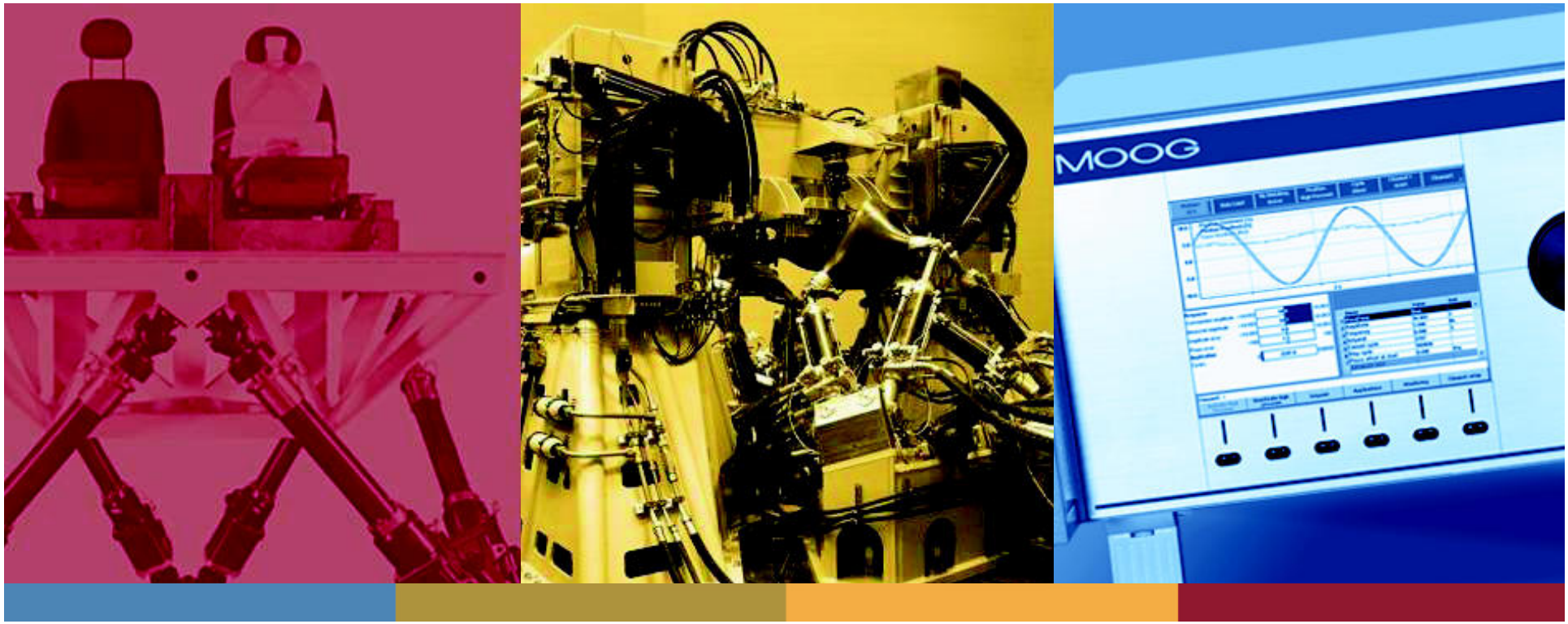
Human and Hardware in the loop testing

PLOT Showcase

23 November 2011

FHI, Leusden

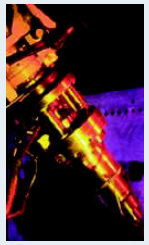


Agenda

- Introduction Moog
- Definition Hardware - and Human in the loop
- Hardware in the loop example
- Driving simulators
- Human in the loop example
- Hardware and Human in the loop (H2IL) combination

Business Segments

Moog Inc.

