

HELPING SMART IDEAS TAKE FLIGHT

Aerospace test solutions

LEADING-EDGE TEST SOLUTIONS ARE JUST THE BEGINNING

In an industry that continually pushes technology to its absolute limits, employing the most advanced test solutions is critical. Aerospace test and application engineers today are managing an array of challenges unheard of just a few years ago. Faster test times, more complex test subjects and the push for greater cost efficiencies throughout the test lab mean engineers must work smarter than ever. And the choice of test systems can make all the difference.

Recognized as a leader in the aerospace industry for the last 55 years, we provide major aerospace companies with turnkey solutions. Our customers can expand test rigs easily, run more tests and increase test accuracy while keeping the tested specimen totally safe.

Today, the global resources of a billion-dollar corporation with applications that range from heavy industry to space and defense reinforce this customer-first approach, allowing our team to deliver high-performance test solutions to aerospace manufacturers and test labs around the globe.

Incorporating the world-class performance of Moog Test Controllers and Moog Servovalves, our technological leadership is unsurpassed. But it's our depth of expertise and collaborative approach to your unique requirements that truly set us apart. It's an approach that focuses on your ideas first, giving you the tools, techniques and ideas to turn today's testing challenges into tomorrow's successes.

GLOBAL REACH, PERSONAL COMMITMENT

Across the globe, Moog teams are hard at work delivering prompt, proactive service to aerospace companies and test labs alike. In more than 26 countries worldwide, our representatives stand ready to help you take your aerospace test applications further than you may have thought possible.

55 years of service

This depth of service is made possible by a robust product line that ensures a high level of consistency and performance integrity. After all, we're part of the same company who pioneered the commercial servovalve more than five decades ago. Today, this legacy in precision closed loop control is stronger than ever.

But this commitment to product consistency and our vast global reach is just the beginning. Through close, collaborative working relationships with customers, we help drive increased productivity, introduce more efficient test methods and produce faster test times.

Meeting one challenge at a time

Rather than relying upon the same off-the-shelf systems that worked for someone else, we work hard to understand your specific test needs and deliver a turnkey solution that incorporates high-performance components and sophisticated software tailored to the application.

To provide faster test solutions, for example, we have developed an array of testing tools that are simpler to set up and more user friendly. Instead of complex interfaces or cumbersome rigs, we've designed servocontrollers that bring modularity and plug-and-play

performance to the test lab. We've created software interfaces that instantly provide the critical data you need, in a highly intuitive format. And we've ensured that all Moog systems will seamlessly integrate with the other equipment in your work environment.

After all, the faster you can complete your testing procedures and protocols, the more cost-effective your entire operation can be.

Flexibility for the future

Whether it's facilitating a better testing methodology or simply helping you upgrade to high-performance digital servocontrollers, our technical experts have gained a reputation for flexibility and unsurpassed service with the world's largest aerospace companies. And we're just getting started.

Here are a few of our key testing applications for commercial and military airplanes, spacecraft and helicopters:

- Iron bird testing
- Aircraft/airframe structural tests
- Spacecraft structural integrity
- Hydraulic system tests
- Landing gear, engine casing, and flight control actuation tests loading tests
- Load calibration tests

AIRFRAME STRUCTURAL TEST PROGRAMME IN RECORD BREAKING TIME

When UK based Agusta Westland (AW) embarked on the full scale structural test of a new variant helicopter they knew they needed to achieve results in a very short time to satisfy their customer's programme. An airframe structural test is a vital pre-requisite to flight clearance and subjects the structure to representative service life conditions in a laboratory environment.

AW approached Moog to work with them to create an innovative, fully integrated high performance test facility, utilising Moogs product line and engineering expertise.

The Challenge

- To develop a turn-key testing facility with more than 100 servo hydraulic actuators.
- To carry out an extensive programme of structural tests.
- To present the test results within a fraction of the time previously attained for such tests.



The Solution

Moog's solution was to incorporate test controllers that helped the customer benefit from greater efficiency and the ability to meet the demands of all its locations. Moogs innovative test products enabled faster and more accurate testing, saving the company time and money on its extensive testing schedules. The dual safety aspect of the system protects the expensive and unique test specimens.

The Result

- Prestigious test facility installed, commissioned and ready for use ahead of programme.
- Test re-configuration time reduced from months to days.
- Results presented to customer on time.
- Industry award was given to the team to acknowledge the achievements of the project.

INNOVATIVE TURNKEY SOLUTIONS PROVEN IN LABS WORLDWIDE

Major aerospace companies turn to us for turnkey solutions that integrate the essential components and software with unmatched consultative expertise. Our core strength is helping maximize your overall investment by bringing together the key systems and knowledge your unique test applications require—affording you the time and resources to focus on other areas.

