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ADDENDA and CORRECTIONS

(ALL TIMES IN THIS BULLETIN ARE UTC)

ACCIDENT

Aircraft Type and Registration:	Boeing 737-600, LN-RPH
No & Type of Engines:	2 CFM 56-7B turbofan engines
Year of Manufacture:	1999
Date & Time (UTC):	23 August 2010 at 1415 hrs
Location:	On approach to London Heathrow Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 6 Passengers - 79
Injuries:	Crew - 1 (Serious) Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	53 years
Commander's Flying Experience:	12,200 hours (of which 3,500 were on type) Last 90 days - 180 hours Last 28 days - 47 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

A member of the cabin crew sustained serious injuries when the aircraft encountered weather related turbulence during the approach. The seatbelt sign was illuminated but the cabin crew were unrestrained. Issues relating to inter-crew communications and procedures relating to turbulence were identified in the operator's report that made several recommendation relating to training and procedures.

History of the flight

The aircraft was on approach to Runway 27R at Heathrow Airport at FL110 in VMC but with cumulonimbus clouds ahead extending to approximately 10,000 ft.

The cabin seat belt signs illuminated and a pre-landing PA announcement, describing the weather and the possibility of turbulence, was made to the passengers by the pilots.

The aircraft was subjected to light turbulence when it deviated to the south of a weather cell indicated on the weather radar, followed by a brief period of more severe turbulence after it appeared to clear the cell. The cabin crew were securing the cabin for landing and were not restrained at the time. Three of the four cabin crew members, including the purser, were not aware of the weather related comments in the PA announcement. One of the cabin crew managed to sit in an empty seat, but was not able to fasten the seat belt

before being thrown into the air and hitting the cabin roof. Despite this she was uninjured. Another cabin crew member, seated on a crew seat in the rear galley and making a PA to the passengers, was also thrown into the air. She landed back on the seat and badly injured her back. The other cabin crew members were uninjured and attended to their injured colleague who was in considerable pain and had to remain on the galley floor for the rest of the flight. An ambulance met the aircraft on landing and the injured crew member was subsequently diagnosed with spinal injuries requiring hospitalisation for 10 days.

Weather

At the time of the accident the Heathrow area was experiencing a low pressure system giving unstable weather conditions. Recorded winds at 10,000 feet were westerly at 35-40 kt. The crew reported cloud tops of approximately 10,000 feet with low precipitation activity. The aircraft's weather radar indicated a few weather cells but these did not affect the aircraft whilst holding.

Operator's procedures

The operator's procedures called for the seat belt sign on short haul aircraft to be illuminated 10 minutes prior to the expected landing time, but earlier when turbulence was expected. Cabin crew were to be seated during flight, with seatbelts fastened, when the seat belt signs were on, except when performing safety related duties. During approach and landing, cabin crew were to be seated when the landing gear chime sounded until the aircraft vacated the runway.

It was intended that the cabin crew should be made aware of expected enroute turbulence by the pilots, although the method of doing so was not specified.

Operator's investigation

The operator's safety department carried out an investigation into the occurrence which highlighted three similar occasions where cabin crew received serious injuries due to turbulence. In all cases the cabin seat belt sign had been illuminated and the crew were unsecured, preparing the aircraft for landing. In one case two crew occupying the aft galley were incapacitated during the approach, each having sustained bone fractures.

Discussion

The events investigated by the operator indicated that encounters with turbulence can result in incapacitation of several members of crew. If cabin crew can be seated quickly and securely when turbulence is expected or encountered, it is more likely that they will remain capable of performing their essential safety duties at the end of the encounter.

Wearing a seat belt while seated helps to protect against unexpected turbulence encounters, but cabin crew, because their duties require them to be mobile, are less likely to be seated in the first place. Clear communication and adequate notice of impending turbulence will therefore assist in protecting the cabin crew by giving them the opportunity to secure themselves.

The operator's procedures called for the seat belt sign on shorthaul aircraft to be illuminated 10 minutes prior to the expected landing time, regardless of atmospheric conditions. Illumination of the seat belt sign, during the approach but because of turbulence, might therefore be misunderstood by the cabin crew without clarification from the flight deck.

Safety actions

The operator's safety department made the following internal recommendations:

- Reconsider procedures on communicating when seat belts should/shall be used.
- Include turbulence injuries during pilot recurrent training.
- Use the IATA Toolkit Standard Operating Procedures for Turbulence Management.
- Revise communications between the cabin and flight deck to clarify when just the cabin is secure and when both the cabin and cabin crew are secure.
- Introduce specific announcements to be made to passengers to help secure the cabin during unexpected turbulence but allowing the cabin crew to remain seated.

ACCIDENT

Aircraft Type and Registration:	Cessna Citation CJ1+, N646VP
No & Type of Engines:	2 Williams FJ44 turbofan engines
Year of Manufacture:	2007
Date & Time (UTC):	7 June 2010 at 1650 hrs
Location:	Leeds Bradford Airport, West Yorkshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Significant damage to the wings and nose, detached nose landing gear, and collapsed right main landing gear
Commander's Licence:	Air Transport Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	3,078 hours (of which 690 were on type) Last 90 days - 72 hours Last 28 days - 27 hours
Information Source:	AAIB Field Investigation

Synopsis

During the takeoff run, the pilot judged that the aircraft would not accelerate to V_1 and decided to reject the takeoff. As he tried to stop the aircraft, both brakes failed, the right brake caught fire and the aircraft ran off the end of the runway. The brakes were probably on, at least partially, during the takeoff run.

History of the flight

N646VP was planned to undertake a private flight from Leeds Bradford Airport to Cannes Mandelieu Airport in France. The pilot arrived at the handling agent's office at 1445 hrs to prepare for a 1630 hrs departure and decided to load the aircraft with 3,320 lb of fuel, which corresponded to full fuel tanks. The flight was to be operated using single pilot procedures but the owner of the aircraft, a licensed helicopter pilot, joined the pilot in the cockpit just before departure and at 1634 hrs they were given taxi clearance. The wind was from the north at 5 kt, varying from between 320° and 070°. There was 30 km visibility, few clouds at 700 ft aal and scattered clouds at 3,000 ft aal. The temperature was 15°C and the QNH was 1008 milibars.

At 1641 hrs the Aerodrome Controller (ADC) cleared the aircraft to line up on Runway 14 and, after stopping on the runway, the pilot applied the parking brake. At 1644 hrs the ADC cleared the aircraft for takeoff. The pilot moved the throttles to the takeoff detent and

confirmed that the FADEC[1] Mode Indicator showed that takeoff thrust had been commanded. He checked on the centre multi-function display (MFD) that the two engine N_1 indications increased to the command bug, confirming that takeoff thrust had been achieved. He checked that the airspeed was increasing on the two airspeed indicators and, at 80 kt, confirmed that the two airspeed indications agreed.

The pilot reported later that, as the indicated airspeed increased towards V_1, he sensed that the acceleration was less than expected and he said "something's not quite right" to the owner in the right seat. The indicated airspeed seemed to the pilot to "hang" and, because he assessed that the aircraft would not achieve V_1, he decided to reject the takeoff. He stated later that he closed the throttles, applied maximum braking, extended the speed brakes and transmitted "ABORT; ABORT; ABORT" on the radio. The ADC asked him whether he needed any assistance, to which he replied "STAND BY".

After the throttles were closed, and with maximum pressure applied to the brake pedals, the aircraft "pulled to the left". At 1645:39 hrs, the ADC transmitted "YOU'VE GOT A FIRE ON THE RIGHT HAND SIDE". The aircraft drifted to the left edge of the runway and responded slowly to the application of full right rudder. Subsequently, the aircraft corrected towards, and then through, the runway centreline, but the pilot reported that by that stage the brakes were totally ineffective. As the aircraft approached the end of the paved surface, the pilot attempted to pull the emergency brake handle, but he accidentally pulled the auxiliary gear control handle instead, which was immediately to its right. When he managed to pull the emergency brake handle, it had no effect and the aircraft ran off the end of the runway to the right of the centreline and down the sloping ground beyond. As the aircraft left the hard surface, the owner moved the throttles to the OFF position to shut down the engines. At the bottom of the slope, the aircraft crossed the perimeter road and hit a fence. During the impact sequence, the right Main Landing Gear (MLG) collapsed and the nose landing gear detached before the aircraft came to a halt. Both occupants were unhurt and were able to exit the aircraft through the main access door on the left side of the fuselage behind the cockpit. The pilot stated that he returned to the cockpit briefly to ensure that the electrics had been turned off.

Footnote

[1] Full Authority Digital Engine Control.

Witness information

The pilot reported later that the aircraft's acceleration appeared normal up until 80 kt. At the point at which he decided to reject the takeoff, he judged that there was more than sufficient runway remaining in which to stop.

The owner reported that he did not notice anything unusual during the takeoff run until the pilot said that something did not feel right and rejected the takeoff. The owner judged that there was sufficient runway ahead to stop safely. He stated that the brakes did not seem to be effective and, when it became clear that the aircraft would run off the end of the runway, he moved the throttle levers from IDLE to OFF.

The ADC watched the aircraft begin its takeoff run and thought that it seemed "slightly slow". He stated that the aircraft had just passed Taxiway 'L' (Figure 1) when the pilot transmitted his intention to abort the takeoff. After a "short pause" the ADC saw flames "burst" out from the right side of the aircraft but he could not see their source. He did not think that the aircraft was travelling particularly fast when the takeoff was

Figure 1

Aerodrome Chart from the UK AIP entry for Leeds Bradford Airport

rejected and was surprised that it ran to the end of the runway and down the slope beyond.

An airport Airside Safety Co-ordinator was in his vehicle, which was stationary at 'VH1' (Figure 1). He reported that following the "ABORT" transmission the aircraft seemed to slow down initially. However, about two seconds after the transmission, flames began to emerge from the right MLG. The aircraft was just approaching Taxiway 'D' (Figure 1) when he first saw the flames.

