

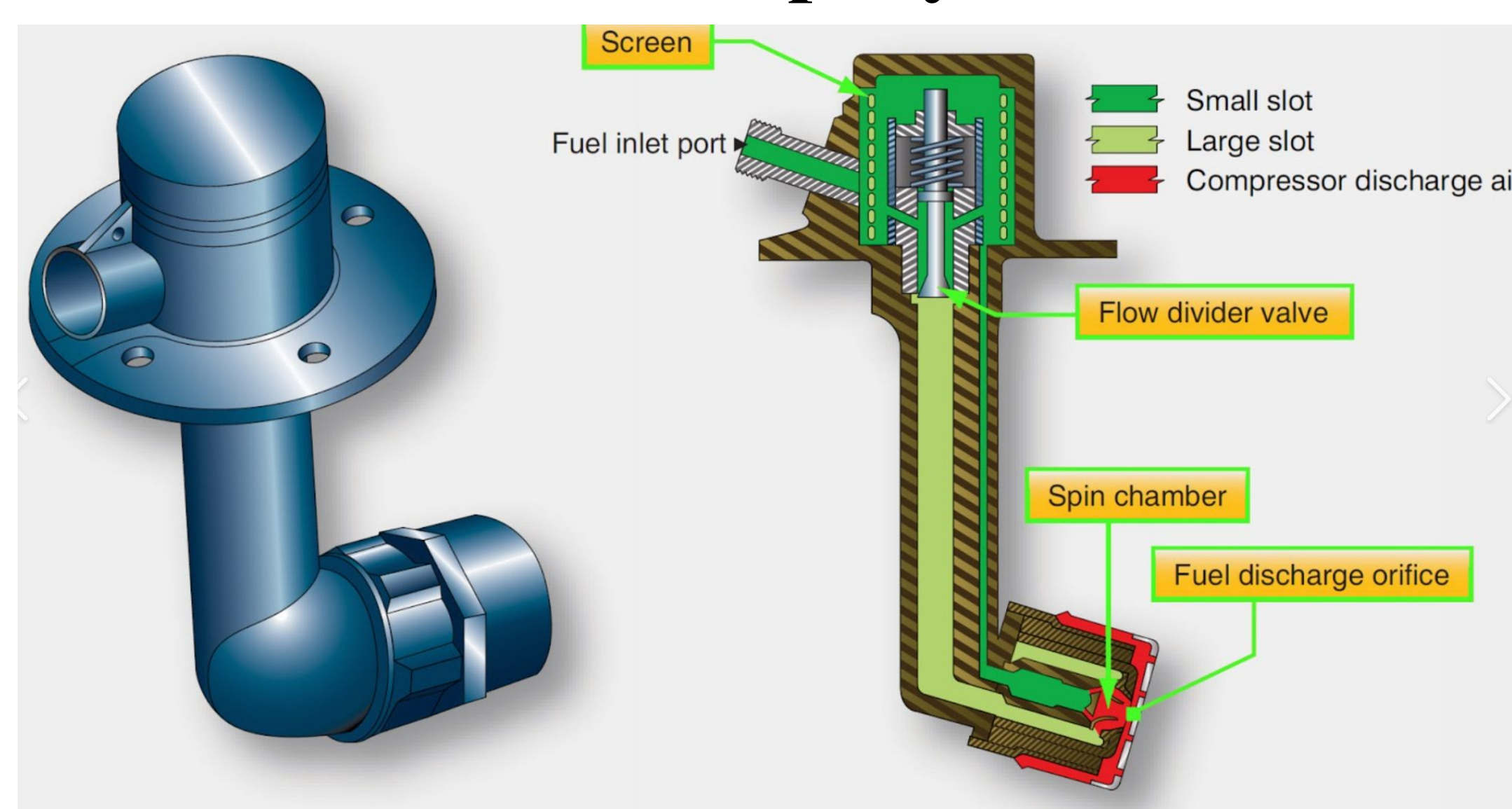
Problem Statement:

There is a need for an improved patternation system that reduces cycle time, minimizes operator-dependent error, and provides consistent, reliable data to determine whether a fuel nozzle meets performance requirements.

Previous Patternation Stand:



Aviation Spray Bar:



Gage R&R Testing:

Statistical method used to evaluate the precision of a measurement system. It determines how much variation is caused by the measurement equipment and by different operators. For the patternation stand, the Gage R&R study verifies that measured differences in fuel spray patterns are due to the nozzle itself rather than errors introduced by the test system, ensuring accurate and reliable measurement results.



