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COMMERCIAL AIR TRANSPORT

GENERAL AVIATION

CONTENTS (Continued)

SPORT AVIATION / BALLOONS

ADDENDUMS and CORRECTIONS

(ALL TIMES IN THIS BULLETIN ARE UTC)

ACCIDENT

Aircraft Type and Registration:	ATR 72-212A, D-ANFH
No & Type of Engines:	2 Pratt and Whitney PW127F turboprop engines
Year of Manufacture:	2001
Date & Time (UTC):	17 September 2005 at 1202 hrs
Location:	Guernsey Airport
Type of Flight:	Public Transport (Passenger)
Persons on Board:	Crew - 4 Passengers - 63
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to lower rear fuselage
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	54 years
Commander's Flying Experience:	10,000 hours (of which 517 were on type) Last 90 days - 110 hours Last 28 days - 41 hours
Information Source:	AAIB Field Investigation

Synopsis

Just prior to touchdown, in good visual meteorological conditions, the co-pilot deliberately flew the aircraft below the glideslope, as he perceived the runway to be short. The approach was de-stabilised and the aircraft landed heavily and bounced, during which the lower rear fuselage struck the runway. The investigation identified that the landing technique employed was incorrect and that the runway length was more than adequate for the aircraft to make a normal landing in the prevailing conditions.

History of the flight

The aircraft departed from Düsseldorf on a non-scheduled public transport (passenger) service to Guernsey, with the co-pilot as Pilot Flying (PF) and the commander as Pilot Not Flying (PNF). Prior to the top of descent, following an uneventful flight, the crew obtained the ATIS broadcast, which included the information that Runway 27 was in use, there was a surface wind of 020°/11 kt, the visibility was in excess of 10 km and there was cloud FEW at 3,800 ft above the aerodrome. They prepared and briefed thoroughly for an ILS approach to Runway 27; the landing weight was calculated to be 20.7 tonnes and the approach speed (V_{APP}) 107 kt (V_{REF} plus 5 kt).

Guernsey ATC vectored the aircraft towards the final approach track, at an altitude of 2,000 ft, and offered the crew the opportunity to carry out a visual approach, which they declined. The aircraft intercepted the

glideslope with the landing gear extended and Flaps 30 set. At approximately 500 ft above the runway, the co-pilot remarked to the commander that he intended to manoeuvre slightly below the glideslope; the commander acknowledged this with a remark which suggested that this had been briefed. (The co-pilot later stated that Guernsey was one of the shorter runways onto which he operated the ATR aircraft and, typically, the route network focussed on major airports with significantly longer runways than Guernsey. He explained that his decision to deviate below the glideslope reflected his relative lack of experience in landing on shorter runways.) The co-pilot then reduced power and the aircraft began to descend below the glideslope. Throughout the approach, the aircraft's speed varied between 110 kt and 127 kt, reducing to 100 kt at the point of touchdown. Just prior to touchdown, the co-pilot pitched the aircraft nose up to an attitude of 6.5º. The aircraft landed hard on the runway and bounced; in the course of the initial touchdown, the lower rear fuselage struck the runway surface. The commander later recalled that there had been 'no flare' and that, although he had been 'guarding' the controls, he had not had sufficient time to take control and prevent the heavy landing.

The crew completed the landing and taxied to their parking position. After the aircraft had been shut down, ground staff informed the commander that the aircraft had been damaged.

Personnel information

The commander and co-pilot had flown together previously and were well acquainted with each other.

The commander was an experienced pilot with a total of 10,000 flying hours and, although he was relatively new to the ATR aircraft, he had previously flown the Shorts SD3-60 aircraft and the Fokker 50, types powered by turboprop engines and of comparable size to the ATR. The commander was on the fourth day of a series of duties, the previous three days being two-sector short-haul flights in the afternoon and evening. The commander did not suggest that he was fatigued during the duty period, and his duty record over the previous days showed a relatively undemanding work pattern with plentiful rest periods during the nights.

The co-pilot was also relatively experienced, with 4,000 hours total time and previous experience on the Fokker 50 aircraft, but was relatively inexperienced on the ATR, with 500 hours on type. He had returned to Germany two days before the accident following two weeks holiday in the United States of America. The day before the accident, he flew four sectors and reported that, although he had slept a little longer than usual prior to reporting for duty for the flight to Guernsey, he was well rested and fit to fly.

Operations manual (OM)

The company's OM included the following instructions regarding the requirement for stabilised approaches:

> *'3.10.4 Aeroplane Stabilization on Final Approach*
>
> *A safe flight profile must be maintained throughout every approach. The aeroplane must be fully stabilized not later than 1000 ft above threshold elevation including the following criteria:*
>
> - *The aircraft is on the correct flight path;*
> - *Only small changes in heading/pitch are required to maintain the correct flight path;*
> - *Power setting is appropriate for the aircraft configuration and is not below the minimum power for approach as defined in the OM-B…'.*

The following instruction was included concerning landing:

> *'3.11.2 Height over Threshold*
>
> *The height of the aeroplane over the landing threshold should be not lower than 50 ft, except when published otherwise in OM-C. The aeroplane has to cross the landing threshold in the correct configuration and attitude.*
>
> *3.11.3 Touchdown*
>
> *Touchdown should be achieved at 300 m beyond the threshold.'*

Landing performance

Given the conditions at Guernsey, the aircraft weight at the time of landing and allowing for a tailwind component of 5 kt, the Landing Distance Required (LDR) was 949 m. The Landing Distance Available (LDA) was 1,453 m.

Meteorological information

Terminal Aerodrome Forecasts (TAFs), Meteorological Actual Reports (METARs), and a dynamic recording of the measured wind at Guernsey were obtained for the period covering the flight. The Guernsey TAF for the period predicted wind of 030°/12 kt, visibility greater than 10 km, and cloud SCT at 3,000 ft. The 1150 hrs METAR was broadcast on the ATIS as Information Bravo, and stated that the wind as 020°/11 kt, varying between 340° and 050°, visibility greater than 10 km, cloud FEW at 3,800 ft, temperature of +14 °C, dew point +4°C and the QNH 1027 mb. Runway 27 was in use.

Examination of the aircraft

The aircraft's fuselage skin directly beneath the rear cabin door had been abraded, as a result of runway contact, over a length of approximately 0.9 m and a width of some 0.5 m. This had affected fuselage Frame Nos 36 to 38, with the skin having worn through to the extent that the flanges of Frames 36 and 37 were exposed. The damage was symmetrical about the aircraft centre line, indicating that the aircraft was in a wings level attitude at the time it initially touched down.

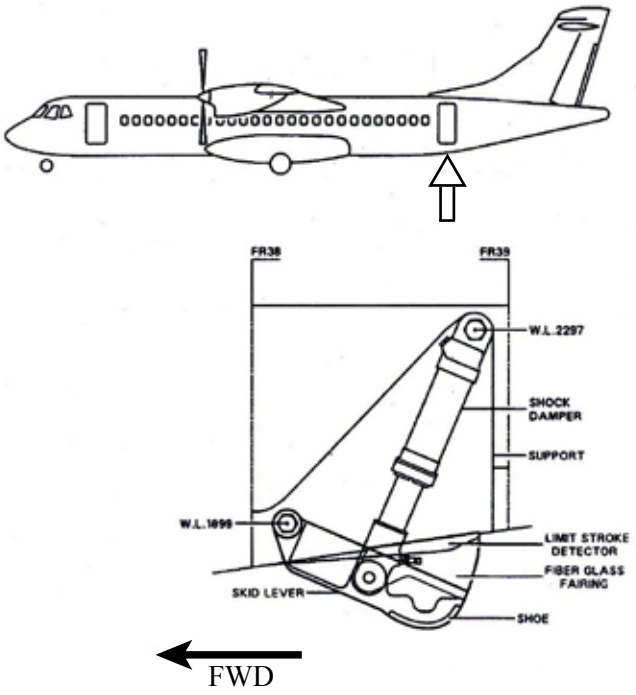
The aircraft was equipped with a tail skid, located between Frames 38 and 39, which comprised a skid lever, hinged at its forward end, and an oleo-pneumatic strut (shock damper) attached to its aft end. A steel shoe was attached to the underside of the lever; this had been painted red in order to provide readily visible evidence of skid contact. It was evident that both the shoe and front edge of the skid lever had suffered severe abrasion, with no trace of red paint remaining on the shoe. According to the aircraft Maintenance Manual, the installation was designed to:

> *'avoid fuselage contact with the runway when the take-off or landing attitude has an angle of 8° or greater.'*

The shock damper had a stroke of 112 mm and, when fully compressed, the forward edge of the skid lever was virtually parallel to, and slightly proud of, the fuselage skin. Two small fins are attached to the fuselage, one each side of the skid; these serve as 'limit strike detectors' and, on D-ANFH had been worn away. Figure 1 shows the damage to the fuselage and skid, together with a diagram of the skid components.

Runway examination

Inspection of the runway the following day revealed a significant scrape mark, some 75-80 mm wide, starting approximately 35 m after the Runway 27 designator numerals; this was around 95-100 m beyond the start of



ATR 72 Tail skid detail

Abrasion damage on fuselage underside

Figure 1

the paved area and 60 m before the first of the touchdown zone markings. The scrape was immediately adjacent to the runway centre line and the presence of red paint strongly suggested that it had been made by the tail skid of D-ANFH. The mark was approximately 9 m in length, with a wider portion extending to some 0.4 m in width along the direction of travel, where the fuselage underside ahead of the skid had also made contact with the runway surface.

Flight Recorders

The aircraft was fitted with a Solid State Flight Data Recorder (FDR) capable of recording a range of flight parameters into solid state memory. The aircraft was also fitted with a Cockpit Voice Recorder (CVR) which recorded crew speech and area microphone inputs, also into a solid state memory. Both recorders were downloaded at the AAIB and data and audio recordings were recovered relating to the subject flight, approach and landing.

The CVR had recorded the entire flight. Much of the conversation between the flight crew was in German, and a German-speaker was employed to assist with the analysis. Although the recording was of good quality there was a period, shortly after the briefing for the approach to Guernsey, during which a PA announcement by one of the cabin crew rendered the conversation between the pilots inaudible[1].

A time-history of the relevant parameters from the FDR during the approach and landing is shown at Figure 2. The data presented starts just over three and a half minutes before the touchdown with the aircraft in level flight at an altitude of approximately 1,800 ft, whilst flying at an airspeed of 175 kt and with the flaps and landing gear up. Some 30 seconds later, Flap 15 was selected and the aircraft turned to the left through 34º, to 275ºM, on to an intercept with the Runway 27 localiser. Height and speed remained unchanged.

At just over two minutes before touchdown, the landing gear was selected down and the airspeed started to reduce. Thirty seconds later, Flaps 30º was selected with the airspeed still reducing. By now, both the glideslope and localiser had been intercepted and a descent was initiated at approximately 700 fpm, based on radio height above the sea. The aircraft was initially above the glideslope, but regained it within a minute as the aircraft passed through 1,500 ft, with an airspeed of 120 kt (13 kt above V_{APP} (107 kt), 18 kt above V_{REF} (102 kt)).

The aircraft remained on the glideslope, during which time the airspeed increased to 135 kt, then reduced to 110 kt, before increasing again to 118 kt, with corresponding changes in pitch and power, until it was at a height of approximately 500 ft, some 15 seconds before touchdown. The aircraft was then manoeuvred below the glideslope, with an initial 5º decrease in pitch attitude to -4º. This caused the airspeed to increase to 124 kt and, as the aircraft was pitched up to 0º, the torque on both engines reduced from 29% to 3%, then increased to 12%, following which the airspeed reduced to 107 kt (V_{APP}).

The flare began two seconds before the main wheels touched down, and the aircraft's pitch attitude increased to the maximum (recorded) value of +6.5º. At this time, the engine torque reduced from 12% to 3%. The recorded airspeed and vertical acceleration at touchdown were 100 kt (V_{REF} -2) and 2.7g, respectively, with the main then nose gear squat switches signifying ground 'contact', over one second later.

Analysis

There was no doubt that the damage to the aircraft was consistent with the fuselage making contact with the runway, heavy enough to cause the tail skid damper to compress to its full limit of travel. The loss of material from the skid's shoe allowed the fuselage structure to contact the runway surface and be abraded. This was as a direct result of an excessive pitch attitude during the landing.

Footnote

[1] PA announcements are recorded on the same channel as the flight deck conversation

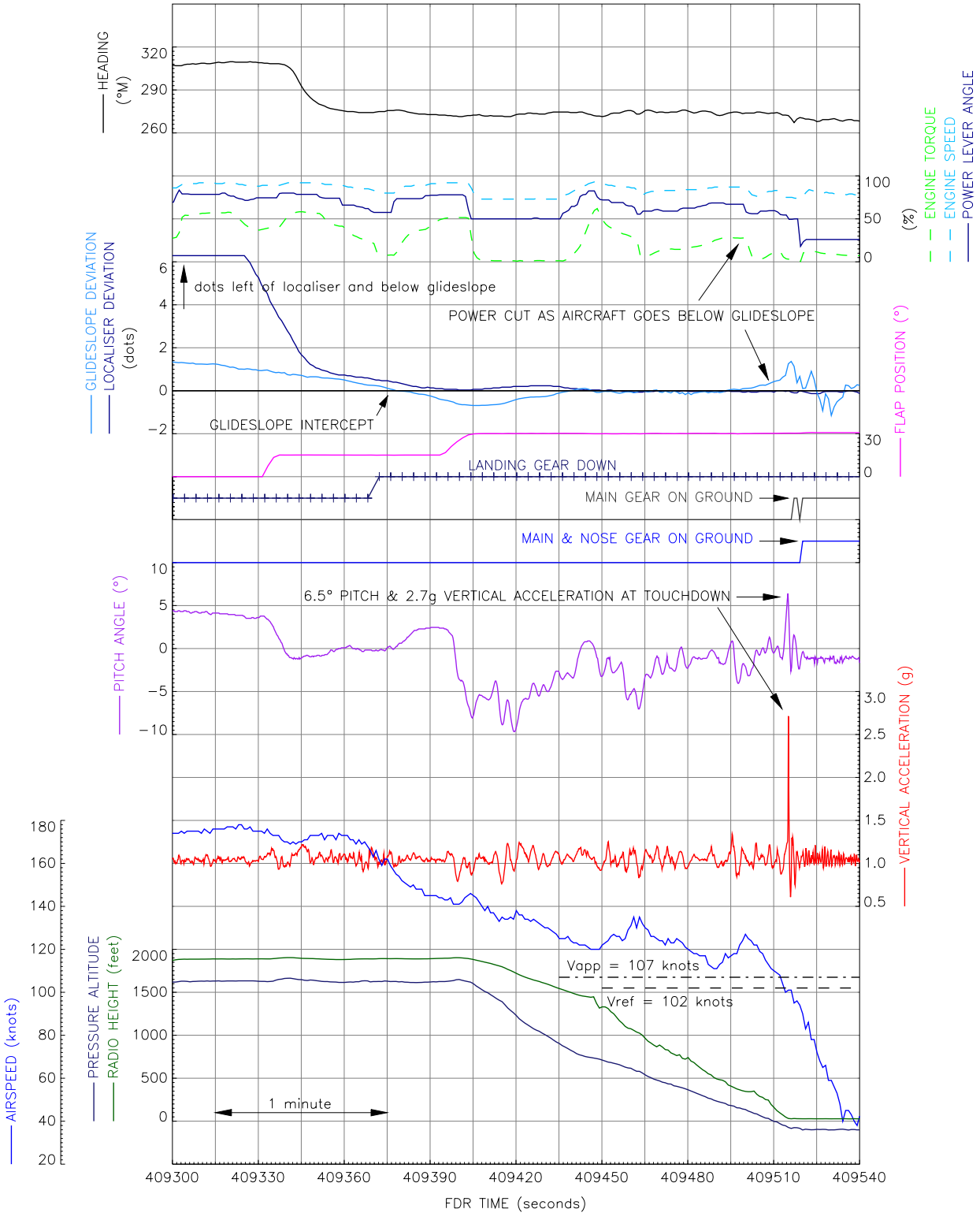


Figure 2

Salient FDR Parameters – Approach and Landing

(Accident to D-ANFH on 17 September 2005)

The flight from Düsseldorf had progressed normally until the aircraft began to descend on approach to Runway 27 at Guernsey Airport, where a fully stabilised approach was achieved, until the aircraft was deliberately manoeuvred below the glideslope. This was not necessarily cause for a go-around but should, perhaps, have given the commander reason to pay particularly close attention to the co-pilot's actions. The Operator's OM requires pilots to fly stabilised approaches, which is the generally accepted practice in the operation of Commercial Air Transport aircraft, and also gives instructions regarding the manner in which the aircraft should be landed. Specifically, it states that the aircraft should cross the threshold at the correct height, in the correct configuration and in the correct attitude. The approach and landing at Guernsey did not meet this OM criteria.

It could not be established from the recorded data whether the decision to deliberately descend below the glideslope in the last moments before touchdown had been discussed during the crew's briefing for the approach. In response to the co-pilot's comment to the commander that he intended to manoeuvre slightly below the glideslope, the commander responded with words which suggested that this deviation had been briefed, although no such discussion was identified on the CVR. However, it is possible that the record of any such conversation was rendered inaudible by a PA announcement made by one of the cabin crew. If the co-pilot had indeed briefed his intention to deviate from the glideslope, then it might have been expected that the commander would have explained that this was unnecessary and inappropriate, and have instructed the co-pilot to fly a normal approach, or elect to carry out the landing himself.

Even with the slight tailwind component, the LDA was significantly greater than the LDR, and both he and the commander should have understood that application of the correct landing technique would assure a safe landing, with a considerable margin. Although the tailwind component and the co-pilot's lack of experience of landing on relatively short runways seem to have played a part in his decision to deviate from the normal landing technique, making such a decision would not have featured in any of his, or the commander's, training.

Aircraft are certificated to certain performance standards, based upon the design/characteristics of the aircraft, the results of flight testing and the application of safety factors to ensure that intended operations will not hazard aircraft. Landing performance is predicated upon the application of the correct technique. Deliberate deviation from the correct technique is unnecessary, except perhaps in extreme and unforeseen circumstances, and deprives the operation of the safety margins that certificated performance provides.

INCIDENT

Aircraft Type and Registration:	BAe 146-300, G-JEBA
No & Type of Engines:	4 Lycoming ALF502R-5 turbofan engines
Year of Manufacture:	1990
Date & Time (UTC):	2 February 2006 at 1810 hrs
Location:	During climb from Belfast City Airport
Type of Flight:	Public Transport (Passenger)
Persons on Board:	Crew - 5 Passengers - 77
Injuries:	Crew - 1 (Minor) Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	9,300 hours (of which 3,500 were on type) Last 90 days - 100 hours Last 28 days - 10 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

During the climb from Belfast, the co-pilot detected an odour in the flight deck air, shortly after which he complained of a dry throat, burning eyes, a tingling sensation in the fingers and of being hot. After donning his oxygen mask he slid his seat back and took no further part in the flight. No other personnel on the flight were affected, including the commander who carried out an uneventful return and landing at Belfast. Subsequent examination of the aircraft revealed deposits in the air conditioning ducting and an unrelated oil leak in the APU bay.

History of the flight

The aircraft had been prepared for a scheduled passenger flight from Belfast to Gatwick. During this sector the co-pilot was the handling pilot. After a normal departure, and during the climb, the co-pilot noticed a smell described as being similar to that of a central heating boiler. The commander, when asked by the co-pilot, did not discern this odour.

Subsequently, the co-pilot complained of a dry throat and burning eyes. Control was handed over to the commander, shortly after which the co-pilot experienced a tingling sensation in his fingers as well as complaining of being hot and sweating. The co-pilot was placed on oxygen and the commander elected to return to Belfast.The co-pilot slid his seat back and took no further part in the flight. The oxygen did not appear to be helping in the relief of the co-pilot's symptoms, although he remained conscious.

After an uneventful descent, approach and landing at Belfast, the co-pilot was given first aid and began to recover. He was taken to a local hospital for further checks, including the taking of blood samples for later tests.

Throughout the flight the commander, cabin crew and passengers did not suffer any ill effects and did not notice any smoke, fumes or odour.

Aircraft examination

An examination of the aircraft's engines, APU, air conditioning and ducting was carried out using existing service documentation issued by the manufacturer. The only anomalies that were found were an oil leak in the APU bay and some light deposits in the air conditioning ducts that run from the air conditioning packs to the cabin and flight deck. The oil leak was traced to the APU air-cooled oil cooler for the APU generator oil which is located on the left fire wall, away from the APU. The air used to cool the APU generator oil is separate to that of the main air supply to the APU and the aircraft bleed air system, and it consists of its own air intake, fan, ducting and exhaust. It is therefore unlikely that the leaking oil from the oil cooler, although pooled in the APU bay, would have found its way into the APU engine air supply.

Blood tests

Tests on blood taken from the co-pilot immediately after his arrival at hospital proved inconclusive.

Other occurrence

Following this first occurrence the co-pilot returned to flying duty. On 16 February 2006 he was conducting a flight from Belfast on a BAe 146 (G-JEBG) and during the taxi from the stand he again complained of stinging eyes and sweating. The aircraft was taxied back to stand and the co-pilot was taken to hospital. No other persons on the flight were affected, although some cabin crew and passengers had detected fumes and an odour in the cabin air. The subsequent aircraft examination did not reveal any definitive cause, although there was evidence of possible contamination of the APU bay with exhaust air from the APU.

Discussion

The co-pilot had become incapacitated during the flight, however he was the only individual affected. It is possible, although not confirmed, that fumes generated by the APU or engine could have been the initiating factor, considering that deposits were found in the air conditioning ducting, and also that the co-pilot had detected an odour in the air of the flight deck. Although an oil leak was found in the APU bay, it is unlikely that this oil had found its way into the air supply system.

Following an investigation into a similar incapacitation on a BAe 146 in November 2000 (Aircraft Accident Report 1/2004 G-JEAK), it was concluded that:

> *'2. Subsequent research and tests suggests that the crew of G-JEAK, and the crew of other aircraft which have suffered similar incidents, may have been exposed to turbine engine oil derived fumes in the cabin/cockpit air supply, originating from either an engine or APU, which had an irritant, rather than a toxic, effect.'*

Several recommendations were made during this investigation and as a result the CAA issued guidance that if contaminated air is suspected then the flight crew should don their oxygen masks and use 100% oxygen.

INCIDENT

Aircraft Type and Registration:	Boeing 757-2T7, G-MONE
No & Type of Engines:	2 Rolls-Royce RB211-535E4-37 turbofan engines
Year of Manufacture:	1985
Date & Time (UTC):	17 March 2006 at 1945 hrs
Location:	On approach to Gibraltar Airport
Type of Flight:	Public Transport (Passenger)
Persons on Board:	Crew - 8 Passengers - 186
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	45 years
Commander's Flying Experience:	11,772 hours (of which 8,381 were on type) Last 90 days - 112 hours Last 28 days - 47 hours
Information Source:	AAIB Field Investigation

Synopsis

Following a surveillance radar approach (SRA) to Runway 09 at Gibraltar Airport, the flight crew lost visual contact with the runway after passing the Visual Decision Point (VDP). During the subsequent go-around, the crew did not follow the correct missed approach procedures but ATC provided effective heading control to avoid the high ground. The lowest altitude of the aircraft when over the land was 2,100 ft. The highest point on the land, just south of the airfield, is 1,420 ft.

Following the incident, ATC and the aircraft operating company made changes to procedures to reduce the chances of a similar occurrence. Additionally, it was considered that the airport lighting should be improved and a recommendation has been made to that effect.

History of the flight

The crew were operating a flight from Luton Airport to Gibraltar Airport. This was their first flight of the day. Company regulations required the landing at Gibraltar to be flown by nominated captains only, hence the commander was the handling pilot. Prior to flight, the crew checked the destination weather, which indicated that the current and forecast weather was within the required JAR-OPS limits of 1,000 ft cloud ceiling and 5,000 m visibility but that there was a possibility of the visibility deteriorating temporarily below limits at the expected arrival time. Due to the forecast, the crew decided to take an extra 1,000 kg of fuel. Before departure, the first officer inserted the route into the Flight Management Computer (FMC), including the

approach to Runway 09; the commander then checked the route and modified the final approach to provide a vertical profile.

The flight was initially uneventful apart from occasional moderate turbulence. Once within radio range of Gibraltar, the crew checked the latest weather. This indicated a surface wind of 060º at 10 kt and visibility of 5,000 m with the lowest cloud scattered (SCT) at 1,000 ft. The commander then briefed the first officer on the SRA approach and associated missed approach procedure for Runway 09 .

