



SETTING THE STANDARD IN MOTION CONTROL

An overview of Moog's Precision
Motion Control Products and Services

MOOG INDUSTRIAL GROUP



MOOG HERITAGE

Founded in 1951 by Bill Moog in East Aurora, New York, Moog has developed a reputation throughout the world as a company with employees and motion control solutions that are at the forefront of the markets we serve. Our high-performance motion control solutions, systems and components control a variety of industrial machines manufactured and installed all over the world – installations where precision, velocity, force and acceleration are critical. With total company sales of close to US \$2 Billion, Moog is recognised as a global market leader for technology and innovation in our target markets, continuously improving machine design and performance.

MOOG INDUSTRIAL GROUP (TEWKESBURY)

Moog has been established in the United Kingdom since the late 60s, recently celebrating its 40th anniversary. The Tewkesbury facility plays a key role in the design, manufacture, development and implementation of a wide variety of industrial and aerospace products, from complete aircraft flight control and actuation systems to specialist microvalves for Formula One cars. Other Moog sites are based near Solihull (auto and aero-test), Reading (slip rings and components), and Insensys at Southampton (pitch control and rotor blade monitoring systems for wind turbines).

The Tewkesbury site comprises 5 manufacturing and assembly plants with 2 dedicated to the needs of the industrial business. Additional manufacturing and support is sourced from our global business units. It is easily accessible by road (Junction 9, M5) and by rail (Ashchurch).

The UK industrial business employs people with roles embracing machining, assembly and test, design and applications engineering, purchasing, sales and marketing. We view our customers as part of our business and we, a part of theirs. We take a collaborative approach to solving their most difficult motion control problems with electric, hydraulic and hybrid solutions. Our team is dedicated, flexible and customer focused.

Moog implements LEAN and Six Sigma manufacturing techniques to optimise our manufacturing processes enabling us to optimise our customers needs, such as delivery and quality.

WHY MOOG?

By choosing Moog, you benefit from a number of key advantages:-

- Proven systems and applications expertise creating high performance, customised motion control solutions
- Significant domain expertise in customers machine design and performance as well as end-user industries
- High performance solutions and products in both hydraulic and electric technologies
- Global engineering and repair/services network to support customers around the world
- World-class manufacturing facilities staffed with skilled, experienced and dedicated workforce
- Flexible organisation focused on collaborating with customers to meet their unique needs

OUR APPROVALS

Moog customers benefit from the following standards and approvals.

Homologation for 2009 FIA Standard ECU.

BS EN ISO 9001-2008 Quality Management System.

BS EN ISO 13920 ATEX Approval.

“ We could not have got to this stage without your knowledge, help and understanding.”

Alan Shilton

*Managing Director,
Thompson Friction Welding*



CUSTOMER FOCUSED ENGINEERED SOLUTIONS

Our engineers collaborate with OEM customers to design Moog motion control solutions for machines and systems where precise control of position, velocity, force and acceleration are critical. Our electric and hydraulic technologies enable machine builders to create unique and flexible designs that perform with greater efficiency, increased uptime and lower maintenance costs.

As our customers challenge us with difficult motion control problems we'll continue to respond with designs, services and products that are reliable and efficient.

Where products are already in service, then we have a comprehensive, popular and cost effective range of plant maintenance services, including repairs, services and skills training.

RECENT UK BASED ENGINEERING PROJECTS INCLUDE:

- Thompson Friction Welding - the world's largest friction welding machine
- Street Crane Xpress - the retractable roof on the Centre Court - Wimbledon
- Formula 1 Teams - dual gain micro servovalve to provide higher precision from high power clutch and gearshift actuation systems
- EMP Designs - Sinking of the Venetian building at the end of James Bond film 'Casino Royale'
- BAE Systems: F-35 Joint Strike Fighter - Control, Monitoring & Safety System for Full Scale Static/Fatigue Test
- Westland Helicopters: Multi-axis rotor blade fatigue test system with adaptive bending moment algorithm

NEW WELDING PROCESS FOR JET ENGINES OF THE FUTURE

When West Midlands based Thompson Friction Welding decided to develop friction welding to a point where it can be viable for securing the blades on jet engines, CEO Alan Shilton approached Moog's engineering team to help them develop a solution based on Moog products and know-how.

