Developing system and sub-system integration test rigs for Aerospace applications.

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NATIONAL INSTRUMENTS

Discuss the challenges aerospace developers face when deploying new aerospace systems for commercial and military aircraft. Also learn how to develop the equipment you need to validate these systems in the lab before integrating them in the aircraft.

What is an Iron Bird

Iron Birds are used to minimize the development risk by testing fully integrated systems well in advance of the first test aircraft, but also to:

Unload ground and flight testing.

Perform Structural Fatigue

Conduct certification testing.

The primary focus of Iron Bird testing is to verify:

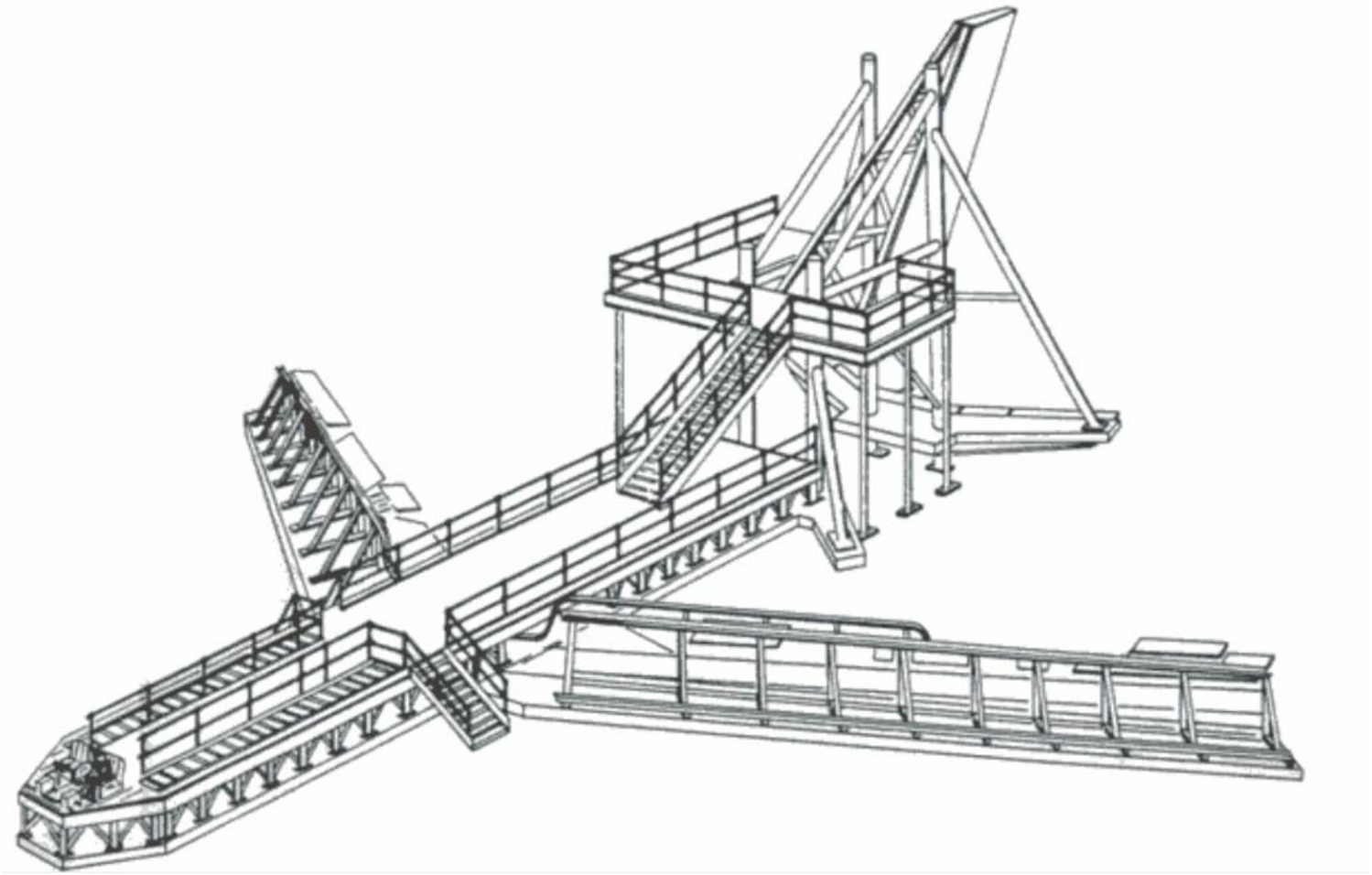
- Avionics*
- flight controls*
- landing gear, flight actuation components, and hydraulics, power systems, HVAC Systems, etc.*

*Requires other aircraft systems are installed for support.

