NTSB National Transportation Safety Board

Office of Aviation Safety

Derivative Certification and Thrust Reversers

Derivative Certification

- Type Certificate defines an airplane
- Derivative certification
  - Changed aeronautical products
  - Allows specific changes

Learjet Type Certificate A10CE

- 1966 Model 24

- 1993 Model 60
  - Bigger fuselage
  - Larger engines
  - Electronics
- Revision of February 1, 1965
  - 14 CFR 25.1309 Equipment, systems, and installations

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14 CFR 25.1309 Differences

- 1965 version
  - Single-level failures
  - “Reasonably probable”
- 1977 version
  - Single and combined failures
  - “Extremely improbable”
  - Improved crew recognition and displays

14 CFR 21.101 Process

- Changed Aeronautical Products
- 1981 FAA Special Certification Review
  - Criticizes derivative process related to 14 CFR 25.1309
- 1993 Learjet 60: Certificated to 1965 version of 14 CFR 25.1309
- 2000 to 2003
  - FAA changed 14 CFR 21.101, AC, Handbook
  - Still allowed *compliance with an earlier amendment for* aspects not affected by change

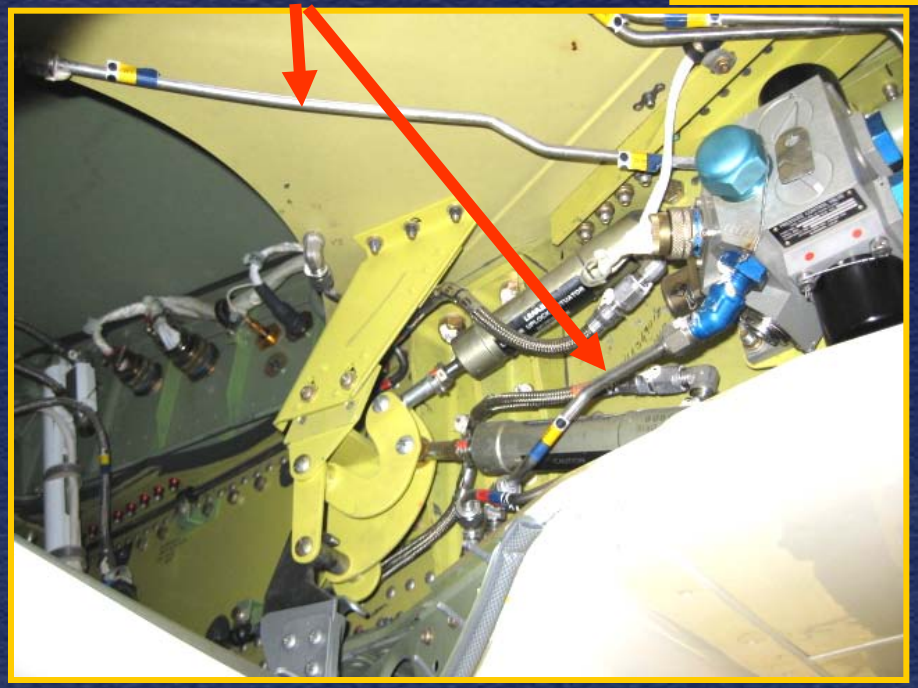
Differences In Protection

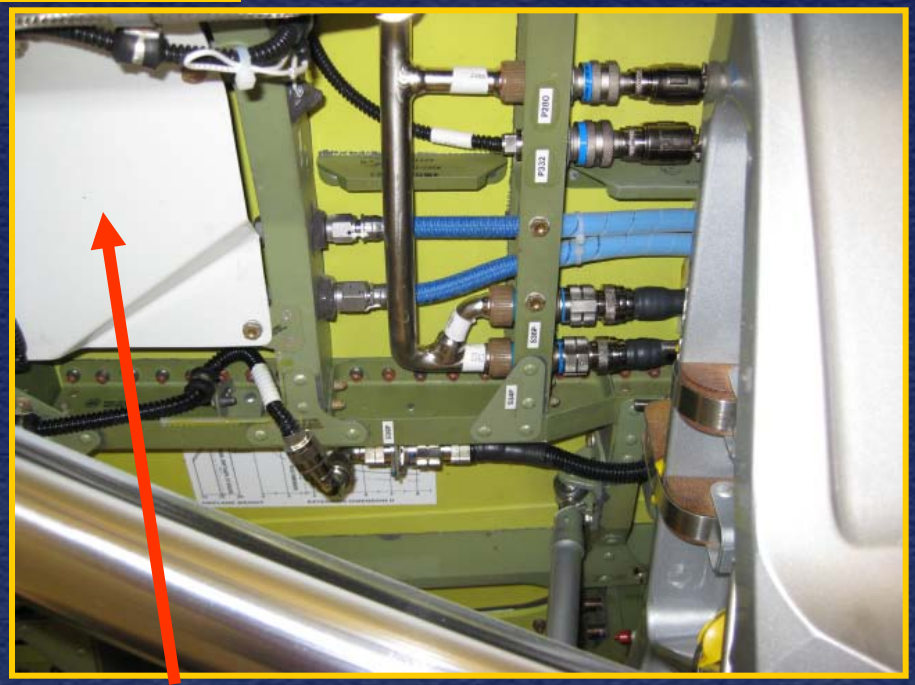
Model 60

Exposed unfused hydraulics

Model 45

Fused hydraulics

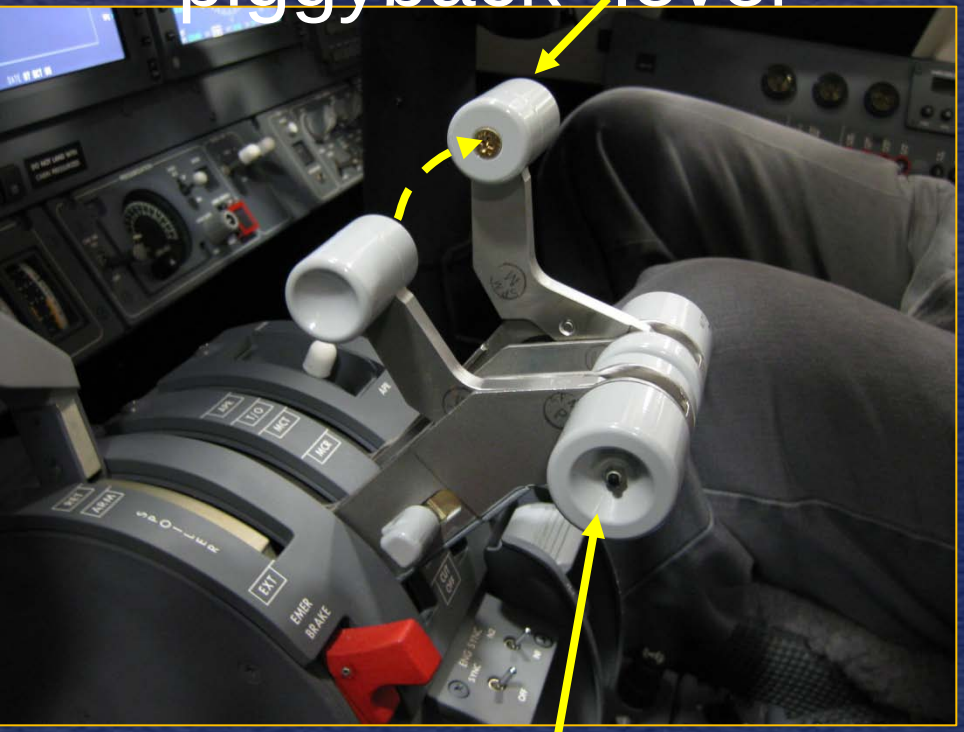




Protective plate

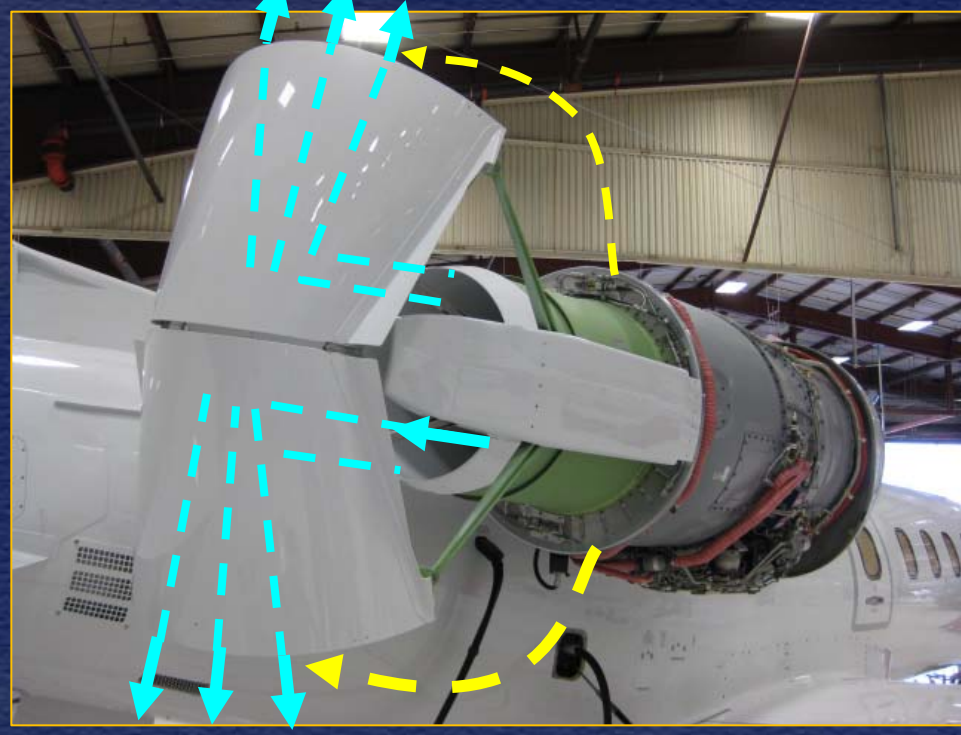
Thrust reverser components

Thrust reverser "piggyback" lever



Both (forward) thrust levers at idle

Deployed right thrust reverser



Blocker doors redirect engine exhaust

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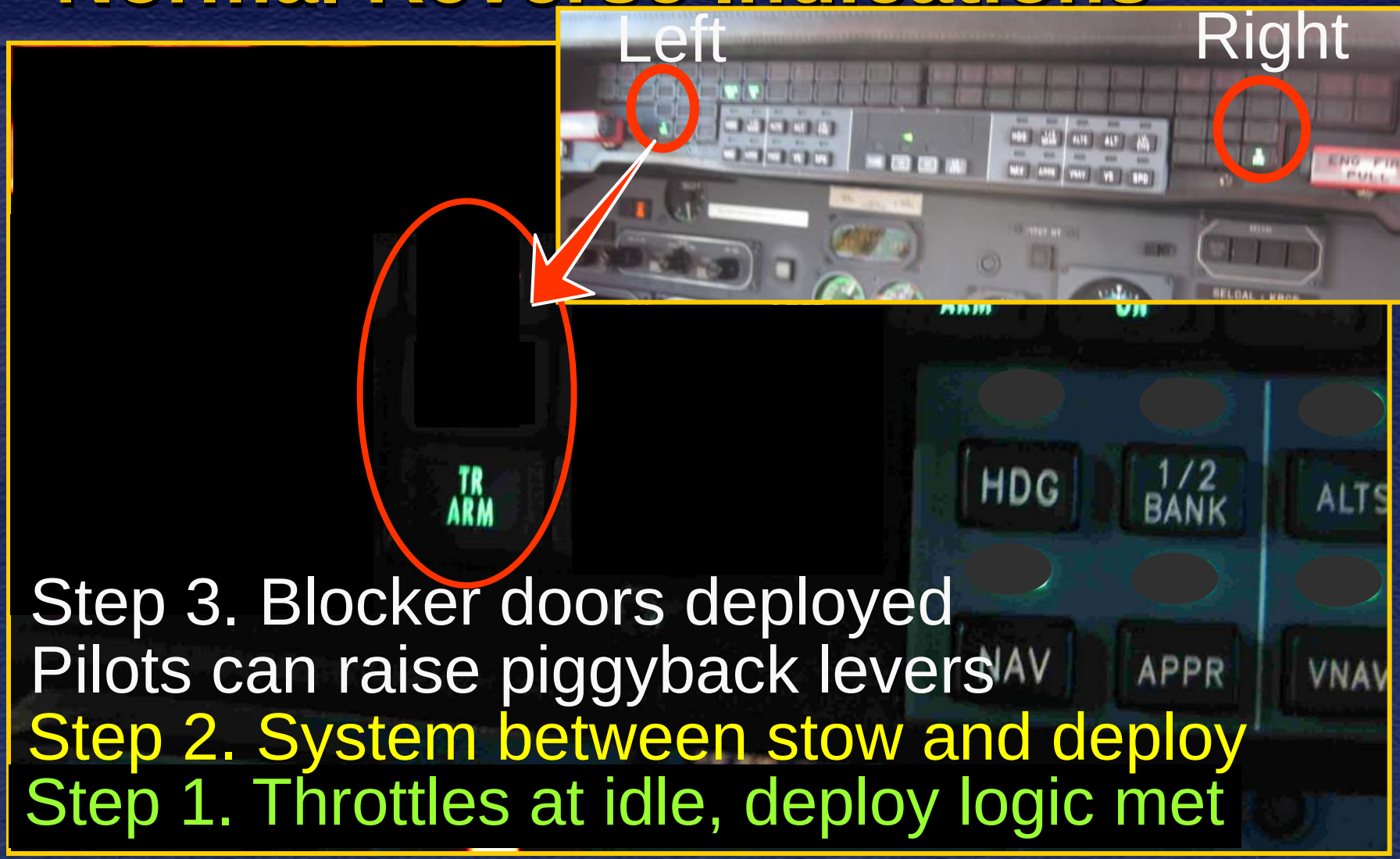
Learjet 60 Thrust Reversers

- Model 60 certificated without reversers
- First Learjet use of electronic engine and thrust reverser control
- No feedback in positions of piggyback control levers

Normal Reverse Indications



Step 3. Blocker doors deployed
Pilots can raise piggyback levers
Step 2. System between stow and deploy
Step 1. Throttles at idle, deploy logic met

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Reverser Requirements

- In-flight (not desired):
  - Worst case is to have reverser open on takeoff
  - Fail-safe concept is to stow reversers
- On ground:
  - Squat switches in ground mode
  - Throttles at idle forward thrust
  - Continually pass system integrity checks
    - Squat switches on landing gear

Normal Operation

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