Description of the braking system

The CJ1+ uses a hydraulically-powered braking system which incorporates an electrically-signalled anti-skid system. The power for the hydraulics is provided by an electric pump which activates to pressurise the brake accumulator to more than 1,300 psi and reactivates if pressure falls below 900 psi. The pump is active whenever DC power is applied to the aircraft and the landing gear handle is in the DOWN position.

Pressure at the brakes is modulated by master cylinders on each of the pilot's rudder pedals. Fluid from the

brake reservoir is received by the master cylinders on the right side of the cockpit, and pressure from either or both brake pedals is ported to the corresponding master cylinders on the left side of the cockpit. The left cylinders receive an analogue input of the foot pressure applied by the pilot on the right and that applied by the pilot on the left, converting whichever is greater into a pressure input to the Brake Metering Valve (BMV). The BMV converts left or right brake pedal commands into power-boosted pressures at the brake cylinders.

The anti-skid system uses electrical transducers on each wheel to feed rotational speed information to an electrical anti-skid Control Box. As a skid or impending locked wheel condition is sensed, a signal is sent to the BMV to release the pressure in the affected brake. The anti-skid system only releases a brake pressure demand; it does not apply any pressure itself.

The parking brake is set by applying and holding footbrake pressure from either seat position and then pulling a parking brake handle underneath the left instrument panel. This action traps the applied pressure in the brake lines such that, when the footbrake is released, the pressure at the brakes remains. If the parking brake handle is pulled with no footbrake pressure applied, no pressure will be present in the brakes. However, any subsequent footbrake pressure will be trapped and maintained, regardless of whether it is a full or partial demand, until the parking brake lever is returned to OFF. It is understood that the performance of the parking brake with full pressure applied is such that the wheels will remain locked even against a full power application on both engines.

The brakes are conventional multi-disc steel assemblies.

Emergency landing gear extension and emergency brakes

Both the emergency landing gear extension and emergency brakes are powered by a single high-pressure nitrogen bottle. Actuation of the emergency lowering handle supplies gas to the hydraulic extension/retraction actuators to 'blow down' the landing gear. If this is followed by a requirement to operate the emergency brakes, sufficient gas pressure should remain to allow several brake applications using gas pressure instead of hydraulic pressure. A handle underneath the instrument panel is used to apply emergency brakes: neither asymmetric braking nor anti-skid protection is available in this situation.

Examination of the aircraft and accident site

The overrun area on Runway 14 at Leeds-Bradford Airport comprises a grass area sloping downwards at about 10 degrees to the perimeter road and fence. The first tyre marks visible from the aircraft occurred as it left the end of the paved surface at the extreme right and carried on down the slope, missing the Instrument Landing System array and approach lights. The spacing of the three tyre marks in the grass showed that the aircraft was not appreciably yawed and there was no sign of braking action, since the grass appeared to have been rolled flat rather than torn up.

After some 83 metres, the aircraft encountered the perimeter road at the bottom of the slope. Whilst the left wheel seemed to have ridden up the lip of the tarmac road, the right wheel hit more firmly and metallic scrapes across the road suggested that damage to the right wheel or landing gear occurred at this point. The aircraft slewed to the right and struck the perimeter fence traveling almost sideways. The fence comprised an inner and outer row of concrete posts supporting chainlink wire fencing with barbed wire on top; the

aircraft demolished a section of the fence and came to rest against some small trees.

A considerable amount of debris was collected from the runway, by the airport authority, and its approximate location plotted. From this it would appear that the first pieces, which were all from the right brake, were sections of friction pad material found roughly in the middle of the runway adjacent to Taxiway 'D'. Further friction material and parts of the brake operating system, including wear indicators, were recovered almost to the point where the aircraft left the paved surface. All showed signs of gross overheating and, where pieces had fallen on joints in the concrete surface, melting of the mastic sealant could be seen. A video taken shortly after the accident by the airport authority traced a visible line of hydraulic fluid starting approximately on the runway centreline adjacent to Taxiway 'D' and curving to the left almost to the edge of the runway, before curving back to cross the centerline and leaving the paved surface at the extreme far right of the end of the runway.

The aircraft suffered significant (but later judged repairable) damage. Both wing leading edges were crushed in several places and the right wingtip had detached. There was a puncture in the top surface of the right wing above the MLG and damage to both flaps, which were in the takeoff setting of 15º. The composite nose radome was also badly damaged and the nose landing gear had detached. Both trailing-link MLGs had remained attached but the right oleo strut had detached at the top, effectively collapsing the MLG, and this had caused the puncture of the wing skin. The speed brakes were retracted.

The hydraulic/pneumatic pressure and contents gauges, visible within the nose baggage compartment, showed that the emergency gear and brake pneumatic pressure had fallen to 200 psi (normally about 2,000 psi) and the power brake accumulator charge had fallen to just above zero psi. The sight glasses for the power brake hydraulic reservoir showed that it was nearly empty.

Airport staff took photographs of the aircraft cockpit following the accident. The images showed that both throttles were in the OFF detent (engines shut down); the flap selector was in the 15° detent (takeoff/approach setting) and the parking brake handle was stowed (parking brake OFF). The auxiliary gear control handle had been pulled and rotated 45° clockwise, which would have released the MLG uplocks. The three-position speed brake switch was found in the centre position between EXTEND and RETRACT.

The cockpit floor on the left side was lifted to expose the parking brake control valve and the cable which connects it to the handle. There were no disconnections and the mechanism worked smoothly.

The Electronic Engine Control (EEC) units from both engines were interrogated for their fault history; no faults had been recorded.

Examination of the mainwheel brakes

After the aircraft had been recovered and placed on jacks in the hangar, the brakes were removed for examination.

The right brake had almost completely disintegrated (Figure 2) and loose pieces, mainly of friction material, were found in the wheel. The whole assembly showed signs of massive overheating and most elastomeric seals had disintegrated. The left brake had not broken up, but similar evidence of overheating had caused some melting and distortion of friction pads and stators (Figure 3).

Figure 2
Right brake

Figure 3
Left brake

Conclusions from engineering examination

Both brakes had suffered exposure to very high temperatures, causing melting and deterioration. The right brake had almost completely disintegrated but the left was also on the verge of disruption. It was evident that the right brake was losing fluid and that, in these circumstances, emergency pneumatic braking would also have been ineffective. The trail of hydraulic fluid and the fire reported by witnesses was consistent with hydraulic fluid coming into contact with very hot components of the right brake.

It is considered that both brakes overheated due to their being on, at least partially, during the takeoff roll and also possibly during taxi to the runway. No faults within the braking system could account for such brake application.

Previous incidents

On 22 September 2008, a Cessna Citation CJ1 rejected its takeoff at Jersey after the crew sensed slow acceleration and smoke was seen coming from the right brake. The crew reported later that the aircraft also seemed sluggish while taxiing before takeoff. The incident was not investigated by the AAIB at the time, but the Air Safety Report (Engineering) showed that no fault was found with the brake system and that the suspected cause of the problem was binding of the right brake. The report stated:

> *'There is a known problem with binding brakes on the CJ series whereby if the parking brake is applied when the brakes are hot the brake discs can sometimes bind.'*

A number of other reports were reviewed of brake-related incidents in Cessna Citation CJ1 aircraft. It was not possible to conclude from the evidence available whether or not binding brakes was a common problem with the aircraft type, but the manufacturer reported that their records did not suggest it was.

Certification basis

The Cessna Citation CJ1+ was certified as a Normal Category[2] aircraft in accordance with Federal

Footnote

[2] Aircraft with nine or less seats (excluding pilot seats); a maximum certified takeoff mass of 5,670 kg (12,500 lbs); and intended for non-aerobatic operation.

Aviation Administration (FAA) Part 23 Airworthiness Standards. For this category of aircraft there is no requirement for a takeoff warning system that provides an aural warning should the aircraft be in a configuration that would not allow a safe takeoff. The EASA accepted the certification because it took place before 28 September 2003 and issued Type Certificate Data Sheet (TCDS) IM A.078.

In December 2008 Cessna issued the following reminder to operators in their 'Direct Approach' magazine:

> *'Make Sure to Disengage Parking Brake*
>
> *There is no parking brake indicator to alert the flight crew that the park brake handle is engaged. Flight crews should follow the procedures in the Airplane Flight Manual (AFM) and the Pilots' Abbreviated Check-list regarding the brake system operation. The pilot in command is the last set of eyes to make certain the brake system switch, circuit breaker, and park brake handle are all in the correct positions before taxi or takeoff.'*

A modification is currently being proposed in the UK which, if approved and fitted, will illuminate a warning light when the parking brake is applied. Cessna have also advised that they are considering fitting a 'parking brake applied' warning on future models of the Citation.

Takeoff and stopping performance

The manufacturer calculated the expected acceleration and stopping performance of the aircraft in the circumstances using a wind of 320°/5 kt, which was a 5 kt tailwind, and a takeoff weight of 10,500 lb[3]. The aircraft should have taken 537 m to accelerate to V_1 and should have stopped in 464 m from V_1 (had it achieved V_1). Applying this stopping distance to the approximate point at which the pilot rejected the takeoff gave a total distance of 1,676 m from the start of the takeoff run. The Accelerate Stop Distance Available (ASDA) for the runway was 2,113 m.

Brake performance

The manufacturer stated that the ability of the brakes to stop the aircraft depended on the work being done by the brakes over an extended period. If the brakes were dragging while the aircraft was moving, even while taxiing at low speed, they would have been absorbing energy and increasing in temperature. If the brakes were dragging during the takeoff run, they may have been quite hot at the beginning of the rejected takeoff (RTO) and would not have been expected to survive the RTO.

Citation CJ1+ Flight Manual

The actions to be taken in the event of a rejected takeoff below V_1 are:

> 1. *'Brakes – AS REQUIRED'*
> 2. *'Throttles – IDLE'*
> 3. *'Speed Brakes – EXTEND'*

Analysis

The aircraft should have accelerated to V_1 in a distance of 537 m in the conditions that existed at the start of the takeoff. In the event, the aircraft was still on the ground after approximately 1,195 m when it had

Footnote

[3] 6,829 lb for the aircraft basic empty weight; 3,220 lb of fuel; 380 lb for the occupants; and 71 lb of miscellaneous cabin items (estimated).

just passed taxiway 'L' and the pilot decided to reject the takeoff. It was clear from this evidence that the aircraft's acceleration was less than expected. Given that the aircraft did not reach V_1, there was more than sufficient runway remaining after closing the throttles for a serviceable brake system to stop the aircraft.