To ensure system reliability, longevity and performance, we incorporate an array of high-quality components. All are engineered for precision, consistency and total flexibility. These components form the building blocks for our full range of turnkey solutions, providing world-class performance in some of the world's most critical applications.

TEST CONTROLLERS



Moog delivers the flexibility, innovation and trusted solutions you need for a smart approach to aerospace testing. The heart of all our solutions is the control hardware and software that sets the pace for the industry. Our feature-rich Aerospace Test Controllers are all based on user input and incorporate the innovations we have learned from working closely on demanding, high performance testing and simulation applications in labs and aerospace manufacturing facilities around the world.

Advanced control technology — Unique force loop model for exacting control and faster testing

User-friendly operation — For maximum flexibility in your test lab and minimum set-up time

Reliability/Traceability — Easily configurable failsafe safety features to protect your valuable test articles and keep those testing going at all costs

Networking — You can be sure to have high-performance interconnect network you need for current and future needs

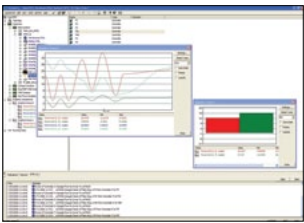
Value — From new equipment to upgrades, you can buy just the features you need

ELECTRIC PRODUCTS



Designed to meet your specific requirements for simple integration, we offer a variety of electric-based actuators that provide a cost-effective means of applying representative test loads (under closed-loop control) to aero structures in the test lab. These general purpose or fatigue-rated actuators are ideal for structural testing applications that require continuous operation with minimal maintenance.

TEST SOFTWARE SUITE



Moog provides open architecture control software developed specifically for your unique needs in static, fatigue and system testing. Our test software provides a user-friendly, straightforward approach to overcome the often complex processes involved in aerospace test applications.

For example, our unique graphical user interface quickly and easily guides you through each step of the process in creating a test, calibrating the system, tuning the controllers, defining your spectrum and running the test. It

eliminates the tedious task of browsing through multiple windows and adds speed and efficiency to the entire test process.

DATA ACQUISITION

The Moog Test Control System provides a high speed digital interface suitable for integrating with several industry standard data acquisition systems to create a complete control and monitoring facility.

Real time Test Spectrum position data, load demand and feedback signals are time synchronised with test article strain monitoring to provide the Test and Applications engineers with comprehensive graphical test monitoring together with data storage for subsequent analysis.

HYDRO-MECHANICAL EQUIPMENT AND SYSTEMS FOR AEROSPACE TESTING

At Moog, we understand that the best aerospace test solutions start with a proper foundation. That is why we focus our expertise and world-class resources on ensuring the core components behind every critical application offer unsurpassed performance reliability and longevity.

SERVOVALVES, MANIFOLDS, ACTUATORS AND PUMPS



Moog Servovalves, Manifolds and Hydraulic Actuators are just a few of the products that are critical to our solutions.

A focus on the performance of these high-quality individual products ensures the entire system can reach higher levels of efficiency, reliability and longevity while ensuring the safety of the test article.

HYDRAULIC DISTRIBUTION MANIFOLDS



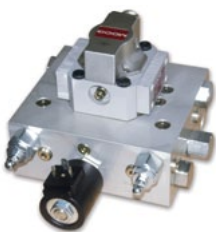
Connects the individual actuator assemblies to the Hydraulic Service Manifold (HSM) or Hydraulic Power Unit (HPU) enabling the connection of large numbers of individual actuators to either the HSM or HPU to enable individual isolation of actuators.

CONTROLLED LOAD ABORT MANIFOLD (CLAM)



Offers high level test article protection with symmetric or asymmetric loading actuators operated under closed loop servo control, and is used in conjunction with a Moog CLAM control system

HYDRAULIC SAFETY MANIFOLDS



A single solenoid ‘power to run’ unit that will unload the test article in a controlled manner upon power failure. Designed to offer a high level of test article protection with symmetric loading actuators operating under closed loop servo control.

STRUCTURAL TEST ACTUATORS



For Specimen Load Application - Designed for a wide range of structural testing, combining our knowledge of structural testing with our expertise in servo hydraulics

HYDRAULIC SERVICE MANIFOLDS



Serves as the switching/isolation interface between the source of the hydraulic power and the local test rig devices.

HYDRAULIC POWER UNITS



Specifically designed to be the heart of the aerospace test system. Units are available in a variety of sizes for virtually any application. The unit provides continuous hydraulic power to ensure your test runs exactly as planned, while offering a superior level of test specimen protection.