Key Specifications:

- Spray Bar Rotation
- Spray Bar Vertical Actuation
- Fuel Isolation
- Fuel Evacuation
- Phase Doppler Particle Analyzer system Clearance
- Cycle Time
- Reliability/Repeatability
- Wiring Safety

Notable Challenges:

1. Being a four person group
2. Vertical actuation method, design on this portion went through multiple iterations
3. Fuel containment, the spray bar expels fuel at a high pressure and the spray chamber needed to be sealed
4. Pneumatic system, complicated fuel measurement and evacuation process
5. Custom designed and fabricated parts led to long lead times

Acknowledgements:

Faculty Advisors:

Dr. Reffeor, Dr. Pung, and Dr. Krauss

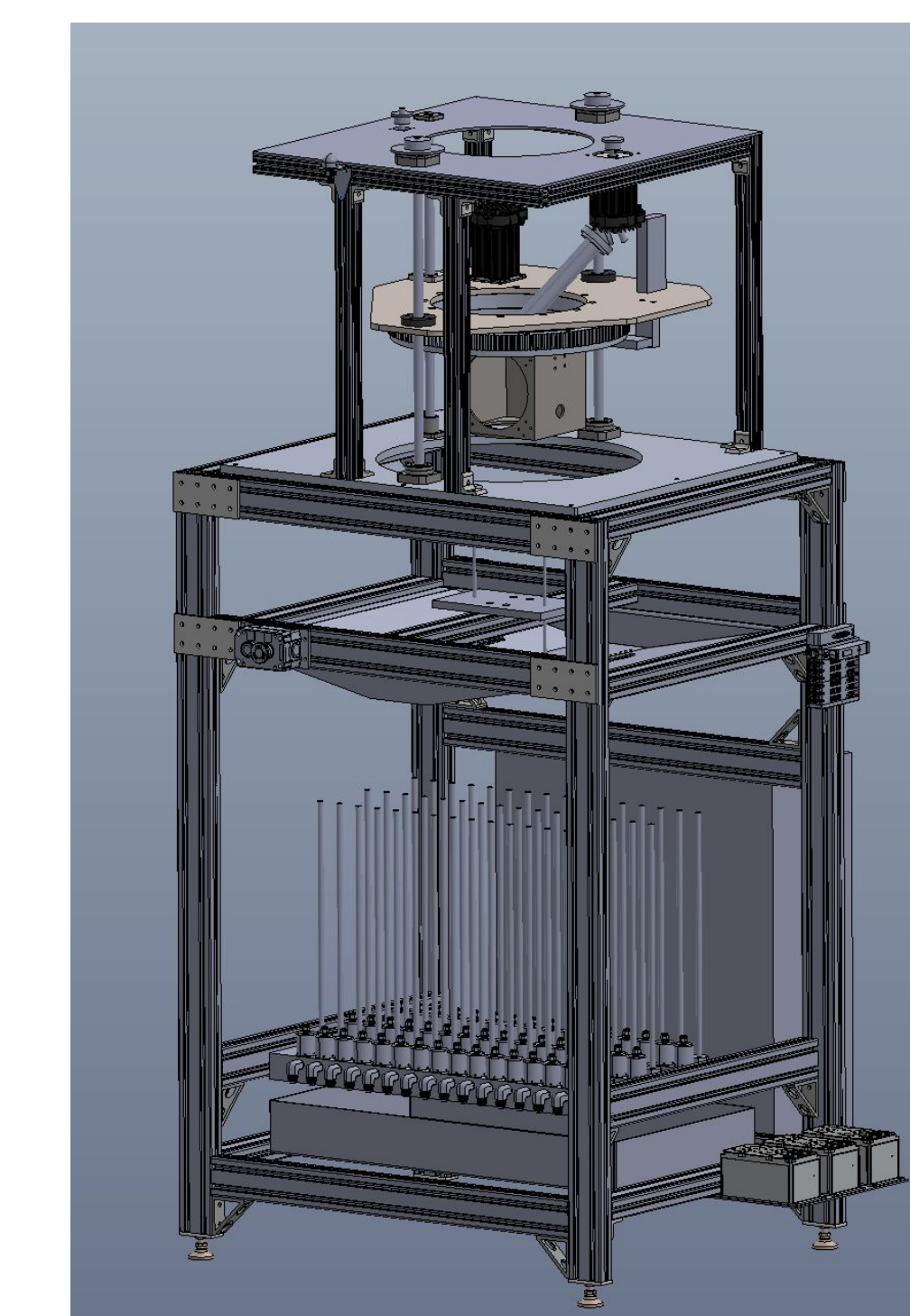
Project Sponsor:

Paul Brown, Dan Huber, Oliva Nied

Description:

The Patternation Stand automates the testing of aerospace spray bars by measuring the fuel distribution pattern to detect irregularities. Distorted spray patterns could lead to uneven temperatures, accelerating wear and material failure in gas turbine engines. A 48-tube linear collection array captures the spray pattern for each test iteration. One servo motor rotates the spray bar in 10-degree increments to measure the full spray pattern, while a second servo motor adjusts the spray bar's distance from the collection array. Pressure transducers measure the collected fuel and transmit the data to a LABVIEW cDAQ for analysis. Pneumatic cartridge valves allow fuel to drain from the measurement tubes between measurements.

Patternation Stand:



Control Panel:



Impact of Project:

- Time Savings
- Improved Reliability
- Pneumatic/Electric Control
- Data Quality
- Higher Accuracy
- Improved Electrical Safety
- Software Implementation