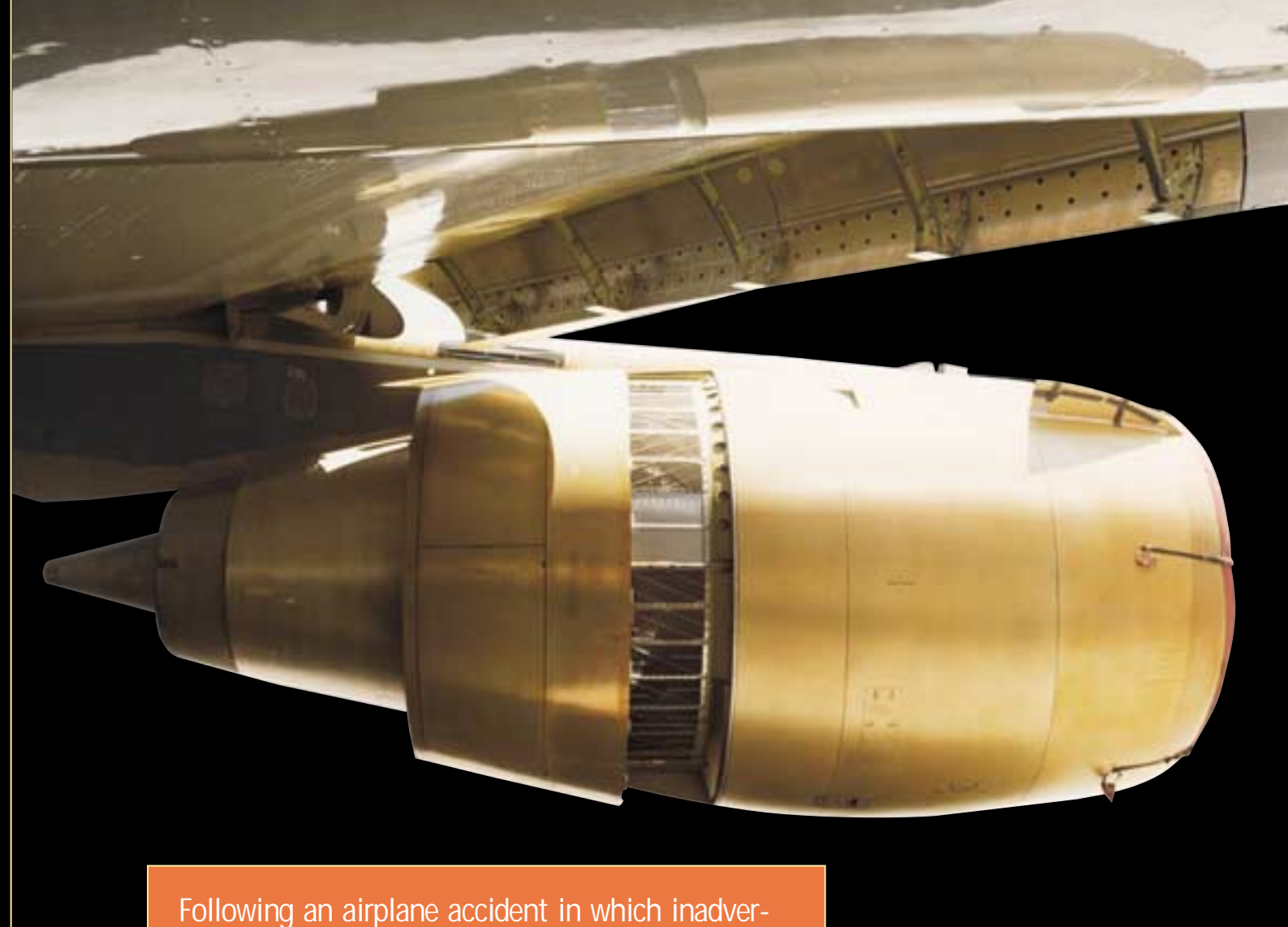


DC-10

THRUST REVERSER

SAFETY

ENHANCEMENT



Following an airplane accident in which inadvertent thrust reverser deployment was considered a major contributor, the aviation industry and the U.S. Federal Aviation Administration (FAA) adopted new criteria for evaluating the safety of thrust reverser systems on commercial airplanes. Several airplane models were determined to be uncontrollable in some portions of the flight envelope after inadvertent deployment of the thrust reverser. In response, Boeing and the FAA issued service bulletins and airworthiness directives, respectively, for mandatory inspections and installation of thrust reverser actuation system locks on affected Boeing-designed airplanes. Boeing and the FAA are issuing similar documents for all models of the DC-10.