During the subsequent descent, the aircraft was transferred to 'Gibraltar Approach' and cleared eventually to 1,500 ft with radar vectors towards point 'Victor'; a navigation point some 9 nm south of Gibraltar. The crew also asked for an update on the weather, which was reported as visibility 5,000 m in rain, cloud 'FEW' at 1,000 ft, 'SCT' at 1,800 ft and 'BKN' (broken) at 3,000 ft. During the westerly track to 'Victor', the crew configured the aircraft for landing and completed the landing checks. The aircraft was being flown on autopilot with the autothrottles engaged and each pilot had 'Map' displayed on his horizontal situation indicator (HSI). Prior to descent, the first officer had checked the accuracy of the map information and the commander later made a further check of the accuracy using the Gibraltar DME. Using the heading selector in response to ATC instructions, the aircraft positioned on a northerly heading past 'Victor'. The accuracy of the aircraft map display was consistent with radar information provided by ATC and the aircraft was cleared to commence descent at the '5.0 nm Radar Fix'. The commander selected a vertical descent speed of 700 ft/min and an indicated airspeed of 135 kt. It was drizzling but the aircraft was clear of cloud and the crew could see the lights of ships on the surface but no lights from the land. As the aircraft approached the VDP at 1,000 ft, the accuracy of the map display was confirmed and the commander saw the runway strobe lights in the expected position. He confirmed that the first officer could also see the strobe lights and when the 'Talk-Down' controller asked if the crew were visual with the runway, the first officer replied in the affirmative. The commander selected 090º on the heading selector and the aircraft started a right turn at approximately 20 to 25º angle of bank. With the angle of bank steady, the commander disconnected the autopilot and autothrottles, selected his flight director off and maintained the existing angle of bank and descent rate of about 700 ft/min. As he was doing so, he continued to check that he could still see the runway strobe lights. The first officer monitored the heading selection and pre-selected the 'Tower' frequency in preparation for an expected frequency change. He also monitored the airspeed and was then aware of ATC asking if they were still visual with the strobe lights. At about the same time, the commander lost sight of the strobe lights and asked the first officer if he still had them in sight. At this stage, the commander considered that he was maintaining a constant heading. The first officer was not visual with the strobes so the commander called "GO-AROUND, FLAP 20". The commander applied manual go-around thrust but did not select the 'Go-Around' switch on the thrust levers. When a positive rate of climb was achieved, the gear was retracted. The first officer informed ATC that they were going around and noted that his ADI was not annunciating 'GA'. He advised the commander who then selected the 'Go-Around' switch; 'GA' was annunciated and the flight directors commanded a climb on the existing aircraft track. About then, ATC instructed the aircraft to turn right onto a track of 180º. The first officer selected the heading to 180º and, as the aircraft turned, noted high ground depicted on the left side of his HSI display; prior to the approach, the EGPWS 'TERRAIN'

function had been selected. Once level at the missed approach altitude, the commander made the decision to divert to Malaga Airport because he considered that low cloud may have resulted in the crew losing sight of the runway strobe lights. The diversion was uneventful and the crew reported the incident when they arrived back at Luton Airport the next morning.

The 'Talk-Down' controller noted that the radar had been producing intermittent returns within about 7 nm range. However, prior to the approach by G-MONE other aircraft had carried out successful approaches to Runway 09. During the approach by G-MONE, the controller noted that there were no primary radar returns from the aircraft at the VDP but checked that the crew were visual with the runway and then cleared the aircraft to land. Thereafter, he monitored the approach using intermittent secondary radar returns. However, at just under two miles range the controller noted that the aircraft appeared to be right of the required track. Two further secondary returns and a very faint primary radar return also indicated that the aircraft was right of track and the controller asked the crew to confirm that they were still visual with the runway. The crew responded that they were not visual and were going around. The controller monitored the aircraft track and noted that the aircraft was apparently in a right turn. He considered that it was turning towards the 'Rock'; high ground immediately south of the airfield at 1,420 ft. He issued a warning about the proximity of the 'Rock' together with an instruction to tighten the turn. When he was confident of the aircraft position from improved radar returns, the controller instructed the crew to turn onto a heading of 180º. Once the aircraft was clear of the land, the controller asked for the crew's intentions and then co-ordinated the diversion to Malaga.

Recorded information

Both ATC and the flight crew reported the incident to their respective organisations but the AAIB was not informed until 22 March. By then the Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) had been overwritten. Nevertheless, the aircraft Quick Access Recorder (QAR) data was available and provided useful information. Additionally, the R/T had been recorded and was also available.

QAR data

The flight path of the aircraft during the incident period was constructed from data recorded on the QAR. This flight path is presented in Figure 1. It commences as G-MONE tracked north on 001ºM towards the VDP. At the VDP, the aircraft was at an altitude of approximately 1,000 ft, at a computed airspeed of 133 kt, and was descending at just under 900 ft/min. G-MONE then entered a descending turn to the right, achieving a maximum recorded bank angle of just over 26º.

Thirty seconds after the aircraft commenced the turn, the engine thrust increased for the 'Go-Around'. At this point G-MONE was descending through 650 ft at 134 kt, with a bank angle of 8º to the right and turning through a heading of 077ºM. The aircraft descended a further 100 ft to 550 ft before it entered a climb. It then achieved a climb rate of about 3,000 ft/min whilst turning onto a heading of 140ºM. It remained on this heading for 12 seconds before turning left onto a heading of 134ºM for a further 12 seconds, followed by a turn to the right onto a heading of 180ºM. As G-MONE turned onto the heading of 180ºM, it was overland and climbing through 2,100 ft.

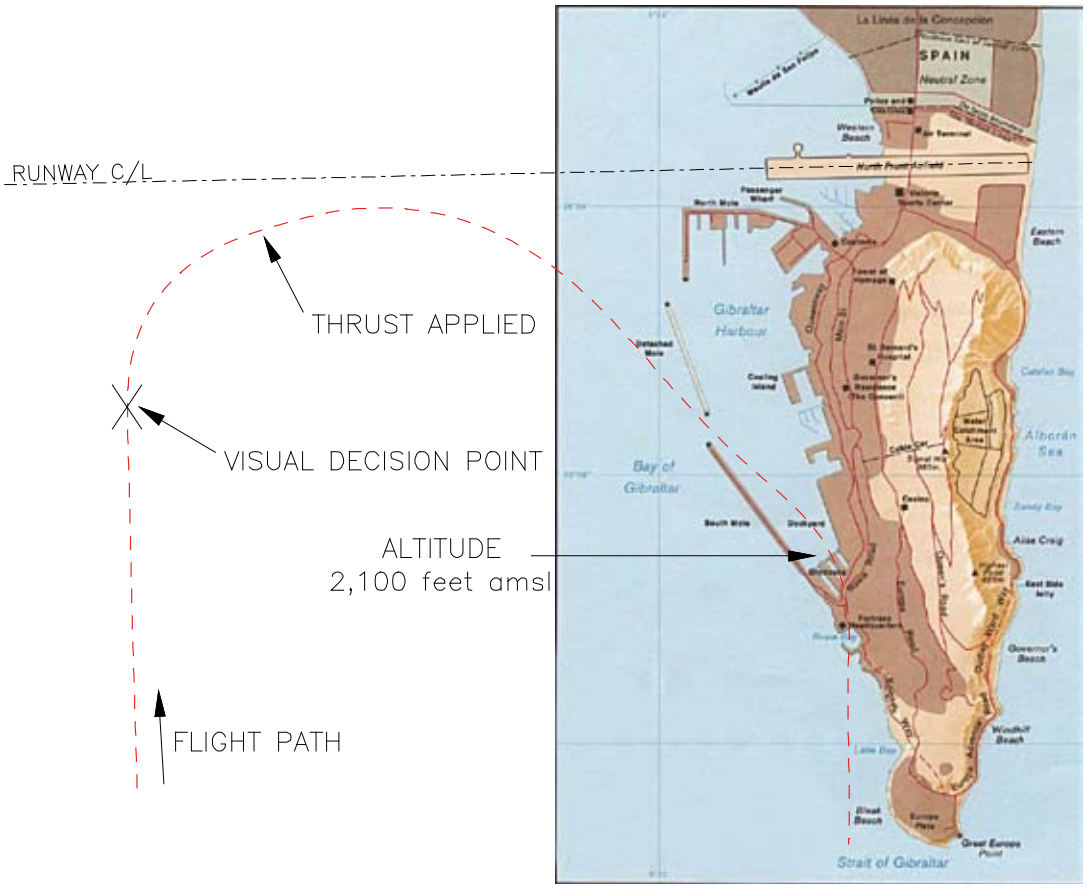


Figure 1

Reconstructed flight path of G-MONE

R/T information

Both 'Approach' and 'Talkdown' frequencies were recorded. G-MONE was transferred from 'Approach' to 'Talkdown' at 1940 hrs and, by 1945:19 hrs the aircraft was heading 360ºM at 1,500 ft amsl and 5.5 nm from touchdown. The controller gave G-MONE clearance to commence descent for a 3º glidepath at 5 nm range and thereafter provided advisory altitudes. At 4 nm range, G-MONE was cleared to land and at 3 nm range (VDP), at 1946:30 hrs, the crew were asked for confirmation that they were visual with the runway. With no immediate response from the crew, the controller transmitted a further request for confirmation and then, with the crew confirming that they were visual, G-MONE was cleared to continue visually for landing. Forty seven seconds after G-MONE passed the VDP, the controller transmitted that the aircraft appeared to be south of track and asked for confirmation that the crew were visual with the runway. The crew replied that they were not visual and were going around. The controller responded with an instruction to tighten the turn and 15 seconds later, informed G-MONE that contact had been regained and instructed the aircraft to turn right onto 180º. At 1948:15 hrs, the controller advised the crew that the aircraft was now passing to the west of Europa Point (the south easterly point of Gibraltar). At 1949:28 hrs, the crew requested a diversion to Malaga Airport.

Operational information

Operating company information

The company assessed Gibraltar as a Category 'B' airport, which required nominated captains to be the handling pilot for the landing. The associated written brief for the airport included information additional to that within the Jeppesen charts. Following this incident the company reviewed the brief and added further information.

Both crew members had previously flown into Gibraltar, and had utilised the SRA approach to Runway 09.

The crew duties for a standard missed approach procedure were detailed in the company Operations Manual Part B. This required the pilot flying to announce "GO AROUND FLAP 20", advance the thrust levers and to press the '*Go-Around*' switch. Thereafter, the crew would retract the gear once a positive rate of climb had been achieved and would monitor the annunciation of 'GA' on the ADI.

The activation of a thrust lever '*Go-Around*' switch would result in the flight director bars appearing on each pilot's ADI, regardless of the position of the flight director switches. The flight director would then command a climb and a heading to maintain the existing ground track of the aircraft. A subsequent selection of *'HDG SELECT'* or *'L NAV'* would give the crew the option of following a selected heading or the programmed missed approach route. However, this selection would cause each pilot's flight director bars to retract from view unless the respective flight director switch was 'ON'.

ATC information

The airport has white low-intensity lights installed each side of the runway, and blue lights at the edge of the runway shoulders, in accordance with existing regulations. The sea wall is indicated by a row of omni-directional red lights and the runway threshold is indicated by a row of uni-directional green lights. PAPIs for Runway 09, set for a 3º descent, are positioned each side of the runway 91 m from the threshold. A strobe light is positioned each side of the threshold for Runway 09, and angled towards the VDP to assist visual acquisition of the runway. This was required because of the presence of other cultural lighting, the low intensity of the runway lights and the lack of conventional approach lights. The ATC procedures required these strobe lights to be '*switched off when aircraft at 2 nm unless required by pilot*'. Additionally, to help with approach guidance, there is a marker buoy with a flashing amber light positioned on the extended centre line of the runway 4,500 ft from the sea wall. There is also a strobe light on each side of the sea wall as a warning to maritime vessels.

All the lights for Runway 09 had been checked as serviceable on both the day of the incident and the following day. Additionally, the ATC assistant confirmed that he had not switched off the strobe lights during the approach of G-MONE since he was not visual with the aircraft. The crew confirmed that both had initially seen the strobe lights but had seen neither the marker buoy light nor any runway lights.

In reported weather conditions of visibility 3,700 m or less, or SCT cloud 700 ft or less, the required ATC procedure was to ask the crew if they are visual with the runway at the VDP.

The published missed approach for Runway 09 is as follows:

'Continue in radar pattern as directed climbing to 3,900' (3885'). When over the upwind end of the runway, or passing 1,900' (1,885') in IMC, climb on runway heading.'

The standard ATC instructions for a missed approach from the VDP is to turn the aircraft onto a north-easterly heading to ensure that the aircraft remains well clear of the 'Rock'.

In marginal weather conditions the ATC procedure is to keep the aircraft on 'Talkdown' frequency, and not to transfer it to 'Tower' until after landing.

The highest obstacle on Gibraltar is on top of the 'Rock' at 1,420 ft.

Weather

The Gibraltar TAF, issued at 1400 hrs and valid between 1500 and 2200 hrs was as follows: visibility of 8,000 m in haze; cloud FEW at 1,000 ft, SCT at 2,000 ft; becoming from 1700 to 2000 hrs, visibility 6,000 m in light rain; cloud SCT at 1,000 ft. There was a 40% probability of a temporary deterioration between 1900 and 2200 hrs to 4,000 m in moderate rain; there was also a 30% probability of a temporary deterioration between 1900 and 2200 hrs to 2,500 m in heavy rain and cloud SCT at 500 ft.

The METAR for 1850 hrs indicated a surface wind from 040º at 6 kt, visibility of 5,000 m in rain, cloud FEW at 1,000 ft, SCT at 1,800 ft and BKN at 3,000 ft. The air temperature was 15ºC, the dew point was 13ºC and the QNH was 1007 mb. The trend indicated no significant change.

The METAR for 1950 hrs indicated a surface wind from 070º at 06 kt, visibility of 5,000 m in moderate rain, cloud FEW at 300 ft, SCT at 1,600 ft and OVC at 4,000 ft. The air temperature was 14ºC with a dew point of 14ºC. The trend indicated a temporary deterioration of 4,000 m visibility in rain and cloud SCT at 1,000 ft.

Throughout the period from 1500 to 2300 hrs, the wind at 2,000 ft was forecast to be from 130º at 20 kt becoming 190º at 20 kt. At 1950 hrs, the wind measured near the top of the 'Rock' was from 090º at 10 kt.

ATC investigation

Immediately after the incident, Gibraltar ATC carried out a comprehensive investigation into the incident. The conclusion was that the controllers and assistants had operated correctly and in accordance with their procedures. The investigation also reviewed the present procedures and made the following recommendations:

1. Controllers to confirm with crews at the VDP that they are visual with the runway regardless of weather conditions. If the crew do not acknowledge promptly that they are visual, the controller will initiate the missed approach procedure. NB*: This recommendation was accepted and an operating instruction was issued to ATC staff on 23 March 2006.*
2. That the runway strobe lights are left on until approaching aircraft are at 1 nm range. NB: *This recommendation was accepted and an operating instruction was issued to ATC staff on 23 March 2006.*
3. An evaluation of the performance of the primary radar and consideration of the need for guidelines for controllers to indicate when the radar performance is not suitable for SRAs.

Analysis

The incident occurred when the crew lost sight of the runway strobe lights after the VDP and commenced the missed approach procedure. During the go-around, the crew did not fly the required heading and ATC became concerned that the aircraft was heading towards high ground. Effective action by the controller ensured that the aircraft's track remained clear of the high ground, even though the altitude of the aircraft was such that no collision risk existed. This analysis covers aspects considered relevant to the incident.

Airport

Gibraltar Airport was considered by the operating company as an airport with a need for particular briefing and crew qualification. The local topography can result in wind variations resulting in strong turbulence and rapidly changing visibility and cloud conditions. These aspects are well documented but must be considered in relation to the location and characteristics of the runway and the lack of approach aids. This is particularly relevant to operations at night when the low intensity of runway lighting, lack of effective approach lighting and proximity of other cultural lighting means that visual acquisition of the runway is difficult to achieve and to maintain. The airport procedures are constantly under review and changes were made shortly after the incident.

Flight crew

The crew were qualified to operate into Gibraltar and were familiar with the procedures. They were aware that the weather was marginal and carried additional fuel. In accordance with company requirements, they configured the aircraft for landing and established the correct airspeed and rate of descent prior to the VDP. This should have ensured that at the VDP the crew were able to visually acquire the runway and maintain visual contact. To enable early visual contact, the handling pilot made full use of the automatic features of the aircraft. At the VDP, both crew members saw the runway strobe lights, confirmed this fact to ATC and the commander commenced a turn to line up on the runway. Seated in the left cockpit seat, it would be difficult for the commander to maintain visual contact with the runway in the right turn. This would be particularly relevant as he would also be involved in other actions such as disconnecting autopilot and autothrottles, switching off the flight directors and transferring to manual flight. It would be easier for the pilot in the right seat to maintain visual contact with the runway but, with the limited runway lights and the ambient lighting at Gibraltar, it would be necessary to maintain continual contact. The first officer acknowledged that he preset a radio frequency during the right turn in anticipation of an expected radio change. It was therefore possible that both pilots may have been 'looking in to the cockpit' at the same time and thus both lost visual contact with the strobe lights. It was also possible that a patch of cloud may have obscured the lights. Nevertheless, it appeared that the approach briefing had not emphasised sufficiently the importance of maintaining visual contact with the strobe lights.

When visual contact was lost, the crew were required to carry out the missed approach procedure. The aircraft was now right of the centre-line and turning right, although the commander thought that he was maintaining a constant heading. This right turn continued as the commander advanced the thrust levers until he was reminded to select the 'Go-Around' switch. When he did so, the flight director bars appeared and commanded the current aircraft track, which was now approximately 140º. Neither pilot was fully aware of

this heading as their priority was to initiate a climb and reconfigure the aircraft. With the climb established the priority would then be to ensure that the aircraft was on the correct missed approach track. However, shortly after the initiation of the missed approach ATC provided heading instructions and the controller's prompt actions resolved the situation.

Without CVR and FDR information, it was not possible to determine the exact timings and actions of the crew. Nevertheless, it was apparent that the crew had not maintained continual visual contact with the runway and then did not comply fully with the go-around procedures. Following the incident, the operating company circulated an account of the incident to all their crews together with appropriate lessons. Additionally, the company crew brief for Gibraltar was reviewed and additional information included on the airport and the associated procedures.

General

During the investigation, it was apparent that an approach into Gibraltar in the minimum permitted weather conditions requires a high level of concentration and effective co-ordination by the crew and ATC. While the operating company and ATC have produced operating procedures based on the existing facilities, a critical factor would appear to be the maintenance of visual contact with the runway. With the limited airport lighting, this currently means that one crew member must continually maintain visual contact with the runway strobe lights, thereby reducing his capacity to monitor the flight parameters. Given the high intensity of the cultural lighting in the vicinity of the airport, more effective approach and runway lighting would provide more capacity for the crew to monitor these parameters. The following recommendation is therefore made:

Safety Recommendation 2006-065

It is recommended that the air regulator review the airport lighting at Gibraltar with the aim of providing, for civilian operations from the airfield, runway approach lighting and improved the runway lighting.

With the other actions taken by ATC and the aircraft operating company, it is not considered necessary to make any further recommendations.

ACCIDENT

Aircraft Type and Registration:	1) Boeing 777-200, N781AN 2) Airbus A340-300, TC-JDK
No & Type of Engines:	1) 2 Rolls Royce Trent 892 turbofan engines 2) 4 CFM56-5C2 turbofan engines
Year of Manufacture:	1) 2000 2) 1993
Date & Time (UTC):	6 November 2005 at 1238 hrs
Location:	Holding Area Runway 27L, London Heathrow Airport
Type of Flight:	1) Public Transport (Passenger) 2) Public Transport (Passenger)
Persons on Board:	1) Crew - 12 Passengers - 267 2) Crew - 13 Passengers - 270
Injuries:	1) Crew - None Passengers - None 2) Crew - None Passengers - None
Nature of Damage:	1) Left elevator and left wing tip damaged 2) Right winglet damaged
Commander's Licence:	1) Airline Transport Pilot's Licence 2) Airline Transport Pilot's Licence
Commander's Age:	1) Not known 2) 59 years
Commander's Flying Experience:	1) Not known 2) 23,000 hours (of which 7,407 were on type) Last 90 days - 216 hours Last 28 days - 56 hours
Information Source:	AAIB Field Investigation

Synopsis

Aircraft entering the Holding Area prior to departure from Runway 27L at London Heathrow Airport, initially follow a single yellow taxiway centreline, which splits into two parallel lines within the holding area. This is wide enough for two 'heavy/widebody' aircraft to position side by side when lined up on the parallel lines. Prior to departure, a Boeing 777 (B777) was holding, in turn, at N2W behind a Boeing 737-800 (B737), in the Holding Area. Whilst in this position, an Airbus A340 (A340) was instructed to taxi to N2E. As it passed behind the B777, the A340's right winglet made contact with the B777's left elevator and its left wing tip. The A340 had not reached the section of the line parallel to the parked B777. This accident happened at the same location as a collision between similar aircraft types reported in AAIB Bulletin 9/2005, reference EW/C2004/07/03.

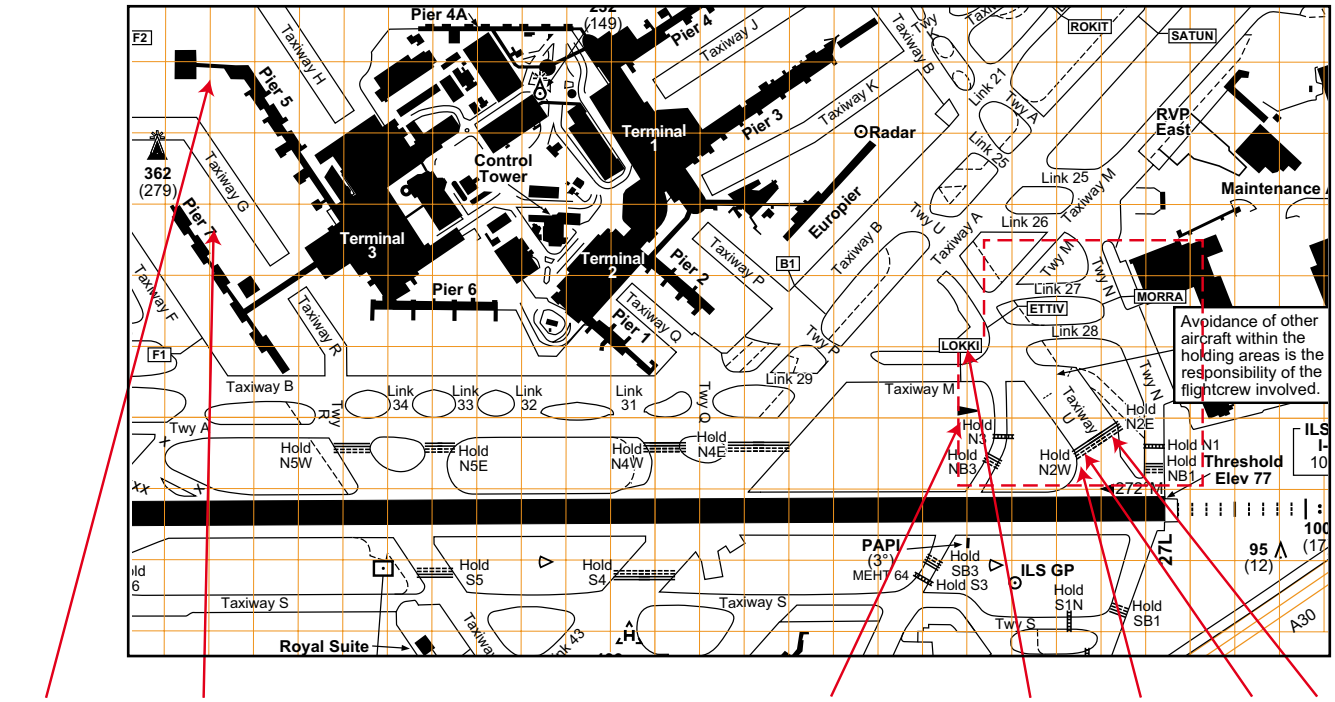
Two recommendations are made addressing the issues of the design and operation of the Holding Area for Runway 27L at London Heathrow Airport.

History of the flight

At the time of the accident it was daylight, the visibility was in excess of 10 km and it was raining. The B777 was cleared to taxi from Stand 320 at Terminal Three, via taxiways Echo and Alpha, to Holding Point LOKKI for departure from Runway 27L. Four minutes later the A340 was cleared to taxi from Stand 335, also at Terminal Three, via the same routing to holding point LOKKI, Figure 1.