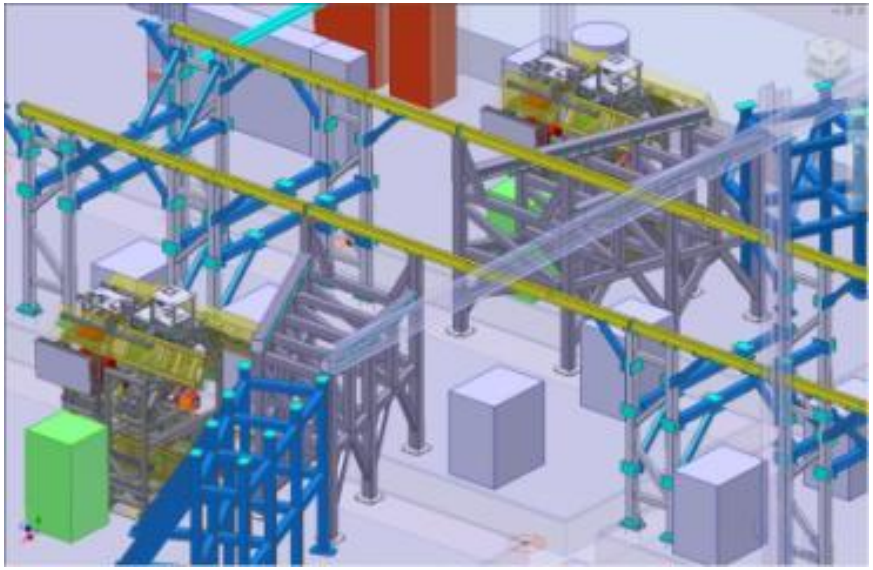
What are some of the Biggest Challenges of Developing an Iron Bird?

- These systems are designed to run 20,000 hours or more:
- Physically very large
- Interface with all sub-systems and components in the designed system.
- Timing – manufacturers are pushing for shorter development times leading to reduced delivery times for the equipment.
- VERY CLOSELY REPLICATE IN VEHICLE POSITION.
- High pressures and hazardous fluids (skydrol)
- AC motors for the simulators are high speed and custom.
- Costs
- Adaptability to changes mid-design.
- Incorporating component test from the designs.

