
NATIONAL
INSTRUMENTS™

# NI Aerospace and Defense Day 2013

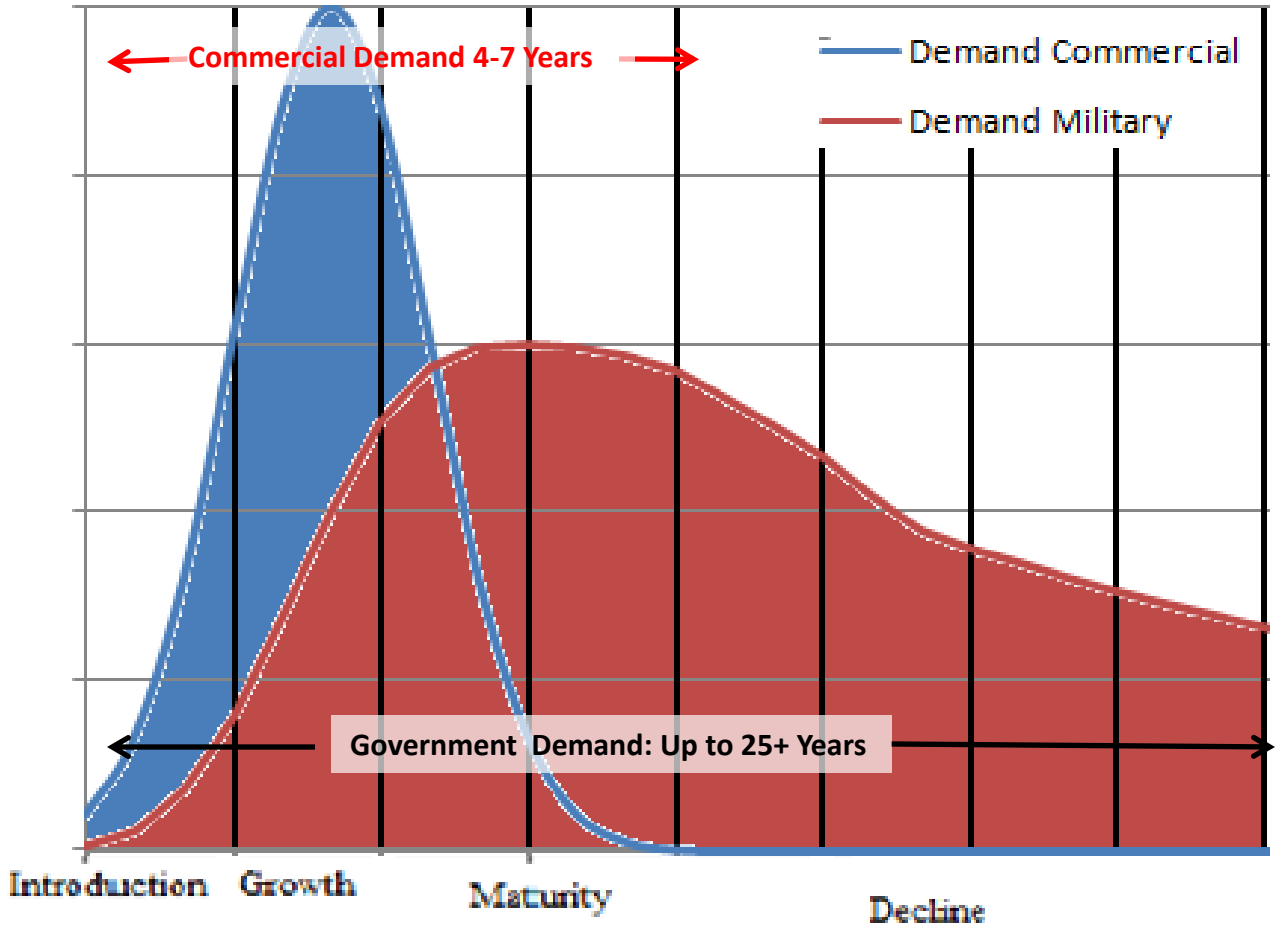
Noah Reding

Automotive and Aerospace Product Manager



NATIONAL INSTRUMENTS

# System Life Cycle Stages




- Military demand lags commercial demands
- Reduced budget
- Impacted weapon system acquisition
- Forced to extend the life of legacy systems
- Reductions in acquisition of replacement systems.