The Challenge

To work with Thompson Friction Welding to help them develop the world's largest linear friction welding machine with previously unseen high dynamics and forces for use by automotive and aerospace industries.

The Solution

Using Moog RKP-II – radial piston pumps, Moog cartridge valves, Moog D674 servovalves, three Moog MSC controllers and hydraulic accumulators, Moog engineers developed a solution.



The Result

The world's largest and only Linear Friction Welding with the following spec:

- Stored Energy 2 mW > 4,500 l/min @ 280 bar (1,188 USg/min @ 4,061 psi)
- Weld time - up to 5 seconds
- Oscillating actuator - Mass 1,500 kg (3,300 lb)
- Frequency up to 100 Hz
- Displacement ± 5.0 mm (0.118 in.)
- Positioning accuracy 13 µm (.0006 in.)
- Forging force 100 tonnes (220,000 lb)

To read the full story go to www.moog.co.uk/industrial.

STANDARD AND CUSTOMISED SOLUTIONS

From advanced customised miniature high performance control systems for Formula 1 racing cars, to heavy duty environments such as the steel industry, to special engineering solutions for Wimbledon's new retractable roof, Moog supplies precision motion control solutions to meet a range of demanding applications.

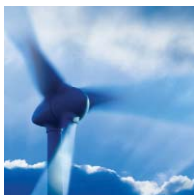
POWER GENERATION, GAS AND STEAM TURBINES



Moog offers a number of products for gas turbine applications, such as a complete line of ATEX approved and explosion proof. We also offer custom solutions for steam applications such as steam chest actuation, to control the speed of the turbine.

- Precise control of fuel metering
- Enhanced safety, through application of customised, explosion-proof servovalves and servoactuators
- Other products include Blow Off Valves to prevent engine overrun, Water Wash Modules to improve gas turbine efficiencies, Fuel Pumps designed for low viscosity fluids and other engineered solutions such as Skids and Start packs

WIND TURBINES



The motion control challenges for wind turbines are particularly complex, ranging from assuring precision control to increasing reliability and safety. Moog offers high-performance solutions across three key application areas: pitch control, data and power transmission, rotor blade testing.

- Pitch control of wind turbines using hydraulic, electric and electro-hydrostatic technologies
- Electric systems include servocontrollers, servoactuator systems and slip rings
- Hydraulic systems include servoactuators, servo-proportional valves with integrated motion control capabilities, servopumps and slip rings for better performance, high reliability and safety
- Hydraulic rotor blade testing systems including control systems and software for flexible testing of new designs

METAL FORMING AND HYDRAULIC PRESSES



Leading machine builders and users understand that with the right motion control solutions, they can achieve higher productivity, better precision and greater part-to-part consistency. From closed-loop cushion control on vertical stamping presses to closed-loop, high performance solutions for press brakes to electric motion control solutions on bending, powder and punch presses.

- Integrated hydraulic manifold solutions and complete hydraulic systems supporting specific for improved functionality, performance and reliability
- Customised solutions based on products such as servo and proportional valves, cartridges and pumps
- Servovalves with digital control and actuators enabling higher quality and productivity

SPECIAL EFFECTS IN FILM AND THEATRE



Our motion control systems are used in the film and theatre industries. The most common applications are robotics, electric/hydraulic actuation, and motion bases used for specialist effects, often in conjunction with Computer-Generated Imagery (CGI).

- Servovalves, servomotors, servodrives and servocontroller systems for stable, flexible control
- Motion Bases for precise movement in CGI applications

AEROSPACE AND AUTOMOTIVE TEST SYSTEMS



Moog expertise, combined with the world-class performance of Moog products such as fatigued Actuators, Servovalves and Test Controllers make us a leader in providing both simple and complex structural and performance test solutions.

