P84 Jet Provost T MK4, G-TOMG

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Aircraft Type and Registration:	P84 Jet Provost T MK4, G-TOMG
No & Type of Engines:	1 Bristol Siddeley Viper MK 20201 turbojet engine
Year of Manufacture:	1963
Date & Time (UTC):	1 August 1999 at 1152 hours
Location:	Woolaston, Gloucestershire
Type of Flight:	Private
Persons on Board:	Crew 1 - Passengers - 1
Injuries:	Crew - 1 Fatal - Passengers - 1 Fatal
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilots Licence
Commander's Age:	43 years
Commander's Flying Experience:	1,043 hours (of which 57 were on type) Last 90 days - 32 hours Last 28 days - 12 hours
Information Source:	AAIB Field Investigation

Historyof flight

The aircraftwas operating a series of pleasure flights over the course of a weekend fromGloucester Staverton Airport. Theweather during the weekend was very warm and the visibility was sometimes hazy. Three different pilots flew the aircraft onthese trips, taking passengers who were members of a local flying club. Payment was made by each passenger as a partcontribution to the costs of the flight. Briefings were conducted in small groups before the flights withparticular reference to the use of the ejection seats and safetyprocedures. Each flight was planned tobe of either 30 minutes or one hours duration.

Thepilot for the accident flight had flown three such flights on the Saturday;this was his first flight on Sunday. The aircraft was refuelled to full tanks before departure and thepassenger, who held a Private Pilots Licence (PPL), was assisted withstrapping in. The aircraft took offfrom Runway 09 and turned left to depart from the airport circuit area. A recorded radar track showed the aircraftclimbing from Staverton and then heading southwest at a speed of about 200kt. At the point where the aircraftcrossed over the Severn Estuary, the radar contact was lost and there were nofurther contacts. It was estimated thatthe lowest altitude at which the radar could have detected the aircraft wasabout 600 feet.

Theaircraft was seen from the west bank of the River Severn heading in asouth-easterly direction, flying along the middle of the river at a heightdescribed as about 50 feet. Severalother people described seeing the aircraft flying 'very low' along theriver. Before reaching the Severn

RoadBridge the aircraft entered a climbing turn to the right, the turn taking theaircraft over the west bank and rising ground. On completion of the turn the aircraft headed north-east and descendedagain towards the river. The aircraftpassed close by a house and the occupants, who were in the garden, thought theaircraft clipped the top of a nearby tree, but later inspection showed no evidenceof damage to the tree. They continuedto watch the aircraft and saw it fly up the river for a short time beforeturning sharply to the left. During theturn to the left, they saw the aircraft descending close to the ground.

Anumber of witnesses saw the aircraft carrying out its final turn and describedseeing it in a steep bank to the left whilst at a low level. During the turn the nose of the aircraft wasseen to drop and the aircraft descended towards the ground. There were no witnesses to the actual impactbut people close by reported that there was an immediate fire. Some people in the area also heard the soundof the aircraft and its engine before impact.

Pilotsexperience

Thepilot gained his PPL in 1990 and first flew G-TOMG in 1996. He completed a conversion course of some 23hours dual instruction, and first flew the aircraft solo in February 1998. He was subsequently approved to authorisehis own flights in the aircraft. Thepassenger held a PPL and had recorded a total flight time of about 150hours. He had no previous experience onthis type of aircraft.

Meteorology

The1150Z weather report from Staverton was as follows:

Surfacewind 170°/8 kt, visibility 12 km, haze, few cumulus cloud at 4,000 feet,

temperature29°C and QNH 1014.

Anotherpilot had reported earlier in the day that to the southwest of the area, out inthe Severn Estuary, the visibility was less good and the horizon wasindistinct.

Pathology

Therewas no evidence of any medical factor having an influence on thisaccident. Both pilots sustained fatalinjuries at the time of the impact.

Operationof the aircraft

Theaircraft was operated on a Permit to Fly and in accordance with the operationalrequirements detailed in Civil Aviation Publication (CAP) 632. This required the operator to produce anapproved Organisational Control Manual, (OCM) setting out the operationalprocedures for the aircraft. One of theoperators requirements for the carriage of passengers was that the intercomsystem should be fully serviceable. There was no stated policy regarding low flying, nor was there any suchrequirement in CAP 632. Rule 5(1)e ofThe Rules of The Air Regulations 1996 states:

Anaircraft shall not fly closer than 500 feet to any person, vessel, vehicle orstructure.

