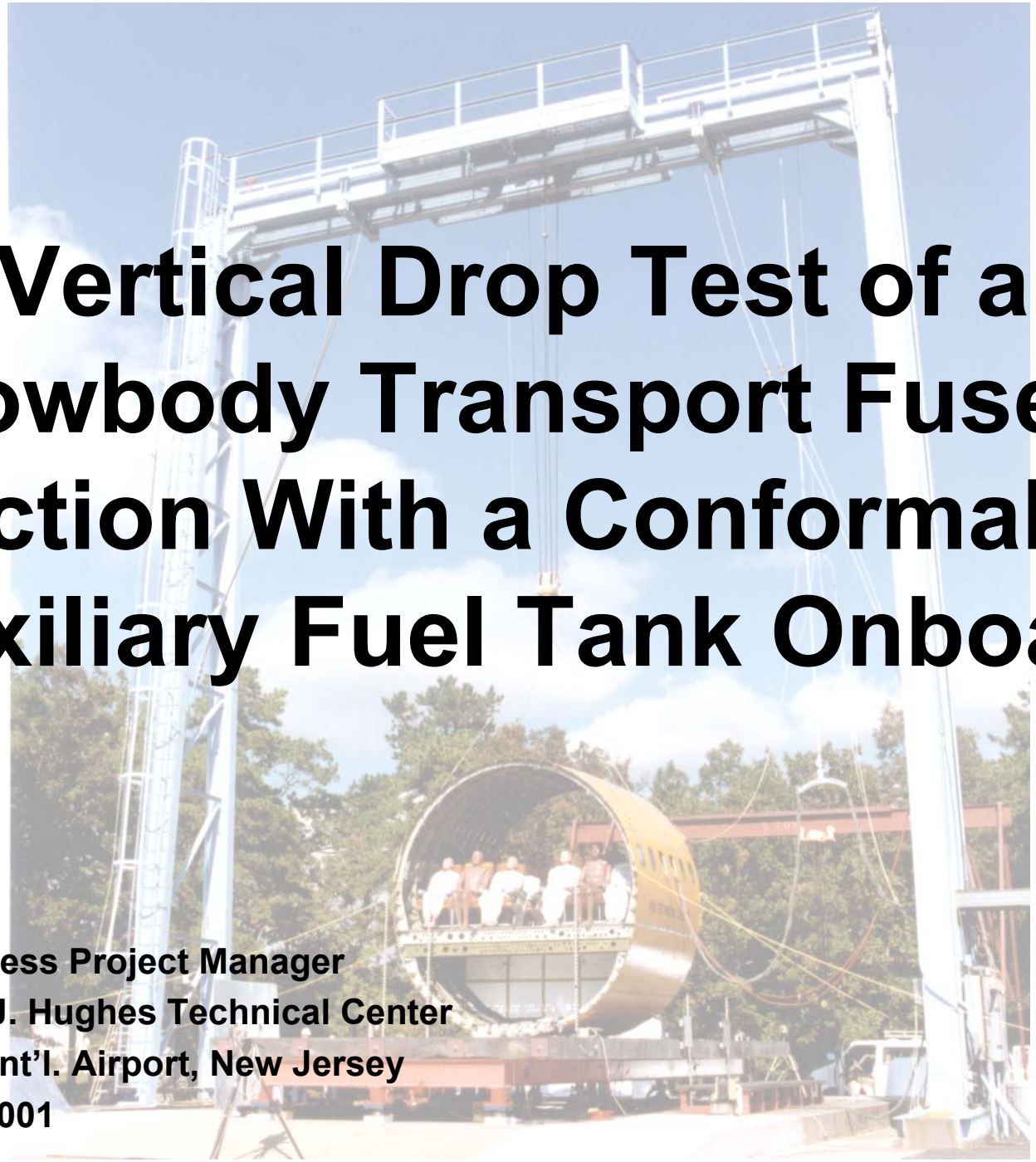

Vertical Drop Test of a Narrowbody Transport Fuselage Section With a Conformable Auxiliary Fuel Tank Onboard

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TEST OBJECTIVE

Determine the interaction between a typical transport airplane fuselage, particularly its floor structure, and a conformable auxiliary fuel tank under severe, but survivable, impact conditions.

BACKGROUND

Aviation Safety Research Act of 1988

(Public Law 100-591)

Sec. 9. Crashworthy Fuselage Fuel Tanks and Fuel Lines

"In order to ensure greater air safety to passengers of air carriers and reduce the incidents of post-crash fires, the Administrator of the FAA shall,…determine the feasibility of installing in air carrier aircraft crashworthy fuselage fuel tanks and fuselage fuel lines…"

BACKGROUND

Two types of fuselage mounted auxiliary fuel tanks have been tested.