Aerospace testing:

- Real-Time Ethernet interface provides test systems with high bandwidth and unprecedented levels of safety. Particularly recommended for a variety of high performance aircraft, helicopter, and spacecraft testing
- Expands rigs easily, runs more tests faster and increases test accuracy, whilst keeping test specimen totally safe
- Protects Test specimen against single point and dormant failures from any part of the control system

Automotive testing:

- Structural Testing - quantitative tests of endurance, fatigue, and structural capabilities of components or modules, such as: Suspension Test Rig, 4-Poster Test Rig, 7-8 Poster Test System
- Performance Testing - assessment of ride and handling behaviours to optimise the quality and performance of a model or full vehicle. This can include extremely fast and precise measurements, including human-in-the loop testing such as: Ride and Comfort, Driving Simulators, Kinematics & Compliance.

FLIGHT SIMULATION



Moog motion platforms for payloads range from 1,000 kg to 25,000 kg (2,200 to 55,100 lb) helping customers provide highly realistic motion cues in simulators for trucks, armoured vehicles, tanks, trains, and fixed wing and rotary wing aircraft.

- Co-developed the world's first all-electric high payload flight simulator (up to 25,000 kg [55,100 lb] Gross Moving Data) to receive Level D Certification from the US Federal Aviation Administration (FAA) and European Joint Aviation Authority (JAA), and the US Military's "Ready for Training" accreditation.
- Turnkey approach encompasses complete hydraulic and electric systems including motion bases, generic- or application-specific software, training, replacement parts, repair, and assistance in tuning, installation and system acceptance

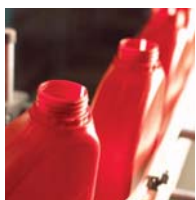
MOTORSPORT



Motorsport presents unique challenges for motion control suppliers. Whereas Formula 1 looks for low weight, small size and performance, rallying looks for ruggedness and the ability to perform in fairly brutal conditions such as extreme temperatures, adverse weather and demanding time constraints.

- A sub miniature range of servovalves, rotary power steering valves (PAS), miniature actuators, fuel regulating valves, oil pressure regulating valves and integrated motorsport systems.
- Turnkey systems - multi-axis shaker tables, ride and handling simulators, kinematics and compliance machines and hexapod systems for more realistic and flexible testing

PLASTICS



Moog has pioneered the design and manufacture of motion control solutions that provide precise control of injection, clamp, ejector, core pull, carriage, shuttle, parison, material handling and other key functions for plastics machinery in both injection and blow molding markets.

Injection Moulding/Die Casting:

- Servovalves, servo-proportional valves, servopumps and self-contained hybrid systems
- Servomotors, servodrives and all-electric injection units
- Hybrid and electric systems both offer energy efficiency, improved speed and performance, better control of new thin-wall molding and the ability to effectively process new materials

Blow Moulding:

- Servovalves, servo-proportional valves, actuators, Total Machine Controllers (TMC) and parison controllers offering better control of wall thickness and greater ease of use for operators
- Servomotors, servodrives, servoactuators, machine controllers and customised linear actuation packages for high speed and high-performance axes

OIL AND GAS



Our servomotors, servodrives and servoactuators improve the performance of downhole tools such as Rotary Steering Systems (RSS), Measurement While Drilling (MWD), Logging While Drilling (LWD), completion tools, production testing and subsea equipment. In the UK the offshore market is a major user of our electric and hydraulic technologies.

- Downhole tools, frameless servomotors and generators with high reliability for use in challenging environments
- Subminiature servovalves and direct drive servo-proportional valves for sub-sea engineering and exploration
- Complete systems for heave compensation, tube joining systems and other handling equipment.

HEAVY INDUSTRY



Applications in steel, aluminium, brass and any metal rolling mills consisting of closed loop axes including: Automatic Gauge Control (AGC), Automatic Width Control (AWC), coilers, oscillators and edge guides.

- Servovalves, servoactuators and servocontrollers for improved dimensional accuracy
- Radial piston pumps for lubrication systems

TEXTILES



Modern carpet tufting machines must handle high-speed mass production operations involving complex colours, patterns and pile. We work closely with machine designers to create new machines utilising ten to 3,000 axes of motion control and to help develop complete systems to control the complicated synchronisation of all these axes in many unique configurations.