"Product Life Cycle Data Model," *American Standard ANSI/EIA-724, September 19, 1997.*

# 1. Open System Approach

- Commercially-Off-The-Shelf (COTS) hardware for system development and quick prototyping
- Flexible Software Platform
- Local development of intellectual property and retaining know-how

# 2. Ecosystem

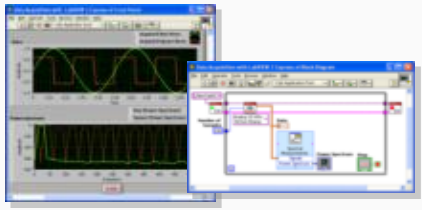
- Local domain expertise for Software Development
- Integration and Ruggedization
- Qualification testing
- Future Maintainability
- Specialized Research support

# National Instruments – What We Do

Graphical system design combines graphical programming software with modular hardware, leveraging the latest technologies

Low-Cost Modular Measurement and Control Hardware

Productive Software Development Tools



Highly Integrated Systems Platforms

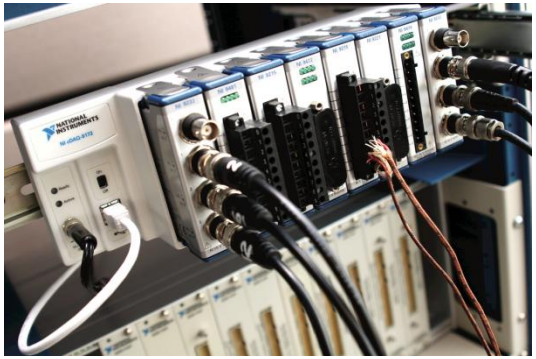


NATIONAL INSTRUMENTS

# Build Better Systems Faster


Long-Term Scalability

Lower Costs



Better integration

# How does Graphical System Design Help?

Theory

Curriculum Integration

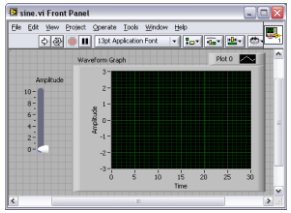
Design / Simulate

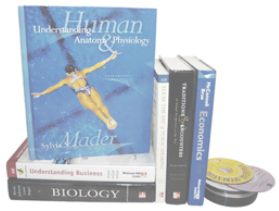
Real World I/O Integration

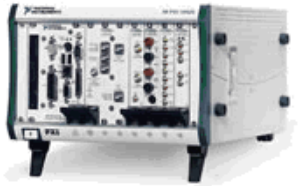
Prototype

Industry Relevant Integration

Deploy

# Applications

Embedded RF | Automated Test | Control, Simulation and Monitoring

Flight Termination System Tester

Radio Communication Test Set

Channel Emulator

HIL Simulators

Condition Monitoring System

Satellite Emulation

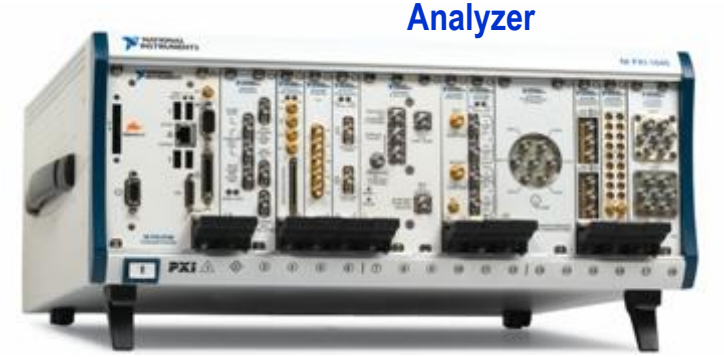
Data Acquisition System

Radar Testing

Fault Signature Analyzer