As the B777 approached LOKKI it was instructed to monitor the Heathrow ATC Tower frequency. On contact with Heathrow Tower, the Air Departures Controller (ADC) instructed the B777 to hold at N2W. This is to the western side of the Holding Area for Runway 27L. Due to the presence of a B737 that was also holding at N2W, the B777 had to line up behind it and wait in turn. (The ADC was an experienced Air Traffic Control Officer (ATCO) who was new to controlling at London Heathrow Airport. He was being supervised at the time by an 'On-the-Job' Trainer (OTJT).)

As the A340 approached Holding Point LOKKI, it too was instructed to monitor the Heathrow ATC Tower frequency. On making contact, the ADC instructed the A340 "When you can, taxi forward to hold N2E." The crew replied "OK, taxi N2E". N2E is the hold on the eastern side of the Holding Area for Runway 27L. As the aircraft joined taxiway UNIFORM, the ADC transmitted "Just caution, the B777 will be moving up shortly"; this transmission was not acknowledged.



With kind permission of the CAA

Figure 1

After the A340 had passed behind the B777, and was nearly in line abreast with it, the pilot of the B777 advised the ADC that he would have to return to stand. He added that the A340 on his left had just collided with him and he could see some damage to the wing tip of the A340[1]. Airport Rescue and Fire Fighting Service (RFFS) and ground operations personnel were dispatched to the scene. They reported damage to the right winglet of the A340 and the left elevator and left wing tip of the B777. Both aircraft were advised to taxi back onto a stand to enable engineers to inspect the damage.

Footnote

[1] The ATIS broadcast at the time contained information to the effect that pilots were responsible for the wing tip clearance of their aircraft in the Runway Holding Area. Similar information was contained in the notes section on the airfield 'plates'.

Aircraft examination

Damage to the B777's left elevator and left wing tip appeared to have been inflicted by the upper part of the winglet of the A340. Damage to the A340 was temporarily repaired and the aircraft was dispatched. The B777 had been equipped with a replacement wing-tip fairing and was still awaiting delivery of a replacement elevator when examined by the AAIB.

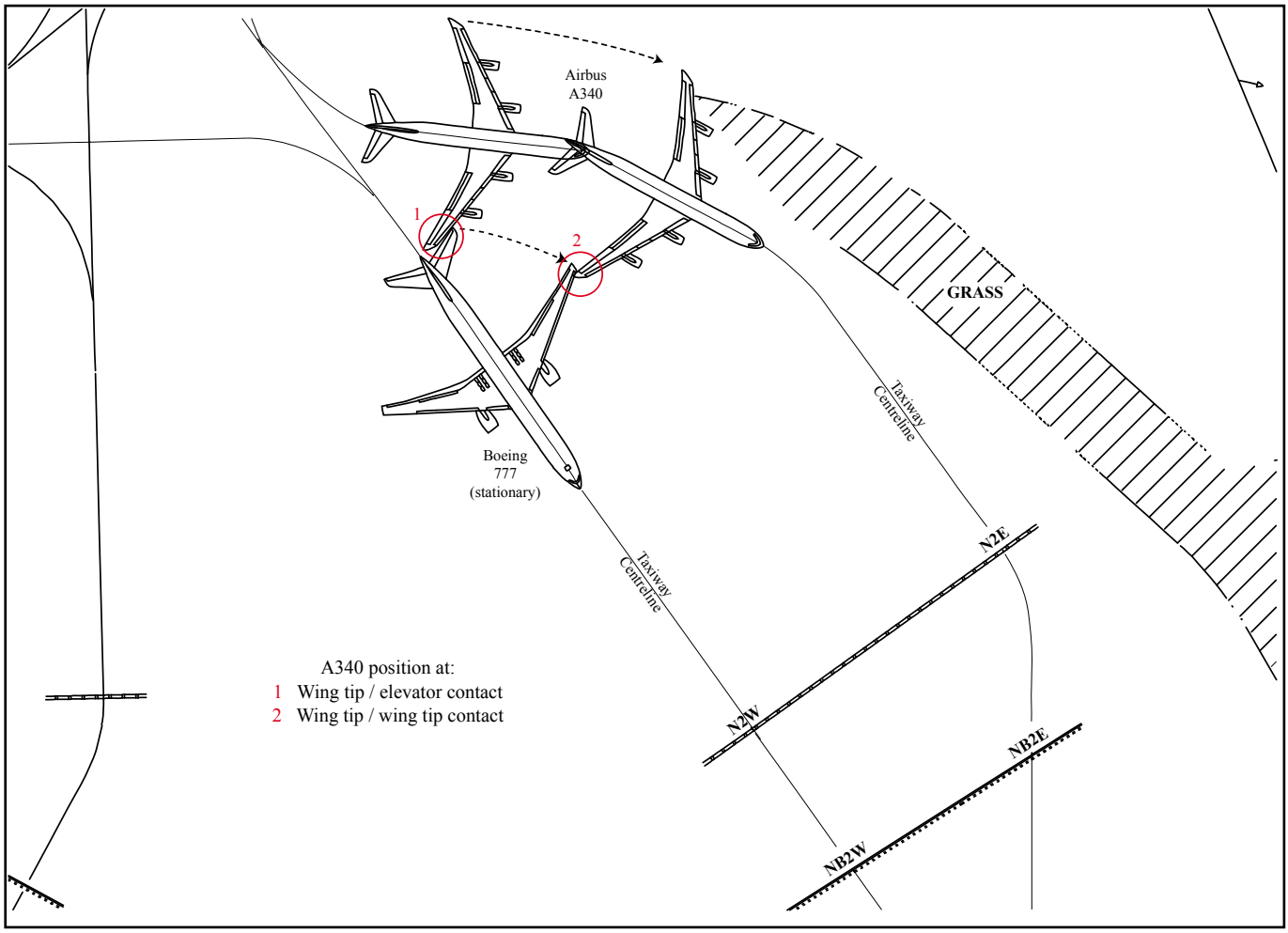


Figure 2

Relative aircraft positions at points of contact

Recorded data sources

ATC radio transmissions and the ground radar display are recorded at LHR and information covering this event was used during the investigation. The ground movement radar showed all ground movements of the aircraft, with a radar signature overlaid with a marker derived from the 'multilateration' system. This system triangulates the location of the aircraft from the ATC transponder transmissions. The flight data recorder from the A340 was downloaded by the airline, on request of the AAIB. It showed that the ground speed at impact was 6 kt and that the collision occurred at approximately 1238 hrs.

Comments by B777 crew

The B777 crew reported that, initially, they thought that the jolt caused by the first collision was the result of an engine surge. After checking the engine instruments they quickly discounted this and realised that they had been hit by another aircraft. Soon after the first collision they felt the second jolt and were now able to see the A340 on their left with what appeared to be a piece of their aircraft's wingtip embedded in its winglet. They added that the first collision was firmer than the second.

Comments by A340 crew

The crew of the A340 had a slot time of 1250 hrs for their departure. Although the ATIS broadcast contained a warning reminding pilots that they are responsible for wing tip clearance in the Runway Holding Area, the crew did not remember hearing this information. However, they had read the notes on their airfield plates that contained the same warning.

The push back, start up and taxi out to LOKKI was uneventful. On transferring to the Tower frequency they recall their first instruction from the ADC as "Taxi november two echo." They did not register the preceding part of the instruction of "when you can" and felt that, given their understanding of English, they would not have realised that there might have been a 'hidden meaning' in this phrase. The commander believed that ATC wanted him to comply with the instruction completely so he did not question ATC to clarify the meaning. The crew also reported that they did not hear the additional call of "Just caution, the B777 will be moving up shortly" made by the ADC.

However, the commander and co-pilot discussed the relative position of the B777. They felt that it was an excessive distance behind the B737 and, as a result, they decided to taxi slightly left of the yellow taxi line in order to give themselves more room. As they passed behind the B777 the commander asked the co-pilot if they were clear. He replied "It seems safe for now" but later added that while he could see the right wing tip, it was difficult to make an accurate assessment due to the obtuse angle. Furthermore, his view was distorted by rain on the window.

The crew were now concerned about the proximity of the grass on the left of the aircraft. Consequently, both the commander and the co-pilot were looking to the left in order to assess their position on the taxiway. Once clear of the rear of the B777, the aircraft turned parallel to it and, again, the co-pilot looked out at the right wingtip. Although, once more, it appeared to be clear of the B777, he then felt a jolt, which was in fact the second collision.

A340 manufacturer's advice

Clearance from fixed obstructions at airports is usually assured by following the yellow taxiway lines, but clearance from movable obstructions, such as other aircraft, is at the discretion of the flight crew. There is,

however, no advice from the manufacturer as to reference points to use on the aircraft or the ground to ensure wing tip clearance. The wing tips on most large transport aircraft are not easily visible from the flight deck and the judgement of distance along a wing, for example, is difficult even in clear conditions.

Comments by the Air Departures Controller (ADC) and the On-the-Job Trainer (OTJT)

The ADC and the OTJT both commented that they considered that the B777 was not excessively far behind the B737 at Holding Point N2W. When the ADC issued the instruction to the A340 to taxi to N2E, he added the phrase "when you can" to emphasise that the decision about when it was safe to proceed rested with the operating crew. In this situation, it was possible that, to the crew of the A340 who did not speak English as their mother tongue, the implied meaning of this phrase was too subtle to be understood by them. The ADC added that he was not unduly worried by the incomplete read back of this instruction, as he would expect a flight crew to stop and query an instruction if they thought there was not enough room, rather than continue forward and risk taxiing into another aircraft.

The ADC transmitted the caution message as a result of him noticing that the A340 was taxiing very slowly behind the B777, as if it was quite tight and the crew were proceeding with caution. He wanted to inform them that the B777 would be moving forward shortly so that they were aware that there was no urgent need to squeeze past. The ADC didn't expect a reply to this message as it was for information purposes and is not a mandatory read back item. He did not make a conscious effort to look at the Ground Movement Radar to assess the movement of the A340 and the space available.

The "when you can" and "caution the B777 will be moving up shortly" messages are both non-standard R/T phrases, but the ADC and the OTJT both stated that it is not uncommon for them to be used.

ATC procedures

The CAA's Civil Aeronautical Publication (CAP)493, the *Manual of Air Traffic Services Part 1* states the following:

> *'3 Air Traffic Control Service*
>
> *3.1 An air traffic control service is provided for the purpose of:*
>
> *a) preventing collisions between aircraft in the air;*
>
> *b) assisting in preventing collisions between aircraft moving on the apron and the manoeuvring area;*
>
> *c) assisting in preventing collisions between aircraft and obstructions on the manoeuvring area;*
>
> *d) expediting and maintaining an orderly flow of air traffic.'*

In addition, the UK AIP AD 2-EGLL-1-11 iv 1 states:

> *'At all times in good visibility an ATIS message will remind pilots that they remain responsible for wingtip clearance'.*

Actions following previous accidents

On 23 November 1995, a similar accident, that occurred between an Airbus A340 and a Boeing 757-236 in the holding area for Runway 27R at LHR, was investigated by the AAIB. As a result, the following safety recommendation was made to the CAA:

Safety Recommendation 96-43

'The CAA should, in liaison with the appropriate ICAO committees, consider what action may be taken in the longer term to ensure that flight crews of large public transport aircraft are better able to achieve a positive clearance between their aircraft and others while manoeuvring on the ground'.

In response to this recommendation, the CAA raised the issue with the UK ICAO Navigation Commission in Montreal, which tasked their Airport Design Study Group to develop appropriate guidance. However, little specific information relating directly to this topic is currently contained in the ICAO Annex 14 or its associated Aerodrome Design Manual. In 1997, the CAA issued CAP 637 titled '*Visual Aids Handbook'*, which reiterates guidance to pilots on the interpretation of aerodrome visual aids, including taxiway markings. This document is currently being reviewed with the intention to re-issue it in 2007.

Following another similar accident at the LHR Runway 27L Holding Area in 1997 (AAIB Bulletin 9/97), Heathrow Airport Limited (HAL), the airport authority, undertook to set up a working party to:

- examine the current daylight (non Low Visibility Procedure) procedures for runway holding areas
- examine whether or not pilots should be given additional guidance within runway holding areas
- review the British Airports Authority (BAA) design standards for runway holding areas.

It has not been possible to find a record of the working party or its conclusions.

Following a further similar accident, at the same place on the airport in July 2004 (AAIB Bulletin 9/2005), an internal memo was issued by HAL. It stated that the Airside Infrastructure Manager was in discussion with the Aerodrome Standards Department of the Safety Regulation Group at the CAA concerning the provision of additional ground markings to indicate the position of the stop bar at the northern end of the Holding Area for Runway 27L. These markings are meant to assist pilots in determining whether an aircraft is in a position that permits it to pass safely.

The Safety Regulation Group stated that they gave approval for these markings a few weeks after this accident. These additional ground markings had not been implemented at the time of this collision.

Analysis

Since 1995, the AAIB has investigated the circumstances surrounding three very similar accidents associated with the Holding Areas for Runways 27L and 27R at LHR. In this recent accident, it was evident that by taxiing slightly to the left of the yellow line, the crew were attempting to slowly 'squeeze' past the B777, with the co-pilot looking out to the right to assess the wing tip clearance, in compliance with the ATC instruction to "taxi forward to hold N2E". By doing so, they ran the risk of the left main landing gear wheels departing the paved surface. The wing tips are difficult to see from the cockpit of large swept wing transport aircraft, even in good daylight conditions. In addition, there is a difficulty in judging distance at a shallow angle along, and beyond the end of a large wing. Although the commander of an aircraft carries the responsibility to ensure that his aircraft remains clear of obstructions at all times, he is at an extreme disadvantage in discharging that responsibility, due to the reasons mentioned above.

The crew stated that they did not hear, or would not have understood, had they heard the implied meaning of the ATC caveat "when you can". However, as they heard the ATC instruction to "taxi forward to hold N2E", they must have been alerted to this by their call sign used by ATC at the beginning of this transmission. The caveat, being non-standard ATC phraseology, was probably missed due to the language issue; this is not an unusual situation with foreign flight crews whose mother tongue is not English.

In light of recent events, the message contained at the end of the ATIS broadcast, and published in the AIP, would appear to be insufficient to prevent collisions in the Holding Areas at London Heathrow Airport. An aircraft crew may not be aware that a collision has occurred, for example, by the jolt of such a collision being masked by movement induced by wind gusts and/or the event occurring at night. It is feasible, therefore, that a damaged aircraft could get airborne and potentially be put into a hazardous situation.

Safety Recommendations

In light of the previous accidents around the Holding Areas for Runway 27L and 27R, and the possibility that an aircraft could take off having had an unknown ground collision, the following recommendations are made:

Safety Recommendation 2006-058

It is recommended that Heathrow Airport Limited review the current layout/design of the Holding Areas for departing aircraft, to ensure that wingtip clearance is maintained between manoeuvring aircraft.

Safety Recommendation 2006-059

It is recommended that Heathrow Airport Limited, in co-operation with National Air Traffic Services, review the current Air Traffic Control procedures applicable to the Holding Areas for departing aircraft, and any future layout of these Holding Areas, to ensure that adequate wingtip clearance is maintained between manoeuvring aircraft.

ACCIDENT

Aircraft Type and Registration:	Boeing 777-236, G-VIIP
No & Type of Engines:	2 General Electric Co GE90-85B turbofan engines
Year of Manufacture:	1999
Date & Time (UTC):	14 May 2006 at 0048 hrs
Location:	400 nm east of New York
Type of Flight:	Public Transport (Passenger)
Persons on Board:	Crew - 13 Passengers - 257
Injuries:	Crew - 1 (Minor) Passengers - 2 (Minor)
Nature of Damage:	Nil
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	49 years
Commander's Flying Experience:	9,007 hours (of which 1,110 were on type) Last 90 days - 138 hours Last 28 days - 41 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

Whilst in the cruise at FL370, the aircraft encountered a short period of unforecast, severe turbulence. A number of occupants were thrown into the air and injured. An on-board doctor, assisted by medical advice from ground based specialists, diagnosed the injuries as minor and the flight continued to London (Gatwick) Airport.

History of the flight

The aircraft, on a scheduled flight from Atlanta (USA) to London (Gatwick), was established in the cruise at FL370. It was a clear, dark night and there were no warnings of turbulence on the Significant Weather Chart produced by the Washington World Area Forecast Centre, or from radio transmissions from other aircraft on the same route. The aircraft's weather radar was tilted one degree nose down but displayed nothing to indicate likely turbulence. Whilst looking out, both pilots visually acquired cloud directly ahead, at short range, and began an avoiding turn. The seat belt signs were switched ON and the speed selected to Mach 0.82; the recommended turbulence penetration speed for that level. The aircraft entered the cloud and experienced two or three large jolts over a period of approximately 10 seconds. It then exited the cloud and the turbulence dissipated.

The aircraft's flight data recorder revealed that during the turbulence, the aircraft experienced a maximum vertical acceleration of 1.633g and a minimum of -0.023g two seconds later. There was also an uncommanded autothrottle disconnection.

The turbulence was encountered immediately after the seat belt signs were switched ON, whilst the cabin crew were serving the passengers refreshment from the service trolleys. As a result of the turbulence, two cabin crew members were thrown into the air together with their service trolley. A female passenger, holding a baby, had not had time to return to her seat and was also thrown into the air. She held onto the baby with both arms and was unable to break her fall, consequently injuring her knees. The baby appeared uninjured and ate and slept normally throughout the rest of the flight. Medical advice was sought from ground based specialists and an on board doctor diagnosed the injuries as minor and the flight continued to London (Gatwick) Airport. After landing an ambulance and paramedics met the aircraft to treat the injured persons. It was subsequently discovered that the baby had suffered a broken leg.

INCIDENT

Aircraft Type and Registration:	Bombardier CL600-2B19 CRJ200, D-ACHA
No & Type of Engines:	2 CF34-3B1 turbofan engines
Year of Manufacture:	2000
Date & Time (UTC):	22 April 2006 at 1951 hrs
Location:	London Heathrow Airport
Type of Flight:	Public Transport (Passenger)
Persons on Board:	Crew - 4 Passengers - 50
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	32 years
Commander's Flying Experience:	6,035 hours (of which 3,552 were on type) Last 90 days - 180 hours Last 28 days - 55 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

As a result of a cargo smoke warning the aircraft returned to London Heathrow Airport; no evidence of smoke or fire was found and the investigation concluded that the warning had been spurious. There have been a number of similar incidents despite the introduction of a modified cargo smoke detector, which was fitted to this aircraft.

History of the flight

The aircraft was on a scheduled flight from London Heathrow to Dusseldorf. Shortly after takeoff, the Engine Indicating and Crew Alerting System (EICAS) gave a 'SMOKE CARGO' warning. The crew carried out the appropriate emergency procedure, declared an emergency and returned to London Heathrow Airport. After a normal landing the aircraft stopped at the first available runway exit where the Airport Fire and Rescue Services (AFRS) were waiting. They reported no evidence of smoke or fire and so the commander decided not to evacuate the aircraft. Following a search of the cargo hold, no sign of fire or smoke was found and the aircraft was towed to a parking stand where the passengers were disembarked normally.

The investigation concluded that the warning was spurious; probably caused by the smoke detector reacting to dust, condensation or electromagnetic interference. This aircraft had been fitted with a new design of smoke detector, which was intended to reduce its susceptibility to these factors.

The aircraft's cargo smoke detectors and fire bottles were replaced and there have been no further reported problems.

Previous occurrences

There have been several instances of spurious cargo smoke indications on CRJ200 aircraft. A previous AAIB report, EW/G2005/03/09, published in Bulletin 11/2005, detailed a similar event that occurred to another of the same operator's CRJ200 aircraft, D-ACHH, on 16 March 2005. This report describes the smoke detector and its history of spurious warnings.

Airworthiness Directive TC AD CF-2001-21 was issued in September 2001 mandating the fitment of a new design of unit within 18 months. D-ACHA and all the subject operator's other CRJ100/200 aircraft have been modified. However, these recent incidents suggest that the new design has not been effective. As a result of the incident to D-ACHH the AAIB wrote to the Transportation Safety Board of Canada (TSB), informing them of the findings. The TSB forwarded the information to Transport Canada and the aircraft manufacturer, Bombardier Aerospace in November 2005. As yet there has been no response from Bombardier.

The operator has incorporated a cleaning task for the cargo smoke detector in the maintenance schedule which is to be performed at C check intervals, every 4,000 flying hours.

ACCIDENT

Aircraft Type and Registration:	Bombardier DHC-8-402 Dash 8, G-JEDO
No & Type of Engines:	2 Pratt & Whitney Canada PW150A turboprop engines
Year of Manufacture:	2003
Date & Time (UTC):	23 February 2006 at 1235 hrs
Location:	Southampton International Airport
Type of Flight:	Public Transport (Passenger)
Persons on Board:	Crew - 4 Passengers - 59
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to fuselage
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	32 years
Commander's Flying Experience:	6,300 hours (of which 3,600 were on type) Last 90 days - 143 hours Last 28 days - 50 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

With the passengers on board, de-icing was commenced. As the de-icing vehicle was being positioned behind the right wing it struck the side of the aircraft. The fuselage was damaged but there were no injuries, hydraulic leaks or fire.

History of the flight

On completion of passenger boarding, de-icing was commenced at the request of the commander. The de-icing vehicle was driven to a position between the right wing and right horizontal stabiliser. With the passengers seated, but the cabin crew still standing, a loud bang was heard throughout the aircraft. The aircraft jolted from side to side and a second bang was heard. The commander immediately informed the passengers that it seemed that the aircraft had been struck by a ground vehicle and instructed them to remain seated until they were cleared to disembark. The crew informed ATC and an airport rescue and fire fighting service vehicle quickly attended the aircraft. The fuselage was visibly damaged but there was no fire, no hydraulic fluid leak and no injuries.

Vehicle driving procedures

It was reported that the driver had positioned the de-icing vehicle behind the right wing, approximately 10 ft from the right side of the aircraft fuselage, stopping the vehicle when instructed to do so by the

member of staff operating the spraying equipment from the external, extendable platform. Those instructions were passed via headset communications. As he moved to apply the parking brake, the driver inadvertently depressed the accelerator, causing the vehicle to surge forward. It was stated that the driver then panicked and, instead of applying the footbrake, pushed the accelerator a second time and the vehicle struck the right side of the aircraft fuselage.

The driver had recently completed his training on the de-icing vehicle. It is the ground services company's policy that newly qualified drivers are accompanied by an experienced staff member until it is deemed by the training staff that such support is no longer required. On this occasion the driver had declined such assistance. There was another member of staff sitting in the passenger seat of the vehicle but he was of the same experience level as the driver. That member of staff did not recall seeing what caused the accident because he was completing paperwork at the time.

The ground services company stated that the normal procedure is for the de-icing vehicle to move around the aircraft in an anti-clockwise direction but on this occasion it had followed a clockwise route.

The ground services company have reviewed the accident and indicated their intention to reinforce the supervision of newly qualified de-icing vehicle drivers.

INCIDENT

Aircraft Type and Registration:	Embraer E120 Brazilia, F-GFEO
No & Type of Engines:	2 Pratt and Whitney PW-118 turboprop engines
Year of Manufacture:	1987
Date & Time (UTC):	31 March 2005 at 0848 hrs
Location:	Seven miles to the west of Isle of Man Airport, on approach to Runway 08
Type of Flight:	Public Transport (Passenger)
Persons on Board:	Crew - 3 Passengers - 7
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	50 years
Commander's Flying Experience:	11,750 hours (of which 2,210 hours were on type) Last 90 days - 117 hours Last 28 days - 37 hours
Information Source:	AAIB Field Investigation

Synopsis

An inexperienced first officer was undergoing line training with the company's chief training captain. The aircraft was being radar vectored for a localiser/DME approach to Runway 08 at Ronaldsway, Isle of Man. The crew had mistakenly selected the IOM VOR frequency instead of that for the ILS, although the commander became aware of this, prior to the aircraft commencing its descent. Believing it would make a good training point he did not identify the mistake to the first officer and left the IOM VOR selected. As a result, the crew used the incorrect DME, descending the aircraft in the procedure to 475 ft over the sea, more than 5 nm short of the runway, with terrain 1 nm ahead rising to approximately 600 ft. When the crew's actions were questioned by ATC the commander immediately climbed the aircraft to 1,600 ft re-establishing on the correct approach path, before landing.

History of the flight

The aircraft, F-GFEO ('EO), was operating a shuttle service between Ronaldsway Airport on the Isle of Man and Manchester International Airport. The commander of the aircraft, the company's chief training captain, was conducting line training with a new first officer who had 250 hours of total flying experience and only five hours on type. They had conducted the first sector of the day from the Isle of Man to Manchester without incident and

were returning to the Isle of Man with seven passengers on board.

