## Discussion

The FAA has received numerous reports of fatigue cracking and/or corrosion in the strut-to-wing attachments on Boeing Model 747 series airplanes. In two cases, cracking resulted in the failure of a strut load path and the subsequent loss of the number 3 engine and strut. In both cases, catastrophic accidents occurred when the number 3 engine and strut separated from the wing of the airplane and struck the number 4 engine, causing it to separate from the airplane. Investigation into the cause of these accidents and other reported incidents has revealed that fatigue cracks and corrosion in the strut-to-wing attachments, if not detected and corrected in a timely manner, can result in failure of the strut and subsequent separation of the engine from the airplane. Investigation also has revealed that the structural fail-safe capability of the strut-to-wing attachment is inadequate on these airplanes.

The FAA has previously issued 13 AD's that address various problems associated with the strut attachment assembly on Boeing Model 747 series airplanes that are equipped with General Electric Model CF6-45 or -50 series engines or Pratt & Whitney Model JT9D–70 series engines. These AD's have required, among other things, inspections of the strut, strut-to-wing attachment structure, and wing backup structure.

## **Explanation of Service Information**

Boeing recently has developed a modification of the strut-to-wing attachment structure installed on Model 747 series airplanes equipped with General Electric Model CF6-45 or -50 series engines or Pratt & Whitney Model JT9D–70 series engines. This modification significantly improves the load-carrying capability and durability of the strut-to-wing attachments. Such improvement also will substantially reduce the possibility of fatigue cracking midspar and upper link fuse pins with

and corrosion developing in the attachment assembly.

The FAA has reviewed and approved Boeing Alert Service Bulletin 747 54A2158, dated November 30, 1994, which describes procedures for modification of the nacelle strut and wing structure. This modification entails the following:

1. Changing the strut by adding a new titanium dual side load fitting to the strut aft bulkhead, replacing the aft end of the midspar web with a new 15-5 stainless steel web, installing new 15-5 stainless steel midspar fittings on the inboard struts, and replacing the aft bulkhead assembly and overhauling the spring beams on the outboard struts;

2. Changing the wing structure by installing a new dual side load underwing fitting and new support fitting, and replacing the end fitting and installing a new stiffener at the wing midspar for the outboard strut location [for certain airplanes, installing new inboard backup fittings, installing new titanium outboard underwing fittings at all strut positions, and replacing the tee fitting common to the rib at wing station (WS) 1140; for certain other airplanes, replacing the tee fitting bolts common to the rib at WS 1140];

3. Changing the electrical wiring and hydraulics by rerouting the wire bundles around the new dual side load fitting, splicing additional wire to the wire bundles, and installing new hydraulic tubes; and

4. Installing the strut with a new upper link, a new diagonal brace, and new side links.

This alert service bulletin specifies that the modification of the nacelle strut and wing structure is to be accomplished prior to, or concurrently with, the terminating actions described in the service bulletins listed in paragraph I.C., Table 2, "Prior or Concurrent Service Bulletins," on page 7 of this alert service bulletin. These terminating actions include the following:

Replacement of the diagonal brace,

new third generation 15-5 corrosion resistant steel fuse pins;

2. Replacement of the strut-todiagonal brace aluminum attach fitting on the inboard engine with a steel fitting;

3. Installation of a large skin doubler and frame stiffener in the area of the precooler exhaust vent;

4. A zero-time overhaul of the springbeams and rework of certain fastener holes of the springbeam support fittings of the outboard strut;

Inspection and torque check of certain fasteners of the strut-to-wing attachment fittings; and

6. Modification of the rib at wing station 669.5.

## **Explanation of the Provisions of the Proposed AD**

Since an unsafe condition has been identified that is likely to exist or develop on other products of this same type design, the proposed AD would require modification of the nacelle strut and wing structure, inspections and checks to detect discrepancies in the adjacent structure, and correction of discrepancies. The actions would be required to be accomplished in accordance with the alert service bulletin described previously.

The FAA has determined that long term continued operational safety will be better assured by design changes to remove the source of the problem, rather than by repetitive inspections. Long term inspections may not be providing the degree of safety assurance necessary for the transport airplane fleet. This, coupled with a better understanding of the human factors associated with numerous continual inspections, has led the FAA to consider placing less emphasis on inspections and more emphasis on design improvements. The proposed modification requirement is in consonance with these considerations.

Accomplishment of the modification of the nacelle strut and wing structure would terminate the inspections required by the following AD's:

AD No.	Amendment No.	Federal Reg- ister citation-	Date of Publica- tion
94–22–08	39–9057	59 FR 58761	Nov. 15, 1994.
93–17–07	39–8678	58 FR 45827	Aug. 31, 1993.
93–03–14	39–8518	58 FR 14513	Mar. 18, 1993.
92–24–51	39–8439	57 FR 60118	Dec. 18, 1992.
90–20–20	39–6725	55 FR 37859	Sept. 14, 1990.
89–07–15	39–6167	54 FR 11693	Mar. 22, 1989.
87–04–13 R1–	39–5836	53 FR 2005	Jan. 26, 1988.
86–23–01	39–5450	51 FR 37712	Oct. 24, 1986.
86–08–03	39–5289	51 FR 12836	Apr. 16, 1986.
86–07–06	39–5270	51 FR 10821	Mar. 31, 1986.
86–05–11 R1–	39–5334	51 FR 21900	June 17, 1986.