- Customised servomotors and servodrives for the precise control of thousands of axes

PRECISION CONTROL IS A SMASH HIT AT WIMBLEDON, USING AN ELECTRIC SOLUTION

When the The All England Tennis and Croquet Club made the decision to install a retractable roof over the Centre Court at Wimbledon they had envisaged a hydraulic solution. However following a design review with Moog, an electric solution was developed.

The Challenge

To provide an electric solution capable of moving over 1000 Tonnes of steel above 15,000 people, within a tolerance of +/- 12.5mm over a span of 75 metres!

The Solution

To move the two sections of roof, and be capable of moving 10 "trusses" each weighing 100 tonnes, Moog provided Brushless Servomotors, Electric Actuators, Servodrives, Servocontrollers, Control Panels, and Main Control Desk, SCADA and Data Logging, Design, Specification Development, Engineering and services, including dynamic modelling, commissioning and future service and support.



The Result

Motion control of a unique retractable roof on an iconic building: -

- Over 150 Axis of control
- Controlled movement of 10 "trusses" each weighing 100 tonnes
- Can be fully deployed in 20 minutes
- Demonstrates Moog's ability to provide Electro-Mechanical Actuation (EMA) technology, and software
- Completed on time for June 2009 championships
- Designed for long life and low maintenance

WORLD CLASS PRODUCTS

Moog's products and systems deliver world-class motion control solutions to a wide array of applications, ensuring high speed and high force in today's most demanding industrial environments.

From our vast range, we offer a variety of hydraulic and electric products as standard, semi-custom or fully customised offerings.

Product Line	Advantages	Range Outline
Axis Control Valves (ACV) 	<ul style="list-style-type: none"> Enables monitoring wear of the electro-hydraulic actuator, enabling better downtime and spares planning Control loop tuning and signal scaling not needed after valve replacement as stored digital parameters are recalled and easily loaded into the new ACV valve No requirement for electric cabinet for control electronics Spool design maintains existing spring failsafe solution. 	<ul style="list-style-type: none"> Flow rate from 0.4 to 4000l/min. Position controller of the actuator integrated in the valve (ACV) FIELD-bus interface to monitor signals and enable remote maintenance. The ACV can also handle existing analogue signals Integrated pressure transducer in "A" for system diagnostics Customised designs to meet special requirements
Cartridge Valves 	<ul style="list-style-type: none"> High flow capability, far above the "subplate valves" Insensitivity to high pressure drops Same cavity for all functions simplifies manufacturing Low flow resistance Compact installation - multi function, sized to match the flow path Multi-function - same device can control direction, pressure and flow 	<ul style="list-style-type: none"> Sizes NG10 – NG160 Flow ranges from 70 – 20,000 l/min @ 5bar pressure drop Standard cartridge valves (DIN) - Please note: DIN designates a 2/2-way cartridge valve according to DIN 24342 or ISO7368 High flow cartridge valves (DIN) with 35% to 50% more flow than standard cartridge at the same pressure drop Active cartridge valves (DIN) Monitored cartridge valves (DIN) for Press Safety Servocartridge valves (DIN and Hydrolux standard)
Direct Drive Servovalves (DDV) 	<ul style="list-style-type: none"> Linear force motor capable of exerting force in either direction, a huge advantage compared with traditional proportional solenoids that can only exert force in a single direction High precision PWM drive electronics Top quality rugged designs suitable for even the most extreme of industrial environments ATEX & IS approved units available Various fluid options including mineral oil, Skydrol and Hyjet 	<ul style="list-style-type: none"> Flow rate from 0.4 to 160l/min Frequency response rates up to 50hz Fieldbus options available including CAN, Profibus and EtherCAT Standard ISO port patterns Volt and current command signals accepted Integrated electronics with spool position output Customised designs to meet special requirements
Electrical Feedback Servovalves (EFB) 	<ul style="list-style-type: none"> Integrated electronics and position transducer allow easy integration in any closed loop control application Top quality rugged designs suitable for even the most extreme of industrial environments ATEX & IS approved units available Various fluid options including Mineral oil, Skydrol and Hyjet 	<ul style="list-style-type: none"> Flow rate from 4 to 4000l/min Frequency response rates up to 350hz Fieldbus options available, including CAN, Profibus and EtherCAT Standard ISO port patterns Volt and current command signals accepted Integrated electronics with spool position output Customised designs to meet special requirements
Mechanical Feedback Servovalves (MFB) 	<ul style="list-style-type: none"> Based on 50+ years of servovalve development and manufacture Top quality rugged designs suitable for even the most extreme of industrial environments ATEX & IS approved units available Various fluid options including mineral oil, Skydrol, Hyjet, demineralised water 	<ul style="list-style-type: none"> Flow rate from 1 to 800l/min Two and three stage designs Frequency response rates up to 200Hz Standard ISO port patterns Range of signal commands accepted Customised designs to meet special requirements