The aircraft took off from Manchester Airport at 0817 hrs with the commander acting as the handling pilot. During the cruise the commander briefed for a localiser/DME approach to Runway 08 at the Isle of Man, Figure 1. He recalled selecting the ILS frequency on his instruments for the approach whilst the first officer retained the Isle of Man (IOM) VOR. The crew were given radar vectors by ATC, to position the aircraft onto an intercept heading for the final approach and were cleared for the localiser/DME approach. The commander stated that, at about this time, and for reasons he cannot recall, either he or the first officer changed the ILS frequency previously selected on the commander's instruments to the IOM VOR frequency. The aircraft was fully configured for landing and the first officer reported to ATC that they were established on the localiser. The Approach controller then instructed the crew to transfer to the Tower frequency. The commander later stated that when he established the aircraft on the final approach track, by reference to the IOM VOR, he believed he was in fact establishing on the localiser. The IOM VOR antenna is positioned 5.2 nm to the west of the I-RH Localiser/DME antenna on the final approach track to the airfield, Figure 1[1].

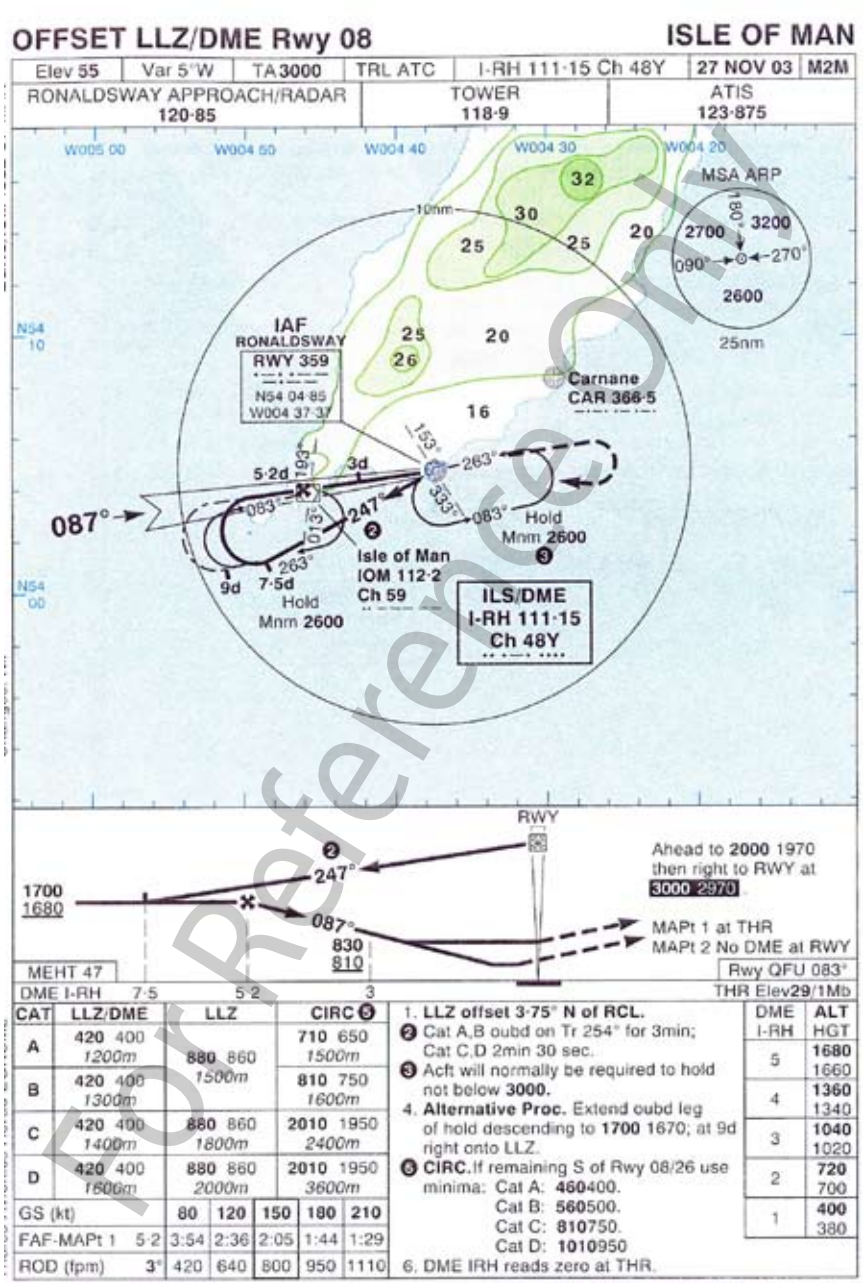


Figure 1

The commander was familiar with this particular approach and noticed that the DME reading was less than he was expecting when initially establishing on the final inbound track. On checking, he realised that he had the IOM VOR frequency selected instead of that for the ILS. The commander considered that this would make a good training point for the first officer

Footnote

[1] Confusion with the DME distance from the airfield had lead to two aircraft descending early whilst on approach to the same runway in 1998. These incidents were subject to an AAIB investigation (EW/C98/6/2) published in the 1/2000 AAIB Bulletin.

and refrained from either resetting the ILS or pointing out the error[2]. When the aircraft was approaching 5.2 DME from the IOM VOR, the commander asked the first officer if they were at the correct point to start their final descent. The first officer confirmed they were and the commander initiated a descent.

The autopilot was engaged and the commander selected a descent rate of about 600 fpm. As the aircraft descended, the first officer monitored the altitude by reference to the approach plate, which contained figures for the altitude to be achieved at various distances based on the I-RH DME located on the airfield. He later stated that they were, at the time, over the sea, which was visible below, and they could make out the Calf of Man, a small island on the south-west tip of the Isle of Man. He could also see the coastline ahead, although cloud cover prevented him seeing the airfield. The weather conditions recorded at the airfield were an easterly wind of about 12 kt, with 4,000 m visibility in smoke, a scattered cloud base at about 600 ft agl with broken cloud at about 2,000 ft agl.

The approach controller was concerned that 'EO was being caught up by a following aircraft positioning to land on the same runway. He was monitoring the distance between the two aircraft on radar when, suddenly, both the primary and secondary returns from 'EO disappeared. He continued to watch and saw the radar return re-appear, but indicating an unusually low Mode C altitude of 400 ft for an aircraft at that distance from the runway. The tower controller had also become aware of this and contacted the crew to ask if they had the ground ahead in sight which, at that time, was approximately 1 nm ahead rising to an altitude of 600 ft. They replied that they did and the commander later stated that he believed at this point the aircraft was at about 1,000 ft above the sea. He also later stated that it was at this time he pointed out to the first officer that the Calf of Man was on their right side, in the 2 o'clock position. He asked the first officer if he believed they were in the correct position. It was only then that the first officer realised they were flying with reference to the IOM VOR and not the I-RH ILS/DME. The commander then climbed the aircraft to 1,600 ft, leaving it in the landing configuration, and both pilots selected the I-RH ILS/DME frequency on their respective instruments. The aircraft was subsequently established on the localiser and, at about 5.2 DME from the airfield, began another descent in accordance with the procedure, landing without further incident on Runway 08.

Flight Recorders

The aircraft was equipped with a cockpit voice recorder (CVR) and a 25-hour duration flight data recorder (FDR). The CVR had not been electrically isolated following the landing and aircraft electrical power had been applied for a sufficient duration to cause the recording of the incident to be overwritten. The CVR therefore did not assist in this investigation. The FDR had retained data for the relevant flight and this was successfully recovered. The FDR recorded a total of 45 parameters and contained an integral clock from which recorded times were taken. These times have been converted to UTC for inclusion in this report.

Figure 2 represents data covering the approach and landing phase of the flight. At 0846 hrs, the aircraft had descended to about 1,700 ft QNH (Point A) and had turned onto a magnetic heading of about 080º, with Flap 25 set. At 0847 hrs, the aircraft was approximately 12 nm from the airfield, at which time it started to descend at approximately 600 fpm on a

Footnote

[2] The operator is based in Paris where a simulator for this type of aircraft is available for training.

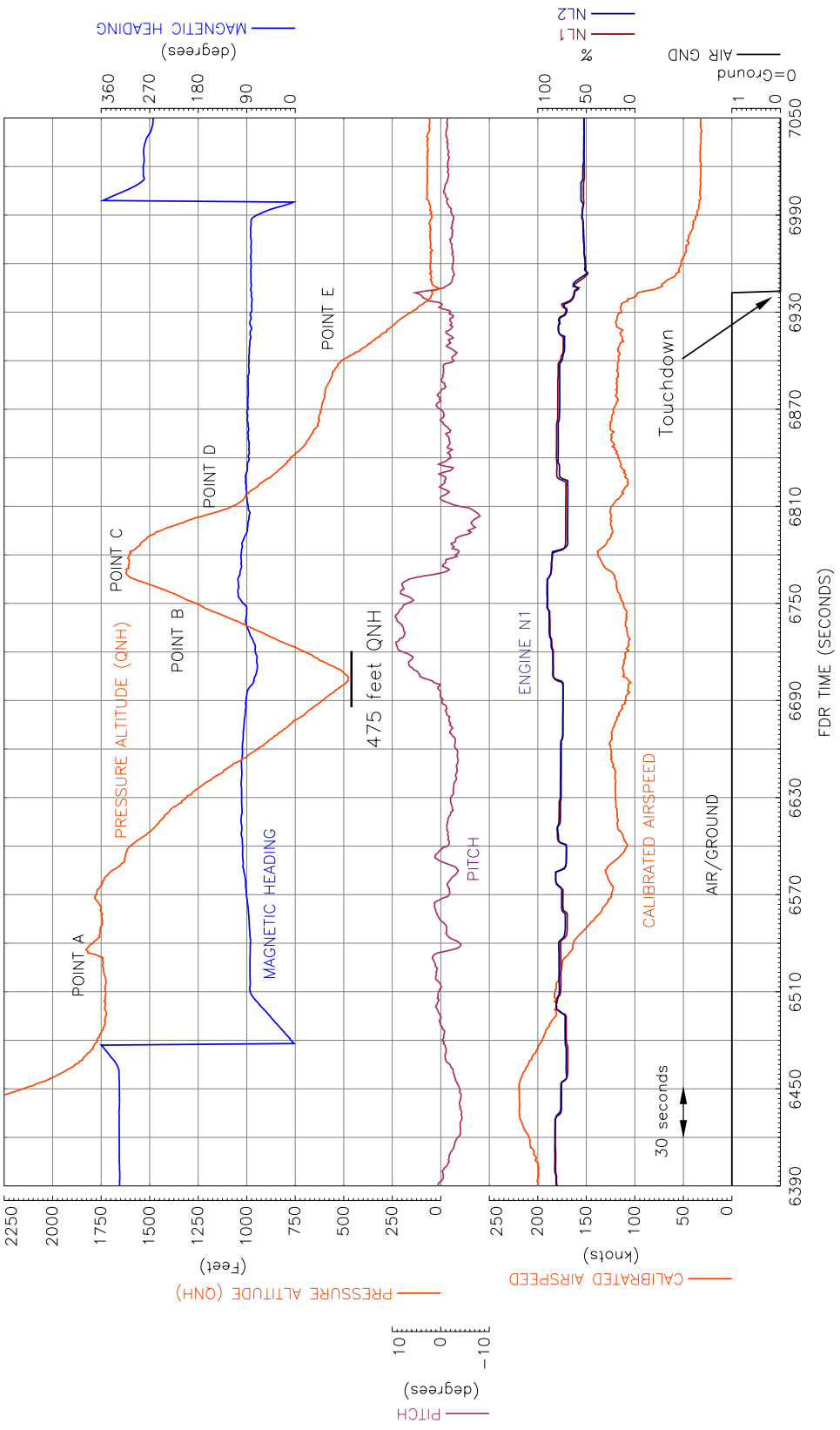


Figure 2

Salient FDR Parameters
(Incident to F-GFEO on 31 March 2005)

glide path of about 3º. The descent continued until, at approximately 475 ft QNH, engine power increased, the aircraft pitched up and started to climb. The climb rate was stabilised at about 1,000 fpm (Point B) until it levelled off at 1,600 ft QNH. The aircraft remained at this level until, at approximately 5 nm from the airfield (Point C), it began its final descent. Initially, the average descent rate was about 800 fpm, (Point D), but this was then reduced as an altitude of 650 ft was approached (Point E). Subsequently, it increased again to about 600 fpm following which the aircraft flew down a glide path of approximately 3º to touchdown, which occurred at 0853:21 hrs. The aircraft taxied clear of the runway and the FDR stopped recording at 0858:32 hrs, when the anti-collision beacon was turned off.

Additional information

ICAO Doc 8168-OPS/611, Procedures for Air Navigation Services (PANS), Volume I Chapter 3 Aircraft Operations, describes the procedures to be used in order to safeguard aircraft from obstacles whilst on the Arrival and Approach Segments of their flight. Section 3.5.5.3 states:

> *'Descent on the glide path/MLS elevation angle must never be initiated until the aircraft is within the tracking tolerance of the localizer/azimuth. The ILS obstacle clearance surfaces assume that the pilot does not normally deviate from the centre line more than half a scale deflection after being established on track. Thereafter the aircraft should adhere to the on-course, on-glide path/elevation angle position since a more than half course sector deflection or a more than half course fly-up deflection combined with other allowable system tolerances could place the aircraft in the vicinity of the edge or bottom of the protected airspace where loss of protection from obstacles can occur.'*

Analysis

It can be seen by reference to the PANS extract that, by commencing the decent some 5 nm early, the aircraft was no longer in protected airspace. The airfield was not visible to the crew at the time and the weather conditions were not favourable for flying a visual approach from this position. Whilst the commander stated he was in sight of the sea below the aircraft, it is generally accepted that it is difficult to judge height visually over water when flying at low level. At the point the aircraft began to climb, in order to establish on the correct approach path, not only had 'EO descended to some 475 ft amsl, about half the altitude recalled by the commander, it was also approximately 1 nm away from high ground ahead, whose maximum elevation was some 125 ft above the aircraft. At this time, the aircraft's airspeed was some 110 kt, which gave approximately 30 seconds of flight time before the aircraft would have descended to sea level or, had it flown level, impacted with the rising ground. As aircraft position data was not recorded on the FDR, it was not possible to determine the margin by which the aircraft cleared the ground as it climbed to re-establish on the correct approach path.

Originally, it was considered that the most likely reason for this incident was that the pilots had made a genuine mistake, unknowingly using the IOM VOR/DME rather than the ILS/DME I-RH to decide when to begin their descent to the airfield. However, later in the investigation the commander was insistent that he was fully aware of his actions, wishing to use the mistake as a training point for the first officer. It is considered that to knowingly take such action (on a scheduled passenger flight) was highly inappropriate and runs counter to accepted practices.

Safety action

The AAIB investigated several similar incidents in

1998. At that time, Runway 08 was not equipped with an ILS and the secondary surveillance radar information for the airport was not recorded. The AAIB report concerning these incidents (1/2000) made nine safety recommendations, two of which are relevant to this incident.

Safety Recommendation 99-55

It is recommended that the Isle of Man Government, Department of Transport, arrange for the installation of an Instrument Landing System facility for Runway 08 at the Isle of Man (Ronaldsway) Airport.

Safety Recommendation 99-56

It is recommended that the Isle of Man Government, Department of Transport, arrange for the Ronaldsway Airport Secondary Surveillance Radar data to be recorded and preserved for a suitable period of time.

In 2000, an ILS was introduced into service for Runway 08, although at the time of this incident the glide slope was out of service. In this instance, neither pilot had the correct approach aid selected. Had the normal ILS been available, the glide slope, or if the ILS frequency had not been correctly selected, the lack of a glide slope indication, would have acted as a significant prompt to both pilots that they had not reached the correct descent point. This incident highlights the potential for confusion when the wrong DME reference is used, where two separately located sources of DME are available. In such circumstances, the careful monitoring of aircraft on approach by ATC, which was the case here, continues to be vital.

Secondary surveillance radar (Mode C) remains un-recorded at Ronaldsway Airport: information that would have been of benefit to this investigation. The Airport Authority recognises this need and is considering the most practical way of incorporating a suitable facility into the existing infrastructure. This has not been achieved, to date, and it seems likely that the matter will be addressed during the construction of a new control tower, planned for 2008.

Safety Recommendations

The operator's procedure, for the non-handling pilot to use his VOR to confirm the aircraft's track relative to the ILS centreline, is protection against flying through the localiser at airfields where parallel runways exist; for this operator notably at Charles de Gaulle Airport in Paris. Whilst this allows a degree of improved situational awareness, it carries with it the risk of confusing the approach aids.

The genuine mis-selection of an approach aid is always a possibility in a busy aviation environment. To counter this possibility, flight crews are trained to monitor each other's actions and, if appropriate, challenge these actions. However, to deliberately deviate from established procedures on a scheduled flight, potentially hazarding the aircraft, raises concerns about the training and oversight of the flight crew conducting this flight.

Consequently, it was the AAIB's intention to make a safety recommendation to the French Regulator, the DGAC, suggesting an audit of the operator to ensure that their procedures and training for instrument approaches adhere to regulatory requirements and best practice. However, the DGAC have advised that, in July 2005, the operating company was sold to another owner and re-named and that, in December 2005, the new company's Air Operator's Certificate (AOC) was withdrawn by the DGAC *'due to unsafe operations'*. The company then ceased trading.

INCIDENT

Aircraft Type and Registration:	McDonnell Douglas MD-11, N701GC
No & Type of Engines:	3 GE CF6-80 turbofan engines
Year of Manufacture:	1991
Date & Time (UTC):	3 December 2005 at 0205 hrs
Location:	On approach to Nottingham East Midlands Airport
Type of Flight:	Commercial Air Transport (Cargo)
Persons on Board:	Crew - 3 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Certificate
Commander's Age:	57 years
Commander's Flying Experience:	25,000 hours (of which 2,500 were on type) Last 90 days - 242 hours Last 28 days - 83 hours
Information Source:	Field Investigation by the AAIB and a company investigation

Synopsis

The incident occurred during an approach to Nottingham East Midlands Airport when the crew were distracted and omitted to set the arrival QNH of 974 mb on any of the three altimeters despite having acknowledged the setting to ATC. When the crew levelled at 2,000 ft, ATC questioned the aircraft's pressure setting because the radar display indicated that the aircraft was much lower than cleared. At the time, the crew were visual with the approach lights.

History of the flight

The crew were on a flight from Cologne (Bonn) Airport to Nottingham East Midlands Airport with the first officer in the right cockpit seat as 'Pilot Flying' (PF). The commander, as 'Pilot Non-Flying' (PNF) was in the left cockpit seat and another first officer qualified pilot was seated on the 'Jump Seat'.

The flight was uneventful and the crew obtained ATIS information 'F' prior to descent. This included the information that the cloud was BKN at 2,500 ft amsl and that the QNH was 973 mb. The crew briefed for an ILS approach to Runway 27 and subsequently they all agreed that the QNH was included in the brief. Then, once the crew had checked in with 'East Midlands Approach' at FL80, the controller advised N701GC that the current ATIS was now information 'G'; the crew responded that they would check the latest information. The only

change from 'F' to 'G' was that the QNH had increased by 1 mb to 974 mb.

At 23 nm range, the aircraft was cleared by ATC to descend to 3,000 ft on the QNH of 974 mb. This clearance was correctly acknowledged by the crew who also requested and were given clearance to intercept the localiser on the aircraft's current heading. At about this time, the crew selected approach mode on the autopilot but the aircraft then started a turn to the left, which was away from the localiser centre-line. The crew reselected the required heading and then reselected the approach mode. Thereafter, the crew configured the aircraft for landing whilst closely monitoring the heading and localiser indication. As the aircraft descended to a new cleared altitude of 2,000 ft, the handling pilot stated that he had the PAPIs in sight. Then, once the crew had reported that the aircraft was established on the ILS, N701GC was transferred to 'East Midlands Tower'. When the crew checked in on 'Tower' with the information that they were established on the ILS, the controller asked for confirmation of the aircraft's altitude; the crew responded with 2,000 ft. ATC then asked the crew to check that 974 mb was set on the altimeter and the crew acknowledged the message. On the flight deck, the three altimeter settings were corrected and the subsequent landing was uneventful.

After landing, the crew discussed the event and then the commander telephoned ATC. He confirmed to ATC that they had received the correct pressure setting but that they had not set it on the altimeters which were, therefore, still on the standard setting of 1013 mb. The crew then contacted their company to report the event and completed the appropriate national reporting procedures.

Recordings

The AAIB were advised of the incident by the CAA on 14 December 2005, 11 days after the incident, following the submission of a Mandatory Occurrence Report (MOR). By then, no relevant information was available from the Flight Data Recorder or the Cockpit Voice Recorder. However, information was obtained from RTF and telephone voice recordings made available by East Midlands ATC, and from a radar recording of the Clee Hill area radar head made available by National Air Traffic Services.

The RTF voice recordings confirmed that the correct QNH was passed by ATC and acknowledged by the crew. Initial contact with 'East Midlands Approach' was at 0159 hrs and, at 0206 hrs the crew reported that they were established on the ILS and were then transferred to 'East Midlands Tower'. The initial call by the crew on 'Tower' was that they were "ESTABLISHED ON THE ILS" and ATC responded by asking for an altitude report and then questioning the altimeter setting. Thereafter, landing clearance was given and acknowledged at 0210 hrs.

When the 'Tower' controller had looked for the aircraft on handover, he had a visual impression that it was lower than normal and checked the Air Traffic Monitor (ATM) radar. This indicated the aircraft's altitude as 900 ft amsl at approximately 7 nm range and so the controller initiated the altitude check with N701GC.

The telephone recording confirmed that the commander contacted ATC at 0230 hrs to readily acknowledge that although the setting had been passed by ATC, the crew had not set the QNH.

The radar recording showed that the aircraft levelled at an altitude of 918 ft amsl (718 ft agl) at 7 nm from the

runway threshold and maintained that altitude until the glideslope was intercepted at just under 2 nm range.

Operational aspects

Crews were required to operate in accordance with the company 'Flight Crew Operating Manual'. Relevant procedures were as follows:

1. The PF calls for the 'Descent/ Approach' checklist 'to the line' at or prior to the top of descent. The checks 'below the line' comprise 'Altimeters' and 'Exterior Lights'.
2. For altimeters, the crew are required to set the QNH on the primary and standby altimeters at transition level.

The crew of N701GC confirmed that they completed the 'Descent/ Approach' checklist 'to the line' but acknowledged that they were distracted and did not complete the rest of the check. The commander also commented that ATC did not inform the crew of the transition level.

Two of the MD 11s in the company fleet have an automated radar altimeter callout at 1,000 ft. N701GC was not equipped with this feature. There was no company requirement to call when the radar altimeter became 'Alive'. All company MD 11s are equipped with automated callouts at intervals from "APPROACHING MINIMUMS" to "TEN FEET". Additionally, all company aircraft have GPWS installed and the crew confirmed that the system had been tested as serviceable prior to take off at Cologne.

The transition level throughout continental USA is FL180. Within the UK, the transition altitude is 3,000 ft unless otherwise notified.

The Manual of Air Traffic Services (MATS) Part 1 required that controllers were not to pass information on transition level to crews unless the crews asked for the information. It also required controllers to include the appropriate QNH in any transmission when an aircraft was cleared from a flight level to an altitude. Thereafter, all reference to vertical position was to be in terms of altitude until the aircraft commenced final approach.

The Jeppesen STAR[1] chart, dated 23 September 2005 for Nottingham East Midlands contained notes to the effect that the transition altitude was 4,000 ft and that the transition level would be given by ATC. This information on the transition level was also included in the UK Aeronautical Information Publication (AIP) STAR charts for most major UK airports.

Company actions

On receipt of the commander's report, the company removed the crew from flying status and required them to undergo additional ground and simulator training before subjecting them to a 'Line' check. The crew were also required to develop and conduct a briefing for other company crews on the incident, including appropriate 'lessons learnt'. The company concluded that the crew had been distracted from primary aircraft control by a navigation problem, with a subsequent loss of situational awareness.

Additionally, the company circulated a Flight Operations Bulletin 1205-03 dated 27 Dec 05 to all crews. This included a comprehensive summary of the incident and concluded that fixation on a particular problem had led to a deviation from Standard Operating Procedures (SOPs). The Bulletin also emphasised the importance of the following:

Footnote

[1] Standard Terminal Arrival Route

1. The completion of all checklists as a crew and ensuring that each checklist was complete before moving to the subsequent checklist. In particular, when the 'Descent/ Approach Checklist' had only been completed 'to the line' the checklist should not be re-stowed until the actions 'below the line' had been requested and completed.
2. The setting of QNH once ATC had cleared the aircraft to an altitude.
3. Inclusion of the radar altimeter in each crew member's 'scan', thereby maintaining good vertical awareness.