AEROSPACE TESTING APPLICATIONS		These range of products can be used in the following fatigue testing applications, which ranges from complete aircraft to sub-assemblies and components.					
Type of Test	Aircraft/Airframe Structural	Hydraulic Distribution Manifold	Hydraulic Safety Manifold	Hydraulic Service Manifold	Controlled Load Abort Manifold (CLAM)	Structural Test Actuators	Hydraulic Power Unit
	Iron bird						✓
	Landing Gear	✓	✓	✓	✓	✓	✓
	Helicopter Airframe, Rotor head and Blade Tests						✓
	Fuselage and Cockpit Pressurisation						✓
	Engine Casing						✓
	Fin Actuation Loading						✓
	Hydraulic System						✓
	Load Calibration						✓
	Spacecraft Structural Integrity						✓
	Sub Assembly	✓	✓	✓	✓	✓	
	Component Testing		✓	✓	✓	✓	

A HIGHER LEVEL OF SUPPORT

From system commissioning to Moog Authentic Repair® services, you can be assured that Moog is there when you need us.

Our trained and authorized engineers are on call across the globe, ready to respond quickly and professionally to help you get the most from your test equipment investment. Rely on us for services that include:

- Application engineering
- Start-up and installation
- Commissioning
- Training
- Design work
- Aftersales support
- Test execution

Participate in future innovation

In addition to ongoing face-to-face collaboration, we know how important it is to listen to customers on an ongoing basis. So we designed a password-protected section on our Web site that allows you to contact us with key insights or questions related to your Moog test systems.

For example, should you have a suggestion related to a feature or a question related to a specific application, it's simple to notify us immediately via this Web site. We also host user groups on an international level to help drive design innovation. It's the ideal way to stay connected and incorporate your insights and input into test system design.

Another key service we offer to customers worldwide is in the area of upgrades. From simple component upgrades to helping you incorporate electric-based systems into your test environment, our specialists and engineers are always available to support your technology needs.

A partner for tomorrow

Isn't it time you work with a partner who understands what makes your aerospace test applications unique? Who can offer both the world-class products and the collaborative expertise you need to reach the next level of performance? And who you can count on for swift, reliable answers and equipment on your schedule, not theirs?

Contact Moog today. And see for yourself how the right partner can help your aerospace test ideas take flight, again and again.

CONTROLLING COMPLEX FATIGUE TESTING ON THE AIRFRAME OF AN F-35 LIGHTNING II

BAE Systems based in the UK required a test control system to enable them to undertake structural fatigue testing on the airframe of a Conventional Take-off and Landing (CTOL) variant of a Lockheed Martin F-35 Lightning II,

The Challenge

Hydraulic actuators apply service loads to the airframe using state of the art control system technology to ensure the safety of the specimen and operators is maintained all the time. The fully production-representative version of the F-35 is subjected to two life times of cyclic spectrum fatigue loading to demonstrate that the economic life of the test article is equal to or greater than the design service life when subjected to the design service load spectrum. Considered one of the most complex fatigue tests undertaken by BAE Systems and by any test facility in the world,

