pitch roll servoactuator. The first deliveries of overhauled servoactuators began 120 days after contract award. These contracts typify Moog’s commitment to support the USAF’s operational readiness goals for high priority weapon systems.

Moog Providing F/A-18 C/D Leading Edge Flap System Safety Upgrade for Worldwide Hornet User Community

Moog is the original design authority for the F/A-18 C/D Leading Edge Flap System and has developed and qualified a safety upgrade to improve system reliability, enhance effectiveness of periodic inspections, and ensure control during possible fault condition. The changes include a redesigned torque limiter and stop module and a replacement torque shaft. The upgrades can be installed at the Organizational (O) level and retrofit actions are planned for worldwide distribution in late 2011.

Moog is also providing internal capabilities to provide cost effective repair and overhaul services for the complete PDU and for all of the subassemblies that make up the PDU. Modifications of older design PDU’s into the latest configuration can also be accomplished to minimize support costs for the end user.

World Class Repair and Overhaul Support for F-16 Leading Edge Flap Drive System

Moog is the OEM supplier for the F-16 maneuvering Leading Edge Flap Drive System (LEFDS). Our products include the power drive units, hydromechanical actuators, rotary mechanical actuators, EM control actuators, angle gearboxes, torque shafts and asymmetry brakes. Moog has recently expanded its capability to support F-16 customers with repairs, overhauls and spares for the Leading Edge Flap (LEF) power drive unit (PDU). The PDU is a complex electrohydromechanical system that accurately controls the position of the leading edge flaps in response to changes in aerodynamic conditions.

Moog has also developed internal capabilities to provide cost effective repair and overhaul services for the complete PDU and for all of the subassemblies that make up the PDU. Modifications of older design PDU’s into the latest configuration can also be accomplished to minimize support costs for the end user.
Moog Expands H-60/S-70 Flight Control Overhaul and Upgrade Services

Moog developed the capabilities to provide overhaul services for the entire family of integrated trim/boost servoactuator assemblies on the H-60/S-70, including the Pitch Trim, Roll Trim and Yaw Boost Servoactuator configurations. Moog inspects and disassembles the integrated assembly, overhauls and tests the individual LRU’s, and reassembles and tests the integrated assembly before delivery to the customer. Moog has recently won its second consecutive 5-year contract with the US Coast Guard (USCG) to provide overhaul services for their HH-60J/T flight controls, previously demonstrating a 50% improvement on turnaround time while significantly lowering the USCG’s total overhaul cost.

Moog is now offering a reliability upgrade to the UH-60 Blackhawk pitch trim actuator. This upgrade, available exclusively through Moog, will enable the pitch trim to stay on wing longer and provide better performance in harsh climates such as salt water, humidity and sand. A tungsten carbide coating has been added to the booster piston providing additional corrosion and scratch protection. The design of the dust boot has been modified to help keep the pitch trim flying longer and the newly designed mounting feet will prevent corrosion by better allowing the surface to shed moisture. All of these reliability upgrades can be implemented on your current pitch trim through Moog’s exclusive overhaul process.

Moog Supports Ongoing Public-Private Partnerships

Moog is committed to supporting its customers through the use of public-private partnerships. Moog currently has several partnerships in place, covering multiple platforms and applications. These partnerships provide significant value by leveraging the specialized expertise, equipment and facilities of each organization.

Moog has been under a public-private partnership with Ogden Air Logistics Center for the overhaul and upgrade of the F-15 pitch and roll channel assembly. Moog has also been under a public-private partnership with the Fleet Readiness Center Southeast for the F/A-18 Leading Edge Flap System.

Moog also entered into a commercial service agreement with the Fleet Readiness Center East for the V-22 Osprey. Moog Military Product Support is actively engaged in discussion for future commercial service agreements with the Tinker Air Force Base for the B-2, and with the Fleet Readiness Center Southwest for the F/A-18 E/F and F-35.

Moog Expands Global Support Capability for Military Aircraft Products

As part of a recent acquisition, Moog now offers full service capabilities for the relevant actuation products originally sold under the GE Wolverhampton, Smiths Wolverhampton and Dowty Wolverhampton names. Key products which have been added to Moog’s support capabilities include:

- CN235 – Trailing Edge Flap Actuation & Controls
- C295 – Trailing Edge Flap Actuation & Controls
- Typhoon – Primary Flight Actuation
- F-35 STOVL – Lift Fan & Swivel Module Actuation
- A129 – Primary Flight Actuation
- AMX – Primary Flight Actuation
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