At a subsequent regular safety meeting in February, the company reviewed the incident and considered the following additional aspects:

1. It was noted that the crew had informed ATC that N701GC was established on the ILS when they were only established on the localiser. It was agreed that the training department would emphasis the correct terminology during recurrent ground school when discussing the Flight Operations Bulletin.
2. The possible inclusion of a "RADALT ALIVE" call during any approach. This was decided against because of the many airports into which the company operates and the fact that some involved undulating terrain which would require more than one such call.
3. A change of procedure to set the QNH on the standby altimeter once the destination airfield pressure setting had been obtained from ATIS information. However, the company decided not to incorporate this as a company procedure but to leave it as an individual crew technique.

Full assistance was provided to the AAIB by the operating company during the investigation.

Analysis

The incident resulted from an omission by the crew to set the QNH on the altimeters even though it was correctly passed by ATC and acknowledged by the crew. Shortly after acknowledging the correct QNH, the crew noticed the aircraft, on autopilot, turning away from the expected heading. Thereafter, their attention was primarily on monitoring the aircraft's lateral position and no-one realised that the 'Descent/ Approach' checklist had not been completed. At night and in sight of the PAPIs, it would then have been difficult for any of the crew visually to appreciate that they were much lower than required by the procedure. Furthermore, the two main and the single standby altimeters would have indicated the same altitude and raised no concerns. The main indication of a discrepancy available to the crew would have been the radar altimeter and it was therefore apparent that the instrument had not been part of any crew member's 'scan'.

The radar recording confirmed that the aircraft remained at a level altitude, albeit more than 1,000 ft lower than required, until glideslope intercept. Close monitoring and effective action by the 'Tower' controller enabled the true situation to be identified and resolved. Whilst there was no possibility of the incident progressing to an accident, the investigation, by both the company and the AAIB, indicated ways to reduce the probability of a similar incident.

The investigation and action by the operating company were thorough and ensured that all their crews were fully aware of the incident together with the factors involved. The importance of ensuring that appropriate checklists are fully completed has also been re-emphasised

together with the need for the radar altimeter to be included in the 'instrument scan'.

During the investigation, it was noted that there was a discrepancy between the instructions within MATS Part 1 and the information included on the approach charts for some UK airfields. Although this discrepancy was not considered pertinent to the incident involving N701GC, the Directorate of Airspace Policy has been informed.

ACCIDENT

Aircraft Type and Registration:	Cessna 152, G-IAFT
No & Type of Engines:	1 Lycoming O-235-N2C piston engine
Year of Manufacture:	1981
Date & Time (UTC):	26 April 2006 at 1057 hrs
Location:	Newtownards, County Down, Northern Ireland
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Extensively damaged
Commander's Licence:	Private Pilot's Licence
Commander's Age:	35 years
Commander's Flying Experience:	76 hours (of which 71 were on type) Last 90 days - 6 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

Following a normal approach the aircraft 'ballooned' during the flare and stalled shortly after the pilot raised the flaps during the go-around. The left wing tip struck the ground and the aircraft was extensively damaged. The pilot and passenger sustained minor bruising.

History of the flight

This was the first flight that the pilot had flown since receiving his PPL licence and the first time that he had taken a passenger flying. The pilot stated that he made a normal approach to Runway 22 at Newtownards, at a speed of 65 kt, and at 300 ft aal selected 3 stages of flap (30º) and moved the carburettor heat to COLD. The pilot continued the descent into the flare and as the wheels were just about to touch down the aircraft 'ballooned' and so the pilot selected full power and commenced a go-around. The pilot reported that the engine appeared slow to respond and the aircraft initially adopted a level attitude before starting to climb. He then raised the flaps by one stage and shortly afterwards became aware that the airspeed was rapidly decreasing. He, therefore, attempted to lower the aircraft's nose, but before he could regain airspeed the left wing dropped, struck the ground and the aircraft turned over onto its back. The pilot and passenger, who both suffered minor bruising, vacated the aircraft through the normal exists. Both the airport and local fire service attended the scene of the crash.

The CFI of the pilot's flying club saw the aircraft commence its go-around and commented that it was

flying slowly approximately 10 to 15 ft off the ground in a nose high attitude. The aircraft drifted to the left of the runway then appeared to stall and enter an incipient spin to the left. The left wing and nose impacted the ground and the aircraft slid along the ground for a short distance before it turned over onto its back.

The pilot reported that the weather at the time of the accident was good with a wind velocity of 220º to 240º at a steady 10 kt.

Assessment of aircraft and ground marks

The CFI and an engineer from the maintenance organisation that recovered the aircraft reported that after the accident the throttle was found in the fully open position and the flaps and flap selector were found in the fully retracted position; photographic evidence confirmed that the flaps were fully retracted. The engineer also stated that ground marks and damage to the aircraft was consistent with the left wing striking the ground and the aircraft sliding for approximately 60 metres before the nose dug into the grass causing the aircraft to turn over onto its back. The engineer assessed the aircraft as being damaged beyond economical repair.

Description of flaps

The C152 is equipped with slotted flaps that are electrically operated and can be moved to one of three stages corresponding to 10º, 20º and 30º. The flap selector lever is mounted on the instrument panel adjacent to the throttle and the slot in which it moves has two indentations that restrict the movement of the selector lever when the flaps are extended. Movement of the flaps to the first stage (10º) requires the pilot to move the selector lever vertically down, whereas selection of second and third stage of flap requires the pilot to first move the selector lever to the right before it is moved down. However, there is no restriction on the upward movement of the flap selector lever and it is possible for a pilot who intended to move the flaps from 30º to 20º to inadvertently move the selector lever to the fully retracted position.

Comments

Whilst no inspection of the engine was undertaken to determine if it was operating correctly, damage to the propeller blades and cut marks in the ground indicate that the engine was producing some power when the propeller struck the ground. Moreover, there was sufficient runway remaining for the pilot to land the aircraft without having to go around.

A characteristic of the C152 is that if a go-around is attempted with 30º of flap selected then a considerable trim change occurs when full power is applied. Therefore one of the immediate actions for a go-around is to retract the flaps from 30º to 20º, which not only reduces the control forces but also improves the climb performance of the aircraft.

The pilot had been taught that the correct procedure following 'ballooning' was to commence a go-around without delay and to this end he selected full power and moved the flaps from 30º to 20º. However, witnesses and photographs taken immediately after the accident indicate that it is likely that when the aircraft stalled the flaps were in the fully retracted position. It is therefore probable that in undertaking the go-around the pilot inadvertently retracted the flaps and then continued the climb at an airspeed that was too low for the configuration of the aircraft.

Since the accident the pilot has undergone further training in slow speed flight and go-around procedures.

ACCIDENT

Aircraft Type and Registration:	Cessna 172R, G-EGEG
No & Type of Engines:	1 Lycoming IO-360-L2A piston engine
Year of Manufacture:	2000
Date & Time (UTC):	6 June 2006 at 1730 hrs
Location:	Strathallan Airport (Airfield), Auchterauder, Perthshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 3
Injuries:	Crew - None Passengers - None
Nature of Damage:	Wing leading edges and nose landing gear spat damaged
Commander's Licence:	Private Pilot's Licence
Commander's Age:	67 years
Commander's Flying Experience:	1,777 hours (of which 1,760 were on type) Last 90 days - 34 hours Last 28 days - 16 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft, with four people on board, touched down approximately 100 m into Runway 10 at Strathallen, which is 600 m in length. Due to a combination of the aircraft's high weight and a light headwind, the aircraft did not slow down as expected. Initially, a go-around was attempted but the aircraft collided with the boundary fence, ran across a field and down a slope, where it was stopped by a row of trees. The occupants sustained no injuries.

History of the flight

The pilot had taken his wife and two other relatives on a two hour sight-seeing flight in the Fort William area. On returning to Strathallan, he confirmed from his GPS receiver that the local winds were light and variable, and that the circuit was clear. After a long final approach, the aircraft landed approximately 100 m along Runway 10, which is a 600 m long grass surface. Despite raising the flaps and braking hard, the aircraft ran on more than the pilot expected. Worried by his proximity to the approaching boundary fence, the pilot re-applied power in an attempt to go-around, but there was insufficient distance remaining. The aircraft passed through the fence, following which the engine was shut down, and ran across an adjacent field and down a slope, coming to rest after colliding with a line of trees. All of the occupants were uninjured and vacated the aircraft normally. The nose landing gear spat was damaged as

were the inner portions of the wing leading edges where they had hit the trees. There was no fire.

The pilot reported that he usually operated the aircraft solo and attributed the accident to the aircraft having more momentum than expected, and increased ground speed on touch-down due to the lack of head wind.

INCIDENT

Aircraft Type and Registration:	DHC-1 Chipmunk 22A, G-AORW
No & Type of Engines:	1 De Havilland Gipsy Major 10 Mk 2 piston engine
Year of Manufacture:	1950
Date & Time (UTC):	25 February 2006 at 1340 hrs
Location:	Prestwick Beach, Ayrshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Engine crankshaft failure
Commander's Licence:	Private Pilot's Licence
Commander's Age:	46 years
Commander's Flying Experience:	775 hours (of which 103 were on type) Last 90 days - 5 hours Last 28 days - 4 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft was returning to Prestwick from the northwest when, without warning, the engine stopped. It was approximately 0.5 miles offshore with insufficient height to glide to the runway and, with a built up area immediately ahead, the pilot elected to carry out a forced landing on Prestwick Beach. Later examination revealed that the engine had suffered a failure of the crankshaft and that, possibly, this had been influenced by the aircraft's previous use for aerobatics and in air racing.

History of the flight

The aircraft had departed Prestwick earlier in the day for a flight to the island of Islay with two on-board; the passenger was also an experienced Chipmunk pilot. The aircraft returned to Prestwick from the northwest with the intention of joining base leg for Runway 03. During the completion of the pre-landing checks, all engine temperatures and pressures were observed to be normal, but a slight vibration was felt through the airframe. Approximately 15 seconds later, without warning, the engine stopped. The aircraft was too low to glide to the runway, and the presence of buildings precluded a landing 'straight ahead', so the pilot carried out an forced landing on an unoccupied section of Prestwick Beach. The aircraft was later recovered to a hangar on the airfield where it was determined that the engine's crankshaft had failed close to the No 2 piston location. The engine was removed and transported to a repair agency where it was stripped in the presence of the AAIB.

Gipsy Major 10 Mk 2 history

In the late 1950's, Bristol Siddeley Engines Ltd, the Type Certificate holder at that time, carried out a series of tests to determine the cause of numerous crankshaft failures on civil and military registered Chipmunks. The test reports indicated that engines subjected to *'comparatively short periods of abnormal operation'* (eg, aerobatic manoeuvres) were susceptible to cracking and failure in the region of the No 2 or No 3 crankpin webs. The average crankshaft life at failure was 850 hours. Three modifications (Mods) were introduced to minimise the possibility of further failures:

- Mod 2602 introduced a crankshaft of different material and surface hardened.
- Mod.2661 retarded the ignition timing of engines fitted with the original crankshaft.
- Mod 2675 introduced a slow running cut off valve to prevent backfiring during shutdown.

All three modifications were embodied on civilian engines passing through Bristol Siddeley's facilities from 1960 but only Mod 2675 was embodied on military engines, until late 1967, when the remaining two modifications began to be embodied.

During the 1960's and 1970's large numbers of Chipmunks entered civilian hands as military operators disposed of their aircraft. The modification embodiment policy for military engines meant that a large number of engines probably entered civilian operation without Mods 2602 and 2661 incorporated. As military operation of the type decreased, spares provisioning was scaled down and production of new crankshafts for this engine ceased in the early 1970's. Replacements can now only be obtained from spares holdings or recovered from dismantled engines. Present day maintenance organisations involved with the engine type have confirmed that crankshafts introduced by Mod 2602 are particularly scarce.

There are currently 125 Gipsy powered Chipmunks on the UK register and, based on information provided by overhaul agencies, it is estimated that approximately 50% of these may have pre-Mod 2602 crankshafts installed. The Type Certificate holder for this model of engine are aware of two similar failures in the last ten years.

Engine examination

The crankshaft had failed immediately aft of the second main-bearing journal. An initial assessment indicated that the failure initiated in the radius between the second main journal and the forward web of the No 2 crank throw. Oil was present on all of the bearing surfaces, the oil passageways were free from obstruction and the crankshaft journals showed no evidence of overheating. Mechanical damage to No 2 and No 3 bearings prevented any assessment of their pre-failure condition; however, the condition of the remaining bearings indicated that that they had been serviceable prior to the failure. Dimensional checks of the crankshaft journals confirmed that the crankshaft had not been re-ground since manufacture. Damage to the accessories drive gear train prevented the ignition timing from being checked but records confirmed that the timing had been retarded in accordance with Mod 2661. Due the scarcity of new spares, crankshafts are usually re-worked rather than replaced, and it is standard practice for engine overhaul organisations to retard the ignition timing, in accordance with Mod 2661, whenever a pre-Mod. 2602 crankshaft is installed. The part number of the crankshaft from G-AORW confirmed that it was of the type superseded by Mod 2602.

The current overhaul life of a Gipsy Major engine is 1,500 hours, with aircraft utilisation typically between 40 and 100 hours per year. This can, as in this case, result in a calendar time between overhauls of over 20 years. A review of the engine log book showed that it had been installed in May 1984 and that the engine had operated for approximately 1,000 hours prior to the failure. The total life of the crankshaft at the time of installation was not determined

Laboratory analysis revealed that the crankshaft failure resulted from crack progression by a high cycle fatigue process. However, the initiation site could not be identified due to smearing of the fracture surface as the failure occurred. Microsections taken from the crankshaft showed that there were no material abnormalities or corrosion present, and also that the crankshaft had not been subject to surface hardening.

The current aircraft owners reported that, prior to its purchase, the aircraft been used for performing aerobatics manoeuvres and had taken part in 'air races'. Due to a combination of airframe g loading, high power demands and gyroscopic forces from the propeller disc, such flights dramatically increase the bending loads experienced by the crankshaft.

Conclusions

Despite the calendar time since the engine last overhauled, there was no evidence, particularly the absence of any corrosion associated with the fracture, to suggest that this extended period contributed to the crankshaft failure. However, the results of the tests carried out in the late 1950's indicated that pre-Mod 2602 crankshafts, of the standard fitted to G-AORW, were susceptible to cracking, and subsequent failure, when subject to *'comparatively short periods of abnormal operation'*. Although the operational history of the crankshaft fitted to G-AORW could not be fully established, it is possible that the aircraft's earlier operation in air races and use for aerobatics contributed to the failure.

INCIDENT

Aircraft Type and Registration:	1) Extra 300, G-OFFO 2) Extra 300, G-ZEXL
No & Type of Engines:	1) 1 Lycoming AEIO-540-L1B5 piston engine 2) 1 Lycoming AEIO-540-L1B5 piston engine
Year of Manufacture:	2006
Date & Time (UTC):	26 March 2006 at 1110 hrs
Location:	15 miles NW of North Weald
Type of Flight:	Private
Persons on Board:	1) Crew - 1 Passengers - 1 2) Crew - 1 Passengers - None
Injuries:	1) Crew - None Passengers - None 2) Crew - None Passengers - None
Nature of Damage:	1) G-OFFO Propeller tip damage 2) G-ZEXL Propeller impact to right wing
Commander's Licence:	1) Private Pilot's Licence 2) Private Pilot's Licence
Commander's Age:	1) 40 years 2) 34 years
Commander's Flying Experience:	1) 4,300 hours (of which 15 were on type) Last 90 days - 40 hours Last 28 days - 20 hours 2) 3,000 hours (of which 5 were on type) Last 90 days - 37 hours Last 28 days - 19 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The pilots of the two aircraft were carrying out formation flying training. With the two aircraft in an echelon right formation the pilot of the lead aircraft initiated a turn to the right. The propeller of the formating aircraft and the right wing of the lead aircraft made contact, causing damage to the propeller and the wing structure. Both aircraft remained in a safe flying condition and precautionary landings were made at North Weald.

General

It was intended to carry out a 'photo shoot' of a formation of four aircraft on the afternoon of the day of the incident. This would involve close formation flying, using four Extra 300 aircraft, flown by pilots experienced in formation aerobatics. The formation flying would include a position described as a 'deep echelon'. This involved the formating aircraft flying approximately 10 ft below the lead aircraft, slightly out to one side and

stepped back; in this formation position the structure of the formating aircraft overlaped that of the lead aircraft.

In order to establish the correct visual references for the 'deep echelon' position the pilot who was to be the leader of the four aircraft formation, flying G-OFFO ('FO'), elected to carry out a training flight. During this flight he would formate his aircraft on another aircraft, G-ZEXL ('XL'), and when in the correct position he would record the references for the other pilots.

A Harvard aircraft located at North Weald Airfield was to be used as the photographic platform. 'FO' and 'XL' were flown from Sywell Airfield to North Weald and their pilots conducted formation training en-route, before landing and briefing the Harvard pilots. Because of the limited flying time available to the pilots they decided to record the references required for the 'deep echelon' position during the return flight to Sywell.

History of the flight

Prior to departing Sywell, the two pilots had carried out a comprehensive brief for the conduct of the sortie to North Weald and the simulated 'photo shoot' on the return flight to Sywell. Both pilots were wearing parachutes in accordance with their normal practice.

The weather was good with the surface wind from 220º at 15 kt gusting to 20 kt, and the 2,000 ft wind from 250º at 40 kt. Visibility was in excess of 10 km, there was no significant weather and the cloud was scattered at 2,500 ft. Moderate to severe turbulence was associated with the strong and gusting winds at the lower levels.

The outbound sector to North Weald was uneventful and various formation manoeuvres were practised. The aircraft transited at an altitude of 1,500 ft where they encountered moderate turbulence, but this did not create any significant difficulties during the formation flying. The aircraft made a normal arrival and landing at North Weald.

The pilots of the Extra 300 aircraft conducted a briefing for the return flight with the two pilots who were to fly the Harvard. The transit would again be at 1,500 ft with the Harvard leading the formation. The Harvard pilots would be responsible for navigation and radio communication. This would leave the Extra 300 pilots free to rehearse the positioning for the simulated photo shoot and allow the pilot of 'FO' to establish the visual references required for the 'deep echelon' position.

The three aircraft departed North Weald with the Harvard leading. 'FO' was in loose 'echelon right' and 'XL' was in loose 'echelon left'. When the formation was level at 1,500 ft and clear of built up areas, the pilot of 'FO' transmitted that he would re-position on the left side of the Harvard with 'XL'. He initially moved into long line astern behind that aircraft, at approximately 100 m, before moving into close line astern and then 'deep echelon right'. As he moved into position, the pilot of 'FO' believed that the pilot of 'XL' was aware that he was in the 'deep echelon right' position; however, this belief was erroneous. Meanwhile, the moderate turbulence generated a certain amount of wing rocking which required constant control inputs in an attempt to maintain the required flight path.

The pilot of 'XL' needed to move closer to the Harvard in order to reduce the distance between the aircraft for the simulated photo shoot and he banked his aircraft to the right. The pilot of 'FO' did not detect the initiation of this movement, which was masked by the turbulent conditions. When the pilot of 'FO' realised that 'XL' was turning to the right, he immediately pushed the control column forward in an attempt to avoid the

other aircraft. The propeller of 'FO' contacted the right wing tip of 'XL', just forward of the aileron leading edge, penetrating the full depth of the wing structure (Figure 1). Both aircraft turned back to North Weald and, having confirmed that no damage had been sustained to the flight controls, completed a precautionary landing.

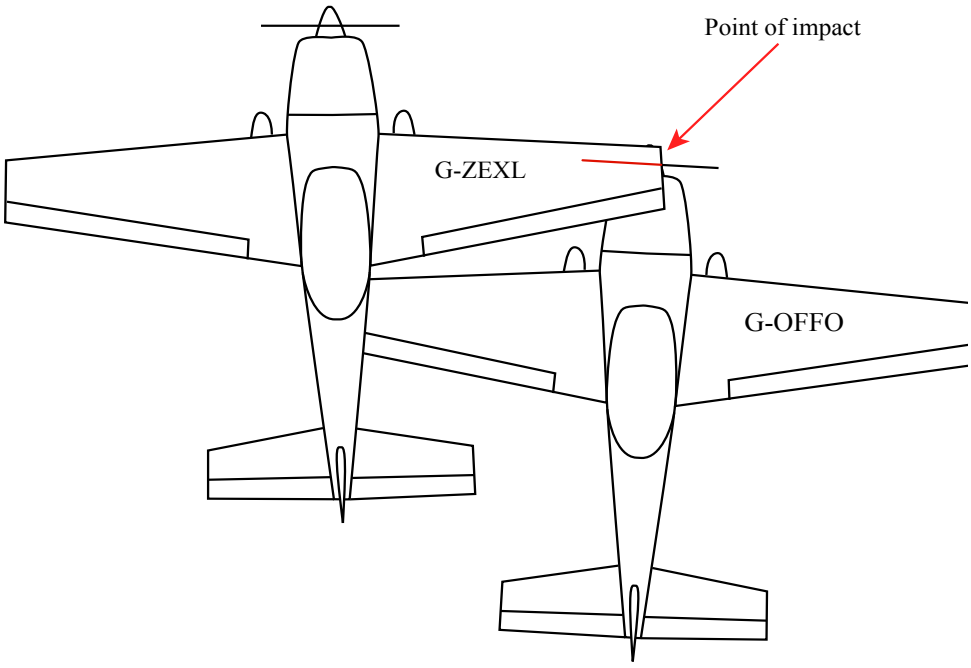


Figure 1

Analysis

Whilst both pilots were very experienced in formation flying they had only recently converted to the Extra 300 and were still becoming accustomed to its characteristics. They had considered each of the manoeuvres that they were to carry out and had briefed how they would conduct the sortie. However, the particular exercise of 'FO' moving into the 'deep echelon right' position had not been specifically briefed. The pilot of 'XL' had expected to take up his position relative to the Harvard prior to 'FO' adopting the 'deep echelon right' position. He was therefore unaware of the close proximity of the other aircraft below and to his right when he initiated the turn towards the Harvard.

Both pilots agreed that the primary cause of the incident was a breakdown in communication. The pilot of 'XL' was not aware of the position of the other aircraft and thought that he was clear to turn to the right. This situation occurred because the pilot of 'FO' had not fully communicated his intention to take up the 'deep echelon right' position, merely that he would reposition to the left of the Harvard; furthermore, the sequence of this re-positioning had not been briefed. The pilot of 'FO' was conscious of the need to maintain good RT discipline and had attempted to keep his transmissions to a minimum.

The two pilots believed that other contributory factors included the gusty wind conditions causing the wing rocking motion, which masked the initial turn to the right, and the need to complete the sortie objectives within the limited flying time available, which may have introduced an expeditious approach to the formation change to the 'deep echelon' position.

Having considered all the factors of this accident the operator has introduced safety actions to improve the briefing process and RT procedures, as well as adopting a more measured approach to formation training.

ACCIDENT

Aircraft Type and Registration:	Fournier RF4D, G-AVKD
No & Type of Engines:	1 Volkswagen Rectimo 4AR-1200 piston engine
Year of Manufacture:	1967
Date & Time (UTC):	31 January 2006 at 1500 hrs
Location:	Lasham Airfield, Hampshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Propeller broken, engine tested for shock load
Commander's Licence:	Private Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	429 hours (of which 155 were on type) Last 90 days - 11 hours Last 28 days - 4 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional enquiries by the AAIB

Synopsis

The aircraft landed on a grass runway with the main landing gear retracted. The pilot believes that he became 'out-of-phase' with the gear position and selected UP when he intended to select DOWN.

Description of the landing gear mechanism.

The Fournier RF-4 uses a manually-retractable single mainwheel with fixed outriggers and a tailwheel. The wheel is raised and lowered by a lever on the right side of the cockpit (see Figure 1): the lever is vertical when the gear is fully down and the pilot moves it aft and down to retract the wheel. In either the UP or DOWN position a locking lever on the right side of the centre console is engaged to lock the wheel in that position. This locking lever is released by a small lever at the front of the mechanism. Thus, to select UP, the pilot retracts the detent, moves the locking lever aft and then pulls the Raise/Lower lever aft until it is lying almost horizontally alongside the seat. The UP lock is then engaged.

History of the flight

The pilot had recently returned to the syndicate which owned the aircraft after an absence of several years. During a local flight, he noticed that his map had been trapped underneath the landing gear Raise/Lower lever, so he released the landing gear lock, which allowed the single wheel to swing freely down under gravity and the lever to move forwards, releasing the map. He then

recalls locking the landing gear but does not remember moving the Raise/Lower lever to retract it first.

During the downwind checks, he believed he had lowered the landing gear, but, upon touchdown on the grass strip, it was evident that it was retracted. The aircraft came to rest with minimal damage. In a prompt and frank statement, he concedes that he had probably flown with the gear locked down and, when it came to extend it before landing, he simply operated the Raise/Lower lever to reverse its previous position, even though this retracted the gear. He pointed out that the positions were not labelled, but doubts whether this would have prevented the error.