Article119 of The Air Navigation Order (ANO) allows that a flight will be deemedprivate if payment made is a share of the direct cost of the flight to thepilot.

Aircrafthandling

Pilotsnotes for the Jet Provost T Mk 4 include the following two items ofinformation:

Duringturns and pull-outs at speeds below 190 kt mild airframe buffet indicates theapproach to a g-stall.

At lowaltitudes, if the aircraft is descending, the minimum safe height for ejectionis roughly one-tenth of the rate of descent. If the wings are not level this minimum increases rapidly as the angleof bank becomes larger.

Thenormal cruise airspeed for the aircraft is 220 to 240 kt. The recovery procedure from a steep turn atlow level in which the nose of the aircraft had dropped would necessitate aroll to decrease the bank angle, followed by a pull up to regain height.

Therecommended method for initiating ejection, if time is short, is to use theseat pan firing handle. The canopywould be jettisoned immediately and the seat would follow within 0.6seconds. There was no evidence that anejection had been attempted.

Previousflights

Threepeople had been for flights with the accident pilot on the previous day. Two of them described flying at low levelalong the Severn Estuary and also flying low over lakes and reservoirs in theBrecon Beacons area. They both reportedthat they were given the opportunity to fly the aircraft themselves but notwhile operating below about 1,000 feet. A number of passengers in the aircraft over the weekend stated that theintercom system was not working well during their flight.

Locationof the accident

Theaircraft was flying close by the west bank of the River Severn immediatelybefore the accident. In the vicinity ofthe initiation of the final left turn there was a low lying rocky outcrop knownas Guscar Rocks. These rocks tend to attracta number of seabirds and the area was popular with birdwatchers. On the landward side of these rocks, towardswhich the aircraft turned, there was a railway embankment and then risingground towards some farm buildings.

Engineeringinvestigation

The accident site

Theaircraft had crashed on a slight up-slope, near the almost flat top of a lowhill, at a height of about 50 feet amsl and whilst on a track of about295°M. This was consistent with theaircraft having been turned through approximately 120° to the left from theheading reported by witnesses as that used by the aircraft when it returned upthe estuary towards Staverton. Thefield in which it crashed had a crop of standing wheat.

Theaircraft had first struck the ground with its left wingtip, which initiated arapid yaw to the left. From theevidence of the ground marks resulting from the impact and ground-slide, it wasdetermined that the aircraft attitude at the time of impact was slightly rolledto the left with the fuselage slightly nose down. By the time the nose and right wing contacted the ground, theaircraft had yawed considerably to the left. The initial impact had severed the left wingtip near the inboard end ofthe aileron cut-out, and the impact of the nose destroyed the forward fuselage.

The aircrafthad slid on its underside for about 40 yards before coming to rest, upright andheading about 170°M. During the courseof the ground-slide, both ailerons and the left elevator separated from theaircraft and the right wing became tucked underneath the fuselage. The wreckage of the cockpit area was forwardand to the right of where the fuselage had come to rest. Both ejection seats were present and hadpartially broken up, but neither of the firing handles of either seat had beenoperated; the canopy frame was also present in the cockpit wreckage.

Theimpact disrupted the aircrafts fuel tanks and the spilled fuel and crop caughtfire immediately after the impact. There had been a fierce fuel fire where the aircraft came to rest, whichmelted the left side of the fuselage, the left tailplane and the rudder. The fire had also melted the skins of thewings, which were lying uppermost under the centre fuselage, melted a hole inthe side of the engine compressor case and had spread into the area of thecockpit wreckage. The fire in the wheatcrop had spread extensively to the north of the accident site.

Theaircraft wreckage was recovered from the field and taken to the AAIB facilityat Farnborough for further examination.

Detailed examination

Althoughthe aircraft had been extensively broken up by the impact and further destroyedby the post crash fire, there was sufficient evidence, both from thedistribution of the wreckage at the accident site and during examination at theAAIB facility, to indicate that it had been structurally intact beforeimpact. There was also evidence thatthe aircraft was in a clean configuration, with the landing gear; flaps andairbrakes all retracted.

Examinationof the main flying controls showed evidence that all control circuits had beenintact up to the time that the aircraft had started to break up but the degreeof break-up and fire damage to the structure precluded the possibility ofestablishing that there had been no control restrictions in flight. However, evidence of contact of the leftaileron horn against the end of its cut-out in the wingtip at impact indicatedthat the ailerons were positioned to roll the aircraft to the right, out of theleft bank. It was not possible todetermine the impact positions of any other flying control surfaces or of thecontrols in the cockpit but, as found, both pilots throttle control leverswere in a similar position at about 75% of the travel towards the maximum powersetting. The airspeed indicator, whichhad had its glass crushed onto the dial face during the impact sequence, showedan indication of 138 kt; there was no evidence of a needle witness mark at aspeed above this.

