

THE FUTURE OF FIDELITY

Simulation solutions

WHERE CAN THE RIGHT SOLUTION TAKE YOU?

At any given moment, in training centers and military bases around the world, a Moog simulation solution is at work providing an unsurpassed level of performance, fidelity and reliability.

For more than 55 years, we've designed motion control subsystems and components for simulators of all types—starting with Moog Servovalves and then moving to hydraulic actuators and control loading systems. Today, we provide complete motion systems in both hydraulic and electric platforms. And while our name is synonymous with leading-edge motion control, it's our high level of design flexibility and unique expertise in solving customer challenges that truly sets us apart.

So how can Moog support your simulation requirements? For some customers, it's helping transition from hydraulic to electric technology. Others turn to us to help them significantly improve the productivity of the training systems. Still others seek our flexibility in providing a variety of solutions such as our advanced g-seat technologies and control loading systems for a range of mission critical training applications to meet their needs.

Simply put, our mission is to deliver the flexibility, innovation and trusted solutions you need for the most productive, highest fidelity simulation solution possible.

GIVING YOU THE LEADERSHIP EDGE

Moog is a leader in simulation solutions because we never stop looking forward. By collaborating with you to move your ideas ahead, our design teams have earned a reputation for innovation and problem solving. In the area of electric technology, our forward-thinking engineers have set a whole new standard in performance and versatility, helping you meet your toughest challenges.

Attaining higher levels of fidelity

We know that the realism of your visual systems has rapidly improved and you need that same level of fidelity in your motion systems. Our high-performance all-electric solutions and advances in control loading technology are unsurpassed in the industry.

Increased reliance on simulator-based pilot training drives the need for constant innovation in training systems. Our team co-developed the world's first all-electric high payload flight simulator (up to 14,500 kg [32,000 lb] payload) 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. This safe and reliable solution allows pilots to log their required flight time training hours on the ground—not in an actual aircraft.

Maximizing your availability and investment

A key concern for all training centers around the world is ensuring more availability with a goal of 24/7 training. Our all-electric systems require low maintenance (our customers estimate as much as 80% lower maintenance costs), leading to more availability.

We also maximize your investment in training facilities and systems. Our technology helps you to improve the efficiency of your systems typically by 75% lower energy consumption. In addition, the electric solution lowers the need for investment infrastructure and facilities since there is no need for a pump room or expensive pipe system. What's more, there are no environmental costs of oil or waste disposal.

Adding flexibility to training systems

Our integrated systems are scalable from low to high payloads and can meet the training needs of customers including business jets, commercial aircraft, helicopters and new categories like Very Light Jets (VLJs). For fighter pilot training, our high-performance G-seats integrated with control loading systems provide a realistic solution.

In addition, common software and hardware interfaces across all our subsystems mean easier and faster installation, commissioning and user training. Our experience means we can help you reduce development time and ensure that the subsystems we recommend have the best performance/size ratio to meet your exact requirements.

Tapping into worldwide support

The surging demand for pilot training in developing countries means OEMs and training centers require a partner with global reach and experience. Over the years, we've installed more than 4,000 control loading channels around the world. We've installed more than 400 simulators and we have operations in 26 countries worldwide. In short, our team of trained engineers is there to support you wherever you are.

Helping you find the right solution

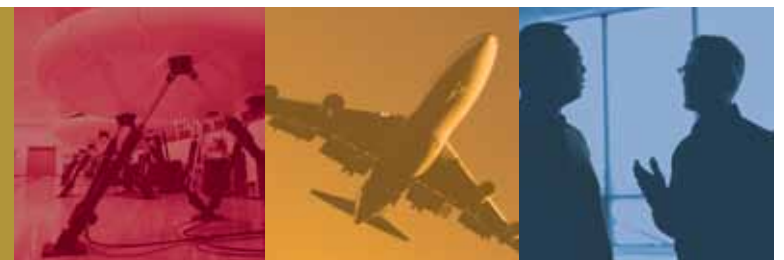
Our deep knowledge of motion systems means we have the resources and proven solutions to help you take advantage of the latest technology. From helping our customers successfully transition from hydraulic to electric technology to incorporating advances in motion control, we work with our customers to find the right solutions.