The engine parameters were checked by the pilot at the start of the takeoff run and he stated that they indicated that the desired thrust was achieved. No fault messages were recorded on the EECs and the pilot did not report experiencing asymmetric thrust. It is probable, therefore, that the engines were performing normally during the attempted takeoff.

If the engines delivered the required thrust during the takeoff run, the reduction in performance would have been caused by the brakes being on, at least partially, while the aircraft accelerated. Furthermore, since the pilot did not report directional control problems in the early part of the takeoff run, there was probably equal brake pressure at the left and right brake assemblies. There were no faults found in the braking system that could have led to the brakes being on during the takeoff run and so the possible causes remaining for the reduced performance were that the parking brake had been left on, some toe braking was being applied, or that the brakes were binding. The investigation could not determine the actual pressure applied to the brake assemblies, but it had to be low enough to be overcome by takeoff thrust, and high enough to generate sufficient heat in the brake assemblies for them to be severely damaged.

It was possible that one or both of the occupants in the cockpit applied some toe braking during the takeoff run. Both occupants were familiar with the aircraft and this possibility seemed unlikely, especially as equal pressure would have to have been applied to both brake pedals, but the possibility could not be discounted. There was anecdotal evidence that the brakes in this aircraft type can bind, in some circumstances, and, although the evidence reviewed during this investigation could not corroborate it, this possibility also could not be discounted.

The pilot recalled applying the parking brake when holding on the runway awaiting clearance to takeoff and this would have trapped in the brake assemblies the hydraulic pressure present at the time. The brakes were designed to hold the aircraft against full power and, if maximum toe braking had been applied before the parking brake was selected, and the parking brake was not subsequently released, the aircraft would probably have remained stationary following the application of takeoff thrust. However, if the aircraft had been stopped using just enough toe braking to overcome the idle thrust of the engines, the pressure trapped in the brake assemblies would have been relatively low. In this case, takeoff thrust might have been sufficient to overcome the brakes although the subsequent acceleration would have been reduced and there would have been heating of the brake assemblies. The pilot did not recall whether or not he released the parking brake before beginning the takeoff run, but photographic evidence showed that it was released when the airport authorities reached the aircraft following the accident. It could not be determined if the parking brake had been released immediately prior to the takeoff run, but the possibility that it remained on could not be discounted.

Therefore, there was insufficient evidence to support or discount conclusively any of the three possibilities.

The actions to be taken in the event of an RTO include extending the speed brakes but the aircraft was found

with the speed brakes retracted. The investigation did not determine whether extending the speed brakes would have altered the outcome, but it seemed unlikely. When the pilot pulled the emergency brake handle it had no effect because the brake system had already been damaged to the extent that it was no longer effective.

SERIOUS INCIDENT

Aircraft Type and Registration:	1) Embraer ERJ 190-200 LR G-FBEE, 2) Embraer EMB 121 Xingu F-TEZZ
Date & Time (UTC):	1 June 2010 at 1000 hrs
Location:	Jersey Airport, Channel Islands
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - N/A Passengers - N/A
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Information Source:	AAIB Field Investigataion and Jersey Airport Limited internal investigation

Synopsis

A bird scaring vehicle entered Runway 27, without an ATC clearance, and operated on the runway for a period of between two and four minutes. Low Visibility Procedures (LVPs) were in force and ATC were unaware that the vehicle had entered the runway.

Sequence of events

The weather conditions at Jersey Airport comprised westerly winds with low cloud, fog and drizzle. LVPs were in force. A routine bird scaring patrol was carried out by a Fire Service vehicle, callsign 'Rescue 6', at 0545 hrs, prior to the airfield's published opening time at 0600 hrs.

Later that morning, an officer in the watch room observed some bird activity on the north side of the airfield during a slight improvement in the weather. The driver of a fire vehicle, callsign 'Rescue 6', was tasked to carry out a bird dispersal patrol. He drove from the fire station, along the roadway south of Taxiway A, to Holding Point H. (A chart showing the airfield layout is included at Figure 1.) At 0956 hrs the driver contacted Ground Movement Control (GMC), using the radio installed in the vehicle, and requested entry to the runway for bird dispersal purposes. The driver was instructed to proceed to Holding Point A1 and to contact the Tower on frequency 119.45 Megahertz (MHz). The instruction was acknowledged and the vehicle moved ahead to A1. The driver stated that he then contacted the Tower on 119.45 MHz using a separate portable radio. At 0958 hrs a carrier wave transmission was recorded on 119.45 MHz. This was followed by an ATC instruction to an aircraft, callsign 'BEE933', registration G-FBEE which had just landed, to "REPORT VACATED".

Rescue 6 entered the runway and stopped for a time on the northern side, opposite Taxiway F, where the driver had observed some birds. The birds dispersed and the vehicle continued along the runway.

At 1000 hrs the Tower Controller (TC) was replaced for a routine break. He carried out a handover and advised the replacement controller that Rescue 6 was holding

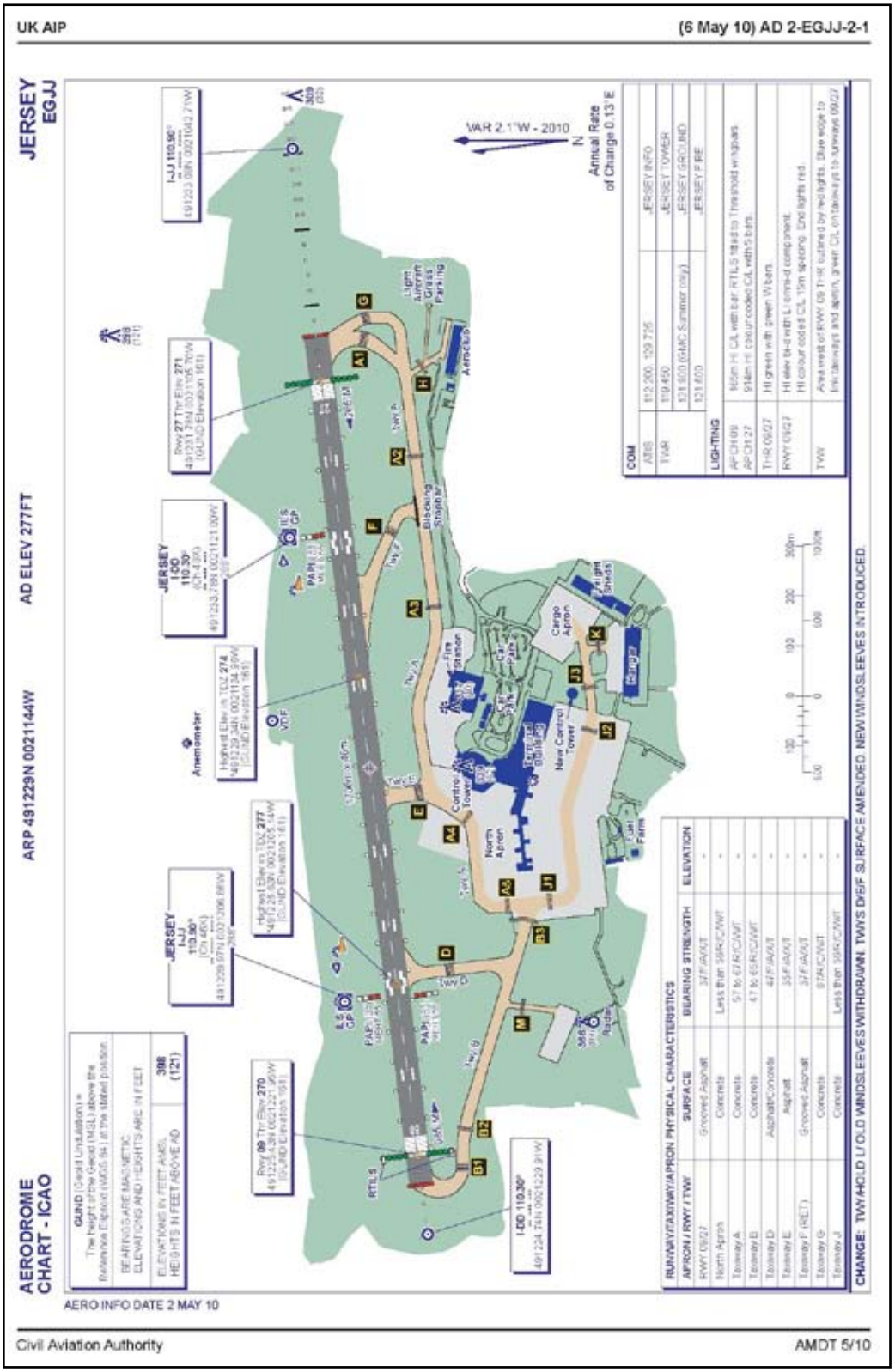

Figure 1

Jersey Airport layout

at A1 but had not yet checked in on frequency. Once the handover was complete the replacement controller called Rescue 6, to confirm his location. There was no reply, so he asked the GMC to call Rescue 6 to check whether the vehicle was still on the ground frequency. The GMC called Rescue 6, received a reply and reminded the driver that he needed to contact Tower, on 119.45 MHz, to enter the runway. The response from Rescue 6 was hesitant and led the GMC to ask for confirmation that the vehicle was still at A1. The driver replied "NEGATIVE, UM I'M LEAVING THE RUNWAY AT B". A further exchange then took place during which it became apparent that Rescue 6 had been on the runway, unbeknown to ATC, and that he had now vacated at the western end onto Taxiway B. The TC, aware of this exchange, was about to instruct an aircraft on short finals to go-around but, before he was able to do so, the aircraft, callsign 'FAF 6797', registration F-TEZZ, reported that he was "GOING AROUND".