Product Line	Advantages	Range Outline
Servoactuators 	<ul style="list-style-type: none"> ▪ Full range of sizes available in Electrohydraulic (EH) and Electromechanical (EM) options ▪ Ability to serve a full motion control solution including motion controllers, drives, motion bases ▪ Pre-configured and customised solutions ▪ High dynamics and precision ▪ Aero and Auto-test derivatives 	<ul style="list-style-type: none"> ▪ In-line or foldback (2 designs). ▪ Light and heavy duty options ▪ EM Maxforce pre-engineered solutions range provides four actuator frame sizes and two styles, with speeds up to 1,600 mm/sec, forces up to 96 kN and stroke lengths up to 2,500 mm ▪ Short stroke A085 actuators have total strokes of 2.54 - 15.24 cm in combination with 6.45 cm², 21.94 cm², and 43.97 cm² areas. Actuators can have position and/or velocity transducers and a wide variety of mountings
Servomotors 	<ul style="list-style-type: none"> ▪ Over 20 years of servomotor manufacture ▪ Highest dynamics and reliability ▪ Smooth low speed performance ▪ Thermal management for operation in demanding industrial environments ▪ Simplified installation and wiring ▪ Quick and easy setup and system commissioning 	<ul style="list-style-type: none"> ▪ AC & DC Brushless servomotors ▪ ATEX & FM approved options ▪ Continuous torques of up to 900 nm ▪ Peak torques of up to 2000 nm ▪ Speeds of up to 12,000 rpm ▪ Air, fan and water cooling options ▪ Resolver and encoder feedback options
Servodrives 	<ul style="list-style-type: none"> ▪ Highest dynamics and reliability ▪ Smooth low speed performance ▪ Thermal management for operation in demanding industrial environments ▪ Simplified installation and wiring ▪ Quick and easy setup and system commissioning. ▪ High speed field bus interfaces ▪ Characteristics matched to optimize the performance of Moog motors 	<ul style="list-style-type: none"> ▪ Range of sizes from 3 – 170A nominal ▪ Single or multi-axis applications ▪ Multiple cooling options ▪ Support of multiple encoders including customer specific. ▪ Multiple high speed fieldbus interfaces with synchronisation between the axis better then 0,1us ▪ Advanced anti cogging and encoder error compensations for highest speed performance ▪ Automatic setup and system commissioning functionality • Support of permanent magnet synchronous motors, linear motors, torque motors and asynchronous motors
Motion Controllers 	<ul style="list-style-type: none"> ▪ Higher machine productivity through short cycle times. ▪ Basis for some of the worlds most precise and demanding applications ▪ Better accuracy due to superior closed-loop control ▪ Cost savings in installation and operation due to flexible hardware and easy-to-use software platforms ▪ Convenience of remote servicing and debugging ▪ Moog's function blocks based on closed-loop expertise 	<ul style="list-style-type: none"> ▪ For closed-loop control (position, speed and force) of hydraulic and electric products ▪ Fieldbus options, Analogue I/O and Digital I/O available ▪ Simultaneous advanced control algorithms and PLC functionality ▪ Use of IEC1131 standards and protocols ensures fast implementation and easy set-up ▪ Cycle times up to 500 micro-seconds ▪ Multiple software configurable interfaces: SSI Encoder, CANopen, RS232, Ethernet, analogue/digital I/O and various serial interfaces ▪ A variety of extension modules, including analogue and digital expansion, CAN extension, temperature module and operator panels
TMC Controller 	<ul style="list-style-type: none"> ▪ Flexible and digital closed-loop control concept allows faster movements and therefore higher productivity of your machine ▪ Control unit based on an industrial PC with a Windows® XP embedded operating system, offering ease-of use and requiring minimal training ▪ Offers increased reliability as the unit can operate without a hard drive making it unsusceptible to vibrations from surrounding machinery 	<ul style="list-style-type: none"> ▪ The TMC-4 controls all blow-molding machines for either continuous extrusion or accumulator head operations ▪ Flexible Function Keys ▪ Compact dimensions allow for integrating the control panel in existing terminal systems ▪ An integrated weight control allows for additional savings of material