Double-walled cylindrical tank

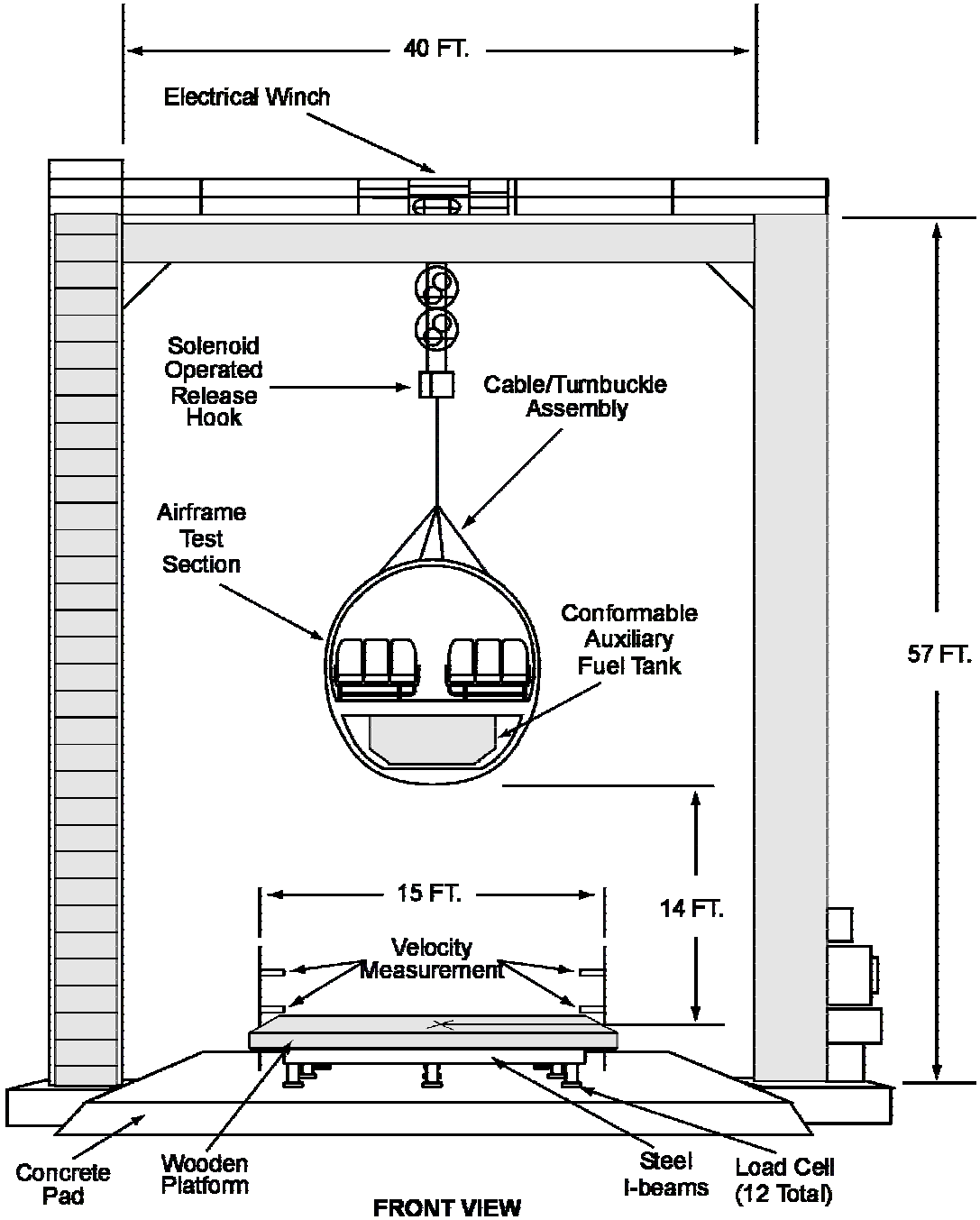
Report DOT/FAA/CT-94/116
April 1995

Conformable tank

Report DOT/FAA/AR-00/56
September 2000

TEST FACILITY

- 30,000 pound lift capability
- Instrumented impact platform



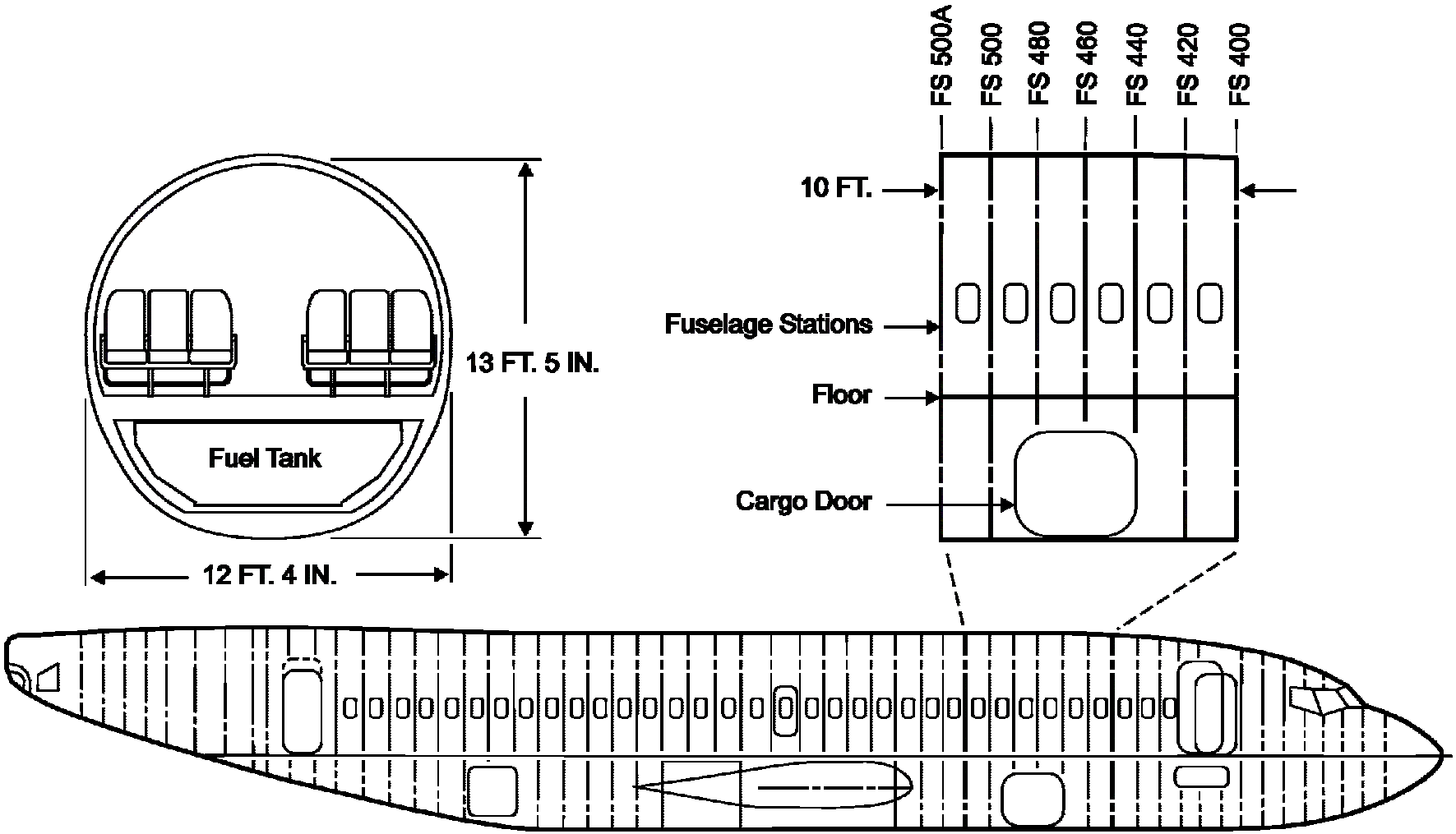
TEST FACILITY

- Onboard and offboard data acquisition systems

TEST ARTICLE

- B737-200 fuselage section, 10 feet long (FS400 – FS500A)
- Six triple cabin seats (three rows)
- Six anthropomorphic test dummies and twelve mannequins
- conformable auxiliary fuel tank
- Total weight 8780 pounds