Example Layout



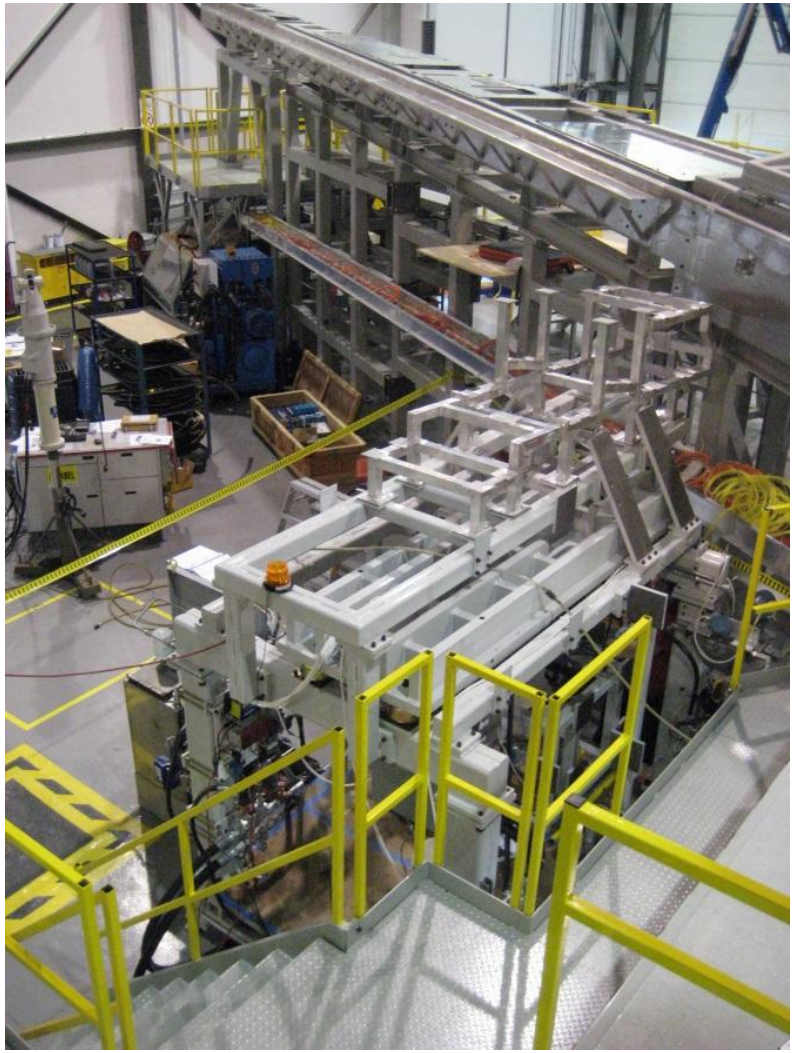
Prime Mover Development for Iron Bird



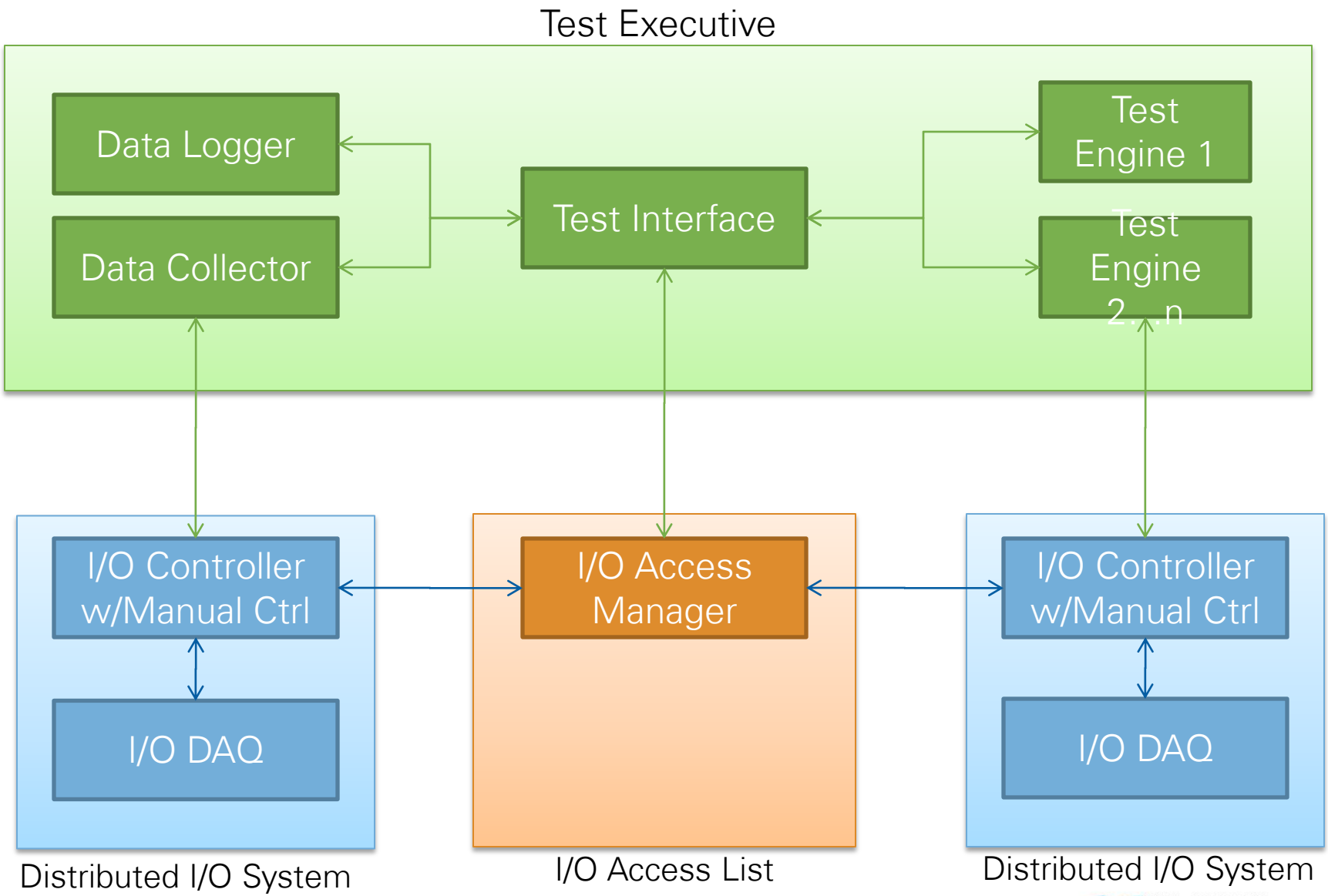
Design for use in the full scale 'Iron Bird' this system provides AC motors at 320HP and 18,300RPM continuous output and the necessary drives, mechanical system, and controls to simulate the performance of the actual turbines. The motors output shaft is directly coupled to the gearbox that ties into the main pump supplying the hydraulic power for the entire aircraft. Also Supplied the RAT and ASG systems

