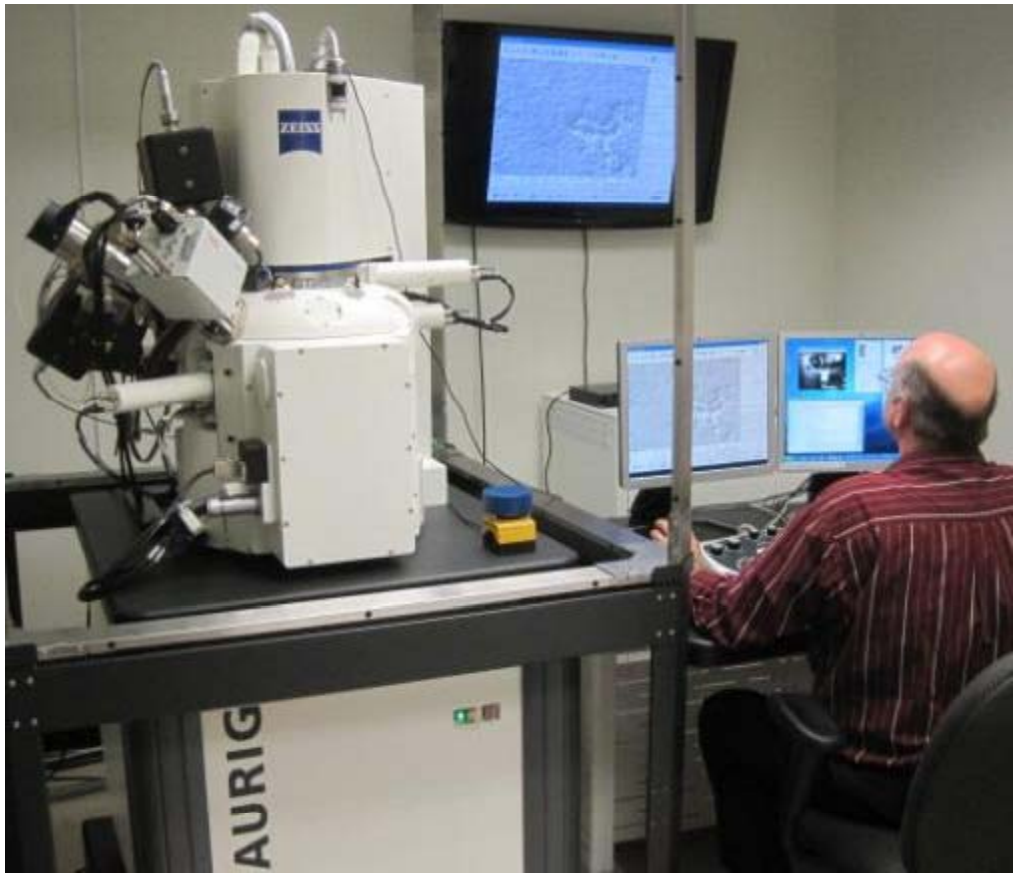
International Investigations

Global Collaboration with Domestic Impact

Materials Laboratory
Michael Budinski

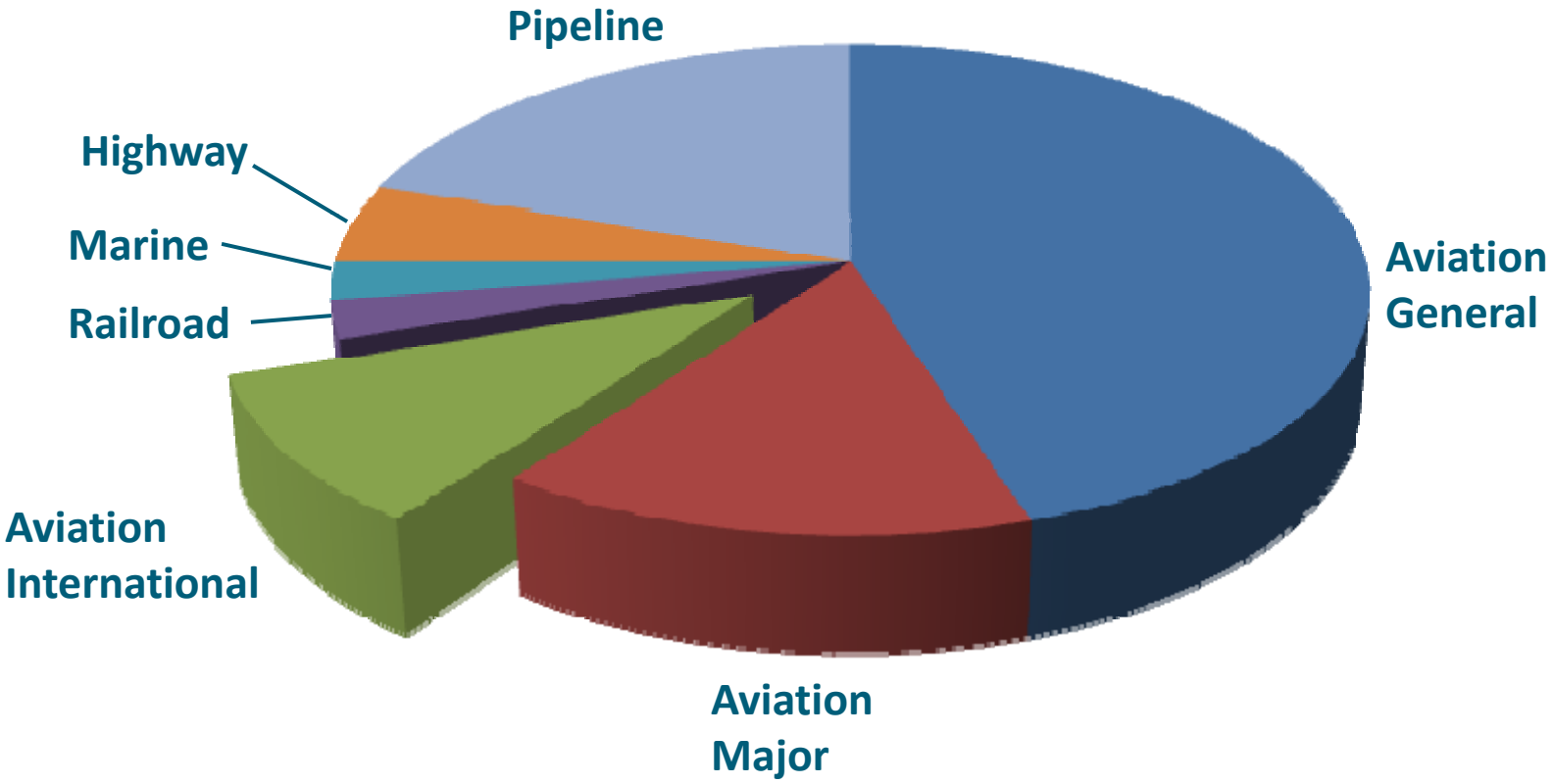
Materials Laboratory: International Overview

- Technical specialists:
  - Materials science
  - Metallurgy
  - Fire science
- Laboratory
  - Material failure analysis
  - Structural analysis
  - Group examinations
  - Experimental testing
  - On-scene examinations
  - Consultation