TEST SECTION



AUXILIARY FUEL TANK

- Located in cargo compartment
- 500 gallon capacity
- Suspended from two longitudinal mounting rails hung from the floor beams

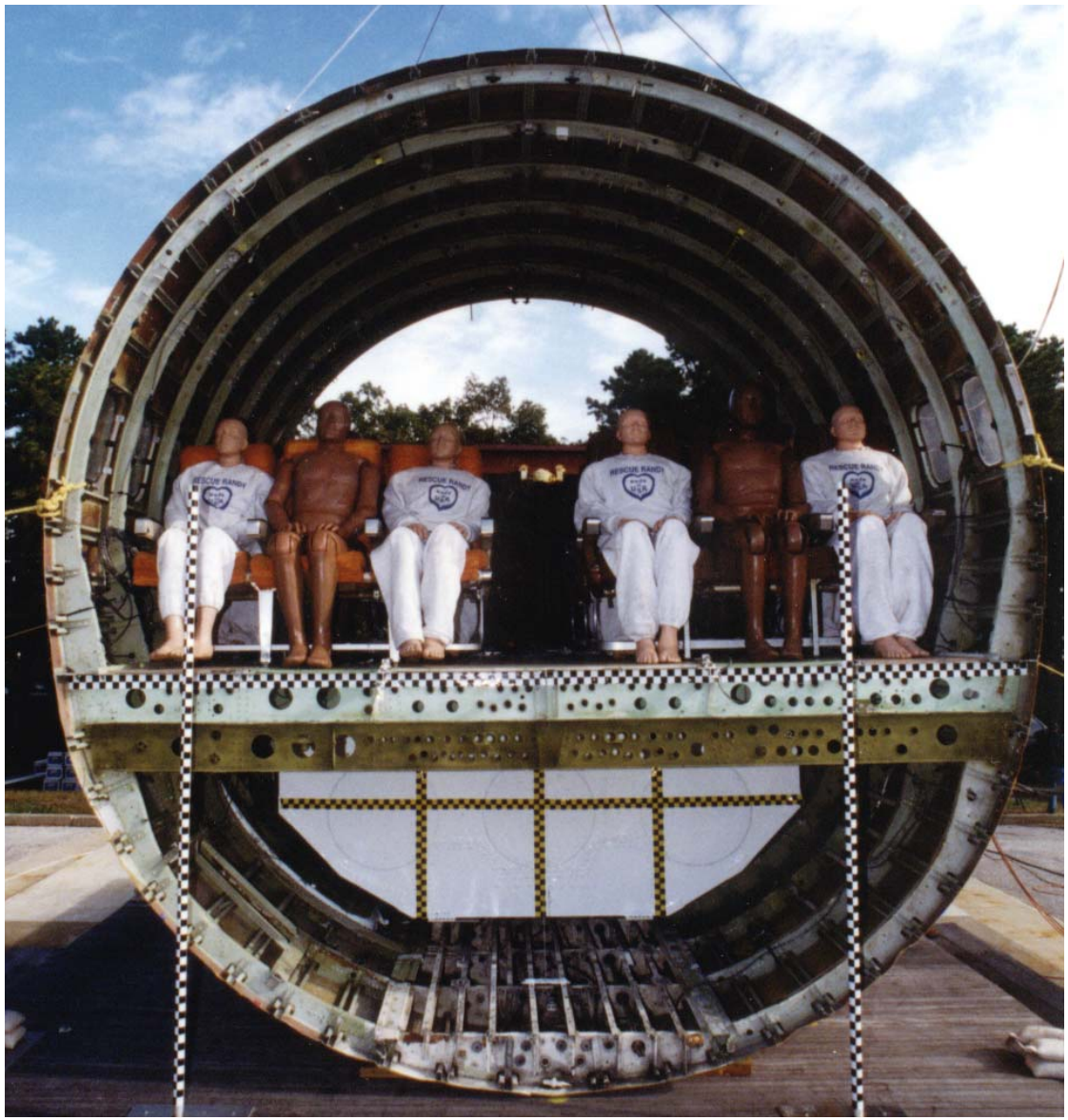
Front View

AUXILIARY FUEL TANK

- Two longitudinal aluminum straps on bottom
- Contained 404 gallons of water
- Pressurized to 1 psi
- No fuel lines connected to tank