SAFETY

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Boeing has initiated a four-phased safety enhancement program for thrust reverser systems on all DC-10 airplanes. The program is designed to ensure compliance with new criteria, established by the U.S. Federal Aviation Administration (FAA), for evaluating the safety of all thrust reversers on commercial airplanes. According to the new criteria, a thrust reverser system is acceptable if an inadvertent deployment is extremely improbable, if the airplane is controllable at any point in the flight envelope in the event of an inadvertent deployment, or both.

The safety enhancement program for the DC-10 is designed to improve the reliability of the thrust reverser system throughout the course of four phases. Each phase increases reliability approximately tenfold.

1. Repetitive inspections of selected thrust reverser subsystems and hardware.
2. Modification of the thrust reverser indication system.
3. Installation of thrust reverser actuation system locks for the wing engines.
4. Modification of command wires for the tail engine thrust reverser.

1 REPETITIVE INSPECTIONS OF SELECTED THRUST REVERSER SUBSYSTEMS AND HARDWARE

Repetitive "health check" inspections involve checking and testing the thrust reverser systems on all three engines of the DC-10. Boeing recommends that an initial inspection be accomplished within 1,500 flight-hours or 6 months

and the repetitive inspections be done at intervals not to exceed 6,000 flight-hours or 18 months. The requirements apply to all models of the DC-10.

Checks for GE-powered DC-10s include a holding torque check of the pneumatic drive motor's internal disc brake; an inspection of the translating cowl

air seal, fairing, and the aft frame; and checks of the feedback rod-to-yoke alignment, translating cowl auto-restow function, position indication for the overpressure shutoff valve, in-flight lockout system function, and fan reverser operation.

Inspections of P&W-powered DC-10s involve checking the stow latch, P-seal/bullnose seal, pneumatic drive unit latch, indication circuitry, running torque, in-flight lockout, and thrust reverser operation.

These inspections are further defined in Boeing Service Bulletin DC10-78A056 and Middle River Aircraft Systems Service Bulletins 78-2004 and 78-3001 for GE-powered DC-10s and Boeing Service Bulletin DC10-78A057 for P&W-powered DC-10-40s. These bulletins will be revised to include additional checks of modified indication systems and new locking systems. The FAA issued a Notice of Proposed Rulemaking (NPRM) in November 1999. An airworthiness directive (AD) mandating the repetitive inspections is imminent.

CF6-6/-50 SWITCHER AND LOCK



2 MODIFICATION OF THE THRUST REVERSER INDICATION SYSTEM

The second phase of the DC-10 safety enhancement program involves modifying the thrust reverser indication light system in the flight deck. All the indicators are placed on the center instrument panel, so they can be monitored when the thrust reversers are in use. The flight crew immediately will notice any indicator that does not light in the proper sequence and should flag it for maintenance before the next flight. This increases the reliability of the thrust reverser system by reducing the exposure time to possible latent failures of the indication system.

Boeing Service Bulletin DC10-78-060, released Dec. 17, 1999, recommends installation of these indication light systems on both GE- and P&W-powered DC-10s within 18 months of the service bulletin's publication date.

In April 2000, the FAA issued an NPRM, requesting comments on

a proposed AD for the indication system on all models of the DC-10. An AD mandating the incorporation of Boeing Service Bulletin DC10-78-060 is expected by the end of 2000.