DELIVERING A NEW LEVEL OF PERFORMANCE

When two world leaders in flight simulation and pilot training decided the time was right to move from hydraulic technology to electric, Moog had the technical expertise and real-world experience no others could match.

The request

Provide all-electric motion and control loading systems for full flight simulator applications, including control software and support. The goal was to move from traditional hydraulic technology to take advantage of key benefits of electric, including higher fidelity performance, lower operating costs and cleaner, more efficient operation.



The solution

Moog partnered with each of these leading suppliers of flight simulators to deliver all-electric solutions uniquely configured to their applications. By adding key know-how in such areas as safety, noise/vibration, compliance, pilot training and maintenance, our team proved instrumental in ensuring the customers' key needs were met in a timely and cost-effective manner.

The result

Critical engineering and design breakthroughs in all-electric systems that are already redefining how the entire industry approaches motion control technology.

LEADING-EDGE PERFORMANCE ACROSS A VARIETY OF SOLUTIONS

Wherever the most demanding training regimen is required, you'll find Moog at work. Our solutions are used to provide highly realistic motion cues in simulators for commercial and military flight simulation, driver training, gunnery training, mission training, industrial simulation and material handling equipment training.

Our core strength is helping you maximize your overall investment by combining the leading-edge systems found on these pages with the technical expertise found only in the minds of our engineers. Here is a quick overview of the key systems we provide.

MOTION SYSTEMS



We are a world leader in the design, development and manufacture of electric and hydraulic motion platforms spanning a variety of applications for payloads ranging from 1,000 kg (2,200 lb) to 14,500 kg (32,000 lb). Our motion systems can be tailored for specific applications in 1, 2, 3, 5 or 6 Degrees of Freedom (DOF) configurations.

We have built more than 1,300 motion bases for leading customers around the world with new electric Level D-compliant simulators coming on line every month.

On the hydraulic side, Moog innovations include higher peak acceleration through our proven servovalve technology that has continually been optimized for the best possible dynamic performance for your specific application. In addition, the very high load capacity of our core products, valves and control electronics are used worldwide in motion systems up to 20,000 kg (45,000 lb).

Overall, our turnkey approach encompasses complete hydraulic and electric systems including:

- Complete motion bases in sizes including 12, 24, 36 and 60 inch actuators in a broad range of payloads
- Motion cueing and maintenance software
- Worldwide product support and service, training and assistance in system installation and commissioning
- System upgrades including transitioning from hydraulic to electric technology
- Customer-specific solutions including special platforms, access bridges, safety systems and other elements of a full turnkey approach

AT THE FOREFRONT OF ELECTRIC TECHNOLOGY

Electric technology is reshaping the way the entire industry looks at motion systems. Our long history of experience includes designing the first 4,500 kg (10,000 lb) electric platform in 1994 and, most recently, becoming the first company to produce electric motion platforms that have been certified for FAA and JAA Level D, and US Military "Ready for Training" accreditation.

Key advantages of electric technology include:

- A more realistic training experience through high-performance motion cueing and fewer audible signatures
- Lower operating and maintenance costs through energy efficiency, simplified PC-based troubleshooting and no expensive hydraulic infrastructure
- Reduced training costs by enabling most training to occur in the simulator, versus in the actual aircraft or vehicle



- Typically 75% less energy costs
- High degree of operator safety
- Simpler installation and commissioning
- A cleaner operating environment

As electric-based applications increase, you can expect a collaborative, face-to-face working relationship with a partner who understands your short- and long-term application needs, your business goals and your unique technological requirements.

CONTROL LOADING



Decades of experience and thousands of control loading channels in the field mean we're your proven source for both military and commercial control loading systems.

Turnkey control loading solutions are fully tailored to customer requirements. A typical

set-up includes a base frame, interconnecting linkages, replica controls and integrated control loading hardware and software.