Software Defined Radio

Spectrum Monitoring



EMCS

N-Channel Phase Synchronized Generation/ Acquisition

Radio Navigation

Structural ATE

Threat Simulator

Multi-channel Embedded Control System

Fault Insertion Unit

FADEC ATEs

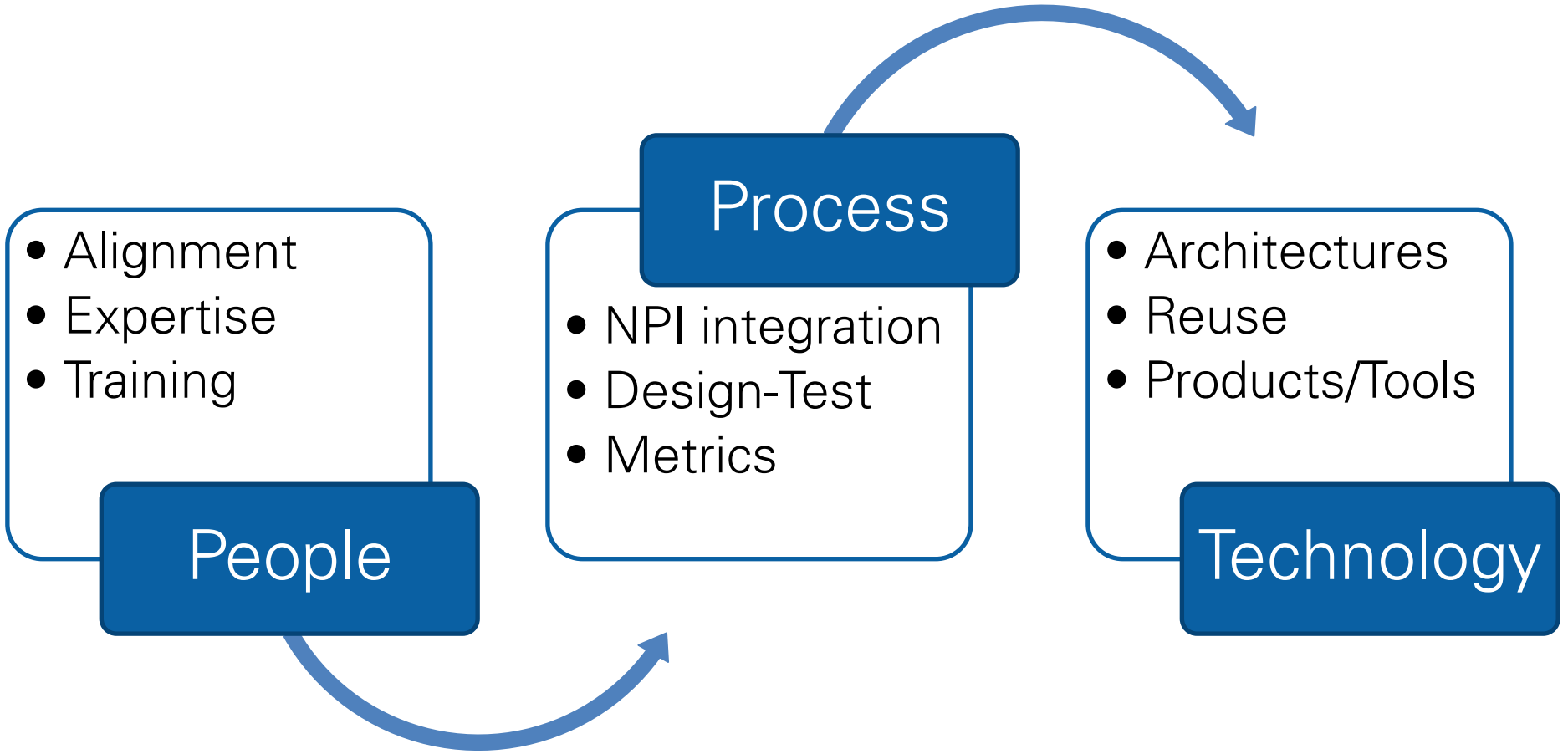
Wideband Record & Playback

Board ATE

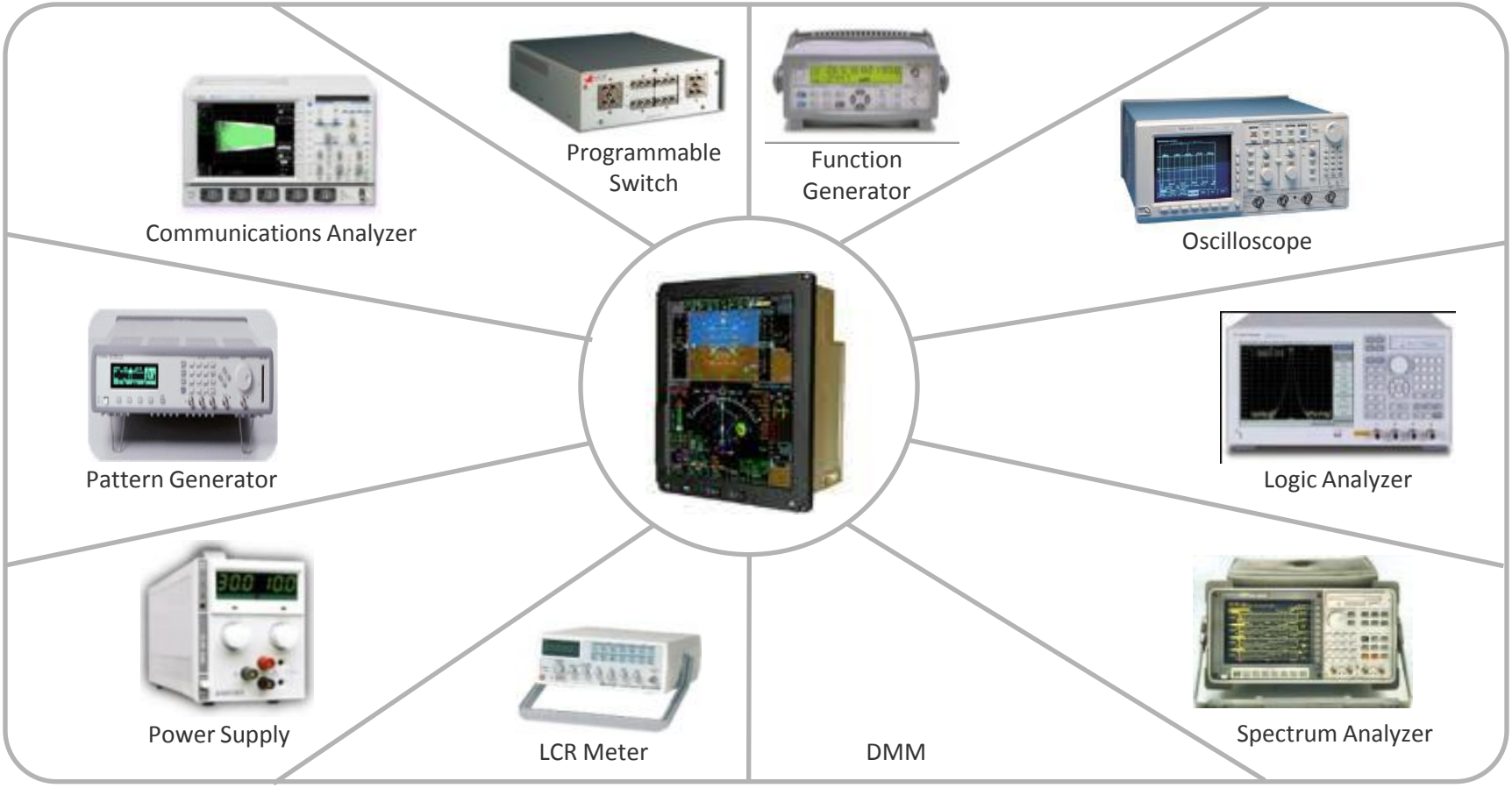
Telecom Standards, IEEE 802.11/ 16, Bluetooth, GSM, CDMA2K, WCDMA

Receiver Testing

# Optimization for Test



# The Traditional Approach






Photos Courtesy of Agilent, Keithley, and Nicolet

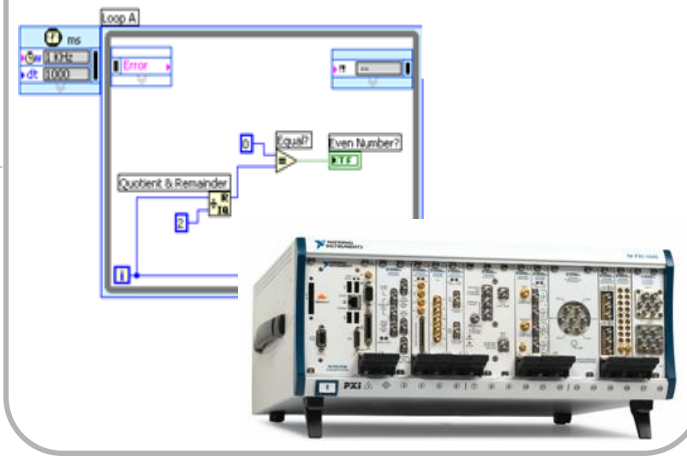


NATIONAL INSTRUMENTS

# NI Graphical System Design Approach

**Traditional Solution**

**PXI Solution**




- Lower cost
- Higher performance
- Smaller size
- Flexibility
- Easily upgradable design
- User-defined solution



