

Aircraft Response to Control Input Data Collection System

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Project Sponsor: JUP



Presentation Overview

- **Motivation**
- **Data Collection System Block Diagram**
- **System Component Description**
- **Unresolved Issues**



Purpose

- **Collect data on the response of the aircraft to the pilot's control stick inputs**
 - » **Control stick position, rudder position, body accelerations, body angular rates, altitude, body position, ground speed, airspeed, etc.**
- **This data can be used to create a model of the aircraft that can be used in simulations**



Flight Test Vehicle



- L - 29 Delfin
- High Altitude
- High Speed
- Fully Aerobatic



Block Diagram Description

- Identify the purpose of the each block
- Discuss options to satisfy the requirements of each block



Position Sensors

- **Continuously monitor the position of the control stick and throttle position**
- **Monitor the full range of control surface movement**
- **Critical issues**
 - » **Safety – must not interfere with control inputs**
 - » **Resolution – how much accuracy will we need**



Position Sensor Options



Source:Penny and Giles Website

- **Linear Variable Differential Transformer**
 - » -35°C to 125°C
 - » Up to 20g
 - » Max 50,000 feet
 - » 1 to 10 VAC 400 Hz
- **Rotary Variable Differential Transformer**
 - » -55°C to 85°C
 - » Up to 20g
 - » Max 20,000 feet
 - » 3 to 30 VAC 400 Hz



Position Sensor Installation



- Easy accessibility
- Common location
- Best range of motion



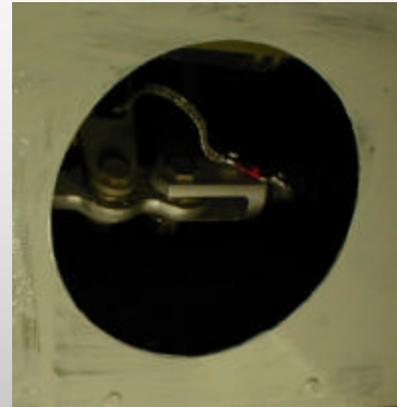
Sensor Location Options

- **Floor under the rear seat**
 - » Easily accessible
 - » All the controls in one common location
 - » May limit range of motion
- **At the control surface**
 - » Harder to access
 - » More wiring due to remote locations
 - » Outside the pressure bulkhead
- **On the control surface**
 - » Good range of motion
 - » May interfere with surface movements



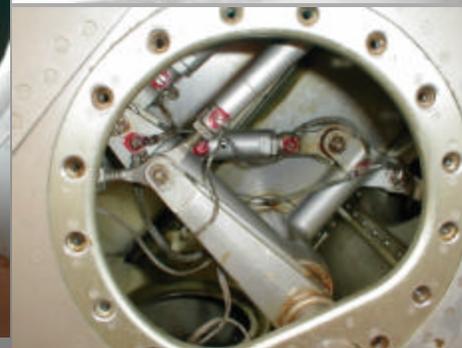
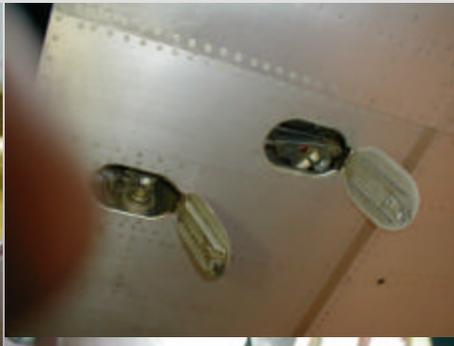
Sensor Locations Options (cont.)

Elevator, Rudder,
& Ailerons



Sensor Locations Options (cont.)

Elevator, Rudder,
& Ailerons



Sensor Locations Options (cont.)

Throttle



Analog to Digital Converter

- **Monitor the control system position signals**
- **Digitize control system position sensor signals**
- **Prepare the signal for processing**
 - » **Identify which signal is being sent**
 - » **Tag the signal**
 - » **Convert it for transmission**



Linear Potentiometer

- Provide barometric altimeter correction to the Air Data Computer



Air Data Computer

- Provide barometric altitude to the Inertial Reference System
- Sends airspeed information to the data collection system



Data Collection System

- **PC-104 serves as a platform for the Condor CEI400-44 ARINC 429 Interface Card**
- **Gateway Solo laptop is used as the data storage unit and runs the data collection programs**
- **Time stamps the collected information**
 - » Time stamp can be set as low as 1ms



Inertial Reference System

- **Primary source of information**
- **Sends several parameters to the data collection system**
 - » **Ground Speed – 10 Hz**
 - » **Body Accelerations – 50 Hz**
 - » **Body Rates – 50 Hz**
 - » **Altitude – 25 Hz**
 - » **Roll and Pitch Angle – 50 Hz**



Unresolved Issues

- **Method of collecting control input information**
- **Formatting the control input signals**
- **Safety issues in installing the control system position sensors**
- **What data to collect and what rates at which to collect it**
- **Coordination of control system data with aircraft response data**



Conclusion

- **Collecting the inertial data is a fairly straightforward process**
- **Collecting the control system data will require more time to develop the necessary methods and systems**



Questions?