Astrip examination of the engine was performed with the assistance of themanufacturer. This showed that theengine had been turning at the time of impact and some vegetable debris hadbeen drawn through to the turbine section. There was no pre-impact damage due to foreign objects on the blades ofany stage of the compressor. The onlydamage was the result of heat from the external fire causing local melting ofthe compressor case and the aluminium compressor blades in the affected zone.

Thefuel control unit was fragmented and the pump severely burned so that it wasnot possible to test either component. It was, however, possible to determine the stroke setting of the fuelpump, as found, which was consistent either with the engine having been runningat a constant speed between 73 and 90% or to have been accelerating from somespeed higher than flight idle.

Historyof the aircraft

Theaircraft first entered service with the RAF in 1963, as XR674, and afterservice at a number of flying training stations was put into storage in 1989,having flown nearly 7,600 hours. It wassubsequently used as a ground trainer and, having been declared surplus torequirements, was bought in 1993 as a non-flying machine by the predecessor ofthe organisation which subsequently maintained it. They also acquired a replacement engine, which had recently undergonea minor repair by the manufacturer and had 650 hours operating liferemaining. The aircraft was thenpurchased by one of the members of the group who subsequently operated it, andwho

commissioned the maintenance organisation to bring the aircraft up toflying condition. The restoration ofthe aircraft was completed over the space of two years, since when it had flowna total of about 260 flying hours without a significant unserviceability.

Themaintenance organisation has CAA A820 approval for the maintenance ofex-military jet aircraft and the staff includes personnel with responsibleservice experience of maintaining this aircraft type. They impose a condition on operators of jet aircraft which theyare maintaining, that aircraft have a current 25-hour/90 day certificate ofmaintenance release. The operatinggroup of GTOMG had accepted that condition and ensured that they complied withit. The last release certificate hadbeen issued on 27 July 1999 and valid until 25 October 1999 or 25 flight hours.

Discussion

Theshort groundslide of such a relatively substantial aircraft after a shallowangle impact indicated that the aircraft had a relatively low energy at thattime, even allowing for the retarding effect of the crop. The characteristics of the accident sitewere consistent with the reading of 138 kt which was retained on the airspeedindicator.

Thereis an inherent degree of risk in flying at very low levels. Any error by the pilot, any failure of theaircraft or any adverse external factor leaves little safety margin. The pilot was flying within the terms of theOCM but had limited experience, and no training in flying at heights below 500feet.

Neitherthe information gained from interviewing witnesses nor the investigation of thewreckage revealed any apparent reason why the aircraft should have entered asteep turn to the left at low level. There is a possibility that bird avoidance was involved but there was noevidence of a birdstrike. There isevidence that the aircraft was flying at about 140 kt when it hit theground. The turn may have beeninitiated at less than the normal cruise airspeed of 220 kt, or during the turnthe speed could have reduced and the nose of the aircraft dropped causing theaircraft to descend towards the ground. The low airspeed would have made a recovery more difficult to achieve.

Thereappeared to have been a late attempt to roll out of the turn. This is consistent with the witness evidenceof the aircraft being seen in a steeply banked turn and the evidence of theground marks indicating that the aircraft was relatively level in roll at thepoint of impact. The evidence of anout-of-turn roll control input suggests that there was not a restriction in theroll control at the time of impact. Thepositions of all the ejection seat firing handles and the presence of thecanopy frame components in amongst the forward fuselage wreckage wereconsistent with there being no attempt at ejection by either occupant.

Thepassenger would have expected to fly the aircraft for some part of the flightbut it is unlikely that he was doing so at the time of the accident. The pilot on previous flights had onlyhanded over control to passengers when flying at heights in excess of 500 feetagl.

Recommendation2000-13

Thefollowing safety recommendations are made:

TheCAA should consider amending the guidelines given to operators in CAP 632 torequire a minimum operating height to be specified in the OrganisationalControl Manual when passengers are carried.

Recommendation2000-14

TheCAA should consider amending the guidelines given to operators in CAP 632 torequire a minimum level of experience specified in the Organisational ControlManual before a pilot is authorised to carry passengers.