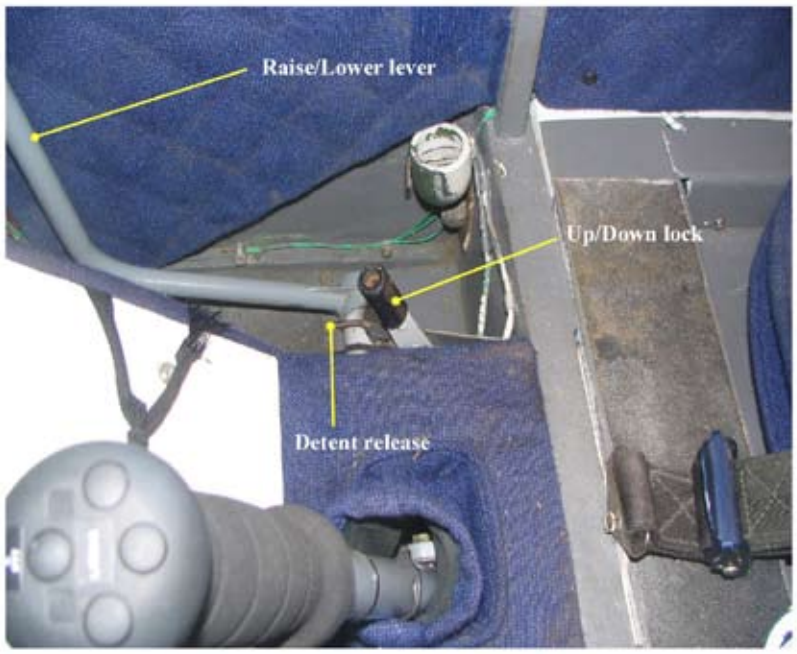


Figure 1
Landing gear controls, G-AVKD

ACCIDENT

Aircraft Type and Registration:	Jodel D117A, G-ASJZ
No & Type of Engines:	1 Continental Motors Corp C90-14F piston engine
Year of Manufacture:	1958
Date & Time (UTC):	10 June 2006 at 1446 hrs
Location:	Old Buckenham Airfield, Norfolk
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to propeller blades, right wing, landing gear and engine underside
Commander's Licence:	Private Pilot's Licence
Commander's Age:	71 years
Commander's Flying Experience:	827 hours (of which 357 were on type) Last 90 days - 12 hours Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

During the landing flare the aircraft experienced a gust and drifted over the left edge of the runway. The pilot attempted a go-around but this was unsuccessful and the aircraft touched down on rough ground to the side of the runway.

History of the flight

The aircraft was landing at Old Buckenham Airfield following a group of visiting aircraft that had already landed successfully. Old Buckenham Airfield has three runways; one grass Runway 02/20 and two Runways 07/25, one grass and the other asphalt. G-ASJZ was using asphalt Runway 07 which has a Landing Distance Available (LDA) of 640 m and a 2% upslope. The wind broadcast via the Air/Ground radio station was 120º/12 kt.

The pilot reported a significant crosswind from the right and he used a 'crab' technique to offset the aircraft heading and track down the extended runway centreline. Just prior to crossing over the runway threshold, the pilot aligned the aircraft heading with the runway centreline using rudder and maintained the track along centreline with a wing down technique. While still airborne, having travelled around 140 m along the runway from the threshold, the aircraft experienced a rapid drift which took it over the left hand edge of the runway. The pilot attempted to go-

around by applying full power and turning the aircraft into wind to bring it back over the runway. However, this did not prevent the aircraft from touching down on rough ground to the left of the runway, approximately 240 m from the runway threshold. The aircraft slewed around in an anticlockwise direction, collapsing the landing gear, removing the propeller tips and tailwheel, and causing damage to the underside of the engine and the right wing. The aircraft came to rest 100 m from the left hand side of the runway facing back towards Runway 07 threshold. Both the pilot and passenger were uninjured and exited the aircraft unaided.

Discussion

The pilot attributed the cause of the accident to a sudden gust. The poor climb capability of the Jodel at low speed and over an uphill slope prevented a successful go-around manoeuvre. The outside air temperature was 25º to 27ºC which would also have affected the climb performance. He also considered it was possible that he may have inadvertently applied some nose-up elevator in an attempt to clear the ground which could have stalled the aircraft whilst still airborne.

ACCIDENT

Aircraft Type and Registration:	Piper L21B Super Cub, G-BMKB
No & Type of Engines:	1 Lycoming O-290-D2 piston engine
Year of Manufacture:	1954
Date & Time (UTC):	6 April 2006 at 1400 hrs
Location:	Redhill Aerodrome, Surrey
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Right elevator damaged
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	62 years
Commander's Flying Experience:	17,081 hours (of which 1,560 were on type) Last 90 days - 13 hours Last 28 days - 8 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

The aircraft was taxiing back to the hangar area after landing when its right elevator made light contact with a holding point marker board, tearing the elevator's fabric surface. This was the second ground accident within five months, involving this marker board, which the AAIB have investigated. The marker board is correctly constructed, positioned and its presence has been well promulgated.

History of the flight

The aircraft, which has a tail wheel, had landed on Runway 26R and been cleared to taxi to Hangar 8 - to the west of the threshold for Runway 18 - via Taxiway A and across the northern end of the grass Runway 18, which was not in use. While manoeuvring for a parking place in front of Hangar 8, the pilot temporarily lost sight of the G3 marker board, which is situated at the holding point on the west side of the displaced threshold for Runway 18. The aircraft's right elevator made light contact with the marker board, causing a 10 cm tear in the fabric of the elevator.

The pilot reported that, when Runway 26 is in use, the grass area between Taxiway A and Hangar 8, across Runway 18, becomes a very busy thoroughfare. He stated that pilots of aircraft returning to the hangar, in those circumstances, are presented with the rear view of the G3 marker board, set against a background of parked

and manoeuvring aircraft and open hangar doors. He also stated that the marker board is only some 25 to 30 m from the parking area in front of the hangar and, when viewed side-on from the north or south, being 10 cm wide, can easily be lost from sight.

Previous accident

AAIB Bulletin: 6/2006 included a report on an accident on 19 November 2005, involving a Stampe SV4C(G), registration G-BWEF, which also struck the G3 marker board while manoeuvring on the ground. That investigation confirmed that the marker board, which had been installed in August 2005, was correctly constructed and positioned at the holding point for Runway 18 and that information about it had been widely disseminated.

The investigation also revealed that the aerodrome Users' Committee had been suspended in 2004 and that, since then, changes to aerodrome procedures or layout had been communicated to all Redhill based users and groups through e-mails. The report recommended that:

> *Redhill Aerodrome Limited establishes a programme of regular formal meetings with flying organisations based at the aerodrome to discuss and monitor operating procedures.*

In response to that recommendation the aerodrome operator stated:

> *'Redhill Aerodrome Limited will consult with the based flying training organisations as to the benefits of re-establishing the User's Committee in addition to the consultation/notification presently undertaken by e-mail and the Redhill Aerodrome web site'.*

Subsequent actions

As a result of these two collisions the aerodrome manager has amended the taxi routes for fixed wing aircraft; these amendments have been promulgated in the Aerodrome Operator's Circular. These routes will be used for the remainder of the summer. In addition, a Users' Meeting has been planned for 20 September 2006, immediately prior to a consultative committee meeting.

ACCIDENT

Aircraft Type and Registration:	Piper PA-18-180 Super Cub, G-BEUA
No & Type of Engines:	1 Lycoming O-360-A4 piston engine
Year of Manufacture:	1964
Date & Time (UTC):	8 April 2006 at 1100 hrs
Location:	Dunstable Airfield, Bedfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Right landing gear collapse
Commander's Licence:	Private Pilot's Licence
Commander's Age:	48 years
Commander's Flying Experience:	294 hours (of which 46 were on type) Last 90 days - 7 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and report by repair organisation

Synopsis

After landing, with very little forward speed, the right wing dropped and the wing tip touched the ground. The attachment lug for the left side of the inverted 'A' frame landing gear support had failed, as a result of a fatigue mechanism, allowing the landing gear to collapse.

History of the flight

The aircraft had landed after completing its second glider tow of the morning when, at low ground speed, the right wing dropped and the wing tip hit the ground. The engine was shut down with the propeller remaining clear of the ground. After leaving the aircraft, the pilot found that the left fuselage attachment lugs for the under-fuselage 'A' frame had failed, causing the right landing gear to collapse.

Aircraft history

The aircraft had been operating from Dunstable, almost exclusively involved in glider towing operations, since 1979. It had been completely refurbished in December 1992. At the time of the incident, the aircraft had completed 11,750 flying hours and approximately 58,000 landings.

In July 1994, the aircraft suffered a similar failure of the left 'A' frame, see AAIB Bulletin 9/94. An examination

of the failed components revealed that the attachment lugs had failed due to a fatigue mechanism. At that time, the aircraft had completed 8,790 hours and approximately 36,700 landings.

Examination

The 'A' frame is attached to the lower fuselage steel tube longerons at a fitting, with an aft and forward lug, welded to the tubes. A detailed examination of the failed components was carried out by the engineer who had been involved in the investigation of, and rectification of, the 1994 landing gear collapse. He reported that the entire fracture surface of aft lug was discoloured, whereas only 75% of the fracture surface of the forward lug was discoloured.

Each lug is thickened on their inner face by the addition of a washer around the 'A' frame attachment bolt hole, which is welded in position. The weld bead extends around the outer 2/3 of each washer. The nature of the fracture surfaces indicated that cracks in both lugs had progressed as a result of a fatigue mechanism. The rear lug appeared to have failed completely, before the remaining un-cracked portion of the forward lug failed in overload. The origin of the both cracks appeared, as in the 1994 event, to have been close to the run-out of the weld beads holding the washers in place, where significant stress concentrations can be expected.

Since the replacement of the attachment lugs in 1994, the aircraft had carried out approximately 21,300 landings. The geometry of the joint between the 'A' frame and the attachment lugs is such that a crack in this area is unlikely to be detected visually during a daily inspection or 50 hour check, particularly since the area is prone to contamination by oil, dust and dirt. The surface of the field at Dunstable, whilst entirely suitable for gliding and glider towing operations, is not as smooth as most airfields used by powered aircraft and, as such, the landing gear of an aircraft regularly operating from such a surface would be expected to sustain higher loads than when operating from a paved surface.

ACCIDENT

Aircraft Type and Registration:	Piper PA-32-260 Cherokee Six, G-BHGO
No & Type of Engines:	1 Lycoming O-540-E4B5 piston engine
Year of Manufacture:	1978
Date & Time (UTC):	11 December 2005 at 1300 hrs
Location:	Eshott Airfield, Northumberland
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 4
Injuries:	Crew - None Passengers - 1 (Serious) 1 (Minor)
Nature of Damage:	Damage to fuselage, wing, horizontal stabiliser, engine, propeller and landing gear (beyond economic repair)
Commander's Licence:	Private Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	390 hours (of which 12 were on type) Last 90 days - 12 hours Last 28 days - 0.5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

Following a normal landing on a paved runway in gusty wind conditions, the aircraft veered to the left and departed the side of the runway without the pilot being able to regain control. The aircraft hit an embankment and three fence posts, damaging the aircraft and causing a serious spinal injury to one of the passengers. The cause of the loss of control on the ground could not be established but the gusty wind, the pilot's distraction during the approach, or an accidental control input could have been contributory factors.

History of the flight

On the day of the accident the pilot decided to take four passengers on a scenic flight from Eshott to Newcastle Airport and then return to Eshott via the bridges over the River Tyne. The passenger in the right front seat had not flown in a light aircraft before but he was keen to conquer his fear of flying and was considering taking flying lessons. The pilot believed that he briefed him not to touch the control yoke or the rudder pedals, although the passenger did not recall such a briefing. The pilot commented that it was a "bit bumpy" during the flight to Newcastle, due to turbulence caused by strong wind, and after landing the pilot and passengers went for coffee at the airport.

The pilot and the front-seat passenger later provided differing reports of what occurred during the flight to Newcastle and the return flight to Eshott, which did not include flight over the bridges on the River Tyne. Without recorded data or independent witnesses it was not possible for the AAIB to reconcile the reports and neither version provided a direct explanation of the landing accident.

Arriving back at Eshott, the pilot set up an approach to Runway 26 using three stages of flap and an approach speed of 85 to 90 KIAS. The pilot estimated the wind to be from 240° and gusting to 15 kt and the wind at Newcastle Airport, 15 nm to the south, was reported as 230° at 17 to 21 kt. The pilot reported that the front-seat passenger was chatting during the approach so he asked him to be quiet, although the passenger's recollection differed: the passenger believed the pilot was distracted because he was having difficulty locating the airfield. The touchdown on the paved runway surface was normal according to both the pilot and front-seat passenger. The pilot said the aircraft tracked straight along the centreline for approximately 35 m and then suddenly veered to the left. At first the pilot thought a tyre had burst so he decided against a go-around. He applied full right pedal but this did not seem to have any effect so he applied the brakes. The pilot reported that he could not regain control and the aircraft skidded off the edge of the runway and hit the side of a soil embankment about 2 ft high. The embankment arrested the aircraft's sideways movement but it continued rolling forwards, striking three solid wooden fence posts in quick succession before coming to rest. The pilot stated that he began his shutdown checks as soon as he realised that they were going to hit the fence. The front-seat passenger said that the aircraft veered sharply to the left shortly after landing and he remembered hearing a "bang, bang, bang" as the aircraft hit the fence posts. He said he also remembered the left side of the aircraft coming to rest while he continued to travel forwards and then he felt himself being jerked forwards, although he did not hit his head. After the aircraft came to rest, the pilot and the front-seat passenger were able to exit via the forward door and the remaining passengers exited via the rear door. Assistance from the airfield services arrived within five minutes. The aircraft's cabin remained virtually intact but, despite this, the front-seat passenger sustained a serious spinal injury and required hospitalisation.

The owner of the aircraft was at the airfield at the time of the accident and watched the aircraft land. He said it was a normal touchdown but then the aircraft disappeared from his view behind a hangar. Shortly afterwards he received a call on his mobile phone from the pilot saying that he had had an accident. The owner initially thought it was a joke because he had seen such a normal landing and had difficulty believing that an accident could have ensued.

Aircraft examination

The aircraft was not examined by the AAIB but photographs of the aircraft revealed that the majority of impact damage occurred to the left wing leading edge and left side of the horizontal stabiliser, which was consistent with the impact with the fence posts and embankment. The propeller blade tips were both bent mildly back, which was consistent with a low power setting. Both main landing gear legs and the nose leg remained attached but the nose leg had sustained a slight bend. Despite the damage, the owner reported that the nose wheel steered freely in both directions when the rudder pedals were applied.

Analysis

The pilot stated that everything happened so quickly after landing that he was unable to determine specifically what caused the aircraft to leave the runway. He thought that there could have been a "freak gust" of wind during the landing or, possibly, his passenger accidentally applied the rudder pedal. However, the front-seat passenger said he did not touch the controls at any point during the flight, that he kept his feet behind a metal rim on the floor and that he believed that his feet would not have reached the pedals.

According to both the pilot and the front-seat passenger, the atmosphere between them during the final approach into Eshott was tense. This would have contributed to the pilot's mental workload and could have contributed to the loss of control after landing, particularly in the gusty wind conditions.

In summary, the cause of the loss of control on the ground could not be positively established but the gusty wind, the pilot's distraction during the approach or an accidental control input could have been contributory factors.

ACCIDENT

Aircraft Type and Registration:	Robin HR200/120B, G-WAVA
No & Type of Engines:	1 Lycoming O-235-L2A piston engine
Year of Manufacture:	2000
Date & Time (UTC):	31 March 2006 at 1505 hrs
Location:	Wellesbourne Mountford Airfield, Stratford-upon-Avon, Warwickshire
Type of Flight:	Training
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Nose landing gear leg and propeller bent; firewall and underside of left wing creased; engine shock loaded
Commander's Licence:	None (student pilot)
Commander's Age:	22 years
Commander's Flying Experience:	32 hours (all on type) Last 90 days - 11 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquires by the AAIB

Synopsis

After a normal landing the aircraft bounced. Subsequently it landed heavily on its nose landing gear, sustaining damage to the landing gear leg, propeller and engine fire wall.

History of the flight

The student pilot had just completed a training sortie with her instructor, during which she flew four visual circuits. All these approaches and landings were assessed as "good" by her instructor who subsequently briefed her for a solo flight during which she was to practise flying visual circuits. This was to be her third solo flight.

Runway 23 was in use. The pilot reported that there was no significant weather. The surface wind was 230º/20 kt gusting 27 kt.

Wind data is recorded every minute from the weather station at Wellesbourne Airfield. A record of the recordings around the time of the accident is shown in Table 1.

Having briefed his student, the instructor monitored the flight from the flying club house, approximately 500 m from the threshold of Runway 23. After an uneventful takeoff, the instructor observed G-WAVA during its first approach.

Time	Average Wind Direction (°M)	Average Speed (kt)	Maximum Gust (kt)
1502	230	12	17
1503	215	13	16
1504	235	16	19
1505	230	20	22
1506	240	18	26
1507	230	21	23
1508	240	19	29

Table 1

Wellesbourne Wind Records

The approach path and airspeed all appeared normal to the instructor. After landing the aircraft bounced slightly. The aircraft then bounced to a height of approximately 10 ft, possibly as a result of a gust of wind. The aircraft then landed heavily on its nose wheel.

The pilot stopped the aircraft on the runway before shutting down the engine and vacating uninjured.

The student pilot could not recall what inputs, if any, she made on to the control column after the initial bounce. Her instructor believes that initially she over controlled on the control column, pushing too far forward and then pulling back slightly before the final landing.

Damage assessment

Inspection by the repair agency revealed that the nose landing gear leg and propeller were bent and the firewall had been creased. The underside of the left wing near the left undercarriage leg was also creased and the engine had been shock-loaded when the propeller touched the runway.

Analysis

The recorded wind information shows that the wind was strong with some large gusts at the time of the accident and a gust probably amplified the aircraft's second bounce. The inexperienced student pilot subsequently over-controlled the aircraft in pitch.

Although there was no appreciable crosswind component, the surface wind conditions were demanding for a student on her third solo flight.

ACCIDENT

Aircraft Type and Registration:	SIPA 903, G-ATXO
No & Type of Engines:	1 Continental Motors C90-12F piston engine
Year of Manufacture:	1951
Date & Time (UTC):	14 November 2005 at 1610 hrs
Location:	Sandown Airfield, Isle of Wight
Type of Flight:	Private
Persons on Board:	Crew - None Passengers - None
Injuries:	Crew - N/A Passengers - N/A Others - 1 (Serious)
Nature of Damage:	Wing tip, propeller, and engine cowling plus minor damage to two other aircraft
Commander's Licence:	Private Pilot's Licence
Commander's Age:	57 years
Commander's Flying Experience:	828 hours (of which 101 were on type) Last 90 days - 18 hours Last 28 days - 5 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft owner was rotating the propeller by hand to introduce a priming charge into the cylinders when the engine started unexpectedly. The aircraft moved forwards, gathered pace, tore the supine owner's clothing and yawed into a hangar where it hit other aircraft. Inside the hangar its propeller struck and injured a person who had seen the 'runaway' aircraft coming towards him and had sought refuge there.

History of the flight

The aircraft was standing outside a row of three hangars with its centreline parallel to the hangar doors and the owner was preparing it for flight later that afternoon. Although the aircraft was fitted with a serviceable electric starter motor, the checklist suggested that the engine should be primed by hand-rotating the propeller. The owner entered the cockpit, checked that the magneto switch was in the OFF position, and pumped the throttle four times to introduce a charge of fuel into the carburettor. He left the throttle set a quarter open, the throttle friction loose, and the mixture in the RICH position. The aircraft was fitted with toe brakes, but no parking brake. Chocks were available near the hangar but the owner did not place chocks in front of the wheels.

The owner then stood directly in front of the aircraft,

and with his hands on opposite blades of the propeller, began to rotate the propeller slowly by hand, in order to introduce the priming charge into the cylinders. As he rotated the propeller, the engine suddenly fired and began to run, and the aircraft began to move forwards. He threw himself to the ground, and the aircraft passed over him, its propeller ripping his jacket and trousers.

The engine speed increased towards what witnesses described as "full power" and the aircraft gathered pace, yawing slowly to the left. Another pilot, who also kept an aircraft at the airfield, was walking in front of the hangars towards the accident aircraft. Realising that he might be at risk from the runaway aircraft, he took refuge in the nearest hangar.

The aircraft continued to accelerate forwards and its left wing struck the door of the middle hangar, causing it to yaw more rapidly to the left, and to enter the third hangar through its open doors. The other pilot had taken refuge standing between the wing and engine of a Luton Minor aircraft in this hangar. The accident aircraft yawed into the hangar and struck two other aircraft, causing further collisions. Its propeller struck the pilot who had sought refuge in the hangar, causing serious injuries to his left hand and thigh.

The engine stopped almost immediately after the collisions. The aircraft owner ran to give assistance to the injured pilot and a third individual, who worked on the airfield and had witnessed events from the far corner of the hangar, summoned the emergency services. The injured pilot was treated by paramedics at the scene and later underwent surgery in hospital.

Examination of the accident site

The site was guarded overnight. The following morning AAIB Inspectors arrived to begin investigations. The aircraft had not been interfered with before the investigation began.

The aircraft was found as it had come to rest, partly in the hangar and turned through almost 180º from its original direction of travel. The throttle was in the fully OPEN position, the throttle friction was loose, and the magneto switch was OFF. The single magneto switch controlled two magnetos; it was operated with a metal 'key', introduced into the switch assembly through a guard. This guard prevented the insertion or removal of the key, unless the switch was in the OFF position. The key was found on the cockpit floor beneath the switch.

Aircraft examination

The aircraft was examined at the accident site and then in an adjacent hangar. The investigation began with an evaluation of the magneto ground (earth) connections. The magnetos generate high tension current which is distributed to the spark plugs in the engine. With the magnetos switched off, a connection to ground is made within the magneto switch, and each magneto is unable to produce energy; then, only an open circuit fault in the ground connection on one or other magneto may cause the engine to run. It was noted that both magnetos were of the 'impulse' type which assist spark generation when turning slowly during starting.

One magneto ground connection was established to be sound. A cable, forming part of the other magneto's ground connection, was tested repeatedly with a portable resistance meter, and appeared to be faulty. The cable and magneto switch were removed to the AAIB premises for further examination; the aircraft was released to its owner for rectification work. The magneto switch was of an unusual type, apparently of WWII military origin and of extremely robust design. No defects were found during the examination of the magneto switch.

Subsequent examination demonstrated that the removed cable was not faulty, but by this time, the aircraft had been dismantled for rebuild, and the opportunity to carry out further investigation had been lost.

Pilot training

The CAA publishes General Aviation Safety Information Leaflets (GASIL), which are distributed to all aircraft owners and Flying Instructors. Between 2000 and 2005, ten articles on propeller safety were published in GASIL. One article stated:

> *'propellers must always be treated as 'live' and potentially dangerous'.*

Another, referring to a previous AAIB investigation, stated:

> *'The AAIB note that this is the fifth instance since February 2000 that a propeller being hand swung has caused injury to the person carrying out a hand swing. On three of these occasions the engine was not expected to start. We must always treat a propeller as live and liable to cause injury'.*

Custom and practise within the flying training community is to train pilots to assume that a propeller is always 'live', that is, any time any propeller is rotated by hand, there is a chance that the engine may start. After this accident, the aircraft owner observed that the CAA Light Aircraft Maintenance Schedule (LAMS) suggests that propellers should be rotated by hand, to ensure that an engine's compression appears normal.

Analysis

The aircraft owner was preparing the aircraft for flight in his usual manner and carrying out the actions specified in the checklist to introduce a priming charge into the engine. Pilots should treat propellers with respect, and handle them with the assumption that they may be 'live'; that is, the engine may start unintentionally at any time that a propeller is rotated.

In this case, despite having introduced a charge of fuel into the engine, which would make it more likely to start, the owner did not take precautions to address the potential consequences of an unintentional engine start. Had the aircraft been chocked, or another person tasked with applying the aircraft's brakes whilst the priming took place, the aircraft would not have moved. If the throttle friction control had been tightened, this would have prevented the engine accelerating to high speed. An engine cannot run and accelerate to high speed without at least one magneto functioning and so a transient fault in one magneto ground connection must have existed.

Safety action

The number of accidents involving propeller handling indicates not only that this is a potentially hazardous activity but it also causes real harm. Whilst the publication of articles in GASIL about safe propeller handling should have had a beneficial effect, GASIL is only one means of communicating safety information.