Iron Bird Prime Mover Development

Iron Bird Prime Mover



Architecture



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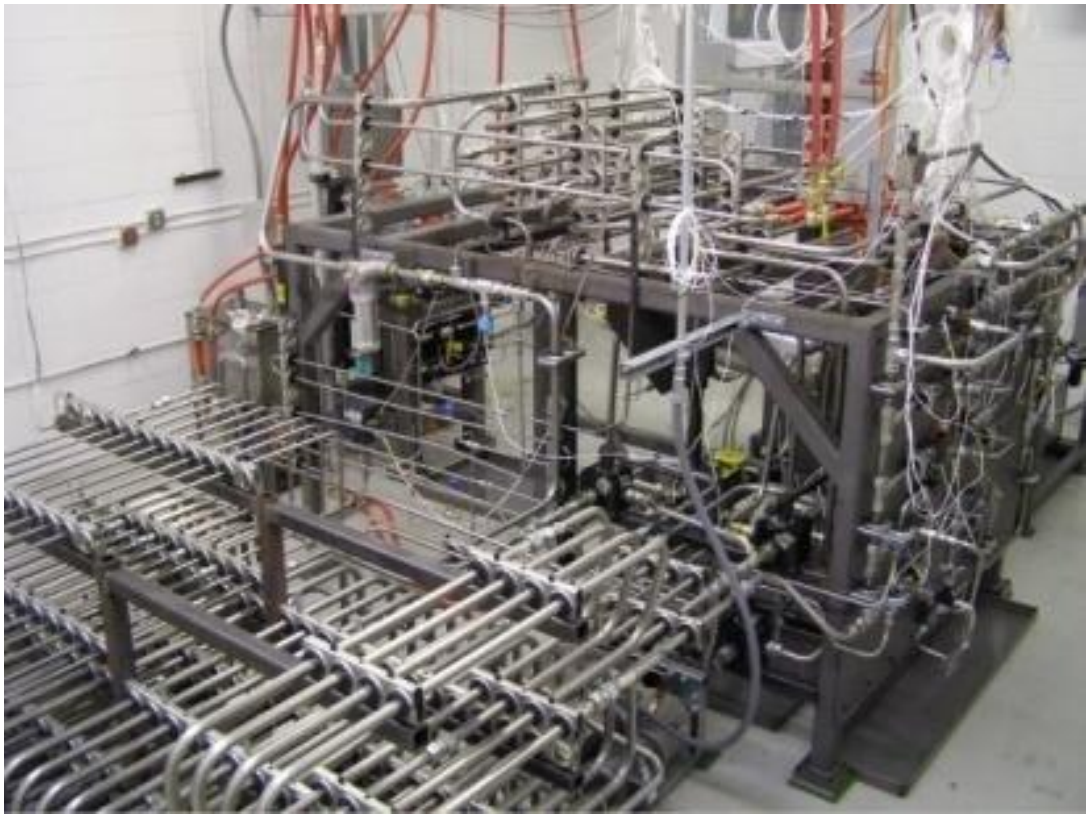
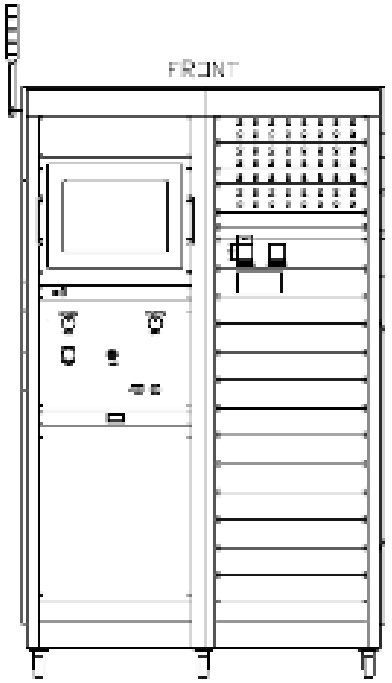
Boeing 787 Hydraulic System Integration Test Rig

Critical design elements:

- Tubing - representative of aircraft volumes in three different operational modes
- Aircraft components - used in the reservoir/single-pump circuit are included in the stand.
- Valves - included simulating flow paths to aircraft "end users" (flight controls and landing/nose gear).
- Flow Control - accomplished using a high pressure, proportional control valve.
- Software - emulated flight control monitoring logic and actuated controls based on conditional inputs during flight simulation profiles.
- Primary Function - model system interactions between the pump and the reservoir, as well as test valve components within the circuit.
- Thermal - operate through entire temperature spectrum (-40degF to +250degF)
- Commonization - of user screens from other testers

Boeing 787 Hydraulic System Integration Test Rig





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Customer Award! Parker Hannifin - *Technical Partnership Award* of Excellence – Boeing 787 'Iron Bird'

Requirements

Recognizes a partnership between a technology solutions provider and Parker HSD where the product has positively affected the success of our business.

The Technology Partnership Award nominees must demonstrate significant value to a major project utilizing innovative technology.

Customer Comments

"The success of the 787 HSTR is attributed to Wineman Technology's unique system design capabilities, innovative software, exceptional project management skills and outstanding customer service"

"They worked with us to understand and accommodate our needs. Their commitment to project completion played a major role in schedule recovery when system requirements changed

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A350 Design Overview

Critical design elements:

Tubing - representative of aircraft geometry tubing lengths and I.D.'s more accurately model aircraft system geometry.

Aircraft Components - used in the reservoir/multiple-pump circuit are included in the stand.