Industrial Group	Space and Defense Group	Medical Devices Group	Components Group	Aircraft Group
Motion control solutions for plastics, power generation, wind energy, metal forming, heavy industry, testing, and simulation	Motion control solutions for satellites, space vehicles, launch vehicles, missiles, armored vehicles, naval systems and surveillance	Range of medical pump technologies and fluid delivery systems	Slip ring and motion technology products for industrial, medical, marine, aerospace, and defense markets	Primary and secondary flight controls for commercial and military aircraft
				

Simulation Systems
Global Leadership with Innovative Solutions

MOOG

Solutions
- Motion Systems
- Control Loading Systems
- G-Seats

Key Accomplishments
- World's first All Electric Motion System with US and EU level D certification
- Over 500 motion base systems installed
- Over 4,000 channels of control loading in the field

Customer Benefits
- High fidelity systems leading to realistic training
- All electro mechanical systems
- Low maintenance and operating costs

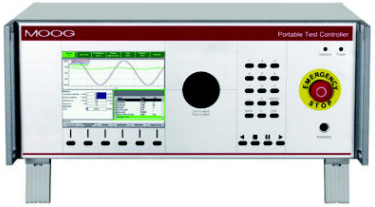
Aerospace and Automotive Testing – Leading-Edge Test Solutions

MOOG

<u>Solutions</u>
- From Test software, controllers and actuators to dedicated high performance test systems

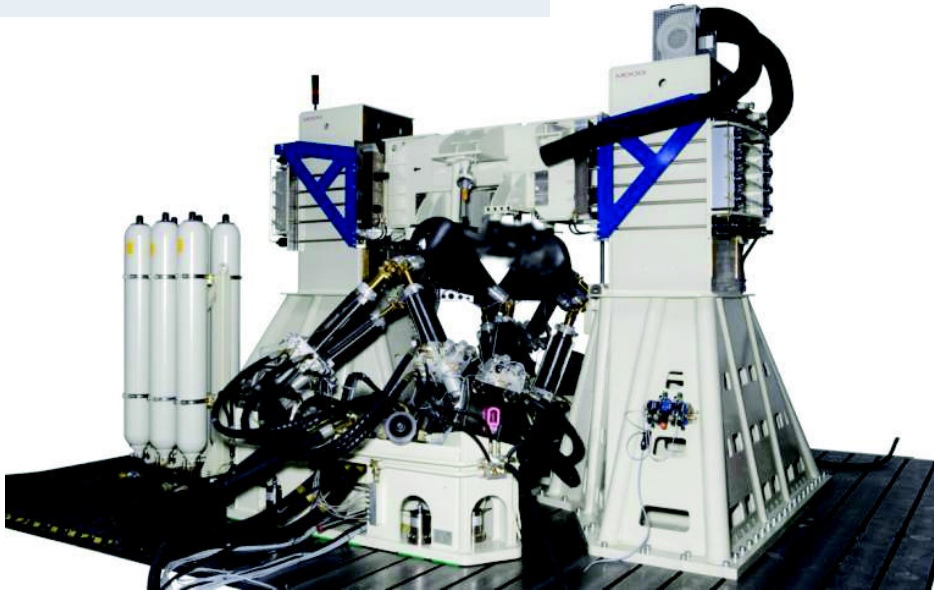
<u>Key Accomplishments</u>
- Aerospace structural testing solutions apply faster load profiles to reduce test times
- Hydraulic hexapods for automotive testing
- Advanced human-in-the-loop driving simulators

<u>Customer Benefits</u>
- More accurate testing
- Quicker set up and improved test speed
- Best price/performance ratio in market
- Customized solutions



Automotive industry challenges:

- Reduce development time to shorten time-to-market
- Improve quality
- Fulfill legislation requirements
- Enhance performance,
- Reduce CO2 emission using new materials
- Optimizing the increasing complexity of modern vehicles
- Reducing costs



What is it?

