Aerospace and Defense Forum 2017
An Industry Event Hosted by National Instruments
ZAL, Hamburg, Deutschland
Dynamik in der globalisierten Flugzeugentwicklung
– Implikationen und Chancen aus der Sicht der IABG

Dr. Thomas Anderl
Head of Department System & HiL Test Rigs
IABG – Partner for Test & Qualification

Fatigue Investigations
Functional Testing
Test Facility Operation

Structural Testing
Environmental Testing

Analysis, Specification, Development

Impact Testing
Shock & Vibration

FEA / Multi Body Simulation
Static and Cyclic Testing

Materials Laboratory
Global Aeronautic Market – Prospects

- **Increase of Air Passengers**
  - 2016: ~ 3.8 bn
  - 2035: ~ 7.2 bn

- **High Backloads and Demand for Passenger Aircrafts**
  (..~35 000 until 2036)

- **Increase of Competitive Pressure in all Markets**

- **Expected Key-Market Development from German Aeronautic Industrie’s point of view**

  - Increase of Air Passengers
    - 2016: ~ 3.8 bn
    - 2035: ~ 7.2 bn

  - High Backloads and Demand for Passenger Aircrafts
    (..~35 000 until 2036)

  - Increase of Competitive Pressure in all Markets

**Key Success Factors**

- Economic Efficiency
- Dynamic Market Response
# Mid & Large Aircraft Development Projects

## Incremental Innovation

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### Disruptive Technologies

- A300NG
- A3X0
- Y1
- C929

Source: BDLI, McKinsey & Company
# Technology Main Streams – 3 examples

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<th>2010</th>
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**Effective & Virtual Design & Testing**

**Additive Manufacturing**

- e.g. A380 spoiler actuator valve block

**more Electrical Aircraft**

Source: BDLI
More Electric Aircraft
– and some remarkable Electric Aircrafts

Solar Impulse

Lilium Jet

Airbus E-FAN

NASA GL-10

ELIAS

Volocopter VC200

Siemens eAircraft
Some Conclusions for IABG Strategy

- Extend Core-Business to new Customers (local & global)
- Extend Services
  - Provide Services for new Technology Streams (e.g. Additive Manufacturing, Electric Actuators) & new Markets (e.g. China)
  - Transfer Defense Services to Aeronautics (e.g. Life Cycle Management, Logistic Support)
  - Transfer Areonautic Services to other Branches (e.g. Wind Power)
- Establish Partnership with Customers, Suppliers & Development Partners
- Operate as Strategic Partner for European & International Industry
End-to-End Support in Simulation & Testing of Systems

- Requirements / Specification
- Concept
- Design
- Manufacturing
- Testing and Certification
- In Service Support

System Specification

System Test

Loads on Subsystems

Assembly Test

Loads on Components

Component Test

Local Stresses and Strains

Material Test
End-to-End Support for the Aeronautics Industry

- Requirements / Specification
- Concept
- Design
- Manufacturing
- Testing and Certification
- In Service Support

Testing - Services
Certification Support
Logistics Support
Life Cycle Cost Management
Analysis and Simulation
Configuration Management
Engineering Support

Training
Core & more/additional international Business

- Static & Fatigue Tests
- Ground Load Calibration
- Qualification Tests of the horizontal and vertical Tail Unit
- Flight Tests
Full Scale Tests (Bombardier\* CSeries\* Aircraft Tests)

- Contributions to the Integrated Systems Test and Certification Rig (ISTCR)
- Static & Fatigue Tests of the Main and Nose Landing Gear (Liebherr Aerospace)
- Performance of the Full-Scale Durability and Damage Tolerance Test (DADTT)

* Bombardier and CSeries are trademarks of Bombardier Inc. or its subsidiaries
IABG Service for Virtual Testing

AUTOMOTIVE  INFOCOM  MOBILITY, ENERGY & ENVIRONMENT  AERONAUTICS  SPACE  DEFENCE & SECURITY
IABG Test Cells & HiL-Test Rigs for Aeronautic Systems
Iron Bird Loading Systems – examples

- Flap Loading System
- Slat Loading System
- Spoiler Loading Systems
  - Mechanical Setup and Interfaces
  - Actuators & Sensors
  - Automation System / Load Control Functions
IABG Automation Platform for System & HiL-Test Rigs

**Test Rig Measurants**

- Sensors
- Load Actuators
- Specimen Device

**Specimen Model**

**NI LabVIEW**
- Customizable User Interface
- Test bench control

**NI VeriStand**
- Configurable data acquisition & logging
- Model integration
- Alarming
- ...  

**WINEMAN INERTIA**
- Customer defineable tests ...

**NI DIAdem**
- Quick location of data
- Data analysis
- Report generation

**NI PXI**
- Specimen & Device Control
- Load Actuator Control

**PC**
- Data storage

**National Instruments**
- Silver Alliance Partner
Advanced Landing Gear Test Cell

- 0..800 kN
- 0..±100 kN
- 0..±125 km/h
- 0..±125 mm
- 1250 kW, 420 rpm
Advanced Landing Gear Test Cell

Operation Modes

Landing gear vertical dynamics
- with fixed drum
- with free rolling wheel

Braking Maneuvers with controlled vertical loads
- at initial speeds values
- at initial speeds with obstacles
- at initial speeds with synthetic road excitation

Brake System interaction during landing/taxiing maneuver with measured road excitation

Rolling during landing/taxiing maneuver with synthetic lateral excitation of the wheel
Functions, Control & Monitoring System

Core Functions
- Controllers
  - Displacement/Force
  - Speed/Torque
- Measured Signals
  - Test Cell Signals
  - Specimen Loads & Deflections
- Plane Vibration Model
- Test Cell Automation

Design & Implementation
- Mechanics
- Fluid Power
- Electrics/Electronics
- Functions

NI PXI Real Time HW

NI VeriStand
LabVIEW
INERTIA
IABG provides End-to-End Support for Aeronautic Industry

- Experimental testing (structural, functional & flight tests, product qualification)
- HiL- and System Test Rigs
- Engineering Support (Design, Virtual Testing, Functional Safety)
- Structural Monitoring and Damage Analysis
- Provision of the test infrastructure

and is strategic partner for the international Industry.
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germany.ni.com/aerospace-defence-forum