There was no further contact between ATC and Rescue 6 despite several attempts to call the vehicle. ATC took action to safeguard the runway and manoeuvring areas until it had been confirmed that the vehicle had returned to the fire station, after which operations were resumed. The driver of Rescue 6 later reported that, when he had vacated the runway, he had noticed that the portable radio was no longer functioning.

Aerodrome information

Jersey Airport is located on an island and bird activity, particularly sea birds, is commonly experienced. Bird control is presently the responsibility of the AFRS. During the summer the airfield's published opening time is 0600 hrs, before which a routine bird dispersal patrol is carried out. After that, patrols are conducted on an as required basis when bird activity is observed.

An AFRS general purpose vehicle, callsign 'Rescue 6', is used for bird control. This vehicle has an installed radio and, typically, the driver will also carry a separate portable radio. The portable radio is intended to be used as a back up, in the case of radio failure, or for occasions when the driver is operating outside the vehicle. However, it appeared that a general practice had developed amongst some drivers whereby the portable radios were used for communications when a second frequency was in operation. A survey of ARFS personnel carried out after the incident showed that a significant number of them were unclear about the correct procedures.

A GMC frequency is available at Jersey Airport and is notified by ATIS when in use. On most occasions ground movement is controlled by the TC on the Tower frequency, 119.45 MHz. However, on the morning of the incident the GMC frequency, 121.9 MHz, was in use, principally for the purpose of Controller training.

Jersey Airport is equipped with a Category 1 ILS, therefore, all aircraft movements are restricted to at least Category 1 minima. There are three levels of LVPs defined at Jersey Airport: Level 1 is in force when visibility is at or below 1,500 m, Level 2 is initiated at or below 800 m and Level 3 occurs at or below 400 m. The AFRS *'Station Orders and Procedures, No L3'*, requires that all mobile vehicles should monitor frequency 119.45 MHz when LVP 3 is in force.

There is a selectable red stop bar located at Holding Point A1. The Aeronautical Ground Lighting log showed that this stop bar had been selected on throughout the period during which the incident occurred and that there were no recorded failures of lighting equipment.

The UK CAA publication CAP (Civil Aviation Publication) 642, entitiled *Airside Safety Management,*

provides guidance and recommends standards to be set by airport authorities and aerodrome operators for drivers and vehicles operating airside. It includes material on driver qualification and testing.

Meteorological information

The airfield weather reports issued around the time of the incident were:

EGJJ METAR 0920	010920Z 26009KT 210V300 0100 R27/0225 -DZ FG OVC000 13/13 Q1015 TEMPO 0800=
EGJJ METAR 0950	010950Z 26011KT 220V330 0300 R27/0800 -DZ FG BKN000 13/13 Q1015 TEMPO 0800=
EGJJ SPECI 0957	EGJJ 010957Z 27011KT 0300 R27/1100 -DZ FG BKN000 13/13 Q1015=
EGJJ SPECI 1000	EGJJ 26010KT 230V310 0800 0500N R27/1100 -RADZ BCFG BKN000 13/13 Q1015 TEMPO 1200=
EGJJ SPECI 1005	EGJJ 26011KT 220V300 0200 R27/0550 -RADZ FG BKN000 13/13 Q1015 TEMPO 0800=

Recorded information

Recorded radio communications for both the GMC and Tower frequencies, together with radar data for aircraft on the approach to Runway 27, were available for the investigation. Closed Circuit Television cameras located around the airport recorded some aircraft movements and some of those of Rescue 6. The time reference for each of these recording media was different but it was possible to co-ordinate events to within a few seconds during the investigation.

A transcript of the recorded communications on 119.45 MHz around the time of the incident is included in the table below.

Time UTC	Frequency	Who	Text
09:57:54	119.45	AIR ATCO	"GENERAL BROADCAST LVP 1"
09:58:03	119.45	?	*Carrier wave*
09:58:19	119.45	AIR ATCO	"BEE933 REPORT VACATED"
09:58:22	119.45	?	*Garbled, not able to transcript*
09:58:34	119.45	BEE933	"933 IS VACATED"

Driver's report

This was the driver's second bird dispersal patrol of the day. He reported that he had been aware that LVPs were in force and that two ATC frequencies were in use. He believed that it was necessary to monitor both frequencies, so he tuned the installed radio to the GMC frequency, 121.9 MHz, and the portable radio to the Tower frequency, 119.45 MHz. When he was given the bird dispersal task, he drove along the perimeter track and stopped at the stop bar by Holding Point H. He contacted GMC and was cleared to proceed to Holding Point A1 and to contact Tower. He recollected contacting the Tower at A1, using the portable radio, and receiving a clearance to enter the runway and to report vacated.

He entered the runway and drove to the northern side where the bird activity had been reported. There were a lot of gulls sitting in the grass, so he drove in a zig-zag pattern and used the vehicle buzzer to disperse them. The birds dispersed without him having to leave the vehicle, so he continued slowly along the runway. After passing abeam exit E, he was called by the GMC and was asked to contact the Tower on 119.45 MHz for permission to enter. He did not understand why this instruction had been given but, after an exchange, he was advised by the GMC that he did not have permission to be on the runway. By now he had reached the end of the runway and turned off onto the taxiway.

Analysis

The weather conditions at Jersey Airport were generally poor during the morning with frequent changes. This is evidenced by the three SPECI reports that were issued in the space of ten minutes, between 0950 hrs and 1005 hours, in addition to the regular METARs, every 30 minutes. LVPs were in force throughout the morning, the level of LVPs varying, depending on the prevailing conditions.

The GMC frequency was in use at the airport, which was a relatively unusual circumstance, and the AFRS procedures required that all mobile vehicles should monitor frequency 119.45 MHz when LVP level 3 was in force. This may have led to the perception that drivers should be monitoring two frequencies, those for the GMC and the TC, rather that just the appropriate ATC frequency. The simultaneous monitoring of two frequencies can lead to calls either being missed or misunderstood.

The perceived need to monitor both frequencies led to the driver of Rescue 6 using the portable radio for communication with the Tower. He recalled that he had asked for and received a clearance to enter the runway from the TC. There is some evidence to support this as, around the time it is calculated that he entered the runway, there were a couple of brief carrier wave transmissions. The portable radio he was using had probably been switched on for some length of time and the battery would have been depleted. Therefore, it is likely that there was insufficient battery power for it to transmit, although for a while it would have continued to receive.

The timing of the transmssions obtained from the transcript suggests that the driver may have heard the end of the instruction given, by the Tower, to 'BEE 933' to, "REPORT VACATED", and misinterpreted it as a clearance for him to enter the runway. The driver's attempted reply was either not transmitted or produced only a carrier wave. The driver therefore, believing that he had obtained a clearance, entered the runway and proceeded to carry out his bird dispersal activities. To enter the runway, he must have crossed the red Stop Bar, which was recorded as having been ON throughout the period of the incident. There was no explanation from the driver as to why this happened. It is possible that he was parked too close to the bar to be able to see it or that he overlooked it because he thought he had a clearance.

The safeguards and procedures that were in place to prevent a conflict on the runway did not work on this occasion. The vehicle occupied the runway for a period of about three minutes but, by chance, there were no aircraft movements during this period. Neither the aircraft that had landed before the incursion nor the aircraft that went around from final approach were aware of the presence of the vehicle and it did not affect their operation.

Safety action

Jersey Airport carried out a comprehensive internal investigation into the incident and made a number of safety recommendations, including one to review driving procedures across the airport. Instructions were issued, by means of safety notices, for aeronautical radios installed in vehicles to be tuned to the active frequency or the frequency instructed by ATC, and for portable radios to be used for emergency backup and when drivers are out of the vehicle on the manoeuvring area (marshalling etc).

ACCIDENT

Aircraft Type and Registration:	Piper PA-31 Navajo, G-FILL
No & Type of Engines:	2 Lycoming TIO-540-A2C piston engines
Year of Manufacture:	1979
Date & Time (UTC):	27 October 2010 at 0708 hrs
Location:	Hague Lane, Wentworth, Rotherham
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to left wing, propellers, nose and right wing tip
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	67 years
Commander's Flying Experience:	7,952 hours (of which 533 were on type) Last 90 days - 67 hours Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

During the landing roll on a grass runway, the pilot experienced negligible braking action and was unable to prevent the aircraft from overrunning the runway and striking a stone wall.

History of the flight

The pilot was landing at a private strip at Wentworth. The runway was oriented 110/290° and had several level changes along its length which required all landings to be made in the 110° direction and all takeoffs in the 290° direction. Touchdown was required to take place on a level portion before the ground rose relatively steeply and levelled out again. The final part of the runway sloped gently down towards the end, which was bordered by a dry stone wall. The surface, from police photographs taken soon after the accident, showed it to be closely mown grass and firm, despite the indications of recent rain. The wind at the time was 220°/10 kt and the pilot reported that the approach was made directly into the setting sun, making it difficult to monitor the airspeed indicator.

Touchdown was achieved on the first level portion of the runway and the brakes were applied very soon afterwards; however the pilot stated that there was no discernible braking action, despite applying firmer pressure on the brake pedals. Seeing that the stone wall at the end of the runway was approaching, he steered the aircraft to the right and towards a hedge, however he was unable to prevent the left wing striking the wall

and causing severe damage outboard of the engine. The pilot was uninjured and evacuated the aircraft normally.

The police photographs indicate that the mainwheels were skidding on the wet grass almost throughout the landing roll of about 630 metres. Whilst the pilot acknowledged that his airspeed might have been somewhat high, he did not feel at the time of touchdown that his groundspeed was unusual and he attributes the lack of braking action to the slippery runway surface.

ACCIDENT

Aircraft Type and Registration:	Auster 5 Alpha, G-AOFJ
No & Type of Engines:	1 Lycoming O-290-3 piston engine
Year of Manufacture:	1956
Date & Time (UTC):	19 October 2010 at 1410 hrs
Location:	Haverfordwest, Pembrokeshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Right landing gear collapsed, propeller broken
Commander's Licence:	Private Pilot's Licence
Commander's Age:	47 years
Commander's Flying Experience:	1,148 hours (of which 142 were on type) Last 90 days -30 hours Last 28 days - 9 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

A bounced landing led to the collapse of the right landing gear with subsequent damage to the propeller.