Hardware in the loop Testing:

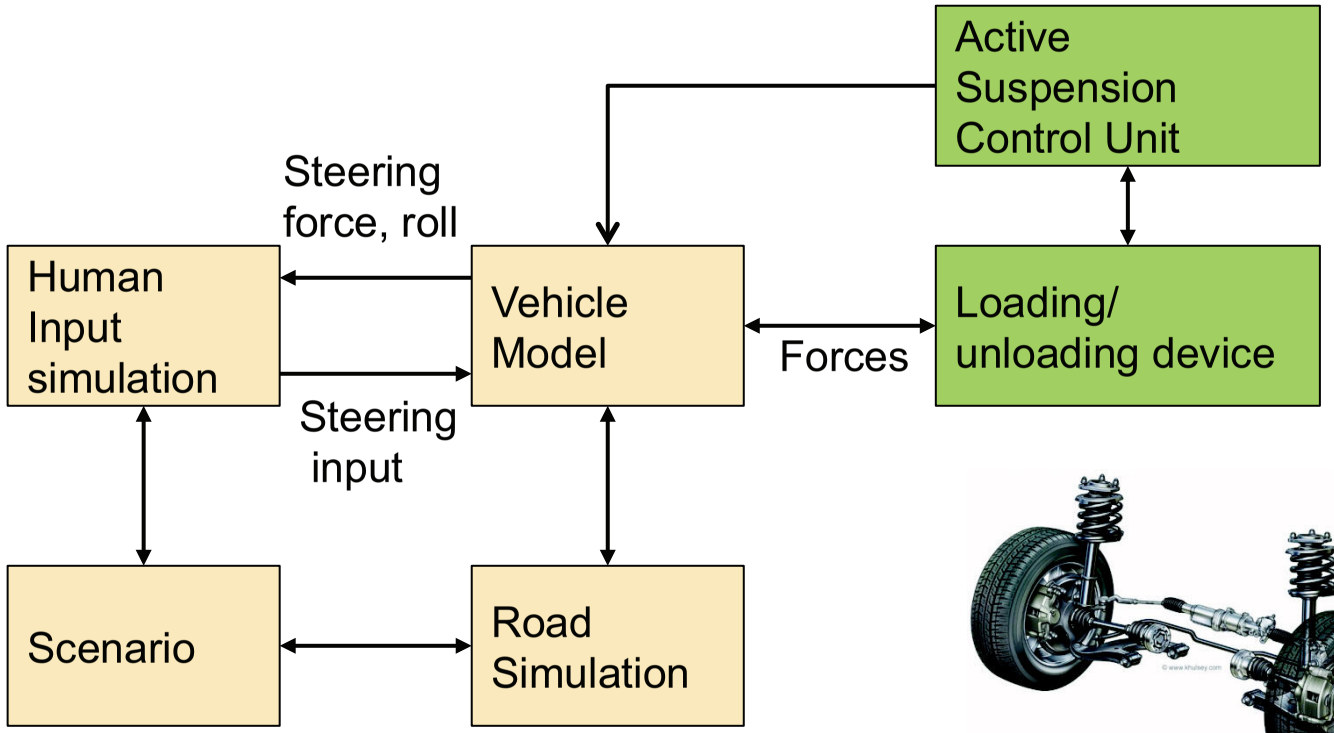
- Testing a product (algorithms) by emulation of sensors and actuators that interface with the product.

Human in the loop Testing:

- Human evaluation of a (virtual) design by simulation of (components or complete vehicles

Hardware in the loop: active suspension

- Optimizing Active Suspension Control Unit algorithms
- Test suspension actuator system



Hardware in the loop Testing: advantages

Start testing earlier in development process:

- Optimizing algorithms before hardware is available
- Emulating missing other hardware real tests can start when part is available
- Complete vehicle proto types are only available late in the process

Reduction of costs:

- Vehicle and component proto types are very expensive
- Complete testrigs are expensive and time consuming

Hardware in the loop Testing: advantages

Reduction of effort:

- Better reproduction
- Systematic variation
- Automated testing
- Easier and quicker optimization

Safe

- Simulation of dangerous tests to reduce risk on equipment, components and driver
- Safe testing of high voltage batteries controls