Product Line	Advantages	Range Outline
<p>Integrated Hydraulic Manifold Systems</p> 	<ul style="list-style-type: none"> ▪ Reduced size and weight ▪ Cleaner, leak free and more reliable solution to most difficult control system problems ▪ Fully integrated features of our IHMS makes installation simple ▪ Eliminates need for sub-plate manifolds, hard or flexible piping, connectors and clamps, all previously associated with distributed systems 	<ul style="list-style-type: none"> ▪ Customised designs for individual applications ▪ CAD System designs using proprietary manifold design software ▪ Wall thickness control ▪ Volumetric flow area calculation ▪ Utilisation of standard and custom components ▪ System modeling and performance capabilities ▪ Can be designed to accommodate the full range of Moog valves
<p>RKP-II Radial Piston Pump</p> 	<ul style="list-style-type: none"> ▪ Second generation pump has significantly reduced sound level for noise critical applications enabling machine builders implement European Union (EU) noise guideline (2003/10/EC) ▪ High flexibility in design due to a large number of sizes, control types and mounting flanges ▪ Total absence of non-ferrous materials inside the pump: well suited for special fluids ▪ No zinc-emission into the oil system ▪ Low natural oil flow pulsation ▪ Less transverse forces on bearing and pistons giving long service life ▪ Increased stability, even under unfavourable operating conditions ▪ Simplified connection for easy set-up and commissioning 	<ul style="list-style-type: none"> ▪ ATEX certified option ▪ 7 frame sizes (19, 32, 45, 63, 80, 100, 140ccm/r) ▪ Capable of being customised to run on various fluids including Skydrol, Hyjet and diesel ▪ Continuous pressure: 280bar (standard series) / 350 bar (HP-series) ▪ Fixed and variable versions ▪ Single-pumps and multiple-pumps ▪ Various controller options (EHV, hydromechanical, mechanical) ▪ Explosion-proof and digital control versions available ▪ Can be tandem mounted
<p>Customised Ballscrews & Planetary Rollerscrews</p> 	<ul style="list-style-type: none"> ▪ Various screw diameter-pitch combinations (screw load capacity and dynamic performances) ▪ Configurable screw end shafts (bearing housings, metric threads, socket heads, wrenches, bored heads, etc.) ▪ Nut customisation (shape, flange, coupling, number of circuits, special machining processes) ▪ Customisation of lubrication and materials appropriate to your application 	<ul style="list-style-type: none"> ▪ Single Flanged ▪ Single Flanged – preloaded ▪ Double Flanged – preloaded ▪ Single Flanged – one start ▪ Single Flanged – two starts ▪ Grades 1-3-5 ISO3408, standard or custom-made according to customer's needs
Test Controllers		
<p>Portable Test Controller</p> 	<ul style="list-style-type: none"> ▪ A portable and standalone test controller ▪ Unique control loops (e.g. force, displacement and acceleration) for faster and more efficient testing and reduced set-up time ▪ Simple operation that allows you to add just the functionality you need for cost-effective integration ▪ Built-in data-acquisition, integrated oscilloscope display and data storage capability on a local hard-disk, make testing easier and saving both lab space and running costs ▪ Flexibility with any hydraulic or electric actuator ▪ Plug and play with all connectors for cost effective, immediate integration ▪ Advanced control expandable up to four channels 	<ul style="list-style-type: none"> ▪ Integrated 640 x 480 full VGA color display ▪ Up to 2.5kHz multi channel or up to 10kHz single channel control loop (software selectable) ▪ Three feedback control possibility (force, position, acceleration) ▪ Bumpless instant mode switching between force and position mode ▪ Multi-channel function generator with a frequency range of 0.1 to 500Hz ▪ Optional analogue IO, digital IO, strain, accelerometer and manifold control boards
<p>Automotive Test Controller</p> 	<ul style="list-style-type: none"> ▪ Advanced control expandable to 32 channels ▪ Proven controller reliability—more than 5,000 control channels installed and used daily in test labs around the world ▪ Advanced safety checks built-in to ensure test article and test data are always protected ▪ High-performance operation for both basic and complex applications 	<ul style="list-style-type: none"> ▪ Pseudo channels capability allowing user to create online calculated channels using formulas and other inputs, ▪ Matrix control provides measurement and control flexibility for more efficient testing ▪ Dual mode, bumpless switching (e.g. Force, Position) to take advantage of full range of application ▪ Scripting for digital and analog I/O as well as limits and peak detectors making set up and running of tests easier ▪ Online adaptive controls for amplitude and phase to save set-up time ▪ Calibration and tuning wizard to facilitate and accelerate setup