Materials Laboratory: International Overview

12-month "snap shot" of Materials Laboratory work based on labor hours

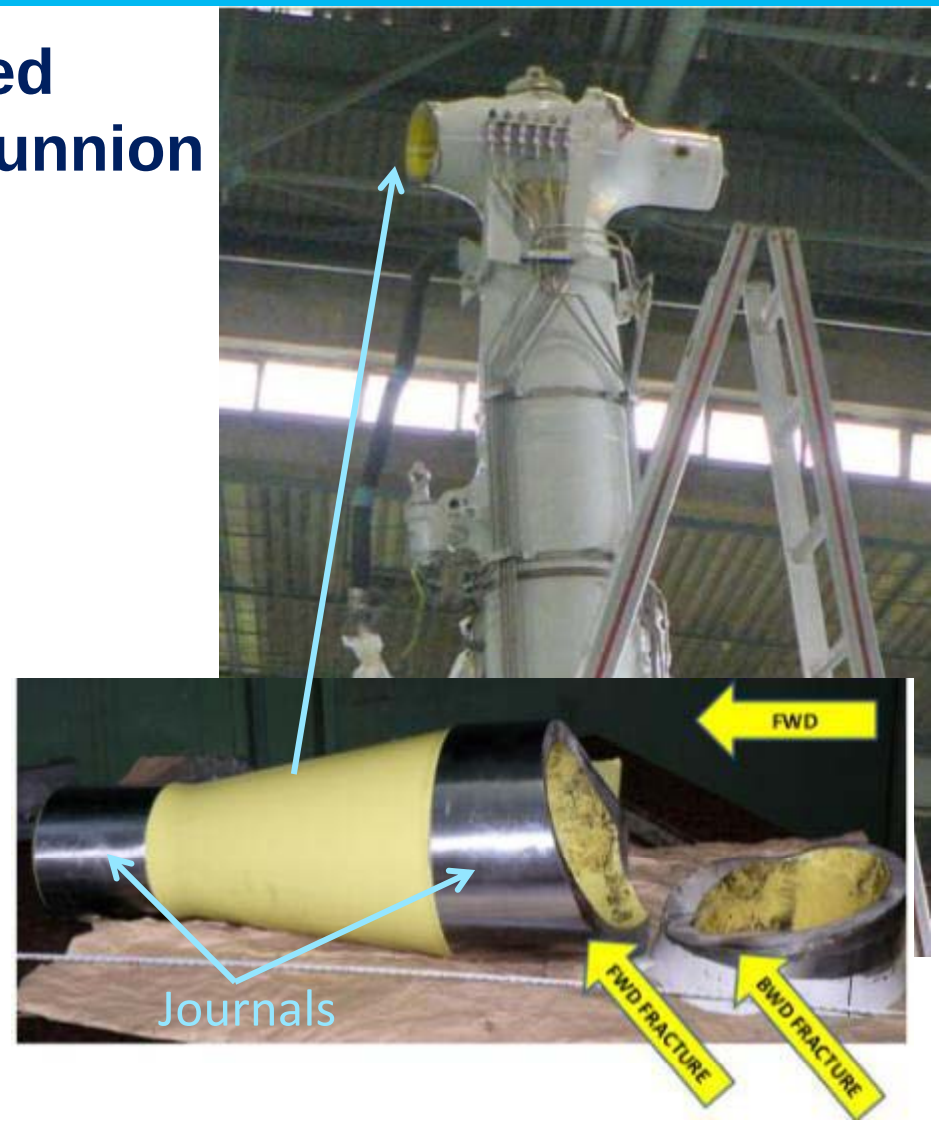


El Al Flight 027, Boeing 777-200, Tel Aviv, Israel

- Normal takeoff from Ben Gurion International Airport—the left main landing gear (MLG) did not retract
- Aircraft returned to airport and landed without incident

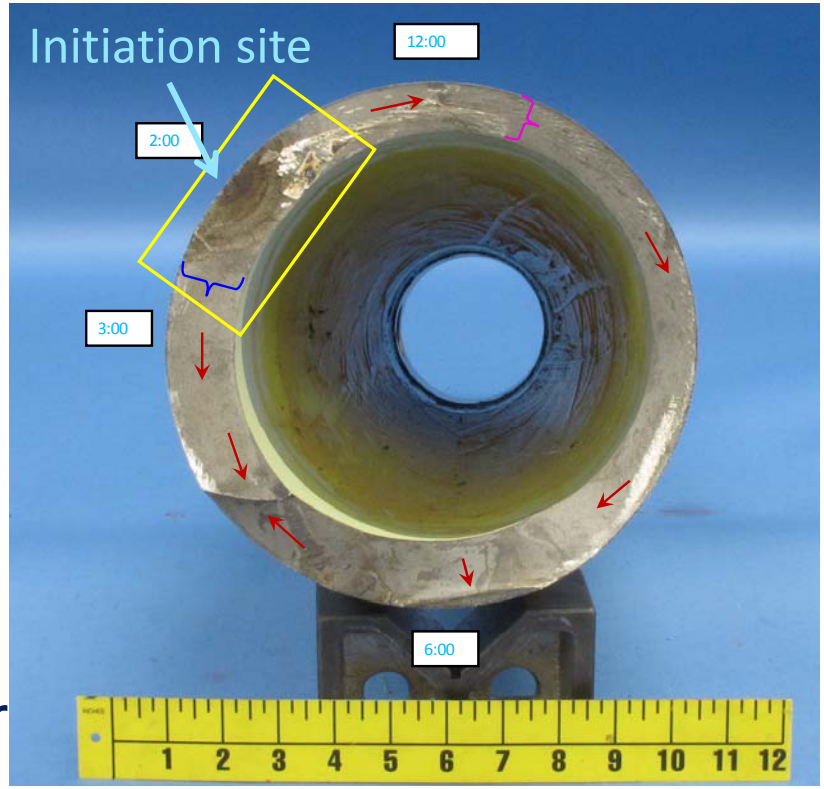
El Al Flight 027, Boeing 777-200, Tel Aviv, Israel