3 INSTALLATION OF THRUST REVERSER ACTUATION SYSTEM LOCKS FOR THE WING ENGINES

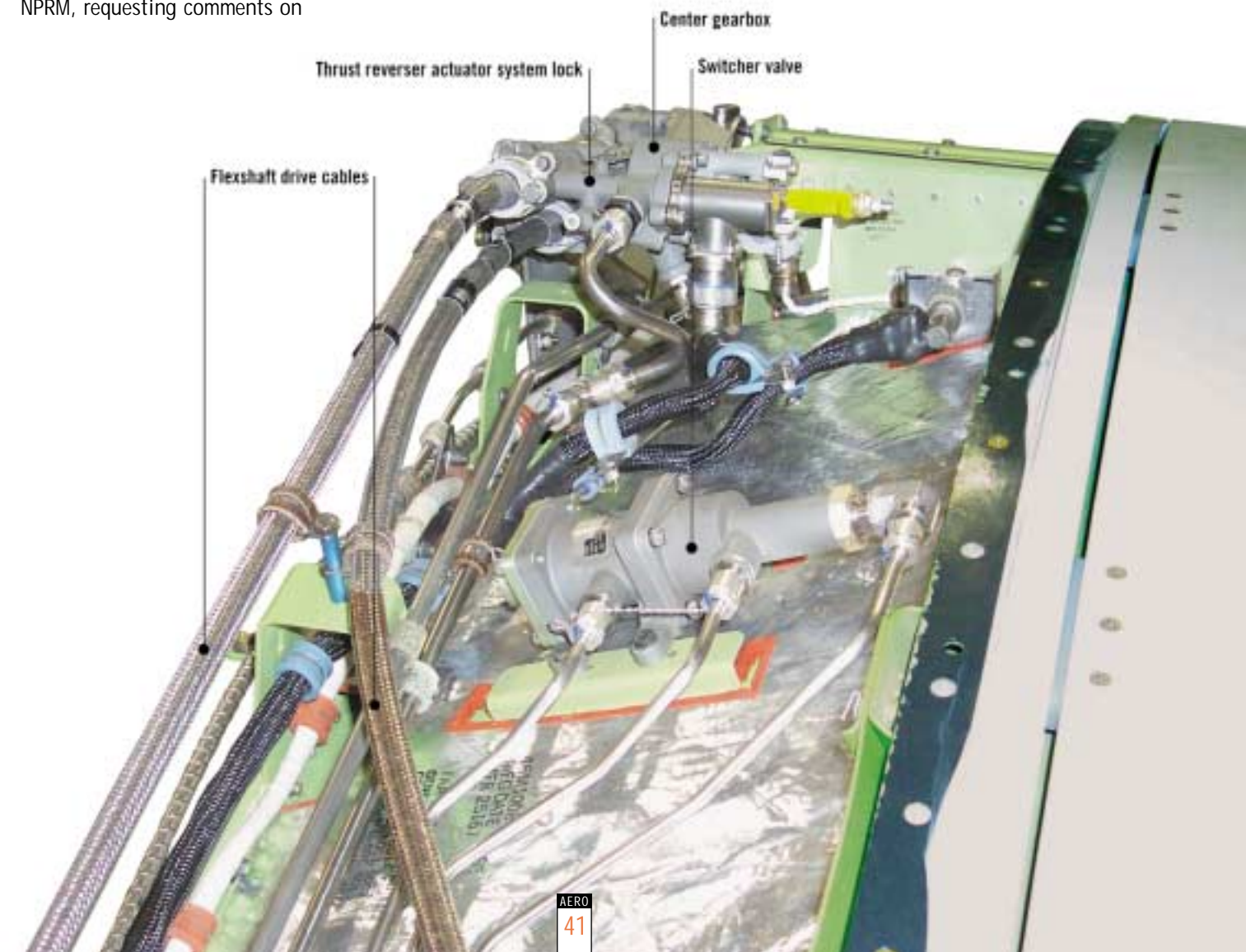
The third phase of the safety enhancement program requires installation of additional, independent locking systems for the thrust reversers on the wing engines (engine nos. 1 and 3). The installation of lock provisions on the tail engine (engine no. 2) thrust reverser is recommended to retain interchangeability between the wing engine reversers and the tail engine

reverser. This allows operators to stock neutral spare reversers and quickly configure them for any engine position.

The basic design elements of the thrust reverser locking system require the modification of the throttle module, the addition of lock-control relay boxes, the modification of the thrust reversers to incorporate the lock hardware (plus the modification of the fan cowl doors on GE-powered DC-10s), and the addition of associated airplane wiring (see p. 43 for requirement details).

Once installed, the new thrust reverser locking system will provide a third, totally independent, level of protection against inadvertent deployment. It will be a positive lock on

LOCK INSTALLATION ON CF6 THRUST REVERSER



the thrust reverser actuation system on each half of the reverser, and it will unlock only when the reverse-thrust levers are moved toward the reverser deploy position. The existing in-flight lockout system is modified to prevent unlocking of the new locking system, even if the deploy command is given in flight. The in-flight lockout system will retain its current function of preventing operation of the air motor. The wiring for the new system consists of dedicated wire bundles with complete separation from existing thrust reverser command wiring. Service bulletins and ADs have been, or will be, released for both GE- and P&W-powered DC-10s.

GE-powered DC-10s. In February 2000, Boeing released Service Bulletins DC10-78-061 and DC10-78-062, recommending installation of the new locking system on all GE-powered DC-10 airplanes within five years. In April 2000, the FAA issued an NPRM, requesting comments on a proposed AD for the addition of the thrust reverser locking system on all GE-powered DC-10 airplanes. An AD mandating the incorporation of Boeing Service Bulletins DC10-78-061 and DC10-78-062 is expected by the end of 2000.