Flow Control - accomplished using a high pressure, proportional control valve to simulate flow requirements to aircraft "end users" (flight controls and landing/nose gear)

Software - emulated flight control monitoring logic and actuated controls based on conditional inputs during flight simulation profiles.

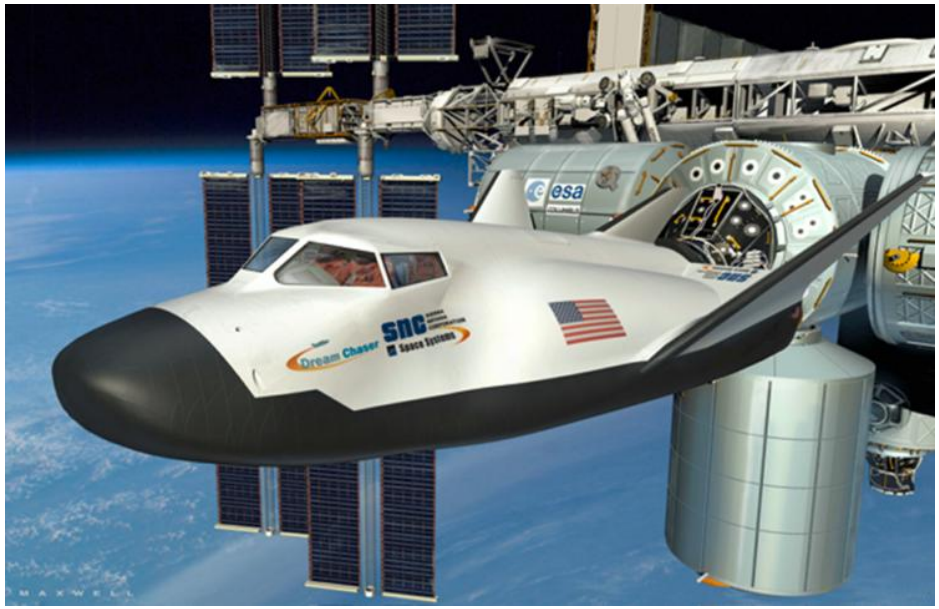
Primary function - model system interactions between the pump and the reservoir.

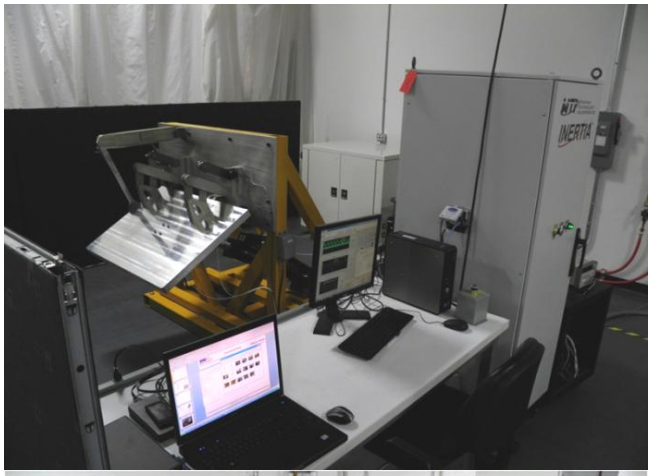
Temperature - operate through entire temperature spectrum (-40degF to +250degF)

Electrical Design Changes - Requirement to maintain a compact, flexible architecture, as well as the requirement to collect 50kHz data to support pump ripple measurements drove the selection of modules and hardware – cDAQ Selected

A-350 HISTR

Commercial Crew Vehicle





This system is designed for the Commercial Crew Vehicle and is intended to test the flight surface actuation systems to ensure that the designed systems are able to operate under actual flight conditions both during orbital flight and re-entry into Earth's atmosphere. The system includes the mechanical system that simulates the flight surfaces and articulates them through their full range of motion during simulated flight scenarios. Communication from the flight control module works integral via ARINC protocol for control of the flight actuation system.

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Embraer Legacy 500 Hydraulic System Integration Test Rig

Critical Design Elements:

Primary function - model system interactions between the pumps/motors and the reservoirs.

Control platform - uses three control racks operated in unison using a MASTER/SLAVE architecture uses cDAQ (one stand will issue commands to the other two stands to coordinate multi-stand test profiles).

Load Simulation - includes load actuators in the hydraulic circuit to simulate the end users in the aircraft (as opposed to simply modifying flow rates). This system is a full mock-up of the actual aircraft hydraulic system, to include actual aircraft tubing assemblies for all flow paths. *INERTIA* will be utilized for the real-time control for the load actuators.