- **Post-flight inspection revealed fractured left MLG forward trunnion**



El Al Flight 027, Boeing 777-200, Tel Aviv, Israel

- Metallurgical analysis of the fractures, materials and specialized crack inspection
- Failure from fatigue at grinding burn cracks
- Examination of MLG steps at the overhaul shop in Singapore
- Opportunities identified to lower the probability of recurrence

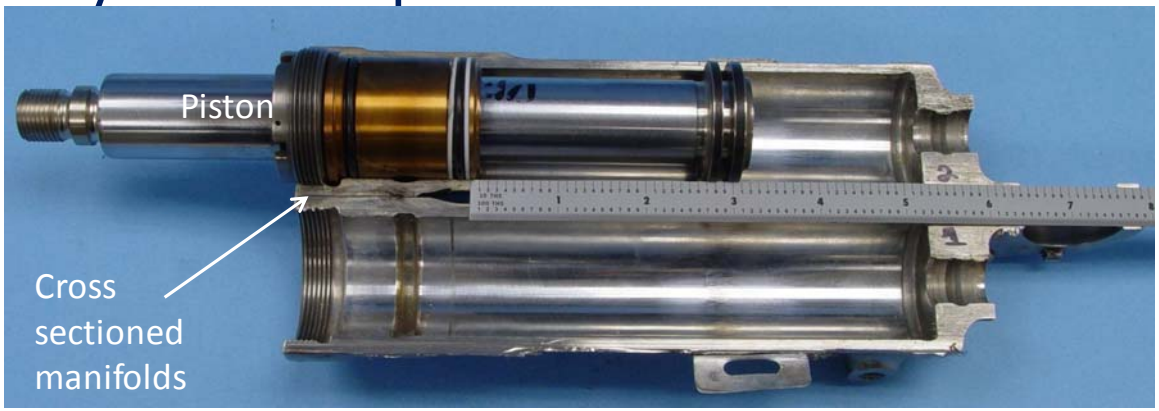


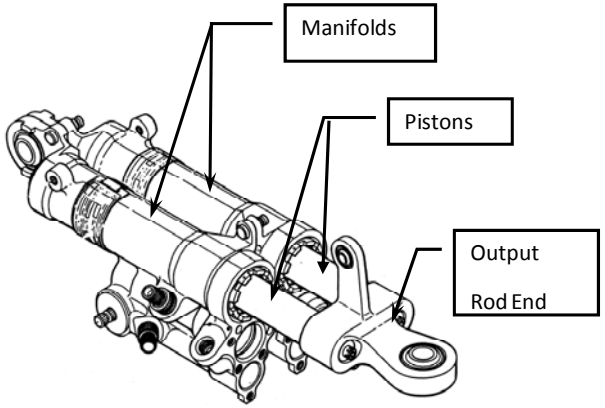
Copterline Oy, Sikorsky S-76C, Tallinn Bay, Estonia