After discussions with the CAA, the AAIB decided not to make a formal safety recommendation to the Authority. The CAA estimated that only 1% of PPL holders would ever need to handle a propeller but the safety issues surrounding propellers are raised at most 'Safety Evening' presentations. Furthermore, the Authority considered that its current 'Good Airmanship' guidance within Safety Sense Leaflet 1 (included in LASORS and available from the Authority's Internet website) represented adequate guidance.

In the context of propeller safety, this leaflet currently states:

> ***Never*** *attempt to hand swing a propeller (or allow anyone else to swing your propeller) unless you know the proper, safe procedure, and there is a suitably briefed person at the controls, the brakes are ON and/or the wheels are chocked. Check that the area behind the aircraft is clear.*
>
> *Use a Check List which details the correct sequence for starting the engine. Make sure the brakes are ON (or chocks in place) and that avionics are OFF before starting engine(s).*

The CAA have notified the AAIB that the Leaflet will be revised to include the phrase "**Always** treat propellers or rotors as live".

PPL Training

AAIB enquiries identified that, whilst the UK National PPL syllabus includes a requirement for training on propeller safety, the JAR PPL syllabus does not make specific mention of the topic. The recent history of propeller handling accidents and incidents suggests that the JAR PPL syllabus should include training on propeller safety. Therefore, the following Safety Recommendation was made:

Safety Recommendation 2006-057

The UK Civil Aviation Authority should take forward a recommendation to the Joint Aviation Authorities that they should revise the training syllabus for the JAR Private Pilot's Licence (Aeroplanes) to include training on all aspects of propeller safety.

Further information

Bulletin readers desiring further information on propellers and their safe handling may wish to read an article on this topic published in the May 2006 edition of 'Pilot' magazine.

ACCIDENT

Aircraft Type and Registration:	Yak 18T, HA-YAP
No & Type of Engines:	1 Vedenyev M14P radial piston engine
Year of Manufacture:	2004
Date & Time (UTC):	8 April 2006 at 1301 hrs
Location:	Shoreham Airport, West Sussex
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 3
Injuries:	Crew - None Passengers - None
Nature of Damage:	None to HA-YAP; rudder damaged on G-CDEK
Commander's Licence:	Private Pilot's Licence
Commander's Age:	38 years
Commander's Flying Experience:	177 hours (of which 33 were on type) Last 90 days - 41 hours Last 28 days - 19 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The Yak pilot inadvertently taxied his aircraft into the rear of another.

History of the flight

The pilot of HA-YAP had taxied to the area of 'K1', the holding point for Runway 20 in preparation for a takeoff from the grass runway. He stopped the aircraft on a northerly heading and approximately 30 to 40 ft behind another aircraft, a Diamond DA40, registered G-CDEK which was awaiting takeoff clearance. The weather was good with a surface wind of 220º/ 17 kt.

In preparation for his engine checks, the pilot advanced the throttle with the intention of turning the aircraft to the left into wind. As HA-YAP started to move forward, the pilot applied full left rudder and brake. However, the aircraft continued to move slowly, directly, forward. After it had moved approximately 10 ft, the pilot centralised the rudder pedals, retarded the throttle and re-applied full brake. Despite this, the aircraft continued to move slowly forward towards G-CDEK. The pilot of HA-YAP considered that a collision was imminent and switched off the engine magnetos. The engine stopped but the aircraft continued to move forward very slowly and contacted the rear of G-CDEK.

Damage assessments

Following the collision, both aircraft returned to the parking area. G-CDEK had sustained damage to its rudder which had to be replaced. There was no indication

of any damage to HA-YAP but the pilot contacted another member of the aircraft owning syndicate who was a qualified aircraft engineer. It was then agreed that, with no indication of damage, the pilot should do an engine ground run before flight; this was successfully completed. A subsequent inspection confirmed that the aircraft was undamaged.

Causal factors

Initially, the pilot of HA-YAP thought that he had experienced a brake failure. However, he later checked the brake system and confirmed that it was serviceable. The aircraft has a non-steerable castoring nosewheel and pneumatic brakes operated by a lever on the control wheel. To obtain full braking effectiveness, the rudder must be centralised. In the collision, the pilot considered that the lack of braking may have resulted from the rudder pedals not being centralised due to a combination of the crosswind and a slight slope at 'K1'. He also acknowledged that the "pressure of the moment" may have been a factor in him not ensuring that the rudder pedals were central.

ACCIDENT

Aircraft Type and Registration:	Zenair CH 601HDS, G-OANN
No & Type of Engines:	1 Rotax 912-UL
Year of Manufacture:	2000
Date & Time (UTC):	23 April 2006 at 1742 hrs
Location:	Near Perth (Scone) Airfield, Scotland
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	Severe damage
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	46 years
Commander's Flying Experience:	280 hours (of which 4 were on type) Last 90 days - 8 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft was descending to a downwind position at Perth Airfield when the engine stopped. Attempts to re-start it were unsuccessful; the pilot carried out a forced landing into a field. The aircraft was severely damaged though the pilot received only minor injuries.

History of the flight

The aircraft departed from North Moor Airfield, near Scunthorpe, for a flight to Perth (Scone) Airfield, a direct distance of 200 nm. Before departure the pilot, who owned the aircraft, checked the fuel quantity on board; there was a full 55 ltr 'header' tank and an estimated 20 ltr in the starboard wing tank. The header tank gauge showed 'full' but the wing tank gauge was unserviceable.

The pilot took off at 1440 hrs and made a brief stop en-route at Charterhall Airfield, near Duns in Scotland, before continuing on to Perth. As he approached Perth the pilot established radio contact and commenced a descent for a downwind join to Runway 21 right hand. As the aircraft was approaching the downwind leg, at 1,000 ft, the engine stopped. The pilot tried to restart the engine but this was unsuccessful and it quickly became clear that a forced landing would be necessary. The pilot landed in a farmer's field situated nearby. The aircraft was severely damaged but the pilot, who was wearing a lap strap with diagonal shoulder strap, received only minor injuries. He was able to vacate the aircraft unassisted and contacted the emergency services. The weather at the time was reported to be fine, with good

visibility and a surface wind estimated to be from the north at 10 kt.

In his report the pilot considered that the engine was either burning fuel at a higher rate than the 22 ltrs/hr that he had planned, or that there may have been a fuel leak. He also thought that carburettor icing was a possibility.

During the flight the pilot had transferred fuel from the wing tank to the header tank. The header tank gauge had continued to indicate full, which the pilot expected since he was transferring fuel to it. However the gauge had continued to read full, even after it should have started to decrease. The pilot therefore ignored the gauge indications, relying instead on his endurance calculations.

ACCIDENT

Aircraft Type and Registration:	Enstrom 280C Shark, G-BXEE
No & Type of Engines:	1 Lycoming HIO-360-E1AD piston engine
Year of Manufacture:	1977
Date & Time (UTC):	13 April 2006 at 1030 hrs
Location:	Sandtoft Aerodrome, Doncaster
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Substantial damage to tail, cabin, main rotors and tail rotor
Commander's Licence:	Commercial Pilot's Licence with Instructor Rating (Restricted)
Commander's Age:	27 years
Commander's Flying Experience:	323 hours (of which 10 were on type) Last 90 days - 118 hours Last 28 days - 61 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The instructor had insufficient power applied whilst hover taxiing resulting in over-pitching of the main rotor blades. A lack of experience on type, an absence of any low rpm warning device and an element of distraction were all contributory factors. The instructor recognised the blades were over-pitched and took appropriate recovery action by lowering the collective and attempting a run-on landing. During the landing the left skid caught the ground, rolling the aircraft onto its side.

History of the flight

The instructor was taxiing the aircraft at a height of about 5 ft above grass when he over-pitched the main rotor blades. He lowered the collective and applied full power whilst attempting to complete a run-on landing. The instructor stated that due to a lack of available tail rotor thrust, he was unable to keep the aircraft straight and despite applying full left yaw pedal, the aircraft ran along the ground to the right. The left skid then caught the ground, rolling the helicopter onto its left side and stalling the engine. Both the instructor and student were wearing four-point harnesses and were uninjured. They were able to vacate the aircraft, unaided, through the right door.

Over-pitching

Over-pitching describes the phenomenon of decreasing rotor rpm resulting in reduced total rotor thrust. It occurs when the main rotor rpm reduces such that it can no longer be recovered by applying engine power alone. Rotor drag increases as the collective pitch angle increases to compensate for reduced rpm and this tends to compound the loss of rpm. Consequently, the collective lever must be lowered in order to reduce pitch and allow the rotor rpm to recover. Similarly, loss of engine rpm causes a loss of tail rotor rpm and hence tail rotor effectiveness. It is possible that tail rotor thrust then becomes insufficient to counteract main rotor torque and so the helicopter yaws despite the application of corrective yaw pedal.

If over-pitching happens in the hover, there is normally insufficient height to restore rotor rpm and the pilot is forced to land.

Comment

The instructor had only recently qualified to fly the Enstrom 280C helicopter. All his previous flying experience had been gained on the Robinson R22 and R44 helicopter types. Both the R22 and R44 have an engine governor and correlator which ensure that the engine rpm matches the main rotor blade pitch demanded by the pilot. The Enstrom 280C has neither a governor nor a correlator. It requires the pilot to match the engine rpm to the power demanded by manually twisting the collective mounted throttle.

The R22 and R44 have a light and horn to warn of low rotor rpm. The instructor stated that the Enstrom helicopter he used to complete his conversion training was fitted with a low rotor rpm warning horn, but no light. The aircraft involved in the accident was fitted with neither.

At the time of the accident the instructor stated he was teaching the student how to hover taxi which was an additional distraction at the time he over-pitched the rotor blades.

Conclusion

The instructor had insufficient power applied resulting in over-pitching the rotor blades. A lack of experience on type, an absence of any low rpm warning device and an element of distraction were all contributory factors. The instructor recognised the blades were over-pitched and took appropriate recovery action but the left skid caught the ground, rolling the aircraft onto its side.

ACCIDENT

Aircraft Type and Registration:	Eurocopter SA342J Gazelle, F-GJSL
No & Type of Engines:	1 Turbomeca Astazou XIVG turboshaft engine
Year of Manufacture:	1973
Date & Time (UTC):	8 May 2005 at 1630 hrs
Location:	Ockington Farm Strip, near Dymock, Gloucestershire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Serious) Passengers - 1 (Serious)
Nature of Damage:	Damaged beyond economic repair
Commander's Licence:	Private Pilot's Licence
Commander's Age:	63 years
Commander's Flying Experience:	600 hours (of which 12 were on type) Last 90 days - 19 hours Last 28 days - 11 hours
Information Source:	AAIB Field Investigation

Synopsis

After making an approach to hover at a private landing site, the pilot initiated a spot turn to the left. After turning through 90° the rate of yaw increased and the pilot, believing he had lost control of the helicopter due to a strong gust of wind, increased collective pitch. The pilot then became disorientated and reduced collective pitch. The helicopter hit the roof of an adjacent building, the tail boom detached and the main body of the helicopter fell to the ground. Both occupants were seriously injured.

History of the flight

After an uneventful flight from Warminster, the pilot, accompanied by his wife, made an approach to their private landing site adjacent to their house. He had to hover-taxi with a downwind component until the helicopter passed just beyond the paved landing pad. His intention was then to make a spot turn to the left, through 180°, and hover-taxi back to the pad for an 'into wind' landing. The pilot initiated the spot turn slowly and stopped after turning through 90°, with the fin approximately side on to the wind. As he prepared to commence the second half of the turn, but before left pedal was applied, the helicopter yawed rapidly to the left. Application of right pedal did not appear to reduce the rate of yaw, so the pilot pulled up on the collective lever in order to gain height. He also applied some aft cyclic to counter a perceived nose down pitch during the turn. The pilot recalled becoming extremely disorientated and releasing his grip on the collective lever in an attempt to grab his wife's hand. He heard a loud bang as the

helicopter contacted the roof of his house, causing the tail-boom to detach. The helicopter fell to the ground and the pilot, who remained conscious throughout, was able to climb out of the wreckage through the helicopter's roof. He used the onboard fire extinguisher to put out a fire in the engine bay and oil tank, but was unable to extract his unconscious wife from the wreckage. After, unsuccessfully, attempting to disconnect the battery and locate the fuel cut off lever, he telephoned the emergency services who were on the scene within 10 minutes. Both the pilot and his wife were air lifted to hospital.

Pilot experience/training

Although the pilot had been flying helicopters for a number of years, nearly all his flying experience was on the Bell 206 Jetranger. He had only recently acquired F-GJSL and this was his fourth flight as pilot-in-command on a Gazelle. During his conversion training, his instructor had demonstrated landings and various approaches to his private landing site. The pilot was very familiar with the site as most of his previous helicopter flying had also taken place from this location. His instructor had recommended that, when possible, spot turns in the Gazelle should be carried out to the right.

The pilot had completed seven hours of conversion training prior to his skills test and he had not experienced any problems with yaw control. He did, however, admit to some confusion regarding the optimum direction to turn the helicopter if there was a choice available.

Meteorology

An aftercast from the Met Office described a high pressure area to the west of the UK feeding a light to moderate northerly wind over the accident area There was no low level cloud and the visibility was excellent. It was estimated that the surface wind in the area would have been between 320° and 340° at a speed of 12-15 kt. Several local residents reported one or two particularly strong gusts of wind during the late afternoon period.

Aircraft description

The Gazelle, originally designed as a military helicopter, was first flown in 1967. It is configured with a three bladed main rotor and a thirteen bladed tail rotor, located within a duct (termed a 'fenestron') in the base of the fin. The cyclic and collective flying controls, which are servo assisted, vary the pitch of the main rotor blades via a series of control rods, levers and bell cranks. The pilot's yaw pedals alter the pitch of the tail rotor blades, also via control rods, bell cranks and cables, controlling the airflow through the fenestron and hence the side thrust produced. The helicopter is also equipped with an automatic Stability Augmentation System (SAS) designed to oppose motion in roll, pitch and yaw through limited authority hydraulic actuators in the cyclic and yaw control systems. The three channel system senses rate of movement in the appropriate axes and provides a damping effect on helicopter response to both rapid control inputs by the pilot and external disturbances.

Most of the civil manufactured Gazelles were delivered with fronts seats of the 'low back' type. These seats consist of a seat pan with a low flexible backrest fitted to a welded tubular structure. Lap belts are attached to the side of the seat pan but no upper torso restraints are fitted. These were not required for Certification by the French Authorities. Upper torso restraints cannot be fitted to this type of seat. However, a high back version of the seat, which is fitted with upper torso inertia reel harnesses, is available and, according to the manufacturer, may be fitted as a direct replacement if the owner so chooses.

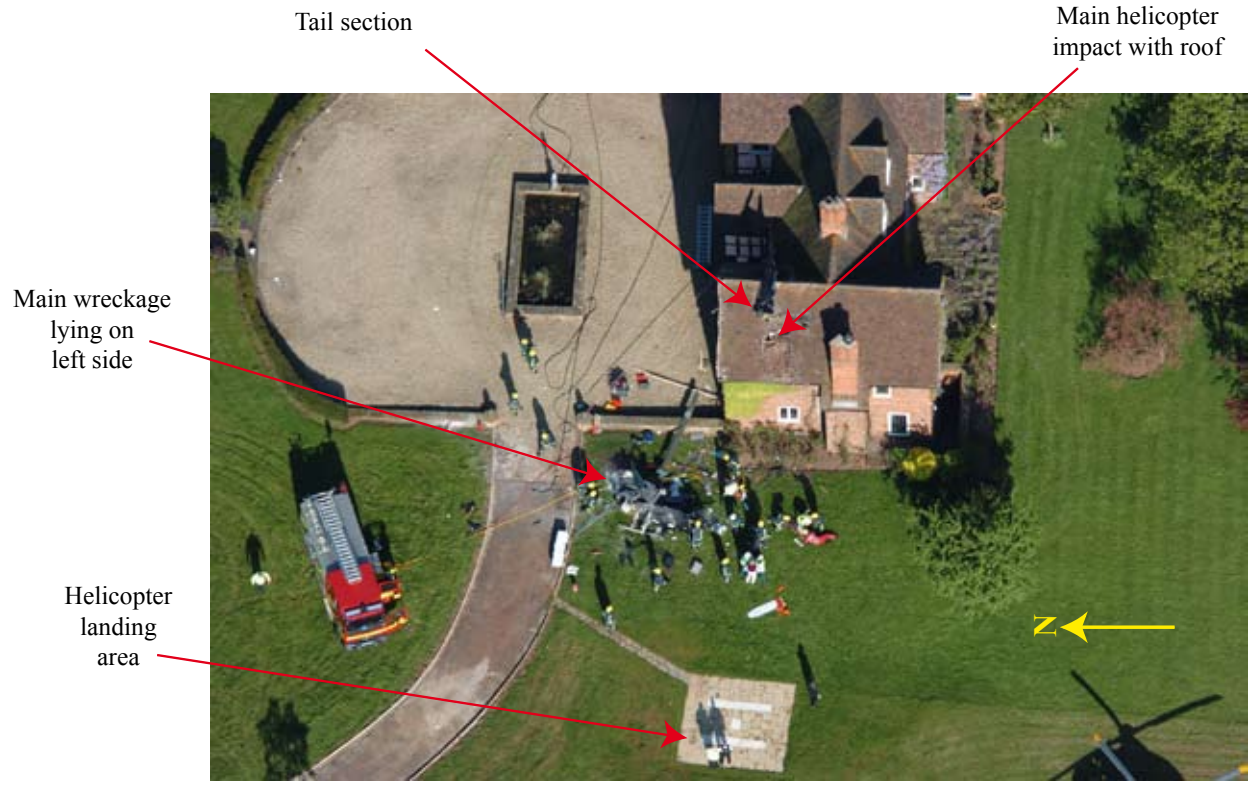
F-GJSL was manufactured in August 1973 as a SA341G civilian model and delivered to the USA. It returned to the manufacturer, Eurocopter, who bought the helicopter in November 1988 to be modified. This involved fitting optimised blades and an upgraded Turbomeca Astazou XIVG turbo shaft engine, converting it to a SA342J model. From February 1989, it flew in France and Canada before being purchased, in March 2001, by an operator in the UK, some 4,984 hours flying time since the modifications. The 342J model of Gazelle is not type-certificated in the UK and, although based within the UK, F-GJSL was maintained on the French Register.

Additional information

The manufacturer also produced the Alouette 2 family and the AS350B Squirrel helicopters without upper torso restraints fitted to the front seats, as this was not required by Regulation. The manufacturer is unable to establish how many remain flying without upper torso restraints but confirms that all models currently manufactured are fitted with such restraints, and point out that many are fitted with crashworthy seats.

Accident site and wreckage examination

The helicopter crashed onto the roof of the pilot's house approximately 16 m to the north of the designated landing area. It struck the pitched roof (Figure 1) with a high rate of descent, whilst in an approximate 30º nose down and right side low attitude, on a westerly heading. The impact had severed the rear structure of the helicopter, comprising the tail boom and fin, which had remained straddled across the apex of the roof. The severity of the vertical impact had caused the rear right skid attachment to be forced up into the fuselage structure. Pieces of the right skid then



Photograph courtesy of Western Counties Air Operations Unit

Figure 1

Impact location and wreckage distribution

detached, falling to the ground at the base of the wall of the house. The remainder of the helicopter, together with the occupants, then fell approximately 25 ft to the ground, impacting heavily on its forward left side.

The main rotor blades had struck the gable end of the roof during the initial impact; one blade had been broken into two parts and all showed evidence of rotation scoring from the impact. The detachment of the tail section allowed the tail rotor drive to become disconnected at the output spline from the intermediate gearbox. The tail rotor drive shaft failed at a location along its length consistent with the position of the impact of the tail section with the apex of the roof. The failure showed evidence of the shaft having been rotating at the time of impact. The tail rotor blades were intact; scoring around the fenestron duct indicated that the tail rotor had been rotating at impact.

Examination of the flying control system did not reveal any pre-accident disconnects or failures in the system. The position of the controls, which run under the cabin floor, had been frozen by the impact which compressed the control rods against the fuselage frames; comparison with a similar helicopter showed a right yaw pedal demand of approximately 75% right and a right lateral cyclic demand. The longitudinal cyclic was in a neutral position.

There had been a small fire around the engine area. The fuel tank had not ruptured and approximately 45 galls of fuel was recovered from this tank.

In summary, examination of the wreckage, both on site and later after its recovery, did not reveal any pre-impact failures or defects within the helicopter.

Helicopter landing area

The centre of the helicopter landing area, shown in Figure 1, was approximately 16 m from the pilot's house. The British Helicopter Advisory Board (BHAB) gives advice, produced in conjunction with the CAA, on setting up an unlicensed helicopter site. This gives a formula for calculating the radius of the landing area within which there should be no obstructions. This is based on the dimension from the forward extent of the main rotor disc to the aft tip of the tail rotor. For the Gazelle, the radius of the landing area was calculated to be 11.9 m; there were no obstructions within this area.

Previous occurrences

The AAIB has reported on six similar events involving loss of yaw control in the hover with civil registered Gazelle helicopters. The most recent was reported upon in Bulletin 10/2002 and occurred to Gazelle G-BZOS on 14 July 2002. Many of these reports contain additional background information relating to loss of directional control with the Gazelle helicopter. A common factor appears to be low pilot experience on type.

The UK armed services have operated the Gazelle helicopter for many years and are aware that high yaw rates to the left can develop. The Gazelle tail fin is considerably larger than most non-fenestron equipped helicopters, making the execution of a spot turn a challenge due to the weathercock effect in windy conditions. The Ministry of Defence Flight Manual (MoD FM) for the Gazelle states that

> *'whenever possible, the first turn should be made to the right to check the maximum rotor torque required'.*

Eurocopter Service Letters

As a result of some of the events mentioned above, Eurocopter produced Service Letter 1518-67-01 dated 26 April 2001, giving advice on apparent loss of tail rotor control. On 4 February 2005, Eurocopter produced Service Letter 1673-67-04 amplifying this advice. It included the following:

> ***'Background***
>
> *From hover flight at take-off at very low speed, the pilot initiates a left turn a few metres above the ground by applying yaw pedals towards the neutral position: the aircraft starts its rotation until the pilot attempts to stop it by applying the right hand yaw pedal.*
>
> *In the various cases which resulted in the loss of control in the yaw axis, the action applied to the right hand yaw pedal was not enough (amplitude/ duration) to stop rotation as quickly as the pilot wished.*
>
> *As the aircraft continues its rotation, the pilot generally suspects a (total or partial) tail rotor failure and decides either to climb to gain speed or get closer to the ground.*
>
> *In the first case, increasing the collective pitch results in increasing the main rotor torque and consequently further speeds up leftward rotation. This results in the loss of aircraft control.*
>
> ***Important Reminders***
>
> *In a quick leftward rotation, if the pilot attempts to counteract this rotation by applying the right hand yaw pedal up to a position corresponding to hover flight, the aircraft will not decelerate significantly.*
>
> *In this situation,* ***immediate action of significant amplitude*** *applied to the right hand yaw pedal must be initiated and* ***maintained*** *to stop leftward rotation.* ***Never hesitate to go to the right hand stop****. Any delay when applying this correction will result in an increase in rotation speed.*
>
> *Intentional or accidental initiation of this rotation phenomena can therefore be physically explained and is in no way connected to tail rotor performance****; in all cases when adequate correction is applied, rotation will stop!'***

Survivability

Both occupants were seriously injured. The passenger seated in the left front seat suffered major injuries to the left side of her body, sufficient to rupture her spleen and diaphragm, fracture several ribs and cause a major contusion to her left lung. The injuries were consistent with the final impact of the left side of the helicopter as it hit the ground. The consultant cardiothoracic surgeon who treated the passenger was of the opinion that the injuries would have been less severe had the helicopter restraint included a bilateral upper body/shoulder (diagonal) restraint.

F-GJSL was certificated to the French Direction General de l'Aviacion Civile (DGAC) requirements and was only required to be fitted, at that time, with lap-belts. These requirements were based on the American Federal Airworthiness Requirements (FAR) Part 27 which, prior to amendment 21, did not stipulate any restraint system. However, FAR 27.2 introduced a retroactive requirement as follows:

> *'For each rotorcraft manufactured after September 16, 1992, each applicant must show that each occupant's seat is equipped with a*

safety belt and shoulder harness that meets the requirements of paragraphs (a), (b) and (c) of this section.

(a) Each occupant's seat must have a combined safety belt and shoulder harness with a single-point release. [...]

(b) Each occupant must be protected from serious head injury by a safety belt plus a shoulder harness that will prevent the head from contacting any injurious object.

(c) The safety belt and shoulder harness must meet the static and dynamic strength requirements, if applicable, specified by the rotorcraft type certification basis.

