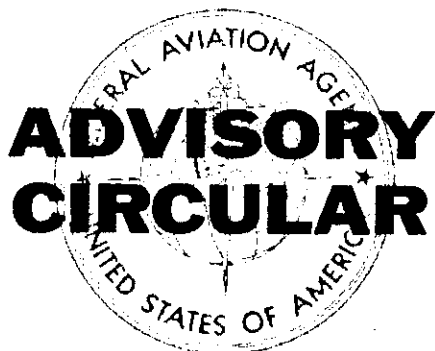


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Federal Aviation Agency



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AIRCRAFT

EFFECTIVE :

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SUBJECT : SHIFTING FLIGHT CONTROL SYSTEMS FROM BOOST-ON TO BOOST-OFF OPERATION ON ALL LOCKHEED CONSTELLATION AIRCRAFT

1. **PURPOSE.** This circular provides guidance material for air carriers and other operators of Constellation type aircraft. It emphasizes recommended procedures and instructions relating to the shifting of the flight control system from boost-on to boost-off operation during emergencies.
2. **REFERENCE.** The instructions outlined under paragraphs 5 and 6 are quoted from Lockheed's Revised Service Information Letter # 509 dated February 4, 1963. This material is incorporated into the Constellation series airplane flight manuals.
3. **BACKGROUND.** A recent Civil Aeronautics Board accident report concerning the fatal crash of a Constellation aircraft at Chicago, Illinois, indicated that a contributing factor to the accident was an inadvertent change of the elevator control due to the loss of a bolt in the elevator boost system mechanism during flight.

In view of the above, this circular emphasizes pilot training in emergency procedures associated with a boost system or flight control malfunction.

4. **INFORMATION.** Since the demonstration of uncontrollable elevator conditions during flight cannot be duplicated effectively, special emphasis must be placed on this particular phase during ground training. A thorough understanding of the symptoms and procedures related to these adverse conditions is necessary prior to flight training.

The following material is quoted from Lockheed's Revised Service Information Letter # 509.

5. **DISCUSSION.** Lockheed's boosted control systems have exceptionally good safety records. Nevertheless, the occasion may arise, however remote, that will require a shift from boost-on to boost-off operation.

The need to shift a boosted surface control system from boost-on to boost-off could be created by a loss of hydraulic pressure or by a discrepancy in the mechanical portion of the affected booster system.

Most control system difficulties should be recognizable by one or more of the following conditions:

- a. Aircraft does not respond to pilot force on cockpit control;
- b. Cockpit control seems to be immovable or requires abnormally high force;
- c. Aircraft starts nosing up or down, rolling or yawing, and application of pilot force on the cockpit control to correct or stop the condition is ineffective. (If the changing attitude is being caused by an auto-pilot malfunction, corrective action on the cockpit control will be effective, since malfunctions of the auto-pilot can be overpowered); and
- d. Application of trim tab has no effect on trimming the aircraft. (If this is a tab system problem, the airplane will respond to pilot force on the primary control.)

An important consideration in shifting a boosted control system to boost-off is the position of the trim tabs which should be at or near normal trim position prior to shifting. If the trim tabs are displaced several degrees out-of-trim (by the pilot or the auto-pilot), the airplane may be expected to lurch when the transition to boost-off operation is made. If time does not permit retrimming prior to shifting to boost-off, the next best thing is to retrim as soon as possible after achieving boost-off operation.

Although the procedure of shifting to boost-off usually will not help if the control system is rigidly jammed by a foreign object, or other serious interference, it is recommended that the shift to boost-off be made regardless because it is possible that the problem will be overcome by doing so.

6. RECOMMENDED PROCEDURE.

- a. For Shifting any Control to Boost-off.
 - (1) Automatic pilot - OFF;
 - (2) Trim tab setting - check for normal trim position if time permits. (If time does not permit, retrim airplane after booster shift is accomplished);

W A R N I N G

A sudden and pronounced lurch of the airplane should be anticipated as the shift is made if the tab setting is more than 2 or 3 degrees from the normal trim position.

N O T E

If the pilot or automatic pilot has unsuccessfully attempted to counteract an attitude change by moving the tabs, the tabs can be out-of-trim by several degrees. That is why it is important to check the setting of the tab and to return it to a normal trim setting before or immediately after shifting - preferably before.

- (3) Booster shut-off handle - pull to OFF; and

W A R N I N G

When shifting the elevator system to boost-off a force on the control column will increase the force required to pull the shift handle. A heavy force could make it difficult to pull the shift handle. Do not apply force on the elevator control column during operation of the elevator shift handle.

N O T E

On the 1649 Starliner, the preceding statement applies to all three controls - elevator, rudder and aileron. On the Model 1649, do not apply force to the surface control system when operating the shift handle of that system.

- (4) If unable to shift for any reason:
- (a) Shift other two control systems to boost-off.
 - (b) Shut off airplane hydraulic pressure, (including auxiliary boost systems, if on, in airplanes so equipped).
 - (c) Pull shift control for malfunctioning system. If the shift cannot be completed, leave hydraulic pressure off for the remainder of the flight.

N O T E

Auxiliary boost or other system pressure can be reestablished provided it does not supply pressure to the malfunctioning system.

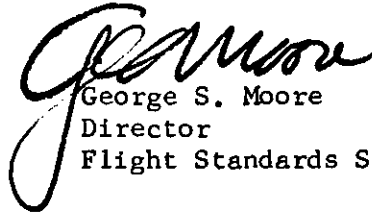
- (d) If the shift is completed on the malfunctioning system, reestablish airplane hydraulic pressure and return the other two control systems to boost-on operation.

b. Special Case Not Shifting to Boost-off:

If any primary control (elevator, rudder or aileron) should become free - that is, cockpit control moves freely with no effect on aircraft attitude - the following is recommended:

- (1) Leave automatic pilot ON if already on;
- (2) Turn automatic pilot ON if not on;
- (3) Do not shift to boost-off; and
- (4) Land airplane with automatic pilot by using automatic pilot controller and/or tabs.

7. ACTION. In accordance with the foregoing, the Agency will place emphasis on ground training programs to assure that crewmembers are well versed on Lockheed's recommended procedures related to the flight control boost systems of Constellation aircraft.



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