History of the flight

The aircraft departed Oaksey Park airfield at 1120 hrs on a private flight to Haverfordwest. The pilot reported that she received consistent weather information en route and during final approach: the wind was from 300º at 10 kt, gusting 20 kt.

The aircraft was on approach to Haverfordwest, Runway 27. The pilot had selected full flaps for landing and made corrections for approach consistent with a 5 to 10 kt crosswind. She reported that initial touchdown was "a perfectly light 3-point landing", close to the runway centreline.

On landing the pilot kept the engine at idle and stick back. She reported that rolling speed was "apparently low", yet after rolling for 10 to 20 m the aircraft left the ground again. The second touchdown was a slight bounce, following which the pilot reported that a gust took the aircraft off to the left of the runway. When the gust subsided the aircraft landed on the grass just to the left of the asphalt. On this third contact with the ground the right landing gear failed, with damage to the propeller resulting. The pilot, who was wearing a four-point harness, was uninjured.

Pilot's assessment of the cause

The pilot did not report that any adverse weather conditions affected the aircraft during the flight from Oaksey Park. She reported seeing the 20 kt windsock

horizontal during final approach, and that the wind appeared to strengthen after the second (bounced) contact with Runway 27.

Subsequent to the accident, the pilot checked conditions recorded by Haverfordwest air-ground radio at 1400. Records show wind from 345º at 15 to 18 kt, gusting 25 kt. The pilot reported that conditions were variable and that the full variation of wind speed and direction may not have been given to her. She also reported that it is possible she misheard the conditions given to her on approach and that she would have made adjustments to the landing had she appreciated the conditions detailed on the recording.

Although the final landing "appeared light", the pilot reported that a "sideways motion" was present, which she believes may account for the landing gear collapse. She believes the strong crosswind was a factor in the accident.

ACCIDENT

Aircraft Type and Registration:	1) Cessna 182S Skylane, G-EFAM 2) Cessna C-165 Airmaster, G-BTDE
No & Type of Engines:	1) 1 Lycoming IO-540-AB1A5 piston engine 2) 1 Warner Aircraft Corp Scarab 165 piston engine
Year of Manufacture:	1) 1999 2) 1940
Date & Time (UTC):	12 September 2010 at about 1400 hrs
Location:	Manchester Barton Aerodrome
Type of Flight:	1) Private 2) Private
Persons on Board:	1) Crew - 1 Passengers - 2 2) Crew - 1 Passengers - None
Injuries:	1) Crew - None Passengers - None 2) Crew -None Passengers - N/A
Nature of Damage:	1) Leading edge of right wing 2) None
Commander's Licence:	1) Private Pilot's Licence 2) Private Pilot's Licence
Commander's Age:	1) 45 years 2) 67 years
Commander's Flying Experience:	1) 402 hours (of which 264 were on type) 2) 15,343 hours (of which 13 were on type) Last 90 days - 25 hours Last 28 days - 19 hours
Information Source:	Aircraft Accident Report Form submitted by the pilots of both aircraft

The pilot of G-BTDE reported that there was a fly-in at the aerodrome (Manchester Barton) with "39 or so visiting aircraft" and that holding point A2 had been designated for relief parking. The pilot of G-EFAM reported that he was conducting pre-flight checks, with engine and electrics off, adjacent to holding point A2. He reported that he was parked in accordance with the instructions of the aerodrome flight information safety officer.

G-BTDE is a tailwheel aircraft and the pilot reported that he was "weaving and taxiing cautiously" to holding point A3, which required him to transit past holding point A2. He also reported being distracted by the GPS and failing adequately to clear his "blind" (right) side.

Both pilots reported that the right wing of G-BTDE collided with, and slid under, the right wing of G-EFAM,

following which the pilot of G-BTDE shut down his aircraft. G-BTDE was undamaged. The right wing of G-EFAM suffered minor damage close to the wing tip but subsequently was cleared for flight by a licensed aircraft engineer.

ACCIDENT

Aircraft Type and Registration:	MCR-01 VLA , G-TOOT
No & Type of Engines:	1 Rotax 912-UL piston engine
Year of Manufacture:	2003
Date & Time (UTC):	17 April 2010 at about 1622 hrs
Location:	Weyhill, near Thruxton, Hampshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Fatal) Passengers - 1 (Fatal)
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	398 hours (of which 180 were on type) Last 90 days - 14 hours Last 28 days - 5 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft was returning from Duxford to a private airstrip near Bournemouth. The pilot reported smoke in the cockpit and that he was diverting to Thruxton. About two minutes later the aircraft crashed two miles east of Thruxton and both occupants were fatally injured in the impact. Evidence indicated that there had not been an engine compartment fire as the source of the smoke, leading to the probability that the smoke was generated by an electrical fault within the cockpit. A large and sustained post-crash fire destroyed any evidence that would have allowed a specific component to be identified as the source of the smoke.

History of the flight

The aircraft had flown from a private site near Bournemouth, Dorset, to Duxford in Cambridgeshire in order for the owner and a friend to attend a 'safety day'. They departed from Duxford at 1530 hrs and followed a direct track back towards the Bournemouth area. Initially cruising at 2,400 ft and receiving a Traffic Service from Farnborough LARS, numerous radio messages were passed relating to traffic; throughout the flight the pilot's voice appeared normal and in later analysis no unusual sounds were heard.

At 1605 hrs, while passing the town of Reading, the aircraft began a climb, reaching 4,600 ft at 1613 hrs. At 1617:10 hrs the aircraft was approaching the western edge of Farnborough's radar cover and was instructed

to squawk 7000 and 'free call' its en route frequency. Shortly after this the aircraft commenced a descent.

At 1619 hrs the Distress and Diversion (D&D) cell at the London Air Traffic Control Centre (LATCC) received a radio call from the pilot on 121.5 MHz. The pilot reported that the aircraft was at 3,600 ft, overhead Andover, that the cabin was filling with smoke and that he intended to land at Thruxton.

The aircraft continued its descent towards Thruxton, routeing over Andover and the D&D controller provided a 'steer' for Thruxton as 260° at a range of 7 nm based on a two-line direction-finding fix. However, although the range and bearing were correct for Thruxton the controller mistakenly said "TURWESTON". The pilot corrected the controller and stated that he intended to make a straight-in approach. The controller then confirmed that the steer was for "THRUXTON" and the range was now (at 1620:40 hrs) 4 nm. The pilot reported "VISUAL" and that "WE MAY HAVE TO STOP THE ENGINE".

At 1621 hrs D&D received a 'carrier-wave only' transmission lasting 9 seconds, which they believed to have originated from the accident aircraft. There was no further radio contact.

Eyewitnesses

Several eyewitnesses, driving along the A303 and in the nearby village of Weyhill, reported seeing the aircraft flying normally, if somewhat lower than usual, then abruptly entering a nose-down spinning manoeuvre until passing from sight. Immediately a large ground fire and smoke column appeared. Some of the eyewitnesses were able to go immediately to the scene of the accident and located the aircraft wreckage, on the edge of a field of crop, 150 m south of the village of Weyhill, Hampshire. Both occupants had received fatal injuries.

Witnesses reported different numbers of turns during the spin, of which four was the most common estimate. One of the eyewitnesses thought the spinning had ceased just before the aircraft crashed. The only witness who felt certain of the direction of the spin believed it to be to the left. No witnesses reported seeing any fire or smoke trail before the aircraft struck the ground.

Thruxton aerodrome

At the time of the accident Thruxton Aerodrome was hosting a major motor-sports event. The airfield was operating before and after the event and sufficient runway was available for G-TOOT; however, the additional infrastructure and the considerable number of spectators would have been visible for several miles.

Crew experience

The pilot had learned to fly in 2003 in the USA and he had amassed just under 400 hours of flying experience. He had purchased the accident aircraft, G-TOOT, in October 2006 and had flown 180 hours in it. He was in current flying practice and the aircraft was based at a short, grass strip. The passenger had held a PPL (A) at one time and it is reported that in 2004 he had conducted some training towards renewing his PPL, as well as flying as a passenger with a variety of friends. He is reported to have had around 150 hours total flying time as a pilot.

Post-mortem examination

A specialist aviation pathologist conducted post-mortem examinations on both the pilot and passenger. He reported that both occupants had received instantly fatal injuries in the ground impact. There was no evidence of drugs or alcohol having been consumed or natural disease which could have any bearing on the accident.

The pathologist commented that:

> *'The absence of elevated carbon monoxide or cyanide levels in the blood of either occupant makes it unlikely that they have been exposed to levels of products of combustion in the cockpit capable of producing incapacitation, and the absence of visible soot in the airways means it is unlikely that they have been exposed to dense smoke containing large particles. However, this does not preclude the presence of fumes within the cockpit…'*

Meteorology

The weather conditions at the time of the accident were a surface wind of 2 kt, air temperature of 16°C, dew point -2°C, no cloud and over 10 kilometres visibility. There was a Volcanic Ash Advisory valid for the time of the accident, however there was no evidence that this had any bearing in this accident.

Recorded information

Radar data from Pease Pottage radar (near Gatwick), and the Heathrow radars was available for the accident flight. The data contained positional information, together with Mode A squawk codes and Mode C heights. These ended at 1621:31 hrs with the aircraft 600 m north of the accident site and at 1,200 ft amsl (about 900 ft agl).

Two GPS units were recovered from the accident site. The first was a Lowrance Airmap 500 that had been destroyed during the impact and ensuing fire; no data was recovered from this device. The second was a Garmin GPSMAP 296. This was normally mounted within the instrument panel but during a search of the wreckage site on the morning after the accident, it was found clear of the main wreckage and detached from the panel. The unit showed slight signs of damage and could be powered up for a few seconds on the residual charge left in its batteries. It was subsequently taken to the AAIB and downloaded.