The Solution

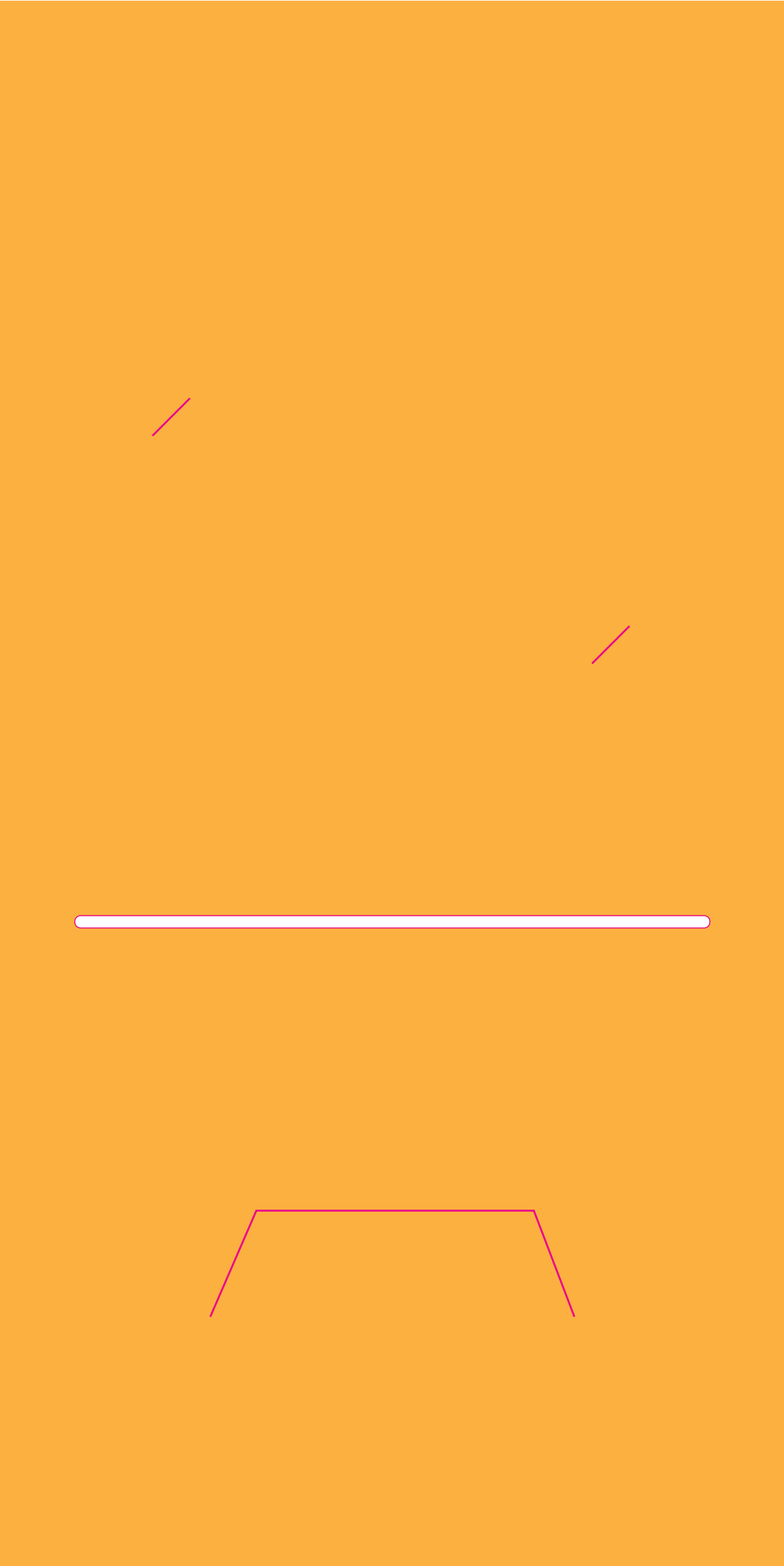
Moog supplied a digital closed loop multi-channel servo control system capable of controlling 165 hydraulic actuators via Moog D761 digital Servovalves and Moog Test Controllers. The system is a transparently integrated Data Acquisition System (DAS) utilising HBM data logging equipment. Moog also helped install, power up and check-out the equipment as part of the preliminary commissioning exercise.



In addition, the test system affords real-time transmission of load cell signals, flight spectrum counters and Test Load Condition (TLC) numbers to the data acquisition system. This data, combined with the corresponding strain data, provides efficient strain analysis for each TLC as the test progresses, saving even more time and effort.

The Result

- The Test Controller integrates with the Data Acquisition system so that specific data logging actions can be carried out automatically.
- Testing can run unattended 24/7 providing significant cost savings.
- A comprehensive safety system is embodied as part of the controller, so that in the event of any system malfunction, the load is removed under full system control without risk to the specimen.
- Moog also provides comprehensive technical support of the systems (static and fatigue) to ensure continued uptime/availability under the auspices of a formal laboratory service and support agreement.



TAKE A CLOSER LOOK.

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

Argentina
+54 11 4326 5916
info.argentina@moog.com

India
+91 80 4057 6605
info.india@moog.com

Singapore
+65 677 36238
info.singapore@moog.com

Australia
+61 3 9561 6044
info.australia@moog.com

Ireland
+353 21 451 9000
info.ireland@moog.com

South Africa
+27 12 653 6768
info.southafrica@moog.com

Brazil
+55 11 3572 0400
info.brazil@moog.com

Italy
+39 0332 421 111
info.italy@moog.com

Spain
+34 902 133 240
info.spain@moog.com

Canada
+1 716 652 2000
info.canada@moog.com

Japan
+81 46 355 3767
info.japan@moog.com

Sweden
+46 31 680 060
info.sweden@moog.com

China
+86 21 2893 1600
info.china@moog.com

Korea
+82 31 764 6711
info.korea@moog.com

Switzerland
+41 71 394 5010
info.switzerland@moog.com

Finland
+358 10 422 1840
info.finland@moog.com

Luxembourg
+352 40 46 401
info.luxembourg@moog.com

United Kingdom
+44 1684 296600
info.uk@moog.com

France
+33 1 4560 7000
info.france@moog.com

The Netherlands
+31 252 462 000
info.thenetherlands@moog.com

USA
+1 716 652 2000
info.usa@moog.com

Germany
+49 7031 622 0
info.germany@moog.com

Norway
+47 6494 1948
info.norway@moog.com

Hong Kong
+852 2 635 3200
info.hongkong@moog.com

Russia
+7 831 713 1811
info.russia@moog.com

www.moog.com/industrial

Moog is a registered trademark of Moog Inc. and its subsidiaries. All trademarks as indicated herein are the property of Moog Inc. and its subsidiaries.

©2010 Moog Inc. All rights reserved. All changes are reserved.

Aerospace Testing Overview
Moog/Rev.2, October 2010, Id. CDL28942-en