Rockwell Commander 114, G-BFAI

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Aircraft Type and Registration:	Rockwell Commander 114, G-BFAI
No & Type of Engines:	1 Lycoming IO-540-T4B5D piston engine
Year of Manufacture:	1977
Date & Time (UTC):	6 August 1998 at 1752 hrs
Location:	Leicester Airport
Type of Flight:	Private
Persons on Board:	Crew - 1 - Passengers - 1
Injuries:	Crew - None - Passengers - None
Nature of Damage:	Propeller bent, engine shock-load, nosewheel doors and right wing tip damaged
Commander's Licence:	Private Pilot's Licence
Commander's Age:	52 years
Commander's Flying Experience:	196 hours (of which 66 were on type)
	Last 90 days - 32 hours
	Last 28 days - 11 hours
Information Source:	AAIB Field Investigation

History of flight

Whilst flying on the downwind leg to land at Leicester Airport the pilot selected the landing gear down, but then noticed that the three green 'landing gear down and locked' lights had not illuminated. He then flew the aircraft away from the circuit and, during the next 80 minutes, attempted to extend the landing gear fully. Following numerous unsuccessful attempts using the main landing gear electro-hydraulic system the pilot tried to extend the landing gear using the emergency lowering system, but found that the handle appeared to be jammed. He therefore elected

to land on a grass area which was parallel to Runway 28 with the landing gear partially extended. A successful landing was made and both occupants, who were uninjured, vacated the aircraft.

Engineering examination

Subsequent examination of the aircraft revealed that the electro-hydraulic power pack had failed and that the landing gear emergency extension handle had jammed in the UP position.

The electro-hydraulic power pack was taken to an aircraft component overhaul organisation where a strip examination was carried out. It was found that there had been a long term hydraulic fluid 'weep' into the electric drive motor and that the hydraulic fluid had contaminated the commutator's carbon brushes. The commutator brushes showed evidence of severe wear, with one of them having worn to the extent that it had worn away the bonding to it's electrical connecting wire (Photograph 1). This had occurred because the contamination of the carbon brushes by the hydraulic fluid had softened the carbon, which lead to the rapid wear. Apart from periodic 'topping-up' of the hydraulic fluid, the maintenance and overhaul of the electro-hydraulic power pack (which was of a similar type to those fitted to numerous other general aviation aircraft) was on an 'on condition' basis and so the power pack was only subject to inspection/repair whenever operational failure occurred.

The landing gear emergency extension handle was mounted on the left-hand vertical wall of the engine and propeller control lever pedestal which was located in the centre of the cockpit, between the two front seats. The handle consisted of a 1.5 inch diameter knob that moved in a small vertically arced slot (Figure 1). The slot was surrounded by an oval shaped plastic trim panel which was attached to the sheet aluminium sidewall of the pedestal by three PK (self tapping) screws (Photograph 2). Between the plastic trim and the pedestal sidewall was a layer of carpet which was glued to the sidewall.

The top of the control pedestal was removed to reveal that the three PK screws that had been used to fix the plastic trim to the pedestal sidewall were much longer (5/8 inch) than those which should have been used (3/8 inch). As a result of this, one of these screws had protruded under the lever arm that connected the landing gear emergency extention handle to the hydraulic valve which it operated (Photograph 2), thereby preventing movement of the handle to the DOWN position. Further examination of the remaining two PK screws revealed that one was bearing against the side of the main engine fuel supply pipe (Photograph 2). In addition, inspection of the plastic trim panel revealed that it had been mounted 'upside-down'.

Upon removal of the plastic trim and the carpet, six holes for the (three) plastic trim attachment screws were found in the pedestal sidewall (Photograph 3). Three of these holes, which

corresponded with the plastic trim being mounted upside-down, exhibited very good evidence of having been made recently. Examination of the side of the main engine fuel supply pipe revealed that when one of these three new holes had been drilled, the tip of the drill bit had damaged the surface of the fuel pipe, but had not penetrated the tube wall. On the outer sidewalls of the two front seat footwells were foot level air vents. Both of these air vents had circular plastic trim panels attached to the aircraft structure by three PK screws. It was found that the air vent's plastic trim panel in the pilot's footwell was attached to the aircraft structure by the three of the shorter PK screws which should have been used to attach the emergency landing gear extension handle's plastic trim to the pedestal sidewall; the three longer PK screws that were found attaching the landing gear emergency extension handle's trim should have been used to attach the air vent's trim.

Maintenance history

Towards the end of 1997 an annual maintenance check had been carried out on the aircraft. During the period of the related work, the owner had replaced all the carpets and arranged for the seats to be refurbished. The removal of the carpets would have required removal of the landing gear emergency extention handle and both footwell air vent plastic trims. There were no entries in the annual maintenance check worksheets to record any work relating to the renewal of the carpets, or refurbishment of the seats. The maintenance organisation stated that they did not carry out any work associated with the carpet removal and replacement, which was reportedly all accomplished by the owner. However, the owner denied this and stated that, following the fitting of the new carpets, the maintenance organisation had refitted the aircraft trims. The maintenance organisation stated that they did remove the seats and replace them following their refurbishment, of which they had no control. Following the annual maintenance check, the owner requested a detailed breakdown of the cost of the associated maintenance work. Listed in this breakdown were work time entries for removal of the carpets (0.5 hrs) and for the refitting of internal trim (11.75 hrs). However the maintenance organisation have stated that these entries related to the removal of the loose carpets, fitting a new plastic central console, refitting door trims and rear passenger seats and trims. Full normal and emergency landing gear extension and retraction tests had been carried out satisfactorily, but these tests were conducted before the seats and internal trims had been refitted.

Manufacturer's maintenance information

Neither the Manufacturer's Maintenance Manual or the Illustrated Parts Catalogue describe, or show the fitting of, the plastic trim associated with the landing gear emergency extension handle and give no warning of the dangers of fitting the trim upside-down, or of using incorrect length attachment screws. Following a previous incident where the landing gear emergency extension handle plastic trim had been fitted upside-down at manufacture, Service Bulletin (SB) No 114-30 was issued on 15 May 96. This SB called for a 'one-off' inspection, before next flight, of the plastic trim and where it was found to have been mounted upside-down, rectification work was required which included the fitment of a replacement fuel pipe. This SB only applied to aircraft that were manufactured after a certain date; it was not applicable to the accident aircraft. The landing gear

emergency extension handle and its plastic trim are also identically located and attached on Rockwell Commander 112 aircraft.

Safety recommendations

In view of the findings arising from this investigation, the following Safety Recommendations are made to the aircraft manufacturer:

Safety recommendation 98-71 The aircraft manufacturer should amend both the Manufacturer's Maintenance Manual and the Illustrated Parts Catalogue for Rockwell Commander 112 and 114 aircraft to describe and show the correct fitting of the plastic trim associated with the landing gear emergency extension handle, together with a warning of the danger of damaging the main fuel supply pipe if the plastic trim is fitted upside-down, particularly if longer attachment screws than those specified are used.

Safety recommendation 98-72 The aircraft manufacturer should reissue Service Bulletin No 114-30, which was issued on 15 May 1996 to require a 'one-off' inspection of Rockwell Commander 114 aircraft to check for inverted fitment of the landing gear emergency extension handle plastic trim and associated main fuel pipe damage due to trim panel attachment screw contact, and extend its applicability to include Rockwell Commander 112 aircraft.