The GPS-recorded track started at 1528:06 hrs at Duxford Airfield and ended at 1616:53 hrs, about five minutes before the end of the flight. The track showed that the aircraft routed to the south-west overhead Luton Airport and Reading, climbing in steps to 4,600 ft amsl south of Thatcham. The average groundspeed during the cruise portions of the flight was 110 kt. The final portion of the accident track, based on the radar and GPS data, is illustrated in Figure 1 and the altitude profile in Figure 2. For reference, the squawk codes and time of the distress call are also indicated on these figures.

Figure 2 shows that the aircraft started descending 30 seconds after the squawk code of 7000 was selected. The descent rate was approximately 1,000 ft/min. The groundspeed during the descent (not illustrated) remained between 100 and 110 kt, slowing to 80 kt over the last 20 seconds.

Figures 1 and 2 also show that the GPS stopped recording during the period the pilot was in contact with Farnborough LARS. For the GPS to stop recording in flight it was either operating on batteries, which happened to run out at that point, or the signal to the GPS satellites was lost while the GPS remained powered. The GPS was, however, panel mounted, which included a connection to the aircraft electrical power supply, and an antenna mounted on top of the instrument dash via BNC connectors and a coaxial cable. A check of the antenna at the AAIB showed that it was still serviceable.

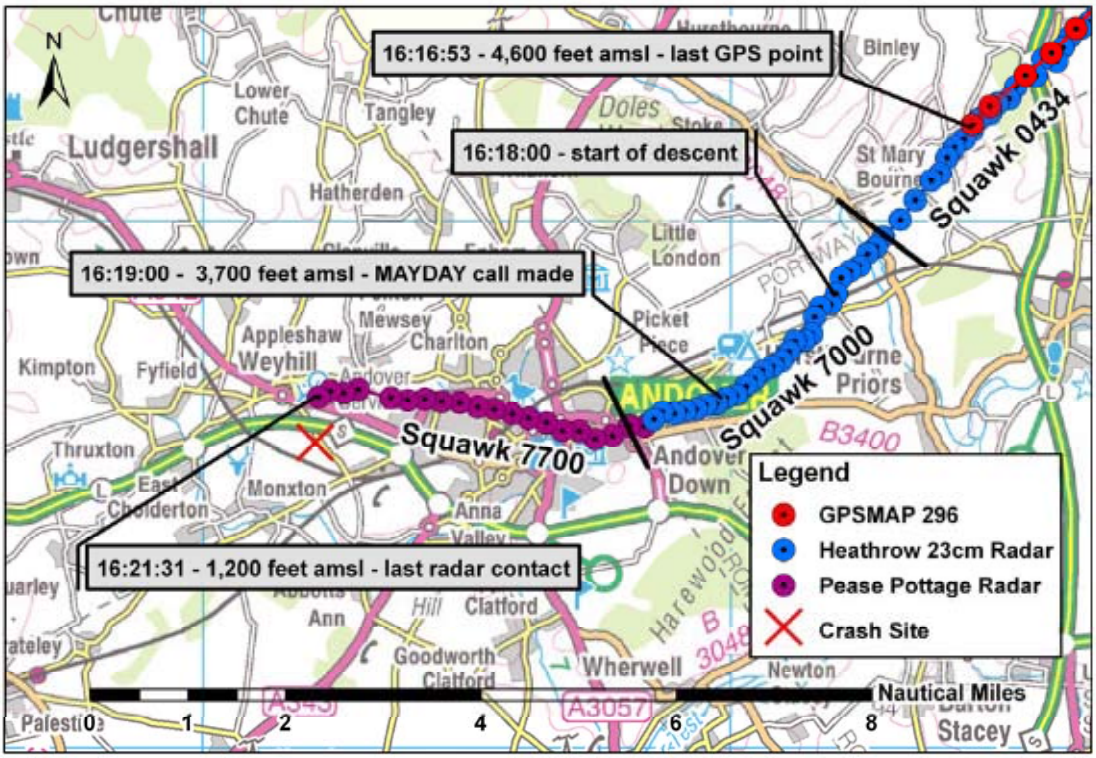

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Figure 1

Final portion of G-TOOT accident track from GPS and radar

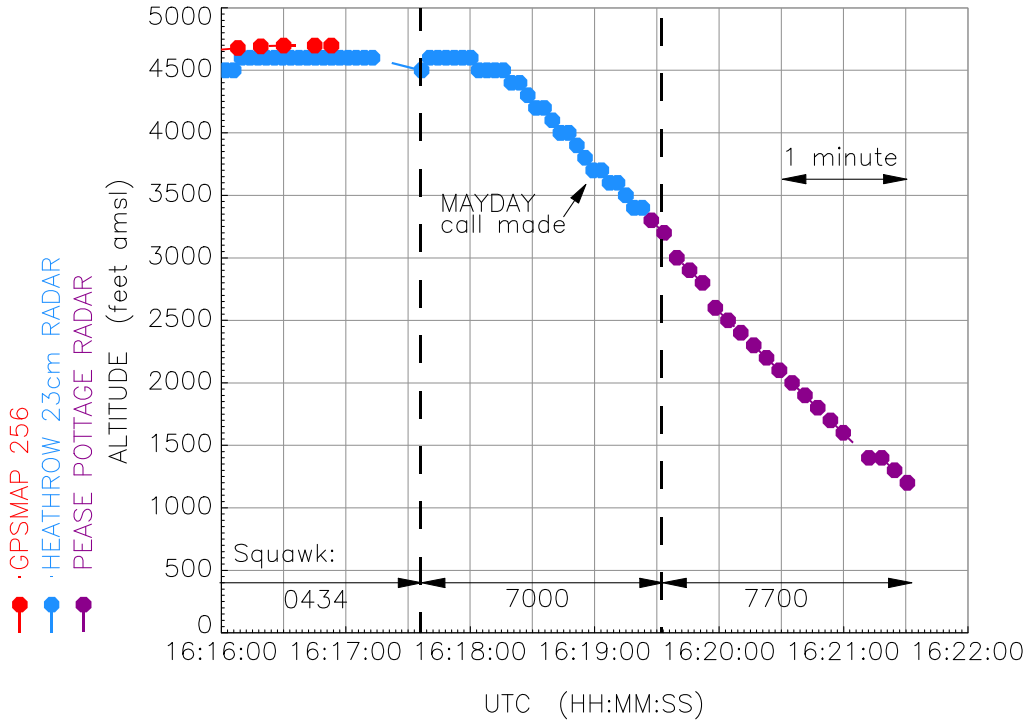

Figure 2

G-TOOT altitude and Mode A squawk codes

Both the GPS and antenna showed signs that each end of the coaxial cable had been connected at impact; however, the cable was destroyed in the post-impact fire so it could not be determined whether the cable had been damaged during the flight, breaking the connection.

It is also possible that the antenna could have been inadvertently covered over with something metallic, capable of blocking the satellite signals. However, determining what this could have been was not possible given the fire damage and disruption of the wreckage.

Aircraft description

G-TOOT had been assembled privately in the UK from a kit of parts supplied by the manufacturer in France and was operating under the provisions of a Permit To Fly. It was an early example of the type. The fuselage and tailfin were moulded from carbon-fibre reinforced plastic (CFRP), whilst the wings were of aluminium alloy skin and foam rib construction, utilising a CFRP spar. The tailplane was similarly of aluminium alloy skin. The aircraft was equipped with flaperons, each built in two sections, connected by spigots and driven mechanically from the root ends. Thus the control mechanism was positioned entirely in the fuselage and fin. Although originally built with aluminium alloy flaperons, at the time of the accident the aircraft had been retrofitted with the latest specification CFRP flaperons. The engine cowlings were manufactured from glass-fibre reinforced plastic (GFRP).

A composite/steel insulated fire-proof bulkhead separated the engine compartment from the cabin and fuel tank. A simple cabin heat system is used in the type. This consists of a pilot-operated flap, mounted on the cabin underside, which can be extended into the external airflow slightly aft of the point where air exits from the engine oil and water coolers at the rear of the lower cowling.

At the time of build, the majority of the electrical system was not supplied by the kit manufacturer, nor was there standardisation of design of electrical systems across examples of the type. Examination of another example of the type did not suggest an obvious route whereby any smoke generated in the engine compartment might enter the cabin.

General wreckage examination

Examination of the wreckage site showed that the aircraft was not greatly fragmented in the ground impact and had not inflicted a significant ground indentation. It had struck a fence, a hedge and the ground in a steep nose-down attitude and the general condition of the ground and the wreckage, together with the distribution of that wreckage, indicated that the impact was at a low forward speed. The general features were consistent with the effects of a spin.

An intense ground fire had destroyed the structure of the fuselage and the left wing. The right wing had separated as a result of impact with the fence and remained in the hedge. The largely unburnt tailplane remained attached to the burnt remains of the tailfin, correctly orientated relative to the fin and fuselage. The two carbon composite right flaperons had remained attached to the unburnt remnants of the right wing and one end of the rudder was identified attached to the burnt remains of the fin.

A number of items were projected into the field from the forward fuselage and cabin area. These included the canopy frame and fragments of transparency, a crew seat, the instrument panel and the upper engine cowling panel. Examination of the area of projection revealed singed grass and some of the projected items were smoke-blackened. This evidence was consistent with the items being ejected, at impact, through a significant fireball.

Thus, the evidence suggested that the aircraft was structurally complete at the time of the impact.

Detailed examination

Following recovery to a controlled facility, the wreckage was subjected to detailed examination. The carbon composite fuselage structure had been reduced to a mass of fibres resting on the melted remains of the skin of the starboard wing. The flying control system was disrupted and largely destroyed by fire, to the extent that control continuity could not be confirmed. The wiring within the fuselage was also massively disrupted and was entangled among the burnt carbon fibres of the fuselage, with all the insulation partly or completely melted. Electrical items, believed to be pilot equipment rather than aircraft parts, were also recovered. These were in a heat-damaged state, consistent with the effects of the ground fire.

Examination of the surviving upper engine cowling revealed sooting around the damaged edges. The aft underside was, however, in a relatively clean condition, without significant surface discolouration. Strip examination of the engine confirmed that it was operating under power at the time of the impact.