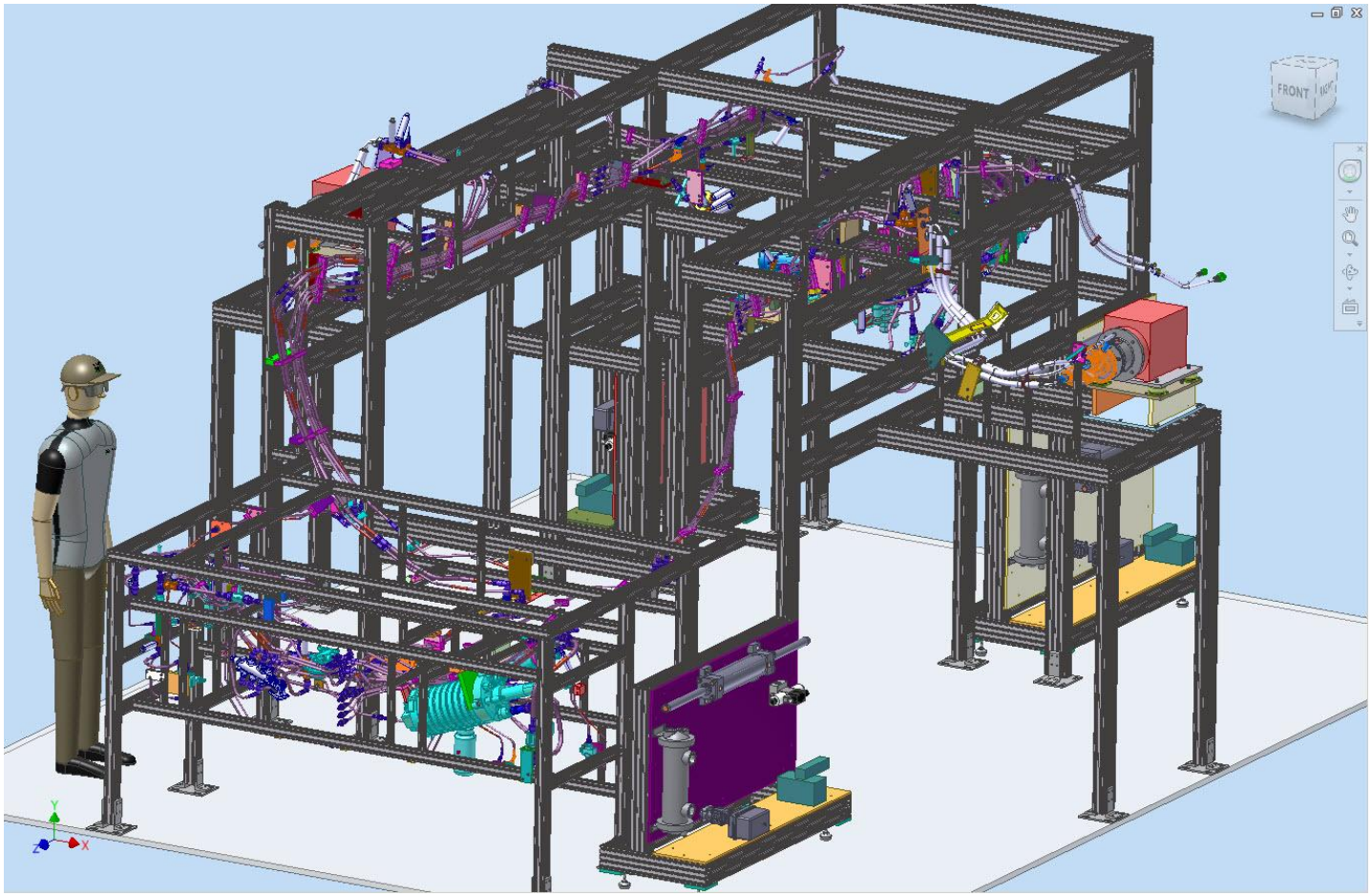
Tubing - representative of aircraft tubing lengths and I.D.'s designed to accurately model aircraft system geometry.

Aircraft components - used in the reservoir/multiple-pump circuit are included in the stand.

Software - emulated flight control monitoring logic and actuated controls based on conditional inputs during flight simulation profiles cDAQ platform used as well as PXI RT for load control.

Temperature - operate through entire temperature spectrum (-40degF to +250degF)

