VACUUM PUMP FAILURE ACCIDENTS
George Irvin

My thanks to David Ball for providing the accident extract below. Those of you reading this or who have been following this thread on AVSUP 11 will want to join me in extending condolences to the families of all involved in these two tragic accidents.

Some will doubtless share my own concern with the view expressed in the AAIB report's final paragraph concerning the LBA flight. The suggestion that the aircraft might have been saved had the crew been more proficient on partial panel is quite unacceptable, particularly coming from a professional body of this calibre. The loss of the A/H shortly after takeoff in IMC will tax the skills of the most experienced pilot, however many hours he or she may have on partial panel. In the absence of a vacuum pump backup system, the loss of primary attitude reference in weather conditions implying turbulence while concentrating on a SID is likely to result in loss of control.

In an experiment carried out by KLM at Schiphol airport reported earlier on this forum, repeated simulations of unanticipated A/H loss led to loss of control in over 90 percent of cases. The AAIB report makes no mention of any vacuum loss warning device fitted to the A/C. The report does not speculate on how the handling pilot might have negotiated a no-gyro approach without PAR given the reported RVR and cloud base. More generally, it seems quite unacceptable that the CAA should not have made vacuum pump redundancy compulsory long ago for all PT ops. The AAIB has now made this recommendation, but the report appears to ascribe blame to inadequate pilot training rather inadequate CAA equipment requirements.

Private pilots holding IR/IMCs might equally take note of the crucial need for vacuum system redundancy here while noting that a range of options exist according to A/C type, ranging from a simple manifold outlet offtake to a second electrically driven horizon. Moreover, to encourage GA in taking such safety initiatives, the CAA might consider waiving inspection and certification charges for installing a backup device.

From the AAIB Web report

History of the flight
On the morning of 24 May 1995 the aircraft had returned to its base at Leeds Bradford from Aberdeen on a scheduled passenger flight landing at 0844 hrs. The crew, which was not the one later involved in the accident, stated that all of the aircraft's systems and equipment had been serviceable during the flight and, after flight, the aircraft technical log was completed to this effect. Some routine maintenance was performed on the aircraft which was later prepared for a scheduled passenger flight to Aberdeen. It was positioned at the passenger terminal where it was taken over by the crew which was to operate the service, comprising the commander, who occupied the left hand seat, the first officer and a flight attendant. Nine passengers were boarded but, as no seats were specified on the boarding passes, it could not be determined which seats they occupied.

The weather at Leeds Bradford Airport was poor with Runway Visual Range (RVR) reported as 1,100 metres; scattered cloud at 400 feet above the aerodrome elevation of 682 feet and a light south-easterly wind. It was raining and the airfield had recently been affected by a thunderstorm. The freezing level was at 8,000 feet and warnings of strong winds and thunderstorms were in force for the Leeds Bradford area.

The crew called ATC for permission to start the engines at 1641 hrs. Having back-tracked the runway to line up, the aircraft took-off from Runway 14 at 1647 hrs and the crew was instructed by ATC to maintain the runway heading (143 M). Radar returns, displayed in the control room, indicated that the aircraft began to turn to the left shortly after becoming airborne. One minute and fifty seconds after the start of the take-off roll and as the aircraft was turning through a heading of 050 and climbing through 1,740 feet amsl, the first officer transmitted to Leeds Bradford aerodrome control:

"Knightway 816 we've got a problem with the artificial horizon sir and we'd like to come back."

The aerodrome controller passed instructions for a radar heading of 360 and cleared the aircraft to 3,000 feet QNH. These instructions were read back correctly but the aircraft continued its left turn onto 300 before rolling into a right hand turn with about 30 of bank. About 20 seconds before this turn reversal, the aircraft had been instructed to call the Leeds Bradford approach controller. The aircraft was now climbing through an altitude of 2,800 feet in a steep turn to the right and the approach controller transmitted:

"I see you carrying out an orbit just tell me what I can do to help".

The first officer replied:

"Are we going straight at the moment sir"

The controller informed him that the aircraft was at that time in a right hand turn but after observing further radar returns he said that it was then going straight on a south-easterly heading. The first officer's response to this transmission was:

"Radar vectors slowly back to one four then sir please".

The controller then ordered a right turn onto a heading of 340. This instruction was correctly acknowledged by the first officer but the aircraft began a left hand turn with an initial angle of bank between 30 and 40. This turn continued onto a heading of 360 when the first officer again asked

"Are we going straight at the moment sir"

To which the controller replied that the aircraft looked to be going straight. Seconds later the first officer asked:

"Any report of the tops sir".

This was the last recorded transmission from the aircraft, although at 1652 hrs a brief carrier wave signal was recorded but it was obliterated by the controller's request to another departing aircraft to see if its pilot could help with information on the cloud tops. At this point, the aircraft had reached an altitude of 3,600 feet, having maintained a fairly constant rate of climb and airspeed. The ATC clearance to 3000 feet had not been amended.

After the controller had confirmed that the aircraft appeared to be on a steady northerly heading, the aircraft immediately resumed its turn to the left and began to descend. The angle of bank increased to about 45 while the altitude reduced to 2,900 feet in about 25 seconds. As the aircraft passed a heading of 230 it ceased to appear on the secondary radar. There were four further primary radar returns before the aircraft finally disappeared from radar.

There had been a recent thunderstorm in the area and it was raining intermittently with a cloud base of about 400 feet and a visibility of about 1,100 metres. Residents in the vicinity of the accident site reported dark and stormy conditions. Several witnesses described the engine noise as pulsating or surging and then fading just prior to impact. Other witnesses saw a fireball descending rapidly out of the low cloud base and one witness saw the aircraft in flames before it stuck the ground. All of the occupants died at impact. From subsequent examination it was apparent that, at a late stage in the descent, the aircraft had broken up losing a large part of the right wing outboard of the engine, and the right horizontal stabiliser. There was some disruption of the fuselage before it struck the ground.

What should have been a routine flight from Leeds Bradford to Aberdeen, albeit in poor weather conditions, turned into a tragedy because the handling pilot's artificial horizon failed. This should not have proved catastrophic because it is possible to retain control of the aircraft using other flight instruments, even when a standby artificial horizon is not fitted. It requires an ability to fly by reference to 'limited panel' which is demanding and needs regular practice. Professional pilots, unlike private pilots, are not necessarily practised and tested in this aspect under existing requirements