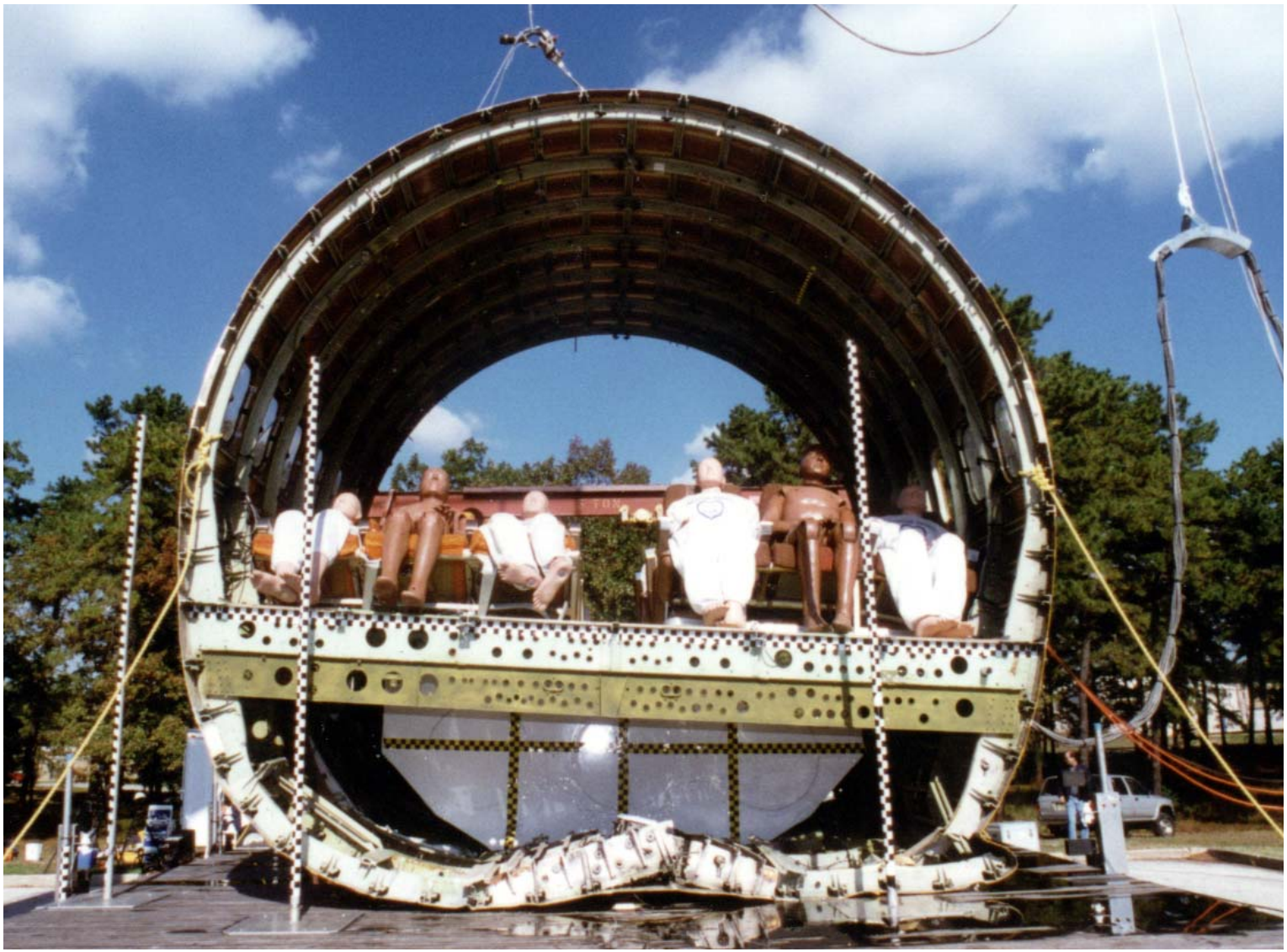
Rear View

PRE-TEST



VIDEO

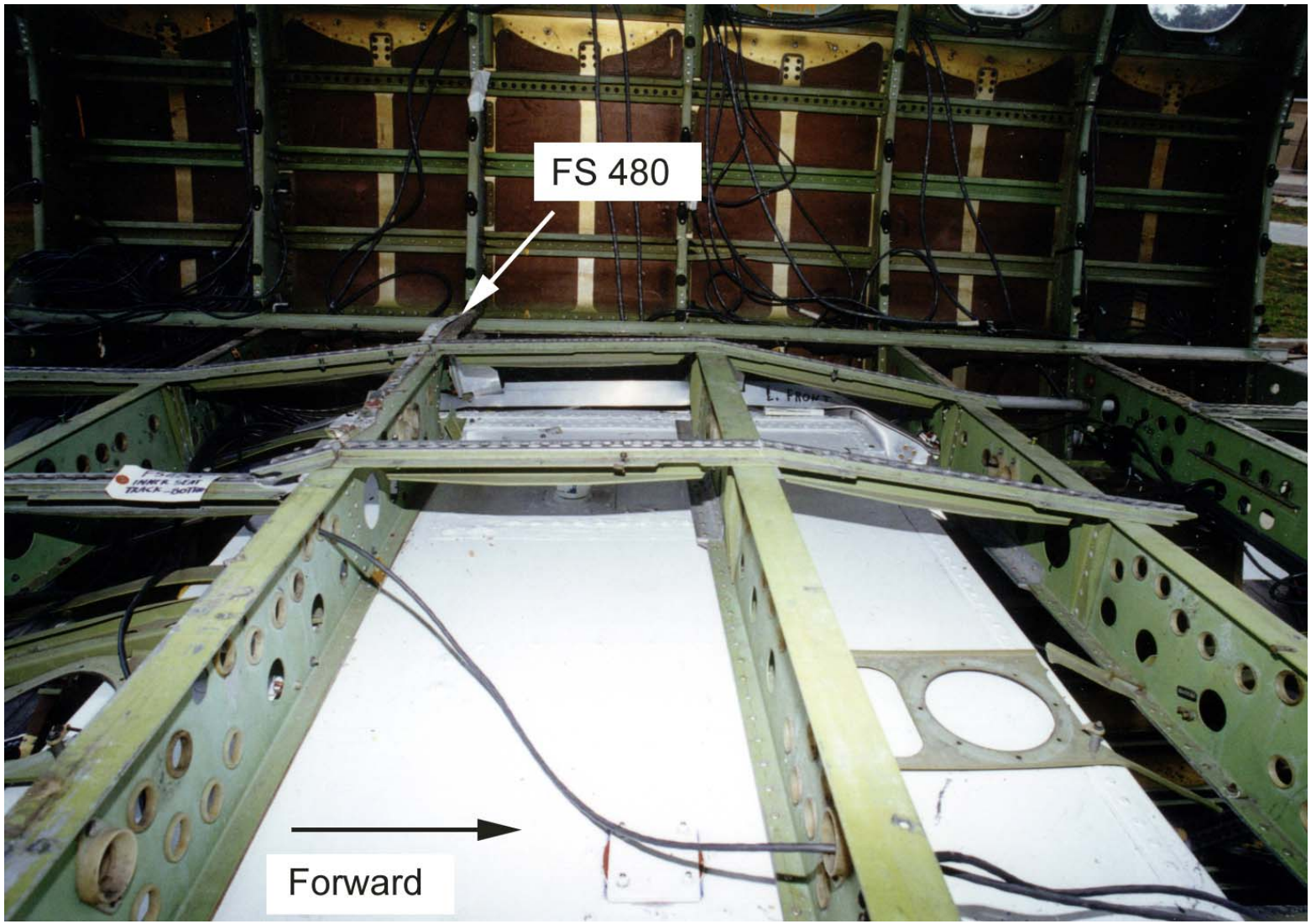
POST-TEST



POST-TEST

- Right side static crush – 11 inches
- Left side static crush – 21 inches