Photos Courtesy of Agilent, Keithley, and Nicolet



NATIONAL INSTRUMENTS

# Pioneers of PXI Technology

Rugged, industrial

Quad-Core CPU

PXI Express Backplane

Timing, Triggering, and Synchronization

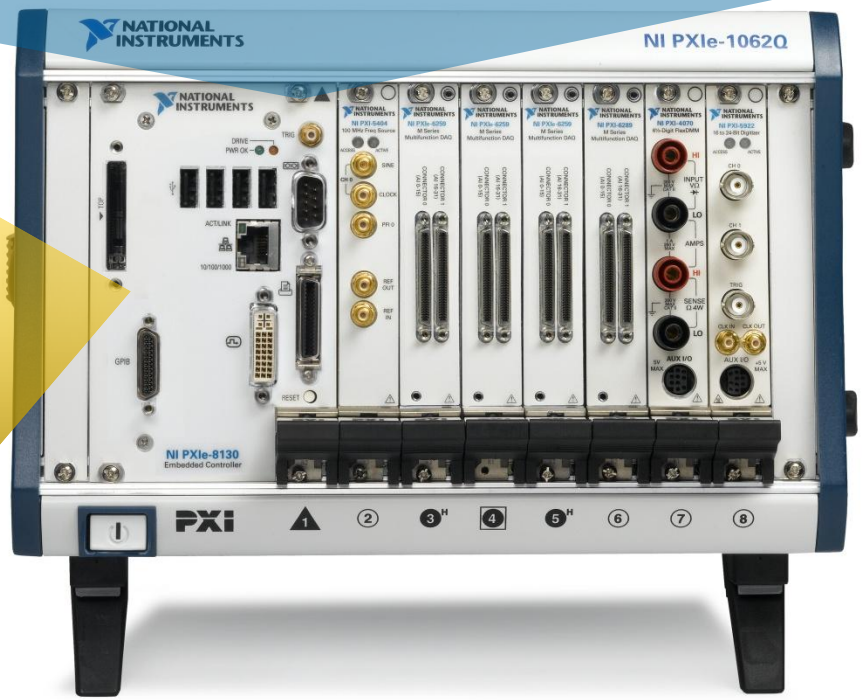
RF, FPGA, Digital IO, Analog IO

Windows or Real-Time OS

NI LabVIEW, NI TestStand

Application Specific Modules

Test Program Set



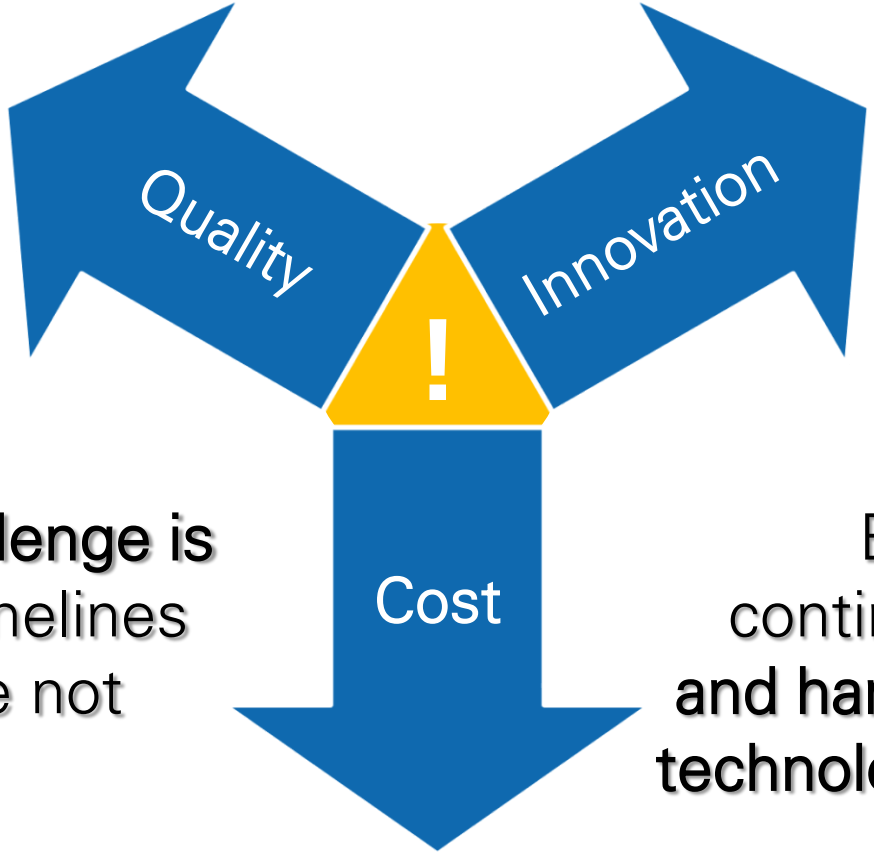
# Embedded Software Quality Challenge

| | Smart Washing Machine | Commercial Aircraft | Luxury Automobile |