Test Controllers

Aerospace Test Controller



- Advanced control expandable up to 500 channels
- Loop update rate 2,500 Hz for ultimate response
- Optimized control loop technology for faster, more accurate testing
- Pseudo channels capability to meet the most complex test requirements
- Distributed system architecture
- Flexibility with any hydraulic or electric actuator
- Plug and play for cost-effective, immediate integration of test modules
- Pseudo channels capability
- Matrix control provides measurement and control flexibility for more efficient testing
- Dual mode, bumpless switching (e.g. position, force) to take advantage of the full range of application
- Scripting for digital & analog I/O as well as limits and peak detectors makes set up and running of tests easier

Engineered Solutions For Power Generation

Blow Off Valves



- High speed actuation
- Two valves per engine set
- Prevents engine over run

Range Outline

- Opening times in less than 80 ms
- Pressure rated up to 210 bar

Water Wash Modules



- Delivers controlled high pressure wash fluid
- Improves gas turbine fuel efficiencies
- Approved for hazardous and extreme environments (ATEX)
- Customised design options

- Capable of delivering 15 LPM at 60 bar and 60°C
- Frequency, voltage and label language options
- On and offshore modules
- European and USA safety standards
- Lifespan of at least 3 years between servicing

Fuel Pumps



- High precision compact modular design
- Specifically designed for low viscosity fuels
- Mountings & body ports to suit OEM standards
- Custom design packages
- Full maintenance capability

- Gear pumps for low lubricity, low viscosity fuels
- Standard delivery pressures of up to 210 bar psi
- Flow rates up to 116cc/rev
- High efficiency
- ATEX options

Complete Flow Controls Solutions



- UK dedicated manufacturing facilities
- 2D/3D CAD systems
- Project and Design Engineering teams
- In-house pump performance testing
- Coded pipe welding capabilities
- Full understanding of European and USA specifications

- Gas and steam valve assemblies
- Fuel & lube oil pumps
- Skids and start packs
- Compressor wash modules
- Bespoke designs to meet specific project requirements
- European & USA Standards

Miniature Actuation Products & Systems



- Developed from Aerospace standard products.
- Extremely high power density
- Used in international Motorsport : Formula 1, WRC rally cars, LMP sports cars & Moto GP
- Has also been applied to Film & Theatre special effects , Oil & Gas production & Robotics
- Sub miniature valves for F1 (92 gm)
- Rugged cartridge direct drive valves for rallying.
- Valve flow rates from 0.4 to 18 l/min.
- Valve response times down to 2.8 mS.
- Miniature actuators with piston diameters down to 9mm
- Gearbox indexing valves.