POST-TEST



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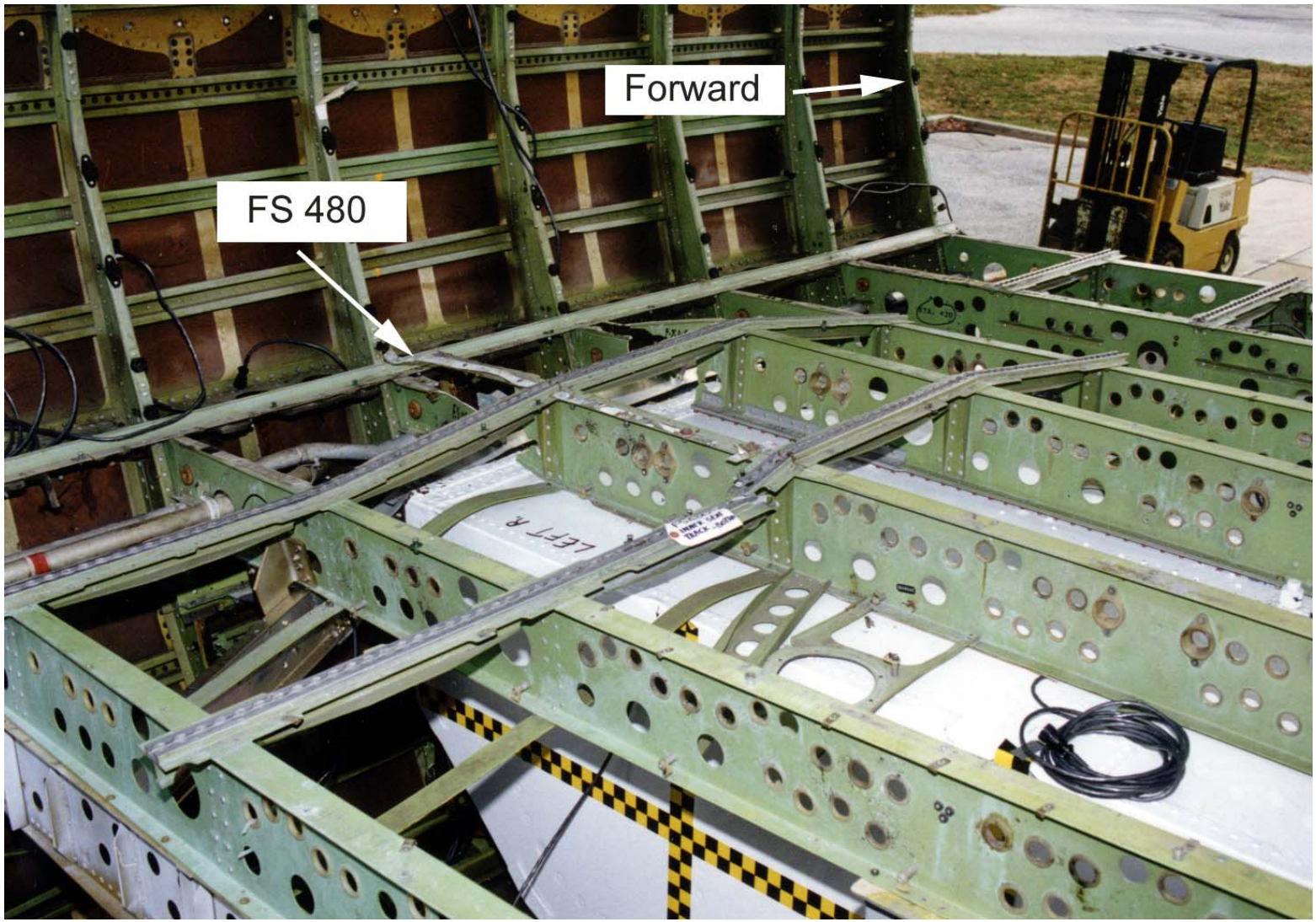

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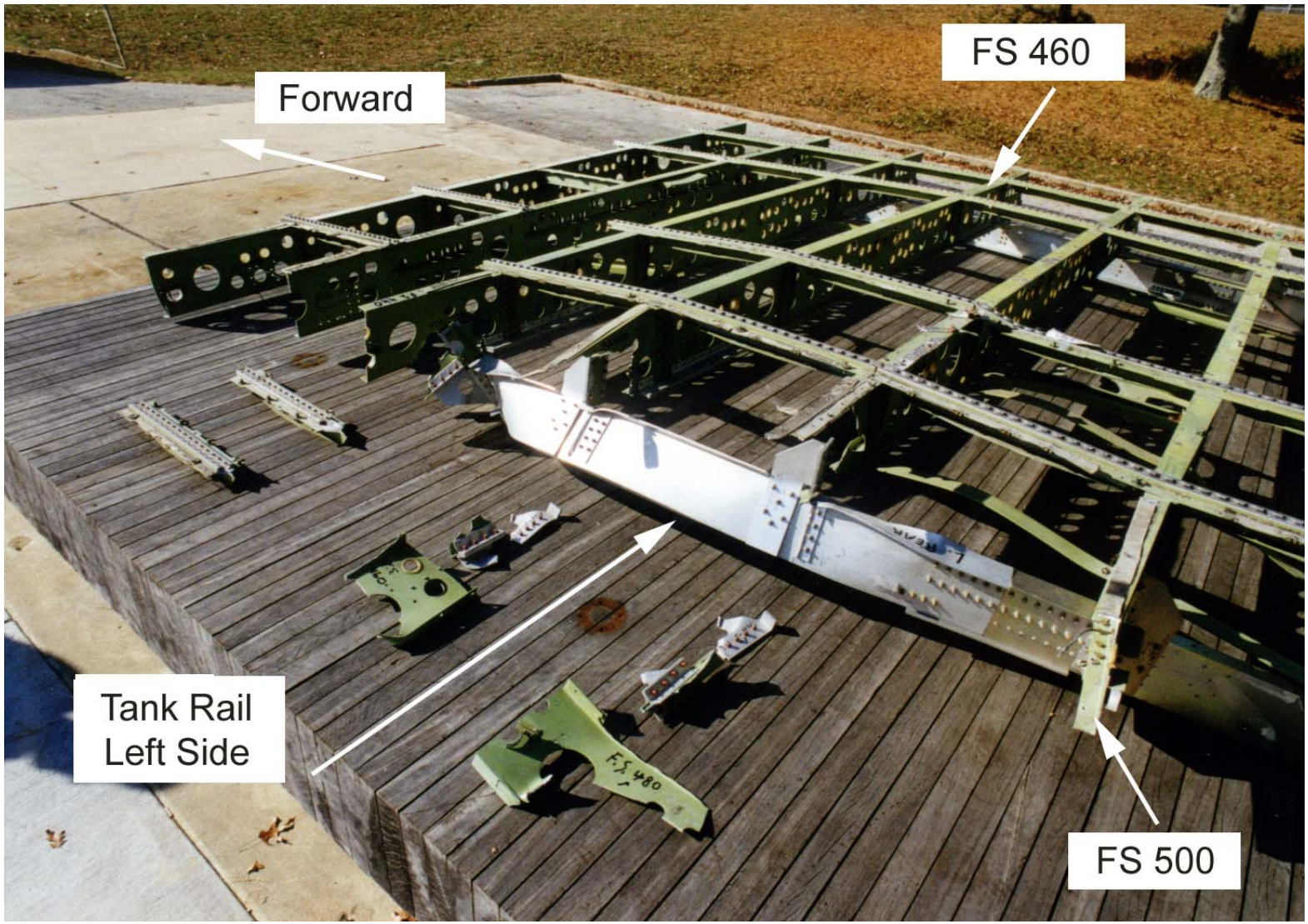