|---|---|---|---|
| |  |  |  |
| **Lines of Code** | 100k | 6.5 Mil | 10 Mil |
| | 10-20 defects produced per 1,000 lines of code* | | |
| **Defects** | 1k – 2k | 65k - 130k | 100k – 200k |



* The Economists.May 16th, 2010. *Tech.View: Cars and software bugs. www.economist.com*

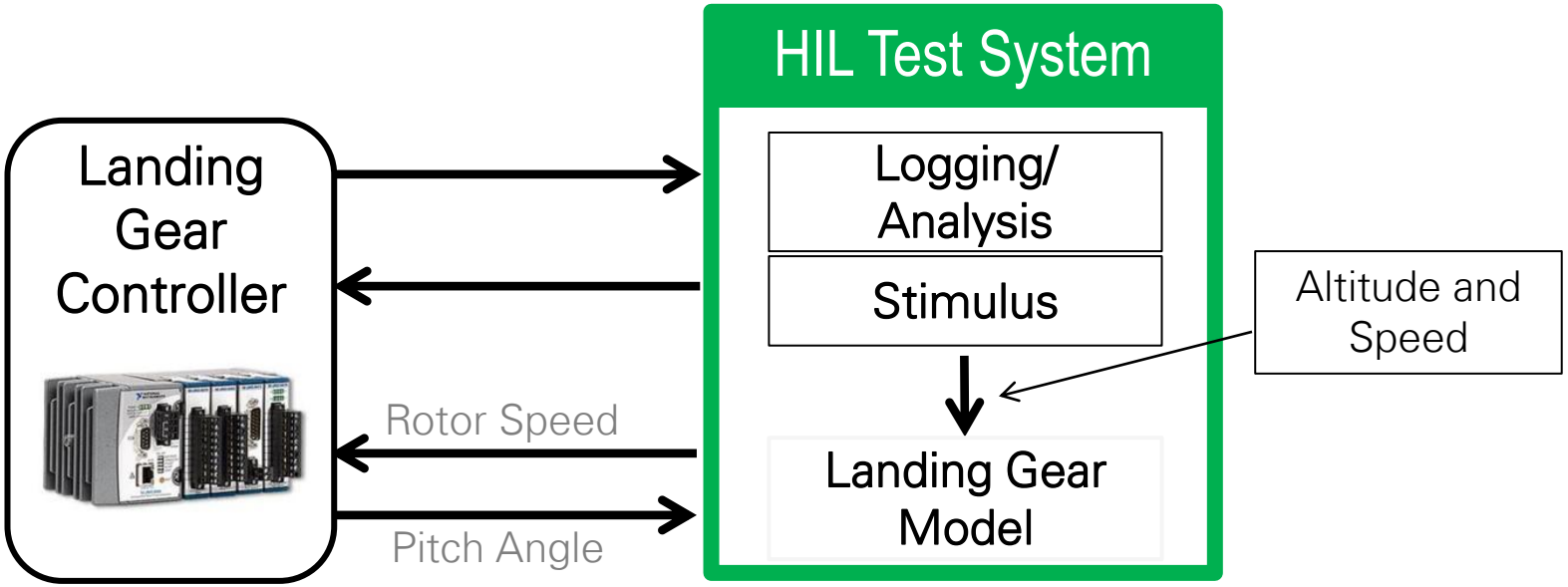
# Diverging Challenges




The **quality challenge is growing**, but timelines and budgets are not increasing proportionally