Embraer Legacy 500 Hydraulic System Integration Test Rig



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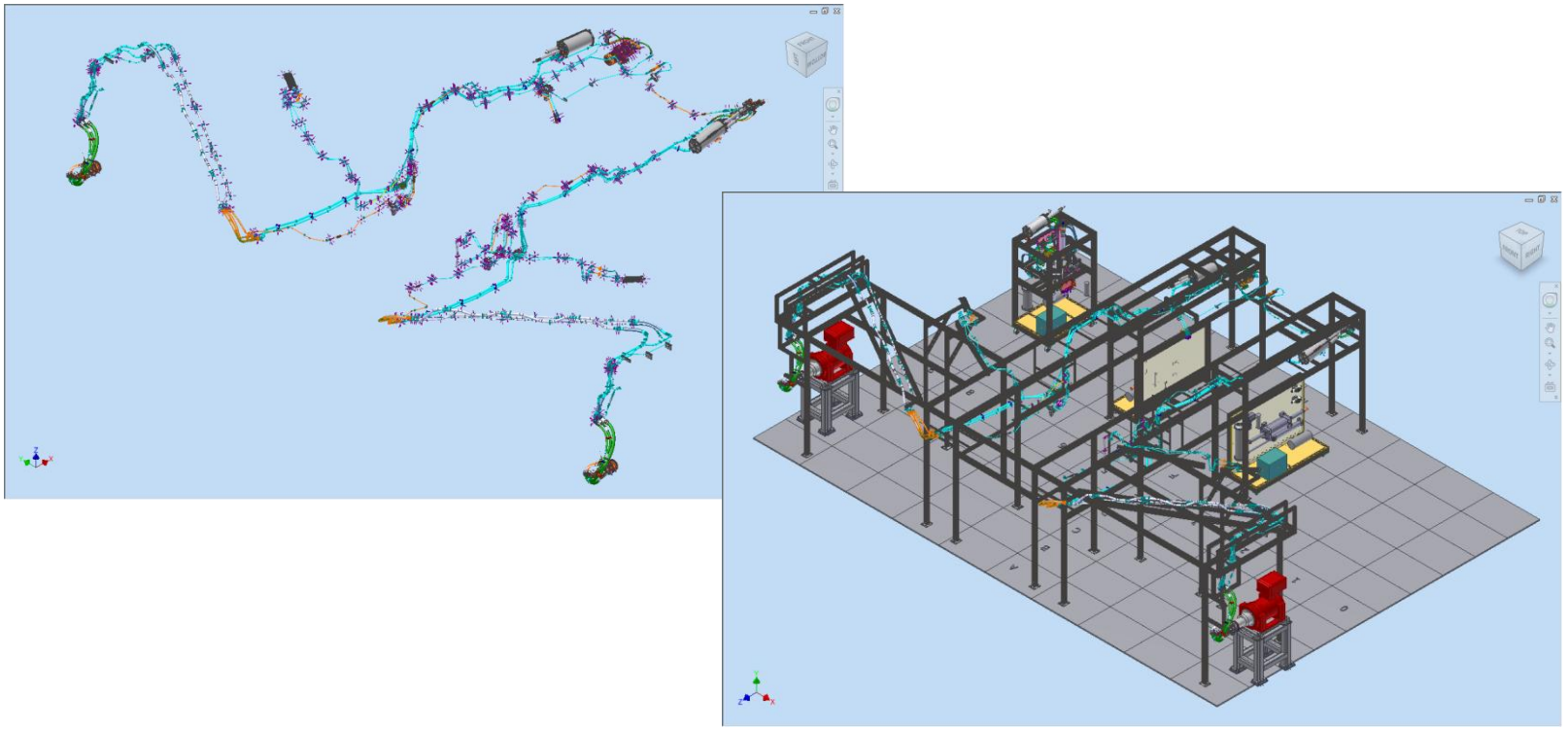
C Series Iron Bird



The design and entering the build phase of the project . The system utilizes the latest architecture for the HISTR's previously developed.

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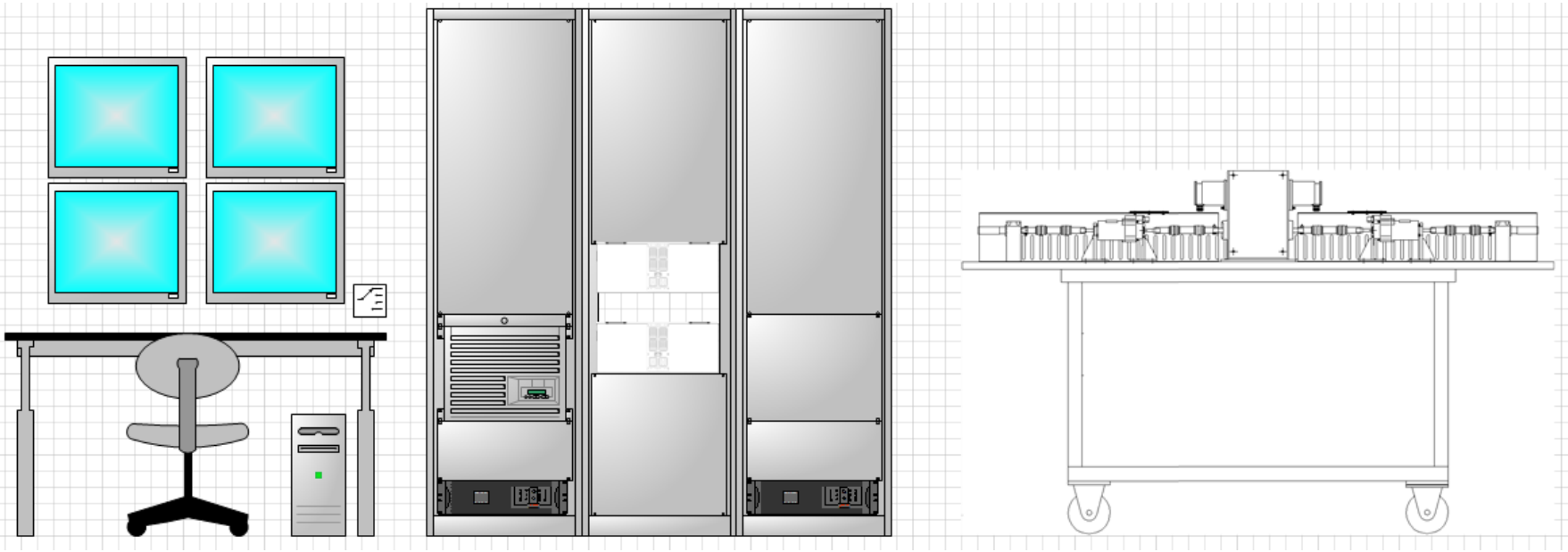
C-Series Assembly