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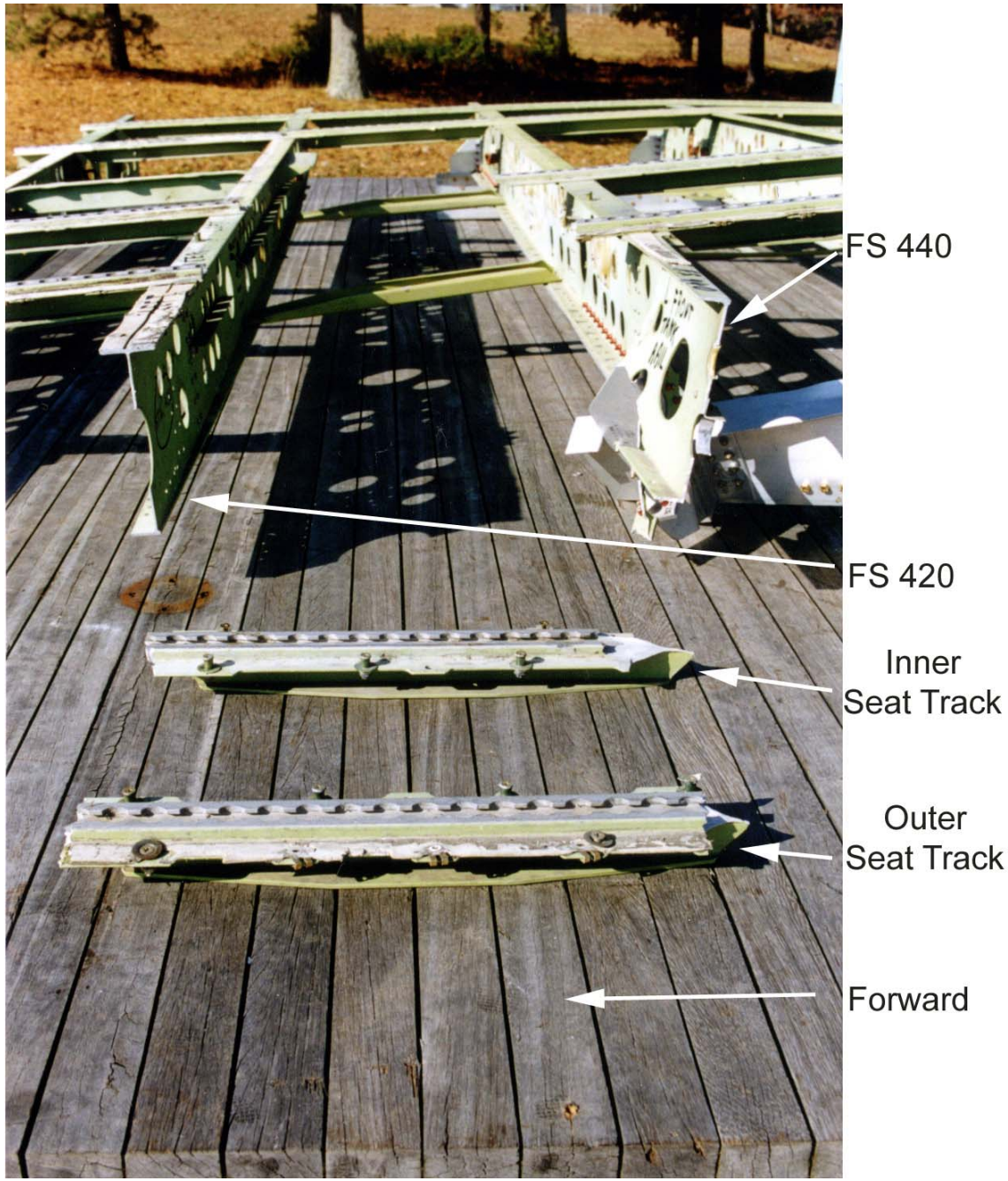