Engineers must continue to **innovate and harness the latest technologies** to remain competitive

# Hardware-in-the-Loop Test Systems



# Real-Time Testing Software Functionality

## Application Architecture

- Stimulus Generation
- Data Logging
- Single-Point I/O
- Alarming
- Calculated Channels
- Run-time Editable User Interface
- User Management
- Multi-Chassis Synchronization
- Closed-Loop Control
- Deterministic Model Execution

# NI VeriStand™

## Real-Time Testing and Simulation Software

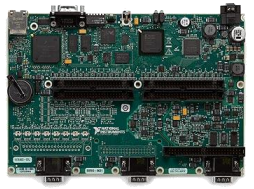
- Stimulus Generation
- Data Logging
- Single-Point I/O
- Alarming
- Calculated Channels
- Run-time Editable User Interface
- User Management
- Multi-Chassis Synchronization
- Closed-Loop Control
- Deterministic Model Execution

**RT PXI**

**RT PC**

**Industrial Controller**

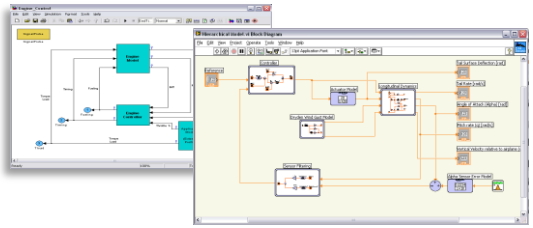
**NI CompactRIO**

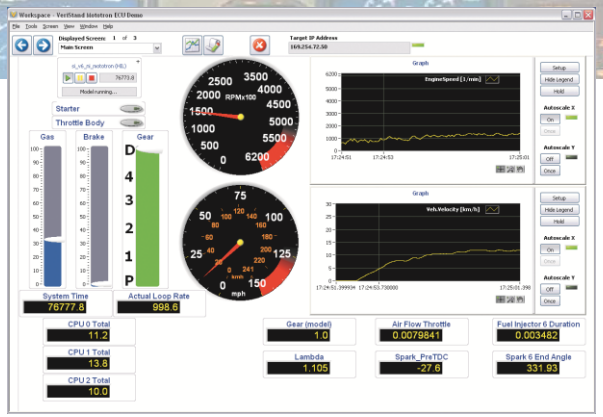


**NI Single-Board RIO**

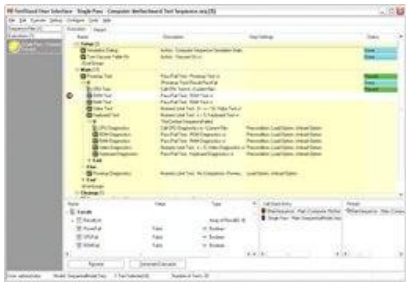
# NI Real-Time Testing Platform

## Modeling and Simulation

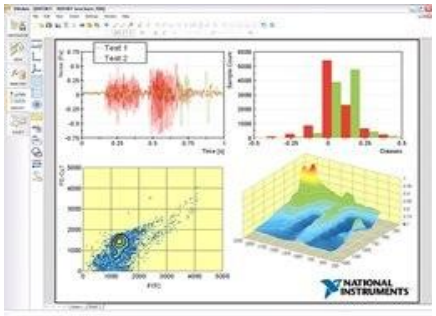




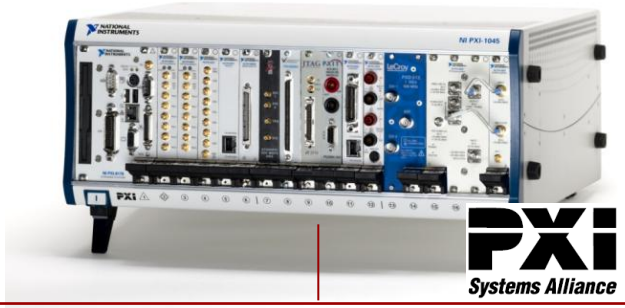
## Test Automation



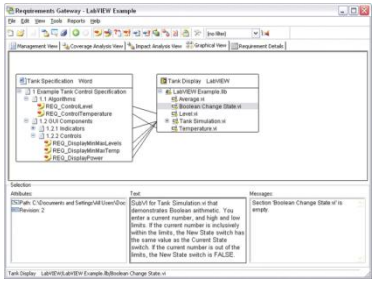
