Roll control difficulties, McDonnell Douglas MD-11F, N583FE, January 15, 2003

Micro-summary: **This airplane experienced uncommanded roll following lowering of flaps.**

Event Date: **2003-01-15 at 2038 UTC**

Investigative Body: **Aircraft Accident Investigation Board (AAIB), Great Britain**

Investigative Body's Web Site: **http://www.aaib.dft.gov/uk/**

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McDonnell Douglas MD-11F, N583FE

AAIB Bulletin No: 8/2003 Ref: EW/C2003/01/03 Category: 1.1

Aircraft Type and Registration:	**McDonnell Douglas MD-11F, N583FE**
No & Type of Engines:	3 GE CF6-80 turbofan engines
Year of Manufacture:	1991
Date & Time (UTC):	15 January 2003 at 2038 hrs
Location:	6 miles north-east of Stansted Airport
Type of Flight:	Public Transport (Cargo)
Persons on Board:	Crew - 3 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Left inboard flap vane failure
Commander's Licence:	FAA Airline Transport Pilot's Licence
Commander's Age:	43 years
Commander's Flying Experience:	8,900 hours (of which 3,688) were on type) Last 90 days - 74 hours Last 28 days - 9 hours
Information Source:	AAIB Field Investigation

History of the flight

The aircraft and crew were scheduled to fly from Paris, Charles De Gaulle Airport to Stansted, Essex before continuing to Newark, New Jersey. The crew consisted of a training captain, a first officer under training who was the handling pilot, and a relief first officer. The operator's normal landing flap setting was 35°, but it was a requirement for the trainee first officer to carry out a full flap landing. The crew therefore planned to use flap 50° for the landing at Stansted. The following has been compiled from crew reports and extracts from the aircraft's Digital Flight Data Recorder (DFDR).

The flight from Paris to Stansted, where the weather was fine, was uneventful until the approach to Runway 23. At about 4,000 feet, flap 35° was selected and the first officer noticed that he needed a small amount of rudder trim to keep the aircraft in balance. The flaps were then selected to 50° and shortly afterwards the captain felt a 'thump', similar to that of a birdstrike. Thereafter, the first officer needed to apply a large amount of right aileron to keep the wings level. The crew quickly reselected the flaps to 35° whereupon most of the requirement for right aileron disappeared. After a brief discussion the crew decided to reselect flaps to 50° with the Configuration Page selected on the Synoptic Display of the EFIS system. On reselection of flaps to 50°, the requirement for right aileron reappeared but, apart from the displacement of the ailerons from the neutral position, all other indications on the Configuration Page, including those for flaps, were normal. The crew reselected the flaps to 35° and carried out a normal landing. During taxi after landing, the flaps were raised and,

shortly thereafter, the Electronic Instrument System alerting system gave a 'HYD 2 QTY LO' message followed shortly by a 'HYD 2 FAIL' message.

On inspection after landing, a large section of the left inboard flap vane was found to be missing. A section of flap vane was later recovered from the village of Thaxted, some 6 miles to the north-east of Stansted.

The DFDR recording showed that just over 50% of right aileron full travel was required to keep the wings level with flaps 50° extended. After the flaps had been retracted to 35°, this requirement reduced to about 15%.

Engineering investigation

The inboard flap vane is an aerofoil section fitted to the leading edge of the inboard trailing edge flap. It is supported at three positions on spring loaded tracks, which extend the vane as the flap moves away from its retracted position. Examination of the aircraft showed that the outboard half of the vane on the left inboard flap was missing, together with its attachment fittings at the outboard and centre positions. The inboard section of the vane was still attached to the flap and both the inboard and centre vane tracks showed significant distortion. Retraction of the flaps during taxiing had resulted in damage to the flap shroud structure and the No 2 hydraulic system.

Figure 1 is reproduced with acknowledgements from the manufacturer's Service Bulletin MD11-57-034 and shows details of both the pre and post modification design of the vane attachment to the inboard flap. The vane outboard attachment was of the pre-modification design