Analysis

The pilot's initial MAYDAY call was calm, providing little sense as to the scale of the emergency and showed that he was both aware of his position and had a plan of action. When the D&D controller made a minor slip, saying 'Turweston' when he meant 'Thruxton', the pilot displayed spare mental capacity by identifying the mistake and correcting it.

The pilot's second call at 1620:50 hrs remained calm, identified a deteriorating situation and included the information that he might have to shut down the engine. The aircraft continued on a track towards Thruxton descending at a constant rate. The final ground position was somewhat displaced to the south of the track to Thruxton, leading to two hypotheses. First, it is possible the pilot had decided to turn away from the airfield and conduct an immediate forced landing. This could have been because of a deteriorating cockpit environment or alternatively the pilot may have seen the considerable ground activity at Thruxton and decided not to increase the risk to others by attempting to land there. The height of the spin entry makes it unlikely that the pilot was attempting to land in the field in which the wreckage was located; however, there were several suitable fields in the area, particularly for a pilot with short grass strip experience.

The second hypothesis was that the pilot had become disorientated by the cockpit environment and had inadvertently turned away from Thruxton.

Regardless of the reason for the aircraft being displaced to the south of the direct track to Thruxton, it would appear that the deteriorating cockpit environment led to control being lost and the aircraft entering a left-hand spin from low level.

Eyewitnesses did not report seeing either smoke or fire from the aircraft before ground impact. The examination of the underside of the top cowling revealed no evidence to suggest that smoke was being created in the engine compartment; a period of such smoke production would be expected to discolour the upper aft region of the engine compartment, including the cowling panel. No evidence of any malfunction was found during engine strip and an examination of another example of the type did not suggest a route by which smoke produced in the engine compartment could readily enter the cabin of the aircraft. The only

functional connection between the two areas was via the external flap which ducted heated air from downstream of the oil cooler and water radiator into the cabin. In view of the clear sky during the accident flight, together with the large area of transparency of the canopy, the cabin air would almost certainly have been at a temperature not requiring further heating. Any smoke entering the cabin through this mechanism would also almost certainly have been noticeable to the eyewitnesses. An engine-fed (fuel or oil) fire would be more likely to generate external smoke through cowling gaps and the burning of oil and rubber seals would have produced larger and more obvious soot particles, which the post-mortem examination suggests were not present.

As such an engine compartment fire was ruled out as the cause of the smoke.

It is likely that the source of smoke was contained within the cockpit area and the smoke generated was of a small particle size. This would be suggestive of an electrical or wiring type source. The anomaly of the GPS stopping about five minutes before the accident suggests that there may have been a developing electrical problem.

The initial impact and then the sustained post-crash fire totally disrupted the electrical system and melted most of the insulation. Similar damage affected the separate electrical items. This precluded a meaningful examination of the system, and the separate items, for the more subtle effects of pre-crash electrical faults. Thus, the wreckage examination did not identify or preclude an electrical fault as the source of the cabin smoke known to have been present in flight. However, the post-mortem examination on both occupants showed it to be unlikely that either had been exposed to incapacitating levels of the products of combustion.

Conclusion

The disruption to the aircraft caused by the post-crash fire compromised the investigation. Despite this, the investigation was able to conclude that an engine fire was not the cause of the smoke, The pilot showed spare mental capacity in his radio transmissions and it is likely that a rapid deterioration of the cockpit environment occurred between the first distress call and the loss of control.

ACCIDENT

Aircraft Type and Registration:	Nipper T.66 RA45 Series 3, G-CBCK
No & Type of Engines:	1 Jabiru Aircraft PTY 2200A piston engine
Year of Manufacture:	1998
Date & Time (UTC):	10 January 2011 at 1000 hrs
Location:	Abbots Hill Farm Strip, Hertfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Wing tips, D-box leading edge, propeller, nose landing gear and left main landing gear
Commander's Licence:	Private Pilot's Licence
Commander's Age:	60 years
Commander's Flying Experience:	2,085 hours (of which 245 were on type) Last 90 days - 6 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

Shortly after takeoff the engine lost power and the pilot closed the throttle and landed the aircraft on a down-sloping area of uneven ground. The main fuel tank, which had been selected for takeoff, was found to be empty and the auxiliary fuel tank contained two gallons of fuel. The pilot considered that fuel had transferred from the main tank to the auxiliary tank through a defective fuel tank selector switch, but also stated that he should have visually checked the fuel tanks prior to flight.

History of the flight

The aircraft had a main fuel tank mounted in the forward fuselage and one auxiliary fuel tank mounted in the right wing root. The two tanks were independent of each other, with no provision to cross-feed fuel. Either tank could be independently selected to supply fuel to the engine via a manually-operated cockpit selector, with the selector isolating the fuel supply from one tank whilst connecting the other tank to the engine. The main fuel tank was equipped with a fuel gauge, which the pilot reported as reading near to empty when approximately three gallons of fuel remained. The auxiliary fuel tank was not equipped with a gauge.

Several weeks before the accident, the pilot had depleted the contents of the auxiliary fuel tank only by running the engine on the ground until it stopped. The

aircraft was then flown on several occasions using the main tank only and with no fuel being uploaded to the auxiliary tank.

The last flight prior to the accident had taken place one week earlier. During the pre-flight inspection, the pilot stated that he had visually checked the main fuel tank quantity. He did not check the auxiliary fuel tank as he assumed it to be empty. After landing, the fuel gauge was reading near to empty and, based on his previous check of the main tank and flight time, he estimated that the main tank contained approximately three gallons of fuel. He then parked the aircraft in a hangar.

On the morning of the accident, the pilot removed the aircraft from the hangar and carried out a pre-flight inspection. The pilot stated that when the weather was cold, as it was on the morning of the accident, the fuel tank filler caps were difficult to remove. Believing that the auxiliary fuel tank was empty, and having previously estimated that the main tank contained approximately three gallons of fuel, he decided not to visually check the fuel tanks. With the main tank selected, he started the engine. After allowing the engine to warm, he then taxied to the runway where he completed the pre-flight checks. During the takeoff run full power was obtained but shortly after getting airborne the engine lost power. Realising that he may not be able to clear the terrain ahead, he closed the throttle and made a right turn to land on a down-sloping area of uneven ground. The aircraft touched down gently at a groundspeed of about 40 kt. However, the left wingtip contacted the ground and shortly afterwards the left and nose landing gear collapsed. The aircraft tipped forward onto its nose and right landing gear before coming to a stop. The left and nose landing gear, both wing leading edges, wing tips and propeller were damaged. The pilot was wearing a full harness and was uninjured. Unaided, he vacated the aircraft through the canopy.

The aircraft was recovered to the hangar, where it was found that the main fuel tank was empty, but the auxiliary fuel tank contained two gallons of fuel. Fuel was drained from the gascolator and carburettor, tested and found to be uncontaminated. The pilot stated that during the previous week, the aircraft had been parked slightly right wing down and he considered that fuel had transferred from the main tank to the auxiliary tank through a defect in the fuel tank selector. He also stated that he should have visually checked the contents of both fuel tanks prior to flight.

ACCIDENT

Aircraft Type and Registration:	Piper PA-38-112 Tomahawk, G-TOMS
No & Type of Engines:	1 Lycoming O-235-L2C piston engine
Year of Manufacture:	1979
Date & Time (UTC):	26 November 2010 at 1125 hrs
Location:	Brecon Beacons, Wales
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Severe damage to airframe and engine
Commander's Licence:	Private Pilot's Licence
Commander's Age:	66 years
Commander's Flying Experience:	266 hours (of which 100 were on type) Last 90 days - 4 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The pilot became lost in a snow storm and descended to establish VMC. He noticed that he was set to collide with terrain and opened the throttle to regain a safe altitude. There was no response from the engine and the aircraft made a heavy landing, which caused it to pitch over onto its canopy.

History of the flight

The aircraft departed Swansea at 1045 hrs on a flight to Sleap for a 50-hour service. The pilot reported that he obtained weather data from the Met Office website prior to departure. The Met Office forecast for weather below 10,000 ft, valid from 0800 to 1700, predicted 20 to 40 km visibility in some areas, with isolated areas of snow and hail of varying intensity up to severe across Wales and the Midlands. Visibility was predicted to reduce to 400 m in severe conditions at fronts and troughs. Fronts and zones on the Met Office chart were valid at 1200 and the chart showed an occluded front on the west Wales coast moving west. The pilot dressed for extreme cold.

The pilot reported that conditions were clear at departure. He took a course north from Swansea and reported VMC past Ammanford before he encountered snow. There was "occasional borderline VMC" in the snow. The pilot, who did not have an instrument rating, decided to continue to Sleap.

The pilot reported that snow from the west was "much more widespread and severe than forecast". At some

point, he turned east to try to "outrun" the snow at 4,000 ft, but he became disorientated and decided to head back to the coast around Swansea and set a course of 215º.

The pilot descended to 3,000 ft to establish position. He expected to be able to maintain 200 to 300 ft clearance from the terrain at that altitude, but the ground appeared to "come up from beneath" him. He applied throttle to regain altitude but there was no response from the engine. The pilot had not experienced engine problems until that point in the flight.

The pilot reported that the aircraft approached the ground "steeper than would have been normal for a landing" and that the aircraft tipped over onto its nose on contact with the ground and came to rest inverted (Figure 1). The pilot was wearing a full harness and exited the aircraft through the cabin side window.

Pilot's estimate of the cause

The pilot became lost in a snow storm, which prompted him to descend to establish VMC, placing the aircraft in the proximity of terrain. He considered the loss of engine response was either due to carburettor icing or a blocked air intake. Carburettor heating had been applied "diligently" and that heating may have "exacerbated carburettor icing" just prior to impact. The pilot also reported that it is possible that snow flakes blocked the carburettor air intake.

Lessons learned

The pilot reported that he would approach conditions of deteriorating visibility more cautiously in the future and would make an earlier decision to seek less marginal weather conditions if he found himself in a similar situation.