Custom Designed Products and Systems



- Dedicated design capability for special actuation systems & products
- Confidential developments undertaken
- Special products for fluid control
- Manufacture of high precision fitted cylindrical components
- Manufacture of high precision EDM [spark eroded] components
- Rotary and linear power steering valves weighing as little as 75 gms
- Fuel and oil pressure regulating valves for F1
- Seal-less brake system components
- Special miniature manifolds
- Turnkey miniature

REPAIRS, SERVICE AND SUPPORT

At Tewkesbury, we offer a world class remanufacturing centre for the repair of Moog servovalves and servo-proportional valves, including a Class 100,000 Clean Room, with state of the art rigs for test and repair. All service work uses Moog authentic parts and Moog trained technicians with access to the original design and test specifications of the product as well as how the current performance relates to factors such as wear patterns, component fatigue, tolerances and revised performance capabilities. for: -

- Moog servovalves and servo-proportional valves
- In addition to Moog servovalves, we are also able to service other Moog products including radial piston pumps, servoactuators, servodrives and servomotors.
- Our service capability has also been extended to inspect, test and clean non Moog valves, as well as replacement of non Moog valves with new Moog for the cost of the repair. Terms and conditions will apply. Please contact us for further information

Moog customers can also benefit from:

- Fast Track Priority Repair Service for when there is an emergency and an urgent repair is required
- Top level informed technical support system from a global team of technology experts
- Facilities to assess and monitor system cleanliness including an oil sampling service to keep your machinery in top condition
- Valve testers for field use to help commission, service and troubleshoot control systems.
- Opportunity to sign up for a FREE quarterly newsletter to keep you informed about our global projects and new initiatives
- Training courses in partnership with the National Fluid Power Centre (NFPC) to enable engineers to maximise their knowledge of their machinery and keep costs down.

SERVICE PROGRAMS TO SUIT YOUR NEEDS

Moog customers can opt for a number of service programs to protect against unexpected downtime and plan budgets better.

Extended Warranty - providing total warranty coverage for one full year (or the equivalent number of working hours) beyond the expiration date of your original product warranty.

Preventative Maintenance - a yearly scheduled examination and thorough testing of your Moog servovalves enabling you to plan your downtime. Can be extended to other Moog products.

Full Service - A comprehensive service contract including temporary replacement servovalve and three-day fast track priority and super-fast one-day service. The full service program covers Moog and non Moog products and ensures an all inclusive service with a pre-defined fee. Particularly suited for businesses operating a complex supply chain or that need longer term cost-management and forecasting.

For further information about our Service and Repair facilities, please contact us for a separate brochure.

“ Our service and repair turnaround has fallen from up to 28 days to just 6 or 8 thanks to Moog’s fast track service.”

Katrina Sutton,

*Materials Team Leader
Wood Group Accessories
and Components Ltd*

SHAKEN AND STIRRED — MOOG HELPS SINK A BUILDING FOR JAMES BOND

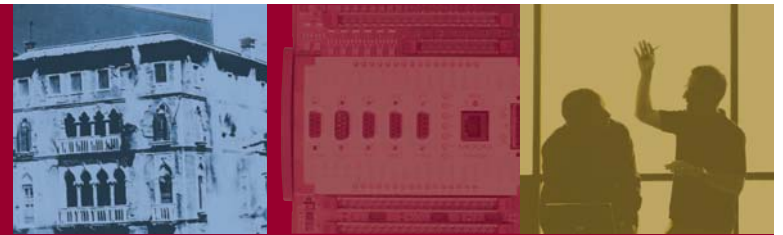
James Bond film 'Casino Royale' has been one of the most successful in this ever-popular franchise. One of the biggest, the sinking of a Venetian building, was a unique motion control challenge that involved Moog and its partner EMP Designs Ltd.

The Challenge

To sink the Venetian building, in the final scenes, using Moog's smooth and safe operation of a huge rig that had to sink one of three motion bases, the largest weighting 80,0000 kg into the water tanks at Pinewood Studios, England.

The Solution

The equipment designed to control the rig centred on an M3000 system, which for this application can be split into the hardware — Moog Servo Controller (MSC); and software — Moog Axis Control Software (MACS). It was used to control six digital Moog Axis Control Valves (ACV), which in turn operated six hydraulic actuators.



The Result

- Moog Servocontroller (M3000) and Moog Axis control software (MACS) providing extreme precision control, which is stable, flexible and cost effective.
- A hydraulic system based on digital valve technology
- Enhanced safety provided enabling team to make a controlled stop should it be needed.
- Ability to integrate a touch screen, giving a complete simplistic overview of the system
- Less prone to external influences such as radio frequencies

To read the full story go to www.moog.co.uk/industrial.

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