P&W-powered DC-10s. Boeing will release Service Bulletins DC10-78-063 and DC10-78-064 in the first quarter of 2001. The bulletins will recommend installation of the new locking system

on the P&W-powered DC-10-40 within five years. Boeing anticipates that the FAA will issue an NPRM, requesting comments on a proposed AD for the addition of the thrust reverser locking system on DC-10-40 airplanes.

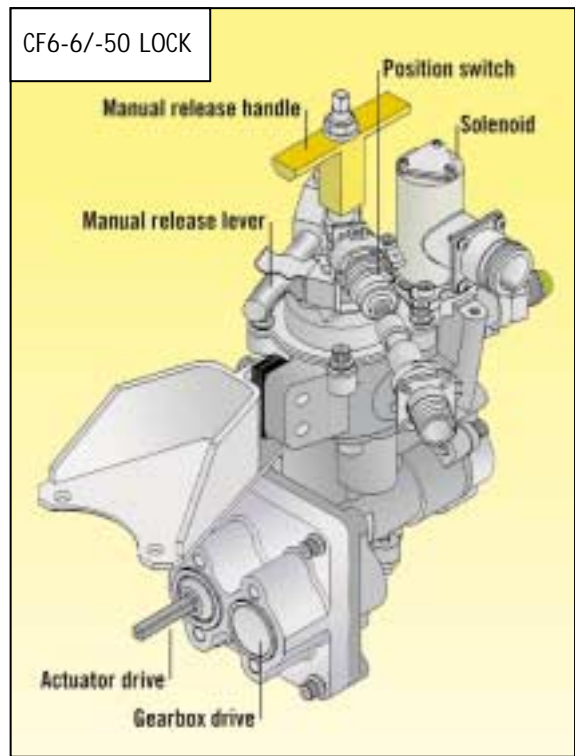
4 MODIFICATION OF COMMAND WIRES FOR THE TAIL ENGINE THRUST REVERSER

The fourth and final phase of the safety enhancement program involves separating the command wires of the tail engine thrust reverser from the aft accessory compartment through pylon no. 2. This is designed to reduce the possibility of an inadvertent deployment of the tail engine thrust reverser as a result of electrical failure in both thrust reverser command circuits.

Boeing will issue Service Bulletin DC10-78-066 by the end of 2000, recommending the modification of the wire harness within five years. The FAA is expected to issue an NPRM requesting comments on a proposed AD on this subject for all models of DC-10 airplanes.

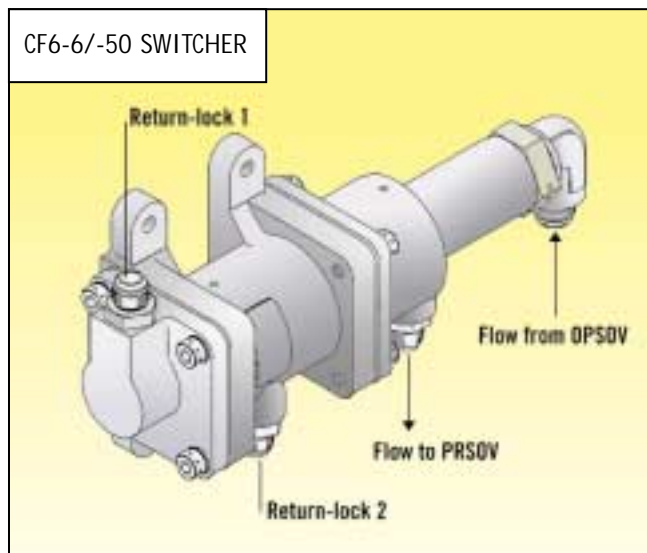
In addition to the four phases above, Boeing has revised the Flight Crew Operations Manual for DC-10s to

recommend that the flight crew disengage the autothrottle in the event of any indication of thrust reverser irregularities, including any indication lights illuminated in flight. The recommendation is based on simulator testing that showed having autothrottle on during an inadvertent deployment diminished the



flight crew's ability to control the airplane.

Editor's note: All Boeing-designed airplanes currently in production comply with the new FAA thrust reverser safety requirements; Boeing-designed airplanes in service are being retrofitted with additional locking devices. On Douglas-designed airplanes, the twinjets (DC-9, MD-80, MD-90, and 717) require no modification; the MD-11 requires periodic checks and separation of the thrust reverser command circuits; the DC-8 is currently under evaluation, but no modifications are expected.



SUMMARY

Each phase of the four-phased safety enhancement program for the DC-10 thrust reverser increases the reliability of the system approximately tenfold. Because each individual phase provides an independent benefit, Boeing recommends that the operators implement each phase as soon as certified by the FAA. Completion of the enhancement program will ensure compliance to the new FAA safety criteria for thrust reverser systems on commercial airplanes.