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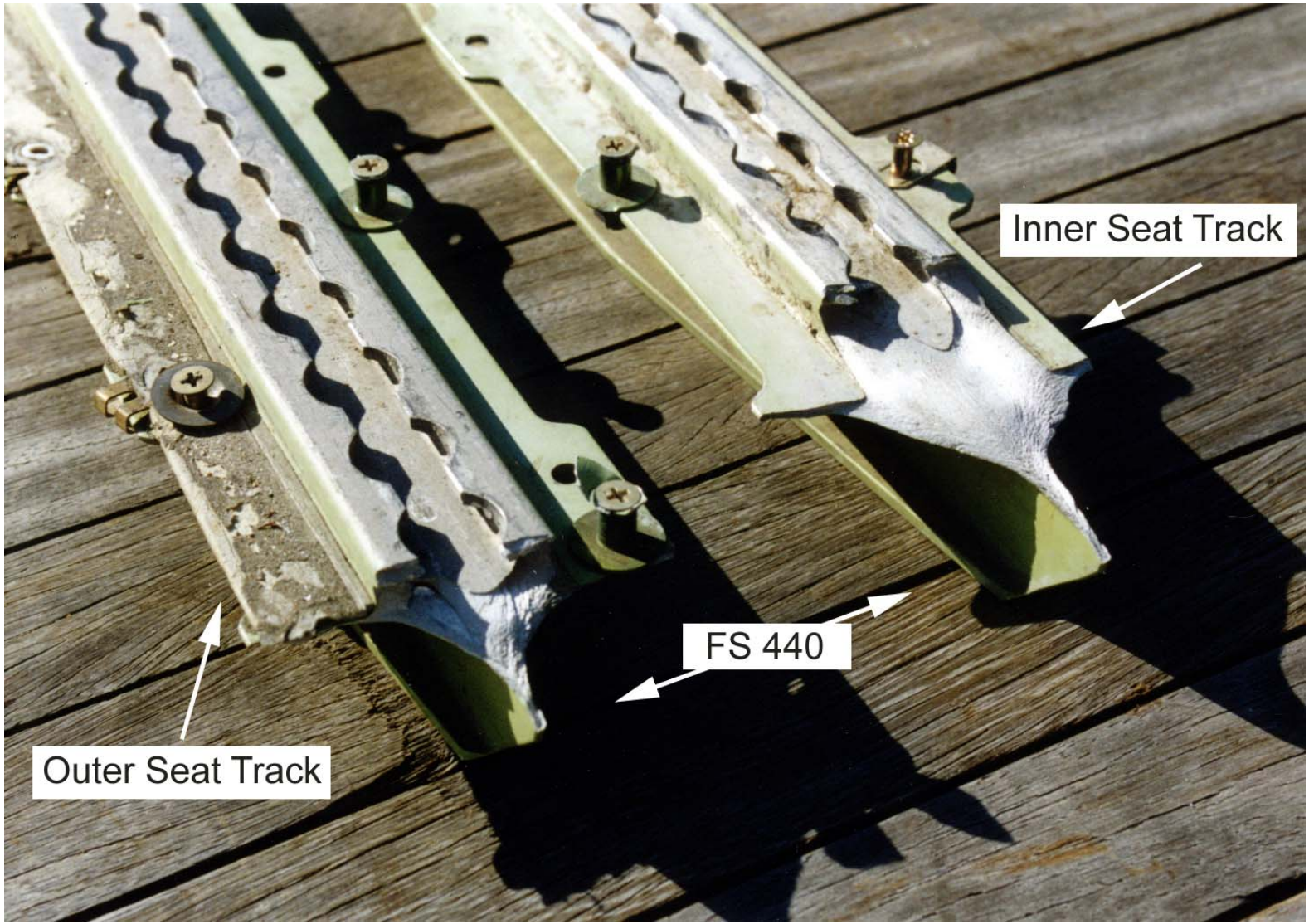

POST-TEST

POST-TEST

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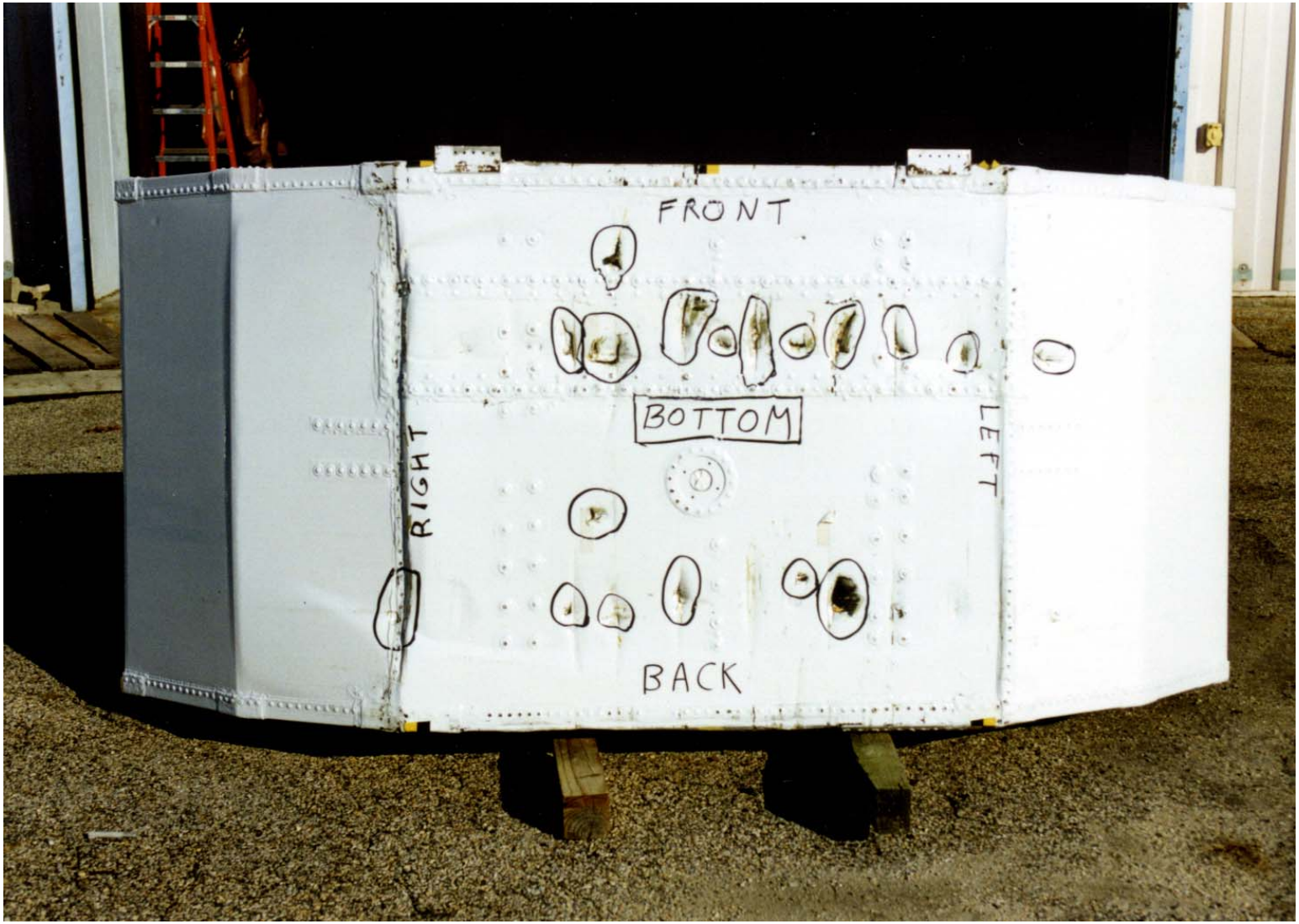