## Analysis and Reporting



## Real-Time Testing




## Requirements Traceability



Real-Time Processor

Analog/ Digital I/O

Bus Interfaces

Fault Insertion

Instrument Grade and RF I/O

Vision/ Motion

# PXI Avionic Bus Interfaces


COMPATIBLE WITH

NATIONAL INSTRUMENTS LabVIEW™

- High-performance MIL-STD-1553, ARINC-429, and ARINC-664 PXI interfaces from AIT
- Combine communication with other I/O in a single PXI-based platform
- Powerful software tools and a 'Compatible With LabVIEW' driver to increase efficiency and reduce testing costs

# Systems Integration Testing Lab

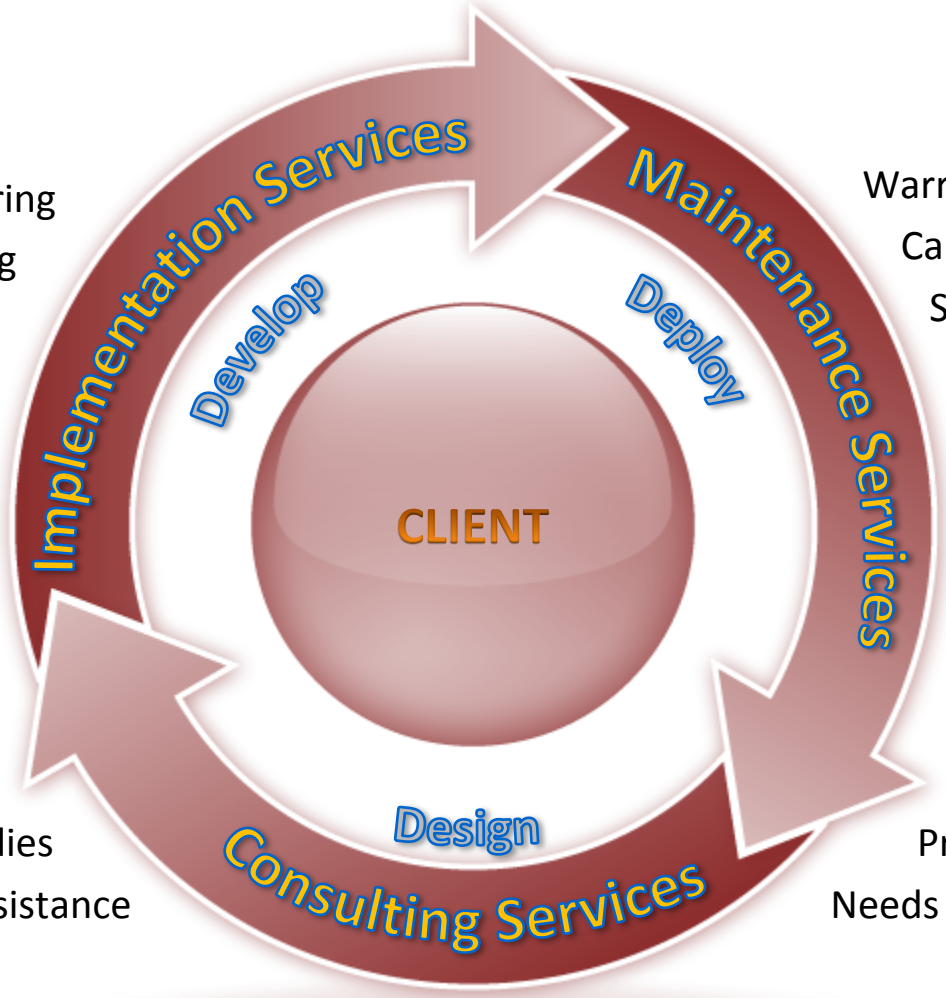

FADEC
APU
Flight Controls
Avionics
Landing Gear

"We selected NI VeriStand for our Legacy 500 Iron Bird because of the breadth of functionality the environment provides out of the box, which significantly reduces our development efforts."

- M.A. Pires, Testing Device Development Coordinator, Embraer

# Summary

Algorithm Engineering
Custom Engineering
System Services




Warranty/Repair
Calibration
Sparing/Rapid Replacement
Preventative Maintenance

Feasibility Studies
Application Assistance

Proof-of-Concept
Needs Assessments