Boeing 747-4H6, 9M-MPD

AAIB Bulletin No: 3/2003	**Ref: EW/C2002/3/8**	**Category: 1.1**
Aircraft Type and Registration:	Boeing 747-4H6, 9M-MPD	
No & Type of Engines:	4 Pratt & Whitney PW-40-56 turbofan engines	
Year of Manufacture:	1994	
Date & Time (UTC):	31 March 2002 at 2129 hrs	
Location:	Stand H9, Terminal 3, London (Heathrow) Airport	
Type of Flight:	Public Transport	
Persons on Board:	Crew - 22	Passengers - 322
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Impact damage to No 4 engine nacelle	
Commander's Licence:	Not relevant	
Commander's Age:	Not relevant	
Commander's Flying Experience:	Not relevant	
Information Source:	AAIB Field Investigation	

History of the accident

The aircraft was in the final stages of preparation for departure, with only the baggage loading to be completed. A tug was located aft of the right wing, facing forwards, hitched to two trailers which were positioned adjacent to a mechanical loader at the rear freight bay doorway. The final two baggage bins were loaded and the tug driver returned to the vehicle to move the tug and trailers away from the aircraft. This would normally involve an immediate right turn to pass behind the right wing. He entered the tug via the right hand door and then slid across to the left seat. The driver later reported that as soon as he released the parking brake the tug moved away, possibly because he had already depressed the accelerator. He also believed that initially he may have been looking back to check that the trailers were clear of the loader. As he initiated a turn to the right, he attempted to apply the foot brake but the tug accelerated further and struck the No 4 engine nacelle which the driver saw before impact but was unable to avoid.

The tug came to rest jammed under the nacelle with its front wheels off the ground. Distortion of the cab caused both doors to jam and the driver, who was uninjured, had to be extricated by the airport fire service. The driver reported that it all happened very quickly and suggested that he may have applied the accelerator instead of, or in addition to, the footbrake.

The flight crew was unaware of the accident until informed by their handling agent. The passengers were disembarked by the normal means.

Accident Site

It was dark but clear at the time of the accident and the surface of the apron was dry. The apron was well illuminated with no light points producing any obvious glare that might have affected the vision of the driver. Inspection showed that the inboard face of the No 4 nacelle was in shadow, but quite clearly visible. Checks with a similar tug and trailer train indicated that the distance from the starting point of the tug to its impact with the nacelle was approximately 13 metres.

The evidence showed that the tug struck the nacelle while travelling approximately perpendicular to the aircrafts longitudinal axis. Contact was by the forward part of the tugs roof, which caused the tug to pitch nose up around the rear wheels until the towing lug and rear lower edge of the body forcibly contacted the apron surface. The tug came to rest pitched 25° nose up, jammed between the nacelle and the apron. The evidence indicated that the collision had been at substantial speed.

Aircraft examination

Examination showed that the tug had impacted the lower inboard part of the No 4 engine nacelle, causing severe localised damage to the nacelle nose cone and fan cowl. Both components were of composite honeycomb construction with fabricated metal bulkheads. The damage affected an area approximately 4 feet wide by 2 feet circumferentially, in which the composite panels had been shattered. Additionally, the bulkheads between the nose cowl and the fan cowl were crushed inwards by 5 inches, with the damage extending almost to the engine fan casing. The tug was removed after the aircrafts right wing had been de-fuelled. Inspections during repair work on the aircraft determined that the engine and its mounts had escaped damage.

Tug examination

The tug (Tracma Type TMX20, constructed in 2001) was a four-wheeled vehicle with rear wheel drive and front wheel powered steering. It was of heavy gauge steel construction, powered by a forward-mounted 2,216 cc diesel engine (rated output 50 shaft horsepower) through an automatic gearbox with three forward and one reverse ratios. It had a rated weight of 3,180 kg, a drawbar pull of 2,000 kg and it was fitted with a 15 mph speed limiter. A trailer towing lug was fitted at the lower rear of the body. The cab had two seats, with the drivers controls on the left side, consisting of an accelerator pedal, a footbrake pedal, a handbrake lever and the steering wheel. The cab had a steel roof supported on narrow pillars, providing a large, undivided windscreen and large side and rear windows. A window in the roof was substantially obscured by a metal guard panel. The cab was fitted with three large rear-view mirrors, one external on each side and one internal. The driver was 5 feet 6 inches tall with a seated eye height of 29 inches (seat pan to eye).

Damage to the tug was confined to limited downward and rearward deformation of the roof structure and shattering of the windscreen. The tug was examined and tested in detail and arrangements were made for an assessment by the Vehicle Inspection Service of the Freight Transport Association. This included a thorough inspection of all the vehicle safety systems, a roller brake test and an operational test of the steering and braking systems. No signs of any pre-impact anomaly with the tug were found and the results indicated that it was in exceptionally good condition compared to many ramp vehicles. It was noted that the interior mirror was relatively large

(8.25 inches wide x 5 inches high, 3 feet from the drivers eye position) and formed a substantial blockage to the view through the right side of the windscreen from the drivers eye position.

Driving tests (without trailers attached) showed that with the gearbox selector at D (forward drive) and the accelerator pedal released, the tug would creep at less than 1 mph on level ground. Full accelerator application produced a lively acceleration, with the maximum speed of approximately 15 mph reached in around 5 seconds, over a distance of 22 metres. The footbrake was particularly effective and treading hard on both the accelerator and brake while at maximum speed caused the tug to stop rapidly.

Drivers background

The driver had been employed by the apron services company since November 1999. He had driven a variety of tugs and other vehicles but had driven the Tracma tug on only one previous occasion. The company had a structured training plan, with 10 to 12 days induction training followed by a 3 day course dealing specifically with electric and diesel powered tugs. The company had around 46 electric and 10 diesel tugs. The tug involved in the accident had been delivered to the company as a new vehicle 1 week before the accident. Test driving indicated that the maximum acceleration of the Tracma tug was generally similar to that of the other diesel tugs but was appreciably higher than that of the electric tugs. The controls for the tugs were generally similar, with the exception that the Tracma tug had a left-hand driving position. Reportedly, it was fairly common practice for drivers of automatic gearbox vehicles on the apron to operate the accelerator with the right foot and the brake pedal with the left foot, rather than using the right foot only.

Discussion

There was no evidence of any pre-impact malfunction of the tug and it appeared likely that the collision had occurred whilst the tug was responding correctly to the drivers control inputs. Trials after the accident found that the tug was readily controllable and had a very effective footbrake that would stop the vehicle rapidly, even with the accelerator fully depressed. This suggested, in conjunction with the evidence that the collision had been at relatively high speed, that the driver had probably inadvertently pushed the accelerator pedal fully down and kept it there and had not managed to apply the footbrake. As the driver had no clear recollection of the detailed events leading up to the accident, it was not possible to determine why this should have occurred. It appeared probable that lack of familiarity with the tug was a factor, with possible confusion related to the left hand drive position and/or surprise at the relatively lively acceleration, particularly compared to the electric tugs. It was also possible that the No 4 nacelle had been largely hidden from the drivers view behind the internal mirror as he started off. While there was no positive indication that this was the case, the blockage caused by the mirror appeared to be an undesirable feature. This was brought to the attention of the company which, having assessed both the beneficial and adverse effects of the internal mirror, undertook to remove it.