Our unique model-follower force-loop technology provides the technical foundation for all our systems. Combined with highly responsive electric actuators and sophisticated software models, this technology provides the highest fidelity control loading available anywhere.

All actuators are based on brushless permanent magnet servomotors and digital control electronics for smooth, reliable performance. We offer an extensive range of high-performance linear and rotary actuators designed for the specific application needs of primary and secondary controls including:

- Electric Rotary Control Loaders with high dynamic are based on high torque servomotors in a direct-drive set-up and capable of generating output torque of up to 200 Nm (1,770 lb in) continuously for high-fidelity requirements
- Electric Rotary Control Loaders with medium dynamic are ideal for secondary controls and primary controls. They provide a medium torque and medium velocity
- Electric Linear Control Loaders are typically used for heavily-loaded primary controls

Our control loading solutions range from basic flight training to high fidelity full flight simulation that meet the highest level of certification from the JAA, FAA and military equivalents worldwide.

G-SEATS



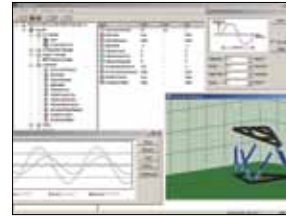
Moog G-seats reflect the depth of experience our team of experts has gained in motion cueing. Each seat features the same high fidelity controllers and user-friendly interface as our motion and control loading systems.

G-seat solutions cover a variety of key applications including:

- Fighter
- Helicopter
- Vibration seats
- G-suit systems

Each system is designed in close collaboration with customers to ensure total compliance with the demanding performance specifications of high-end training simulation.

SOFTWARE



Moog software gives the operator the tools to take simulation applications to the next level of performance and certification.

Our Motion Cueing and Maintenance software is US FAA-certified and features Advanced Platform Kinematics (APK) that enables full use of the kinematic envelope.

Our Control Loading software is available in either generic or aircraft-specific models that exactly replicate the controls of the simulated aircraft.

Designed for total flexibility and straightforward user operation, Moog software can be tailored to your specific application needs by our team of expert software engineers.

PRODUCTS



Moog Servovalves and Actuators are just a few of the high-performance components that are critical to Moog simulation solutions. By focusing on the performance of these high-quality individual 'building blocks,' the entire system can reach higher levels of fidelity, reliability and efficiency.



A HIGHER LEVEL OF SUPPORT

Partnering with Moog means you have a team of specialists behind you long after the installation and commissioning of your particular simulation solution.

From system commissioning to Moog Authentic Repair® services to ongoing product support, our expert engineers are on call around the world whenever you require assistance, troubleshooting, on-site repairs or replacements and maintenance. Likewise, we provide a full array of informative training materials and workshops designed to maximize your system investment.

Take the next step

Whatever your simulation requirements may be, we invite you to sit down with our team today. You'll find a group of experts committed to your ongoing success. And the leading-edge solutions you need to make a difference.

DIVING INTO MORE SUCCESSFUL TRAINING

Electric Boat Corporation, a premier designer and builder of nuclear submarines, sought to upgrade all of their hydraulic motion bases to electric technology, Moog, having successfully designed, produced and installed a complete system in 2001, approached the new challenge with a productive long-term solution.

The request

Upgrade the customer's entire submarine simulator portfolio—eight simulators in all—to electromechanical actuation. In addition, Electric Boat Corporation requested the design and delivery of two more full systems for increased training capabilities.



The solution

We delivered a solution that resulted in approximately 30% more cabin space—ideal for the limited space and building restrictions where the simulators reside. To meet the customer's unique performance requirements, all hardware, electronics and software is integrated and tailored to their exact specifications. Finally, by choosing an electric-based solution, Electric Boat Corporation was able to eliminate the 'wobbling' caused by hydraulic systems.

The result

An electric simulation solution designed to meet the customer's stringent performance specifications and provide high-performance training for many years to come.

TAKE A CLOSER LOOK

Simulation solutions from Moog are available around the world. For more information, visit our Web site or contact one of the locations below.

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The Future Of Fidelity
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