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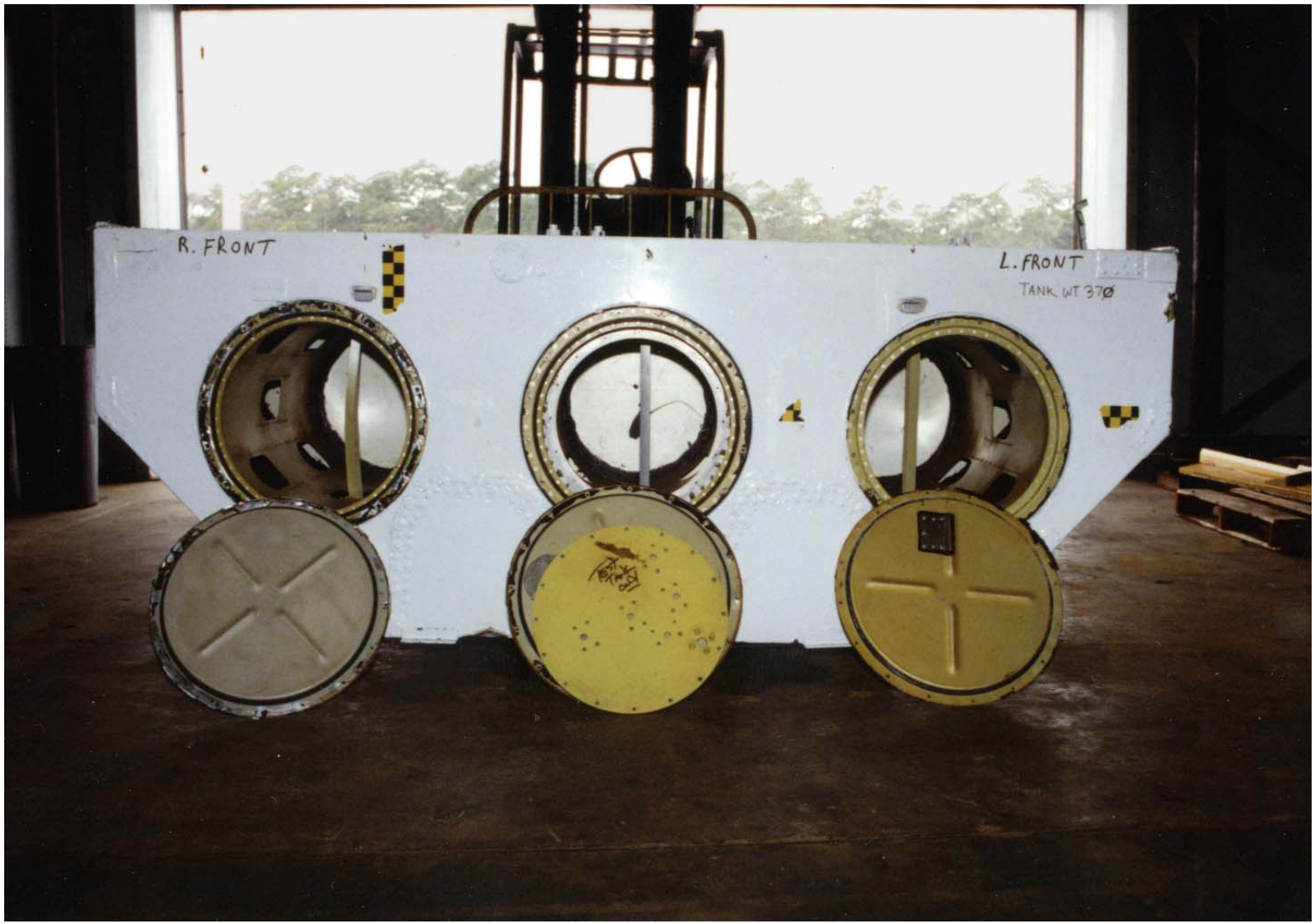

POST-TEST DATA

- 121 data channels
- Left side data differs from right side data due to asymmetric fuselage crushing
- Two major pulses
  - Initial fuselage impact with drop test platform
  - Auxiliary fuel tank impact with floor beams
- Average seat track accelerations
  - Left side 50 g's @ 10 ms pulse duration
  - Right side 67 g's @ 12 ms pulse duration
- Average fuel tank acceleration
  - 60 g's @ 45 ms pulse duration
- Other cargo area and cabin area accelerometer data similar

CONCLUDING REMARKS

- A narrow-body transport fuselage section with an on-board conformable auxiliary fuel tank was dropped from a height of 14 feet resulting in a vertical velocity of 30 feet per second.

- Two acceleration pulses characterized the reaction of the fuselage to the impact. The first pulse corresponds to the initial impact of the fuselage with the drop test platform, the second pulse corresponds to the impact of the cabin floor beams with the auxiliary fuel tank.

CONCLUDING REMARKS

- A cargo door and its associated reinforced doorframe located on the right side of the test section helped support the right side resulting in less damage. A portion of the cabin floor on the left side was severed loose by its impact with the auxiliary fuel tank. This may have contributed to the fracture of the seat tracks on that side.

- The ten-foot long fuselage test section sustained severe nonsymmetric damage. The left side crushed almost 2 feet; the right side less than 1 foot.

CONCLUDING REMARKS

- The acceleration levels and pulse durations on the left side seat tracks were 50g and 10 ms while the right side seat tracks experienced 67g and 12 ms.

- The seats were not a primary focus of this test. However, the seats experienced major structural damage.

- The bottom of the conformable auxiliary fuel tank was punctured in numerous locations resulting in simulated fuel spillage. The fuel tank was very strong and rigid in its construction thus allowing it to maintain its structure. This resulted in the fuel tank fracturing the floor beams directly above it; consequently, the floor beams penetrated the passenger cabin.

CONCLUDING REMARKS

- It appears that the use of such fuel tanks limits the inherent ability of the fuselage structure to absorb energy resulting in a more severe crash condition for the occupants