FSECU (Flap and Slat Test System) HiL



This test Stand executes all the functions and tests on a single actuation segment (torque tubes, slat an flap actuators, skew sensor, wing tip sensor, and all other components that make up the system including the left and right ECU. Will enable the customer to scale to the full system and is being designed to commonize across all platforms.

Projects Under Contract

HISTR for the Global 7000/8000

Control system for the Dassault Falcon HISTR

Simulation system for integration with the HISTR controller

FSECU HiL system for Global 7000/8000

Defense Applications

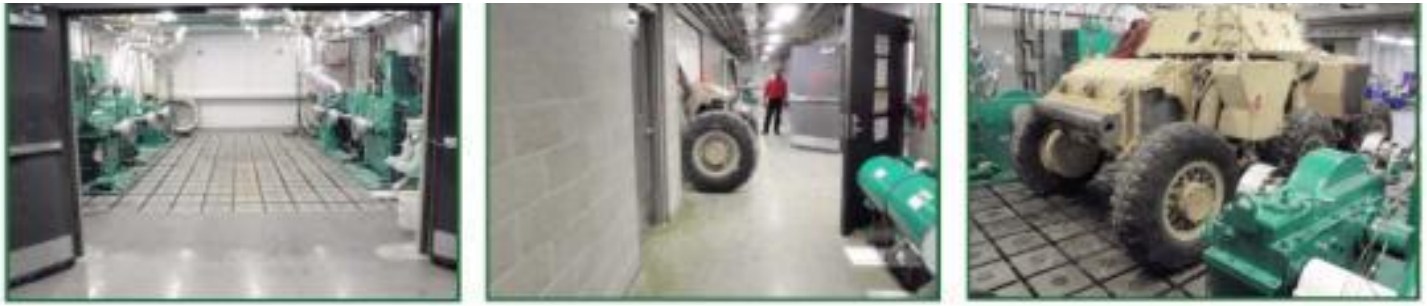
Turbine Test Cell Modernization JASSAM & HARPOON (2 Cells)

Legacy Equipment

Modernization

WTI was contracted to modernize two turbine engine test cells. These test cells run production tests for both the JASSAM and Harpoon missile turbine engines and communicate with the custom engine control and fuel system. This system is based on the NI PXI platform and our *INERTIA* software platform.

MSU Autonomous 6WD Dynamometer Control & Data Acquisition System



Vehicle arrived 21 January 2010 - 1800hrs.
Vehicle departed 2 February 2010 - 1800hrs.

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WTI was contracted by MSU to deliver a state of the control and data acquisition system for a 6wd independent electric motor per wheel dynamometer system. Our *INERTIA* system was selected and is capable of independent control on a per wheel basis allowing dynamic control of each dynamometer in three modes: torque, speed, or model based control. Any Matlab based model environment can be used; however, in this case, the customer chose to utilize TruckSim for the simulation mode.

F35 - Turnkey Clutch Dynamometer

WTI has successfully developed a full turnkey solution clutch dynamometer including a motor, drive bearings, clutch engagement, guarding, and control system. The control system provides closed loop control of drive speed (up to 7800 RPM), as well as clutch engagement torque (up to 30,000 in-lbs.), distance (up to 1”), and force (up to 5,000 lbs.).

Who is WTI?

NATIONAL INSTRUMENTS™ Gold Alliance Partner

WTI has Been in business 23 years and currently employs a staff of approximately 48. Of these approximately 28 engineers are experienced in LabVIEW development. Our staff is recognized as being some of the most capable LabVIEW developers available anywhere!

LabVIEW Certified Architect

6 Certified Architects on Staff

LabVIEW Certified Developer

11 Certified Developers on Staff

Inc. 5000

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