No: 2/86 **Ref: EW/G85/07/18**

Aircraft type and registration:	Bell 222 G-DMAF (twin engined helicopter)
Year of Manufacture:	1981
Date and time (GMT):	10 July 1985 at 1710 hrs
Location:	Oxted, Surrey
Type of flight:	Private (business)
Persons on board:	Crew — 1 Passengers — 7
Injuries:	Crew — None Passengers — None
Nature of damage:	Main undercarriage distorted and leg cracked
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	52 years
Commander's Total Flying Experience:	8830 hours (870 of which were on type)
Information Source:	Aircraft Accident Report Form submitted by pilot and AIB discussions with maintenance organisation.

The accident occurred shortly after the aircraft lifted off for a flight from Oxted to Battersea. A hover turn to the right at a height of around 5 feet was made in order to check the area behind and to line up for the best take-off path. Hover torque was 80%. On attempting to stop the turn it was found that the aircraft was not responding to yaw pedal inputs, and continued turning to the right in spite of full forward displacement of the left pedal. This pedal then motored aft against all the pilot's efforts to resist it, and the rate of turn began to increase. The collective was lowered and a slightly yawed landing made after a total of 1¼ turns. There were no injuries and the aircraft sustained only minor damage.

Yaw pedal movement on the Bell 222 is transmitted to the pitch change arms of the tail rotor blades via a rod and bellcrank lever linkage. A hydraulic servo jack is interposed in series in the linkage part way along the run to provide reduced pedal forces and prevent transient tail rotor loads feeding back to the pedals. An input lever arm pivoted on the jack body transmits yaw pedal demands to the jack pilot valve via a link rod. The arm and rod are connected (Point A, Fig 1) by a pivot pin which is retained axially by a rivet fitted through the pin bore and carrying a washer at either end. Inspection of the aircraft revealed that the arm was disconnected from the rod.

The ram of the servo jack is earthed to structure and the jack body moves to provide position feedback and thus cancel an input demand when it has been matched by jack displacement. In the event of an input disconnection position feedback is lost, and any displacement of the pilot valve from its null position will cause the jack to drive to full travel. The pilot valve is not self-centering.

A search at the accident site located the missing pivot pin beneath the aircraft, but in spite of a

search with metal detectors the associated rivet and washers were not found. There were no signs that the rivet had been forcibly removed from the pivot pin. It was not possible to ascertain whether the rivet had been inadequately formed and had fallen out, or had never been installed.

It was also found that no rivet was fitted in the pivot pin connecting the lever arm to the jack body (Fig 1, Point B). The maintenance organisation involved checked two other Bell 222's in their care and found that the rivet at Point C on one aircraft appeared inadequately formed with little spread of the tail. This rivet was fitted with the tail on the jack body side of the link and inspection with the actuator in situ was considered extremely difficult.

An Alert Service Bulletin issued by the manufacturer shortly after the accident and an Emergency Airworthiness Directive issued by the Federal Aviation Authority required inspection of the rivets at the above three points.

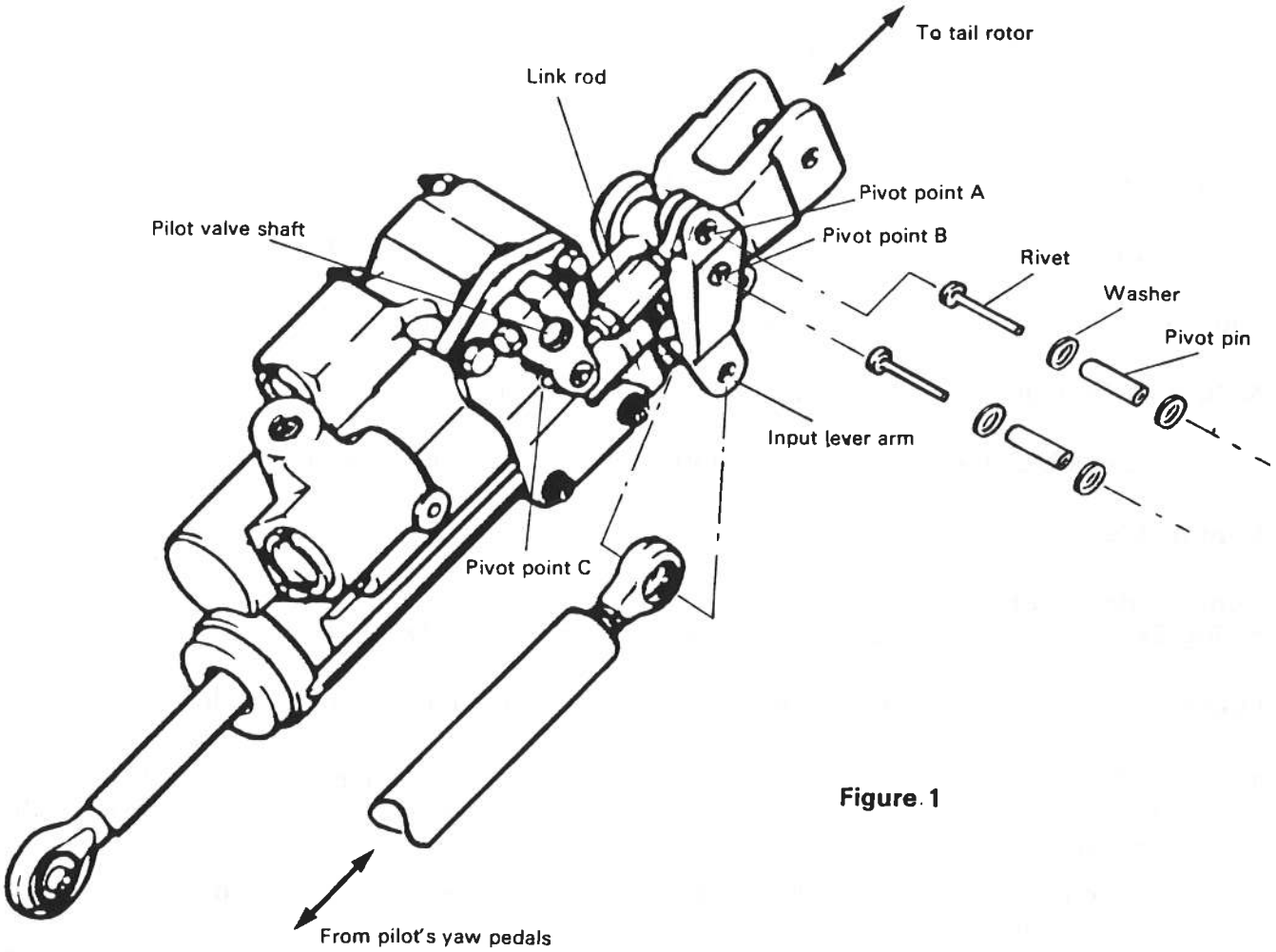
To tail rotor
Link rod
Pivot point A
Pivot point B
Pilot valve shaft
Rivet
Washer
Pivot pin
Input lever arm
Pivot point C
From pilot's yaw pedals

Figure 1