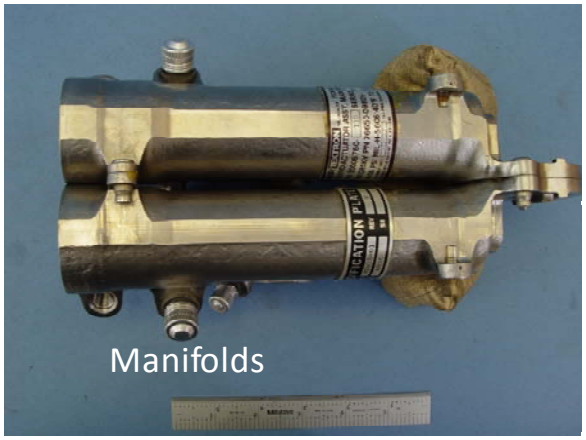
- Copterline Sikorsky S-76C+ helicopter (OH-HCI Finland), crashed into the Baltic Sea shortly after takeoff from Tallinn, Estonia
- The investigation revealed the failure of the forward main rotor actuator

Copterline Oy, Sikorsky S-76C, Tallinn Bay, Estonia

The NTSB conducted a metallurgical evaluation of the main rotor forward actuator components, exemplar actuator pistons, and other system components



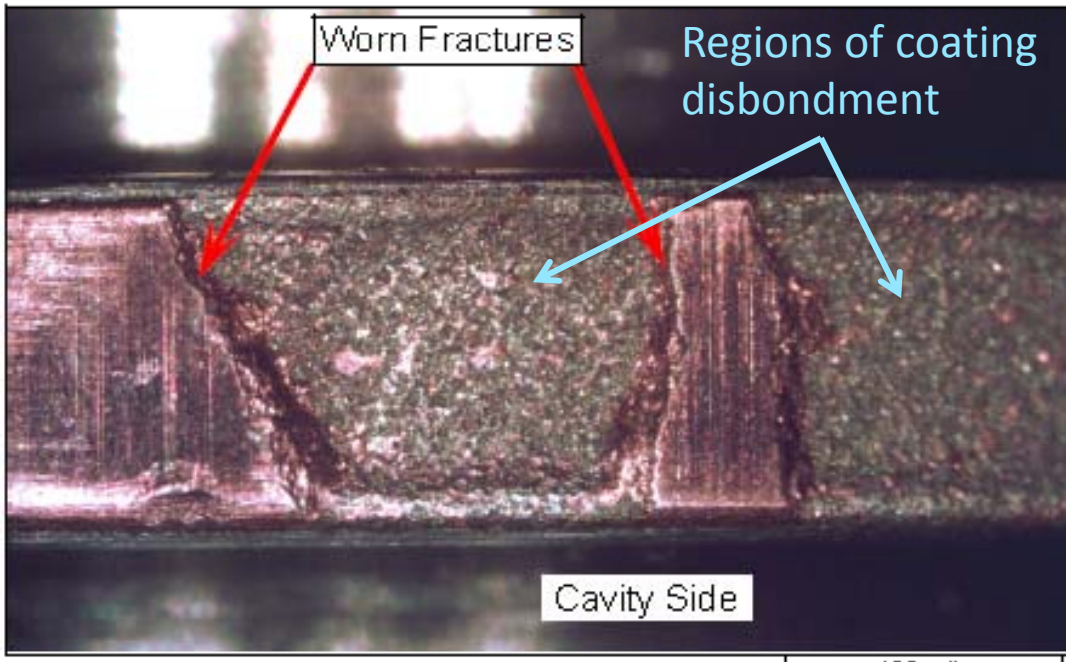




Copterline Oy, Sikorsky S-76C, Tallinn Bay, Estonia

Metallurgical evaluation revealed failure of the coating system on the actuator pistons

- Excessive wear of components
- Hydraulic fluid leakage
- Blockage of a fluid return port



Copterline Oy, Sikorsky S-76C, Tallinn Bay, Estonia

NTSB Safety Recommendations A-05-33 through -35 issued, which ask for:

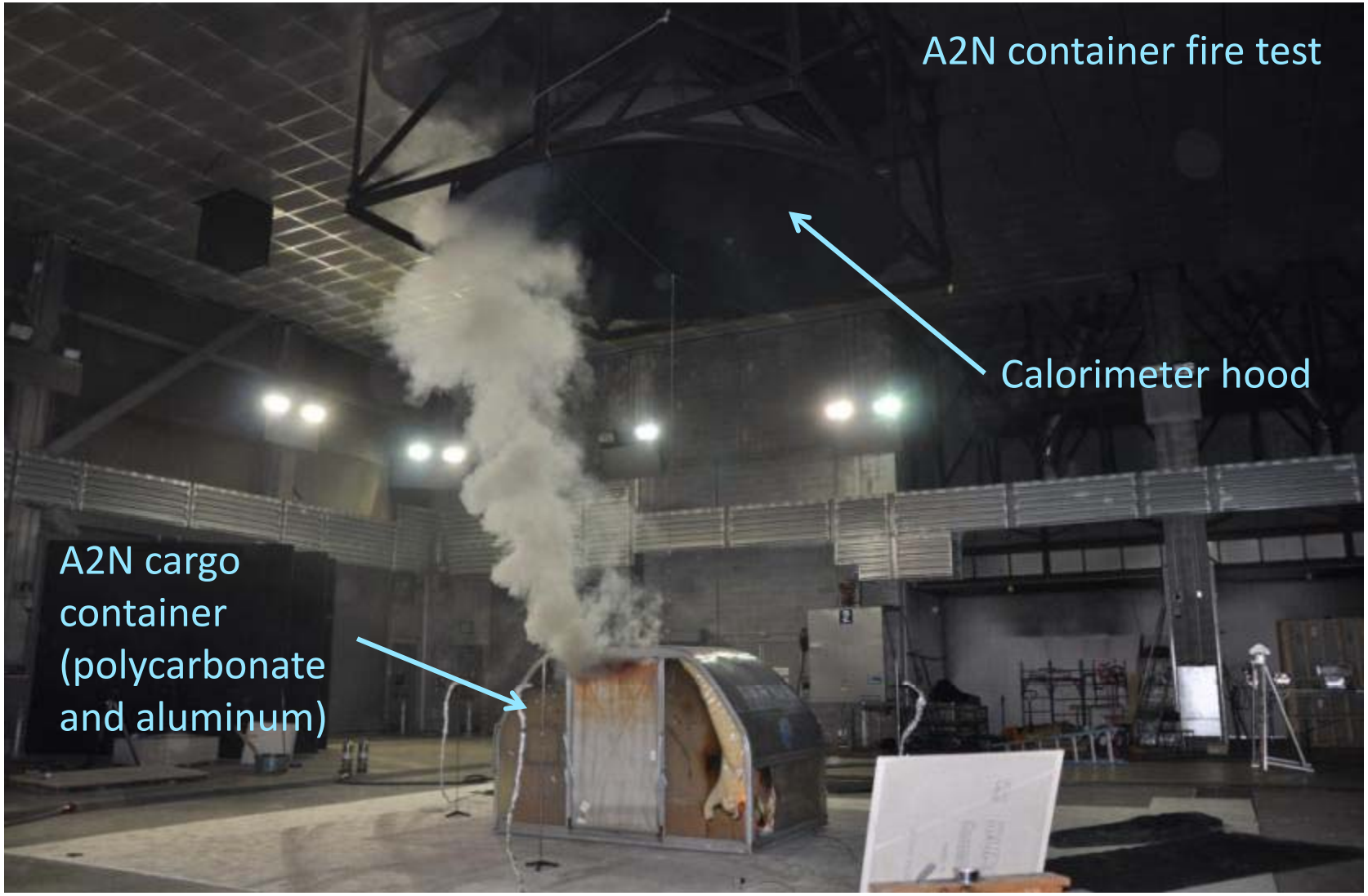
- Immediate leakage testing of in-service actuators
- Visual and laboratory examination of hydraulic fluid filters
- Preflight check of flight control “stick jump” and control movement smoothness