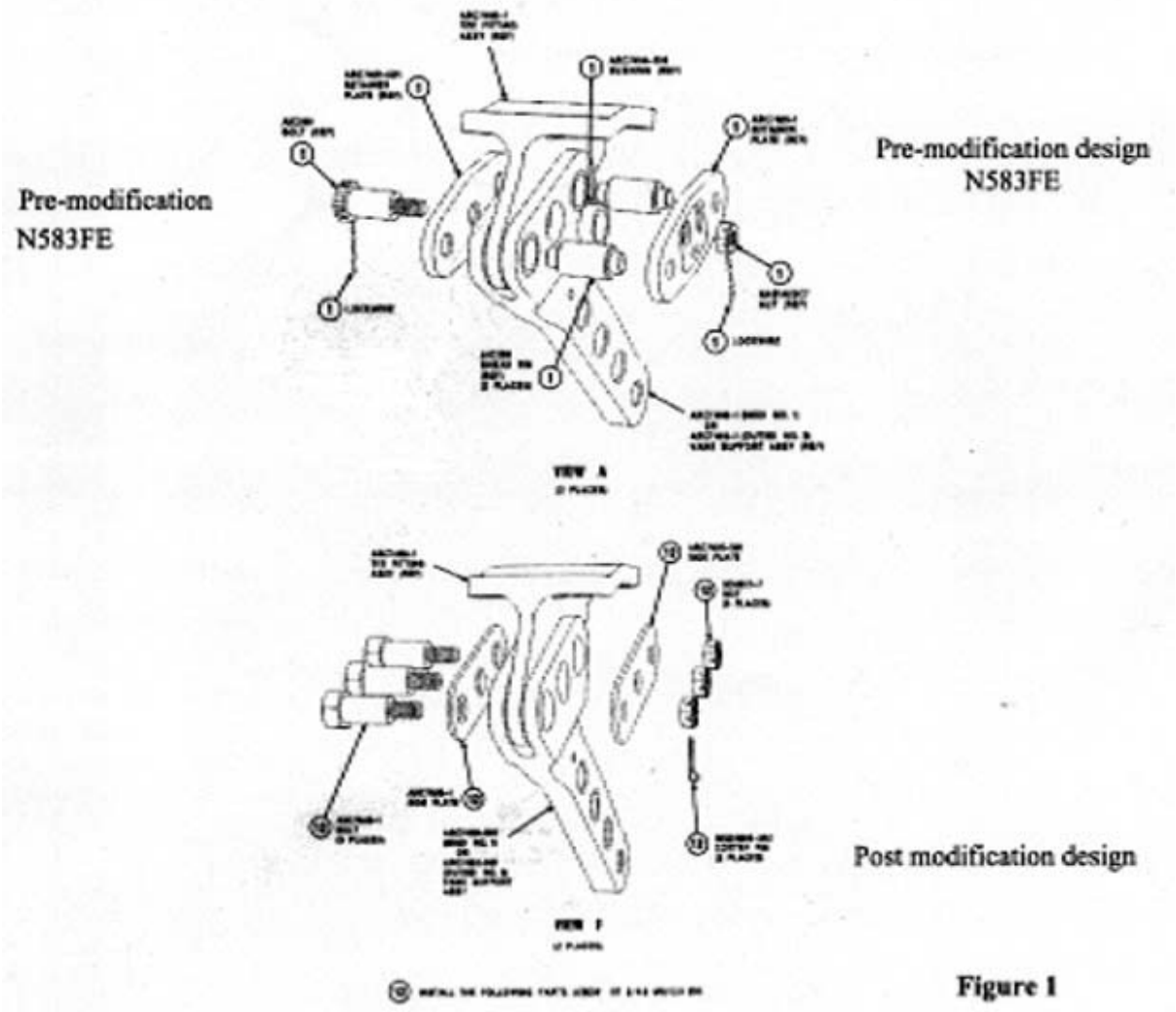

Figure 1

After dismantling, a locking (retainer) plate and nut, each with part of the broken locking wire attached, were found inside the flap, in a pocket for the vane outboard track. No other attachment parts were found, and for these parts to have been retained in the flap it was necessary for them to have detached whilst the flap was retracted. Subsequent operation of the flap would have allowed the remaining attachment items to fall from the aircraft.

Analysis of the fractured lock wire was conducted using a Scanning Electron Microscope (SEM). The material of the lock wire was consistent with the required MS20995C32 specification and ASTM A580 material, which is an annealed and passivated corrosion resistant steel. The standard of workmanship employed in locking the wire appeared adequate. The two strands of the wire had fractured in a brittle manner, consistent with a fatigue process, and there was evidence of a notch or groove in the wire at one of the two fractures, which were co-located. It is possible that the wire had been accidentally nicked. The position of the fracture was such that it was likely that the wire would have made rubbing contact with a corner of the nut, and this may also have accounted for the nick and subsequent fracture.

It seems probable that the vane outboard rail had become detached before the approach to Stansted, and that this possibly accounted for the initial slight amount of trim required when the flaps were set to 35°. With the flap vane attached at only the inboard and centre positions, it became possible for aerodynamic forces to fail the vane as flap 50° was deployed. Loss of the outboard half of the flap vane would then account for the roll moment noted by the crew, as there would have been an

asymmetry of lift between the left and right wings, and the consequent necessity for the pilot to apply right aileron. Upon retraction of the flaps to 35°, this lift asymmetry would have been reduced.

There was normally no maintenance requirement to disturb the outboard attachment area of this vane and, during checks, only routine visual inspections would have been conducted. In March of 2002, a Special Inspection to check for cracks in the flap vane 'Tee' fittings (see Figure 1) would have required this area to be dismantled. The last major work input associated with this area was during a 'C' check, carried out in July 2002, when this area was inspected but not disturbed.

In 1996, the aircraft manufacturer issued Service Bulletin MD11-57-034, in response to a report of the in-flight loss of an inboard flap vane, during the approach to land. This event was attributed to flap vane attachment points becoming disconnected due to either broken or missing lockwire. The Service Bulletin introduced at the inboard and outboard positions as an optional modification, three bolts/nuts locked with cotter pins, in place of the one bolt/nut locked with safety wire and two location pins.

The operator conducted a fleet inspection of its MD-11 aircraft, and found two further cases where the lock wire was broken although the detail parts had not become disassembled. The operator plans to modify all its MD-11s as described in Service Bulletin MD11-57-034 within the next 18 months.