(d) For purposes of this section, the date of manufacture is either

(1) the date the inspection, acceptance records, or equivalent, reflect that the rotorcraft is complete and meets the FAA-Approved Type Design Data; or

(2) the date the foreign civil airworthiness authority certifies that the rotorcraft is complete and issues an original standard airworthiness certificate, or equivalent, in that country'

In France, there is no equivalent retroactive requirement; however, their regulation in '*Arrêté du 24 Juillet 1991*' stipulates, in Chapter II paragraph 2.4.2, the following:

'For all airworthiness certificated French aircraft having made their first flight after the 1st of January 1983, and for all French aircraft having made its first flight after the 1st of July 1988 .... the flight crew members seats and the forward seats when there is a possibility of collision with the occupant's body and the facing structure, in forced landing acceleration conditions, have to be equipped with a shoulder harness;'

For certification on the UK register the helicopter would, in the past have had to comply with any Additional Requirements for Import (ARI), which would have specifically included high seat backs and upper torso restraints. Under European Aviation Safety Agency (EASA) regulations, the French DGAC requirements valid at the time of Certification prevail, although any existing UK registered aircraft already fitted with the upper torso restraints would not be required to have them removed. This situation is also applicable to other older Eurocopter models.

Discussion

The advice from Eurocopter, which is mirrored in the Ministry of Defence Flight Manual applicable to MoD operated Gazelle helicopters, is that immediate and positive application of right pedal, up to the maximum, must be applied and held to counter a high yaw rate to the left. The pilot of F-GJSL, had only 12 hours on type, including his seven hour conversion course with an instructor. He had 600 hours experience flying the Bell Jet Ranger. He was aware of the advice issued by Eurocopter but believed that he had lost directional control of the helicopter, as he was applying right pedal in an attempt to stop the rotation. As described in the Eurocopter Service Letter, raising the collective lever exacerbated the situation, by increasing the rotation to the left. Immediate and sustained full application of right pedal is therefore required to stop the rotation. There may have been a tendency for the helicopter's nose to dip forwards, due to the centrifugal effect of the high turn rate. Should the pilot have introduced some aft cyclic to make a correction, then this might explain why the helicopter 'backed' onto the adjacent building.

Unlike the Bell 206 Jet Ranger, there is little inherent friction on the collective lever in the Gazelle and, when the pilot released the lever to grab his wife's hand, the lever may have migrated downwards. This would have reduced the pitch on the main rotor blades, resulting in the helicopter descending onto the roof of the building.

Pilots who are inexperienced on the Gazelle need to be particularly aware of this apparent loss of tail rotor control. Unlike several helicopter types routinely used for training, the main rotor rotates in a clockwise direction (when viewed from above) and right pedal rather than left pedal is needed to oppose main rotor torque. Also, the fenestron-equipped Gazelle requires greater pedal deflection than that required for manoeuvring other training helicopters. Additionally, the tail fin is considerably larger than non-fenestron equipped helicopters, leading to more challenging spot turns in windy conditions. In view of these characteristics, the statement in the MoD FM of:

'whenever possible, the first turn should be made to the right to check the maximum rotor torque required'

seems appropriate advice for civil operators to follow in order to avoid, as far as possible, a high yaw rate to the left developing when making spot turns.

The severity of the injuries sustained by the occupants and, in particular, the passenger seated on the left front seat, was exacerbated by the lack of upper torso restraints. Upper torso restraints would have been a requirement had the helicopter been on the UK register; however, the French requirements for this generation of helicopter were only for a lap belt to be installed. As EASA are now responsible for all helicopter design requirements within most European countries, the following recommendation is made:

Safety Recommendation 2006-066

It is recommended that the European Aviation Safety Agency introduce requirements to ensure that upper torso restraints, in addition to lap straps, are installed on all front seats in helicopters for which they have airworthiness responsibility, where such a modification is available from the manufacturer.

ACCIDENT

Aircraft Type and Registration:	Robinson R22 Beta, G-OHFT
No & Type of Engines:	1 Lycoming O-320-B2C piston engine
Year of Manufacture:	1989
Date & Time (UTC):	20 April 2006 at 1449 hrs
Location:	Gloucestershire Airport
Type of Flight:	Training
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	Damaged beyond economic repair
Commander's Licence:	Student Pilot
Commander's Age:	40 years
Commander's Flying Experience:	89 hours (all on type) Last 90 days - 4 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot and further telephone enquiries by the AAIB

Synopsis

During a solo, hover taxiing exercise on the airfield, the student pilot lost control of the helicopter and the right hand skid contacted the ground. The helicopter rolled onto its right side, breaking off the rotor blades and shattering the canopy in the process.

History of the flight

The student, who had not flown for 28 days, was briefed by his instructor to carry out solo general handling exercises around the airfield. After a normal start, he hover taxied the helicopter approximately 600 m to a position just south of Runway 27. Here he maintained the helicopter in a low hover awaiting clearance to cross both this runway, and Runway 22, which was the active runway. When clearance was received the hover taxi was recommenced on a northerly heading with the surface wind from 190° at 8 kt. Having crossed Runway 27 the pilot reduced his groundspeed to near zero and commenced a turn to the left in order to cross Runway 22 on a perpendicular track. During this turn, he stated that the helicopter began to oscillate in roll and then pitched nose down causing the right hand skid to contact the ground. The helicopter rolled to the right and struck the ground on its right side, breaking the rotor blades and shattering the perspex canopy in the process. The pilot, who was wearing a lap and diagonal seatbelt, was able to vacate the wreckage with minor cuts and bruises.

Witnesses assessed the hover height just prior to the accident at approximately 5 ft although the pilot estimated that he was at 15 ft. His instructor commented that the normal hover taxi height would be between 5 and 10 ft.

Discussion

The accident occurred whilst the student pilot was hover taxiing downwind at a lower height (albeit the correct one) than he probably realised. This meant that when control difficulties were experienced during the turn, he probably overestimated the height available in which to rectify the situation. The flying school required student pilots to fly with an instructor if they had not flown within the previous 30 days. Although he was technically just within this limit, it is likely that a pilot with his limited experience would have found these judgment exercises demanding, having not flown for 28 days.

Follow up action

As a result of this accident, the flying school involved has amended its Flying Order Book which now states:

> *'a student who has not flown for 10 days shall have a dual flight, duration as required, prior to any solo flight'.*

ACCIDENT

Aircraft Type and Registration:	Robinson R44, G-MAMK
No & Type of Engines:	1 Lycoming O-540-F1B5 piston engine
Year of Manufacture:	2002
Date & Time (UTC):	16 April 2006 at 1455 hrs
Location:	Holt Lodge Inn, Llan-y-pwll, Wrexham, North Wales
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 3
Injuries:	Crew - None Passengers - None
Nature of Damage:	Substantial; aircraft damaged beyond economical repair
Commander's Licence:	Private Pilot's Licence
Commander's Age:	24 years
Commander's Flying Experience:	68 hours (of which 14 were on type) Last 90 days - Not known Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent AAIB telephone enquiries

Synopsis

Following a heavy landing, the pilot raised the collective lever, but then lost control of the helicopter in yaw and it fell onto its right side.

History of the flight

The helicopter was on a private flight from Liverpool to a landing site beside a hotel near Wrexham. The weather was good, with a light breeze of up to 10 kt. The pilot reported that he flew an orbit around the planned landing site, and flew an approach into wind (judged from the windsock beside the landing site). He transitioned into the hover without difficulty but the subsequent landing was heavy, and he raised the collective to correct this. He recalled that he then applied too much right yaw pedal, and lost control of the helicopter, which fell onto its right side. There was no fire, and the occupants vacated the aircraft without injury.

Examination of photographs taken shortly after the accident, together with further discussions with the pilot, indicated that the approach and landing had been flown downwind. A flying instructor, experienced on R44s suggested that the high weight at which the helicopter was being flown may have contributed to the difficulty in achieving a smooth downwind landing.

ACCIDENT

Aircraft Type and Registration:	Mainair Blade, G-BZLM
No & Type of Engines:	1 Rotax 582-2V piston engine
Year of Manufacture:	2000
Date & Time (UTC):	29 April 2006 at 1819 hrs
Location:	St Boswells, Galasheils, Scottish Borders
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Minor) Passengers - 1 (Minor)
Nature of Damage:	Severe damage to the left wing, landing gear and engine
Commander's Licence:	Private Pilot's Licence
Commander's Age:	38 years
Commander's Flying Experience:	91 hours (of which 39 were on type) Last 90 days - 5 hours Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft was operating from a grass strip. The takeoff was normal until a height of approximately 30-40 ft when it ceased climbing and the left wing struck a light stanchion. The aircraft then descended and struck the ground.

History of the flight

The pilot and a friend had flown from Eastfortune to the private airstrip at St Boswells. The weather was good with a surface wind from 030° at 10 kt, visibility greater than 10 km and with scattered cloud at 4,000 ft. The transit and landing were uneventful and during the flight the engine had performed normally.

After a short break, the pilot and his passenger prepared to return to Eastfortune. The engine start was normal and the aircraft was taxied to the south-eastern edge of the field. The takeoff utilised the longest length available at the strip, which was approximately 250 m, and had a level, dry, grass surface orientated to 340°. The calculated takeoff mass was 375 kg with a maximum permitted takeoff mass of 390 kg.

The pre-takeoff checks were completed and the engine power check was normal. The throttle was advanced to the maximum power setting and the engine responded normally. The aircraft took off in the normal distance, which was approximately 120 m, and began to climb

away. At a height estimated by the pilot to be about 30-40 ft, the aircraft stopped climbing; there was no sound of rough running or a drop in power although the pilot did not remember checking the engine rpm gauge. The aircraft remained in level flight despite efforts by the pilot to climb away by making a large forward movement of the control bar. The left wing then struck a light stanchion. The aircraft continued ahead briefly and then descended, impacting the ground at the side of a building.

Both the pilot and passenger received broken bones; although the pilot was able to extricate himself from the wreckage the passenger had to be assisted. The emergency services attended the scene and both persons onboard were removed to hospital. The two occupants were wearing protective helmets which may have prevented additional injuries.

Previous incident

On 15 April 2006, the same pilot was flying from Eastfortune to Hawick in G-BLZM and, when crossing the Lamermuir Hills, the engine rpm decayed. This occurred some four or five times and the pilot attempted to set maximum power. The engine started misfiring and would not achieve the normal 6,000 rpm. The pilot landed safely at a nearby private grass strip and then contacted his flying instructor to seek advice.

The pilot then cleaned the fuel filter, which contained fluff and dirt, and checked the spark plug gaps, which were correctly set. After completing an engine power check he departed and returned to Eastfortune, the engine performed normally throughout the flight. In a post flight discussion with his instructor he was informed that the previous owner of the aircraft had run the engine on a fully synthetic two-stroke oil mixture. The current owner used mineral oil, which be believed, can leave an oily film on the fuel filter if the filter is not changed regularly.

Conclusion

A contaminated fuel filter had previously led to a loss of power from the engine. The pilot and his instructor considered that the type of oil used in the two-stroke mixture may have been a contributory factor in the subsequent accident. However, Rotax engines are cleared to operate with any oil specified by the engine manufacturer; these currently include both fully synthetic and mineral oils. An additional factor in the accident may have been the large forward movement of the control bar in the marginal climb conditions.

ACCIDENT

Aircraft Type and Registration:	Thruster T600N, G-BZJC
No & Type of Engines:	1 Jabiru 2200A piston engine
Year of Manufacture:	2001
Date & Time (UTC):	9 October 2005 at 1325 hrs
Location:	Stokes Bay Golf Course, Gosport, Hampshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Impact damage to wings, tail plane and propeller. Engine shock loaded
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	42 years
Commander's Flying Experience:	82 hours (all on type) Last 90 days - 8 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional enquiries by the AAIB

Synopsis

Following an engine failure, the aircraft collided with a tree whilst on the approach to the forced landing site. The aircraft was extensively damaged; however, the pilot and passenger were uninjured. The cause of the engine failure was not established.

History of the flight

On the morning of the accident the pilot and passenger departed their home airfield at Sandown on an uneventful 40 minute flight to Goodwood. After stopping for lunch they departed Goodwood at approximately 1304 hrs on the return journey to Sandown. The aircraft climbed to 4,000 ft and on approaching the coast near Thorney Island the pilot became aware of a large cloud formation over the Isle of Wight. In order to remain clear of cloud the pilot entered a glide descent to 3,000 ft. On reaching 3,000 ft he realised that he was still too high and, therefore, continued his descent to 2,000 ft, which was the height that he normally flew across the Solent. Shortly after descending through 3,000 ft the engine started to run roughly so the pilot opened the throttle to increase power, which appeared to clear the rough running, and turned to track along the coast until he was satisfied that the engine was operating normally. As the problem appeared to have cleared, the pilot headed out across the Solent at 2,000 ft. The engine however, began

to run roughly again and eventually stopped. The pilot turned back towards the nearest land at Gosport and said he made a 'Mayday' call on 120.225 MHz, the Solent Radar frequency to the effect 'MAYDAY, MAYDAY, MAYDAY, G-BZJC, ENGINE FAILURE, 2,000 FT OVER THE SOLENT HEADING FOR GOSPORT, TWO PERSONS ON BOARD'. During this period the passenger assisted in attempting to restart the engine by operating the electrical starter whilst the pilot flew the aircraft and operated the throttle and choke levers. As the pilot completed the turn he noted that the tide was in and consequently there was no foreshore on which to land. However, immediately ahead of the aircraft was a golf course with a fairway running perpendicular to the aircraft's track; the pilot noticed that there were three golfers on the fairway. Beyond the golf course and approximately 400 yards from the shore was an open area, subsequently identified as six adjacent football pitches, which the pilot selected as his landing area.

As the aircraft approached the shore the pilot made a second 'Mayday' call. He states that he then encountered a great deal of sink as he crossed the coast and realised that he would not be able to clear a small tree that was situated along the edge of the fairway and his intended landing site. The aircraft hit the tree and became entangled with one wing touching the ground. The pilot exited the aircraft and then assisted his passenger out of the wreckage before making the aircraft safe. The pilot and passenger, who were both wearing four point harnesses, were uninjured and the golfers, who were approximately 30 yards away from the crash site, were unaware of the aircraft until the impact. Approximately 5 minutes after the accident a Coast Guard helicopter landed and a crewman offered assistance.

The pilot stated that the aircraft had 35 litres of Mogas on board when he departed Sandown and that following the accident he could see that approximately 20 litres of fuel remained in the tank.

Rescue co-ordination

At approximately 1323 hrs the controller at Solent Radar was informed by a pilot of a commercial aircraft outbound from Southampton (Eastleigh) to Alderney that he had heard a 'Mayday' message. When asked to relay the message the pilot stated that he had no details apart from "MAYDAY, MAYDAY, MAYDAY*"* and the report of an engine failure. At this point the controller heard an aircraft transmit *"*MAYDAY, MAYDAY". The controller accounted for all the aircraft working Solent Radar and established that none of the aircraft had heard any other details from the unknown aircraft. The commercial aircraft and a commercial helicopter operating in the area offered to divert to the Solent area to search for the aircraft. Meanwhile, the controller alerted the London Area Control Centre and was subsequently informed that a light aircraft had crashed on the golf course near Lee-on-Solent. Following the incident the supervisor at Solent Radar reviewed the radio recordings and confirmed that the controller's account was correct.

A yachtsman, who was also a qualified pilot, was sailing in the Solent when he observed the aircraft descending and disappearing from view. From the flight profile he believed that the aircraft might have crashed and, therefore, made a radio call to Solent Coast Guard explaining that he might have just seen a small aircraft crash in the vicinity of Stokes Bay. The controller at the Solent Maritime Rescue Coordination Centre (MRCC) scrambled the Coast Guard helicopter and contacted the supervisor at the London Area Control Centre, who was unaware of the emergency.

The Coast Guard helicopter was tasked by Solent MRCC, at 1326 hrs, with conducting a search for the

crashed aircraft. The helicopter crew spotted the aircraft in trees on the golf course at 1331 hrs. Solent MRCC was informed of the sighting and the coast guard auxiliary shore based team were deployed to the crash site. The helicopter landed on the fairway and the winchman talked to the pilot and passenger who were both uninjured. Solent MRCC were informed that a medical transfer was not required and the helicopter left the scene at 1348 hrs.

Aircraft information

The Thruster T660N is a 3-axis microlight aircraft equipped with conventional controls. The pilot and passenger sit side-by-side and are provided with four-point safety harnesses. The aircraft fuel system consists of a 50 litre fuel tank and an electrical and mechanical fuel pump. The fuel quantity is established from a sight glass mounted in the cockpit. The accident aircraft was fitted with a four cylinder, air cooled, carburetted engine mounted on the keel tube forward and above the enclosed cockpit. In order to help stabilise the engine temperature a Perspex cover is fitted around the engine sump; some owners also fit insulation around the sump and oil filter. Carburettor heat is provided by engine oil which is fed through a jacket around the induction pipe between the carburettor and engine. The aircraft was equipped with a handheld radio integrated into the intercom system, which was connected to the pilot's and passenger's headset and boom microphone.

The pilot normally planned on a fuel consumption of 10 to 12 litres/hr. It is believed that the aircraft had last been refuelled with Mogas obtained from a garage forecourt.

Meteorological information

An aftercast for the time of the accident reported a weak ridge of high pressure covering southern England with a light south westerly flow over the Lee-on-Solent area. Data from a radiosonde ascent for Herstmonceux, which the Met Office assessed as being broadly representative of the airmass affecting Lee-on-Solent at the time of the accident, reported the following conditions:

Height AMSL (ft)	Temperature (°C)	Dew Point (°C)	Humidity (%)
2,000	7.8	3.2	73
3,000	6.9	-5.4	41
4,000	5.2	-8.8	36

The CAA carburettor icing prediction chart indicates that with these conditions there would have been a risk of light icing during the cruise or descent at 3,000 ft and a serious risk of icing at any power setting at 2,000 ft.

Aircraft damage

The crash resulted in the aircraft being suspended in a tree with one wing touching the ground. The aircraft was dismantled the following day and moved to a maintenance organisation where a detailed damage assessment was carried out. The engineer who dismantled the aircraft was not aware of the actual fuel contents, but stated that there was no evidence of fuel having leaked out of the fuel tank and gained the impression that the fuel tank was empty.

The major damage to the aircraft was to the wings and tail plane with the cockpit remaining intact. There was some impact damage to the propeller, which another engineer, who undertook the damage assessment, believed indicated that it was not rotating when it struck the tree. He also noted that the fuel tank, which was still intact, was empty. This engineer could find no obvious external damage to the engine, which rotated freely when turned over by hand, and reported that the Perspex cover around the engine oil sump was in place. There was no evidence of additional insulation having been fitted to the engine.

The engine was returned to a maintenance organisation who undertook a 1,000 hour top end overhaul. The strip down revealed no mechanical failure or obvious reason why the engine should have stopped.

Comments

No detailed fault diagnosis of the engine or aircraft systems had been undertaken to determine the cause of the engine failure. The inspection of the aircraft and engine revealed no mechanical failure or obvious reason why the engine should have stopped. There was also no record of any previous engine problems in the engine log book and the pilot was unaware of any recent problems with either the engine or aircraft fuel system.

The total flight time on the day of the accident was approximately 65 minutes which, using the pilot's fuel consumption figure, would have required around 13 litres of fuel. This was confirmed by reference to the published data for the engine, and in discussion with another flying school. Therefore unless there had been a fuel leak there would have been sufficient fuel on board to complete the flight. Without a fuel sample it was not possible to eliminate the possibility of fuel contamination.

The engine on the aircraft was equipped with a carburettor heater which utilised warm engine oil to prevent the build up of ice in the induction pipe between the carburettor and engine. The engine on the Thruster is open to the elements and is known to cool quickly. It is also known that an engine is most vulnerable to carburettor icing when it is operating at a low power setting. The pilot described a glide descent from 4,000 ft to 2,000 ft during which the engine started to run roughly. The weather at the time was conducive to carburettor icing and it is possible that the engine temperature had dropped sufficiently such that the engine oil was not warm enough to prevent the build up of carburettor icing. CAA Safety Sense Leaflets 4 and 14 also warn of the increased risk of carburettor icing when operating on Mogas. Whilst carburettor icing can neither be ruled in nor out, this accident serves as a reminder that carburettor icing can occur even on engines equipped with oil fed carburettor heaters.

Faced with an engine failure and a potential ditching in the Solent the pilot transmitted a 'Mayday' message to Solent Radar. However, neither Solent Radar nor any other aircraft operating in the area heard the full 'Mayday' message and consequently they were unable to identify the position of the aircraft. It was Solent Coast Guard, following reports from the yachtsman and helicopter crew, who eventually established the location of the crash site. Although the first abbreviated 'Mayday' message was heard by a number of aircraft, a replay of the recording of the transmission tapes confirms that the controller at Solent Radar did not receive this 'Mayday' call. However, he did hear the second abbreviated 'Mayday' call which would have been made when the aircraft was at a much lower height. This suggests that when the pilot made the first of these 'Mayday' calls, the aircraft had been at a height sufficient to communicate with Solent Radar. Assuming that the pilot kept the transmit button pressed long enough for him to pass his message, the evidence suggests that either there was a fault in the radio installation, or the quality of the installation was such that it severely limited the range at which the transmissions could be detected.

BULLETIN CORRECTION

AAIB File:	EW/C2003/12/01
Aircraft Type and Registration:	AS355F1, G-XCEL
Date & Time (UTC):	2 December 2003
Location:	Hurstbourne Tarrant, near Andover, Hampshire
Information Source:	AAIB Field Investigation

AAIB Bulletin No 7/2006, page 40 refers

Two incorrect statements was made in this report.

1. Section titled **Helicopter description:**

This section described the operation of the 'beep trim' rocker switch. The rocker switch moves in a forward and aft sense and not left to right as described. The text should have read: .....if the pilot increases torque on the right (No 2) engine by moving the switch **aft** it not only increases the power output of that engine, but decreases power from the left (No1) engine.

2. Section titled **Examination of the accident site:**

This section describes the position of the MRGB, the Combining Gearbox and the main rotor as being 20 m south-west of the fuselage. The text should read:.....These were found, in an unburnt condition, 20 m south-east of the fuselage.

BULLETIN ADDENDUM

AAIB File:	**EW/G2006/04/27**
Aircraft Type and Registration:	DR 107 One Design, G-IIID
Date & Time (UTC):	21 April 2006
Location:	Tatenhill, Staffordshire
Information Source:	Aircraft Accident Report Form, and follow up correspondence and photographs submitted by the pilot

AAIB Bulletin No 7/2006, page 72 refers

The last paragraph of this report commencing 'The pilot reported that…..', should be changed to read the following:

> The tail wheel assembly is attached to the spring, which is round in cross-section, by a pin. A hole is drilled vertically through the tailwheel unit and the spring, and the pin is then driven in, which produces an interference fit. The pin ends are flush with the tailwheel unit and therefore there is no means of locking the pin, other than by the interference fit. The pilot reported that when he examined the aircraft, he found that the pin securing the tailwheel assembly to the spring, was missing. He tried to locate the missing item but was unsuccessful, and consequently, the reason for its loss could not be established. A post-incident photograph provided by the pilot, showing the tailwheel in situ held by a temporary pin, showed no deformation of relevant areas around the hole for the missing pin.
>
> A later standard tailwheel unit uses a longer pin which employs a split pin as a secondary means of locking.

FORMAL AIRCRAFT ACCIDENT REPORTS ISSUED BY THE AIR ACCIDENTS INVESTIGATION BRANCH

2004

1/2004 BAe 146, G-JEAK during descent into Birmingham Airport on 5 November 2000.

Published February 2004.

2/2004 Sikorsky S-61, G-BBHM at Poole, Dorset on 15 July 2002.

Published April 2004.

3/2004 AS332L Super Puma, G-BKZE on-board the West Navion Drilling Ship, 80 nm to the west of the Shetland Isles on 12 November 2001.

Published June 2004.

4/2004 Fokker F27 Mk 500 Friendship, G-CEXF at Jersey Airport, Channel Islands on 5 June 2001.

Published July 2004.

5/2004 Bombardier CL600-2B16 Series 604, N90AG at Birmingham International Airport on 4 January 2002.

Published August 2004.

2005

1/2005 Sikorsky S-76A+, G-BJVX near the Leman 49/26 Foxtrot Platform in the North Sea on 16 July 2002.

Published February 2005.

2/2005 Pegasus Quik, G-STYX at Eastchurch, Isle of Sheppey, Kent on 21 August 2004.

Published November 2005.

3/2005 Boeing 757-236, G-CPER on 7 September 2003.

Published December 2005.

2006

1/2006 Fairey Britten Norman BN2A Mk III-2 Trislander, G-BEVT at Guernsey Airport, Channel Islands on 23 July 2004.

Published January 2006.

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