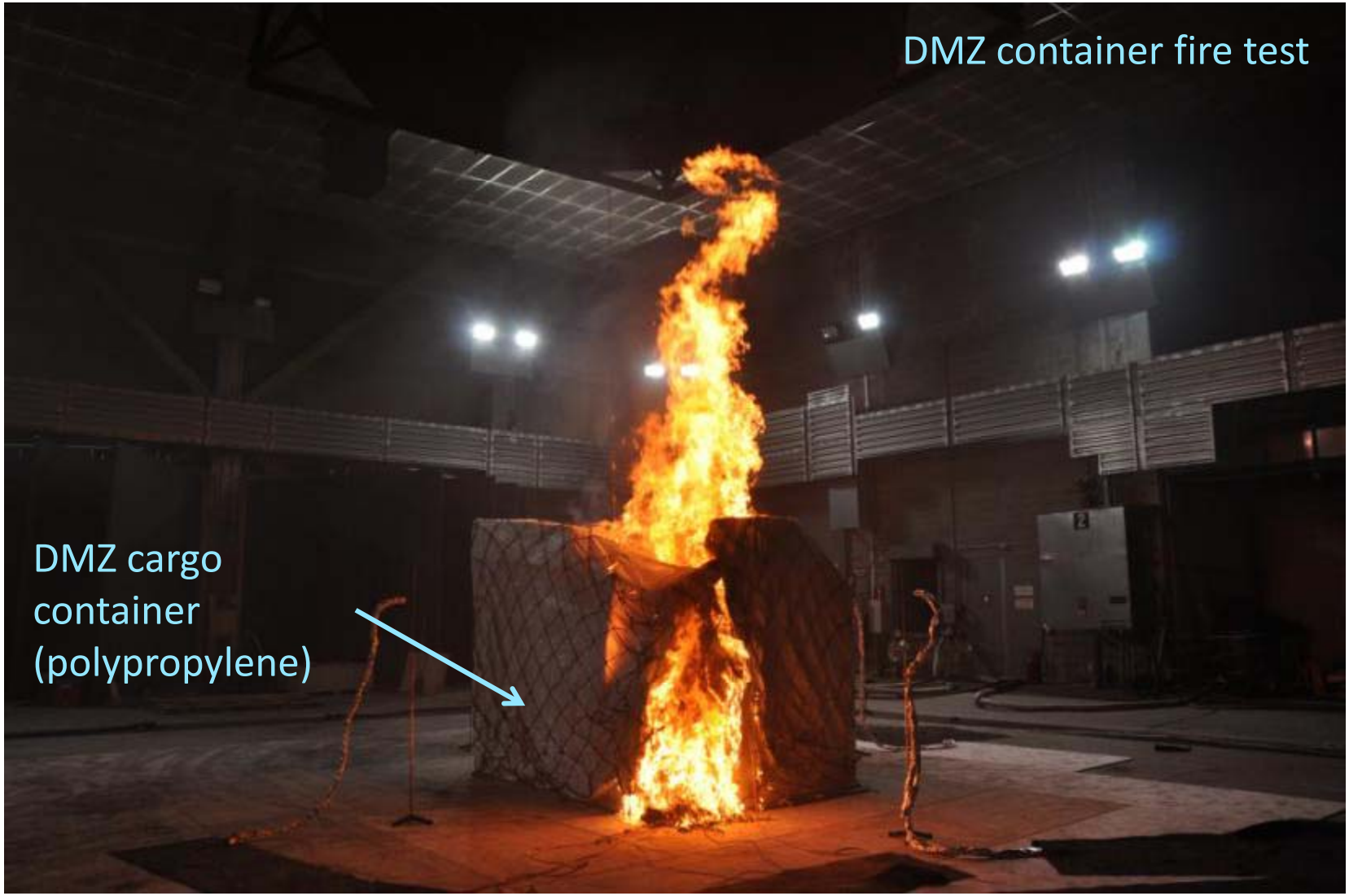

UPS Flight 6, Boeing 747-400F, Dubai, UAE

- NTSB Materials Laboratory fire investigator on scene
- Developed a fire test program to understand cargo fires:
  - Quantify the fire load posed by lithium-ion batteries relative to ordinary combustibles
  - Quantify the size and growth rate of a cargo container fire

Cargo Container Fire Experiment



Cargo Container Fire Experiment

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