Figure 1

G-TOMS inverted on hillside
(photograph courtesy of Cambrian Flying Club)

ACCIDENT

Aircraft Type and Registration:	Pitts S-2B Special, G-IIDY
No & Type of Engines:	1 Lycoming AEIO-540-D4A5 piston engine
Year of Manufacture:	1982
Date & Time (UTC):	7 November 2010 at 1330 hrs
Location:	Leicester Airport, Leicestershire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Canopy destroyed, damage to fabric on right lower main plane and tail, denting to canopy frame
Commander's Licence:	Private Pilot's Licence
Commander's Age:	57 years
Commander's Flying Experience:	1,471 hours (of which 500 were on type) Last 90 days - 15 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The canopy had not been correctly secured before departure. As the pilot opened the throttle to take off the canopy opened and detached, striking the wing and tail as it fell to the ground. The takeoff was rejected, there were no injuries and the aircraft sustained minor damage.

History of the flight

The aircraft was being flown from the rear seat by a pilot who was experienced on the type, with another pilot, also current on the type, occupying the front seat. The canopy on this aircraft was fitted with a non-standard warning horn, which sounded if the canopy locking lever was not in the fully locked position. Before departure the pilot flying (PF) closed and locked the canopy and confirmed the horn was not sounding. He then opened the throttle and commenced the takeoff, at which point the canopy opened and detached from the aircraft. The pilot abandoned the takeoff and taxied clear of the runway. Following inspection by the pilot, he determined that the canopy locking mechanism remained in the locked position and concluded that it could not have engaged correctly on the aircraft fuselage.

The pilot commented that he was aware of canopy detachments happening to several other Pitts S2B and S2C series aircraft in the UK. Other Pitts pilots

contacted also commented on the apparently high number of canopy detachments. However, the CAA Mandatory Occurrence Report database only holds records of one detachment in the previous 10 years. Although anecdotal information supported the pilot's assertion that there is an issue with the operation of the canopy locking system, the lack of reported cases means that no safety recommendation has been made.

The pilot commented that, to ensure the canopy is secure, in future he would attempt to pull it rearwards and push it upwards after it has been locked.

ACCIDENT

Aircraft Type and Registration:	Silence Twister, G-TWSR
No & Type of Engines:	1 Jabiru Aircraft PTY 2200A piston engine
Year of Manufacture:	2006
Date & Time (UTC):	11 October 2010 at 1700 hrs
Location:	4-5 nm north-east of Gloucestershire Airport
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Landing gear mechanism, underside and wings scratched, engine crankcase distorted around No 4 cylinder
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	42 years
Commander's Flying Experience:	9,500 hours (of which 838 were on type) Last 90 days - 270 hours Last 28 days - 92 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The aircraft was about 5 nm north-east of Gloucestershire Airport at 800 ft amsl when the engine began to run roughly. The oil temperature and pressures appeared normal; however, the rough running of the engine worsened with what the pilot described as "lots of mechanical noise". He decided to make a precautionary landing into a field. During the descent, as the aircraft passed through 700 ft amsl (approximately 570 ft agl), the engine stopped. The aircraft touched down in the field which had been recently cultivated and the mainwheels dug into the soft earth during the landing roll.

The force on the landing gear legs bent them backwards and pushed them upwards into the stowed position. The aircraft came to a stop shortly afterwards. Apart from damage to the landing gear mechanism, the aircraft suffered scratches to its underside. The pilot, who was wearing a full harness, was uninjured and informed ATC at Staverton that emergency services would not be required. A subsequent inspection of the engine revealed damage to the crankcase around the No 4 cylinder.

ACCIDENT

Aircraft Type and Registration:	Schweizer 269C-1, G-CEAW
No & Type of Engines:	1 Lycoming HIO-360-G1A piston engine
Year of Manufacture:	2006
Date & Time (UTC):	22 May 2010 at 1150 hrs
Location:	Liverpool Airport, Merseyside
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	Extensive
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	51 years
Commander's Flying Experience:	370 hours (of which 230 were on type) Last 90 days - 1 hour Last 28 days - 1 hour
Information Source:	AAIB Field Investigation

Synopsis

The pilot was performing takeoffs and landings at Liverpool Airport when the helicopter entered ground resonance while landing. The rotor rpm (N_R) was too low for flight but, instead of closing the throttle, the pilot attempted to restore the N_R to the normal speed. The ground resonance increased rapidly and the aircraft was damaged beyond economic repair. The pilot recalls losing control; his next recollection is receiving medical treatment 40 m from the helicopter. His injuries were classified as minor.

The helicopter's landing gear dampers were subjected to several tests, but with inconclusive results.

History of the flight

The pilot was carrying out some general handling manoeuvres around Taxiway Y at Liverpool Airport. The weather conditions were good, with a light and variable wind, and the temperature was 24ºC. The pilot completed a landing on the shoulder of the taxiway, facing west, which gave him a lateral slope of about 3°. He then lifted the aircraft back into the hover, carried out a 180° turn and landed again, this time facing east. As the pilot lowered the lever, he experienced a violent and divergent vibration. Suspecting ground resonance, the pilot decided to lift back into the hover, but, on checking the N_R he realised that it was below the green arc (the operating range for flight). He opened the throttle to increase the N_R but was unable to lift to the hover because the increasing vibration made the aircraft uncontrollable.

This was the pilot's last recollection. The next thing he remembered was sitting on the ground, approximately 40 m from the helicopter, being treated by the emergency services. The pilot was taken to the local hospital where he received 20 stitches to the back of his head. The aircraft was damaged beyond economic repair but there was no fire (Figure 1).

Figure 1

Ground resonance

All fully articulated helicopters are susceptible to ground resonance with, according to the manufacturer of G-CEAW, three-bladed aircraft more susceptible than those with more blades. Ground resonance is a condition which can occur when the relatively equal angular spacing between the main rotor blades is not maintained, due to movement permitted by the lead-lag dampers, whilst operating on the ground. This results in an out of balance condition in the main rotor, creating a lateral oscillation of the aircraft. This is normally damped by the landing gear oleos and tyres or, in the case of the Schweizer 269C, the landing gear dampers and struts. When one or all of the landing gear damper pressures differ from the design values, they may not attenuate the lateral motion and the subsequent divergent oscillation can increase to the point of breaking up the aircraft.

The flight manual for the helicopter contains the following caution when performing the external check of the landing gear.

> *'Ground resonance can result if the helicopter is operated when landing gear damper extension, oil type, and/or oil to air proportions are incorrect.'*

The manufacturer examined photographs of the helicopter and of relevant components, which were taken after the accident and confirmed that the damage to the aircraft was consistent with ground resonance.

Once ground resonance starts it can develop very quickly. The FAA Basic Helicopter Handbook contains advice for pilots who experience ground resonance. It states:

> *'Corrective action could be an immediate takeoff if RPM is in the proper range, or an immediate closing of the throttle and placing the blades in low pitch if RPM is low.'*

Landing gear damper description and maintenance history

The dampers are fixed-orifice type hydraulic units, filled, to a specified level with hydraulic oil and charged with nitrogen gas. The rear dampers have a higher charge pressure (725 psi) and lower fluid level than those at the front (350 psi). Thus the effective spring stiffness

is determined by the gas pressure whilst the damping is governed by the rate at which the fluid is transferred through the internal orifices.

The pressure in the dampers can only be set at manufacture and subsequent overhaul; there is no provision for checking or topping up the pressure during service due to the small volumes of gas involved. The condition of the units is assessed by means of a pre-flight visual check of the aircraft stance, together with a dimensional check of the dampers at the 100 hour inspections.

The helicopter underwent a 1,200 hour check in November 2009 at 1,172 flight hours. The work carried out included sending the landing gear dampers, for resealing and recharging, to a small component maintenance company that is familiar with the units and has a long experience of servicing them; they were thus aware of the different charge pressures between front and rear. The recharging process was conducted using a dedicated rig in which the damper was connected to a nitrogen supply: the rig's pressure gauge was subjected to an annual calibration check. The helicopter maintenance company had requested that the pressures were set to the lower limits, as the flying instructors had stated that doing this tended to lessen any vibration. However, the component maintenance company misinterpreted this request and set them to the upper limits. When the helicopter maintenance company realised this (via a telephone conversation, before the dampers had been refitted to G-CEAW), the units were sent back again and recharged to the lower pressure limit on 26 November 2009. The worksheets relating to this activity were made available to the investigation; these indicated that the pressures were set in accordance with the values stipulated in the associated Maintenance Manual. Only after this second visit to the component maintenance company were the dampers finally reinstalled on the aircraft.

Other work conducted during the 1,200 hour check was a dynamic balance of the main rotors. This resulted in an adjustment to two of the lead-lag dampers; the adjuster nut on one of them was turned 3.875 flats, with the maximum allowed by the Maintenance Manual being 4 flats. Changing the damper length in this way results in a small change in the angular displacement of the main rotor blades, with an attendant possibility of altering the magnitude of the lateral oscillations. The helicopter maintenance organisation stated that they keep a record of successive adjustments to ensure that the totals do not exceed the 4 flats limit.

The next maintenance activity on the aircraft was a 50 hour check on 30 April 2010 at 1,264 flight hours. This included a visual inspection of the landing gear dampers. At the time of the accident the helicopter had flown 121 hours, without incident, since the 1,200 hour inspection in November 2009.

Examination of components

Photographs taken after the accident showed that all three lead-lag dampers were broken. Unfortunately, these were not available for examination as the wreckage was disposed of shortly afterwards. The only components that were retained were the landing gear dampers, which appeared to be undamaged, with no fluid leakage. In view of their potential to cause ground resonance, it was decided to send them to the helicopter manufacturer for testing.

It was not possible for the charge pressure to be measured directly, for the same reasons noted above. The tests involved subjecting the units to a compression load/deflection test and comparing the results with those from serviceable dampers. It was found that, for a given load, the forward dampers were compressed by a smaller amount than with a serviceable unit.

Similar results were obtained with the rear dampers, although the differences were much smaller. Overall, these results suggested that the forward landing gear dampers were significantly overcharged, and the aft dampers were slightly overcharged. The helicopter manufacturer concluded that this condition did not allow the dampers to stroke sufficiently to attenuate the normal oscillating motion of the aircraft, thus resulting in ground resonance.

The dampers, which had not been opened or otherwise tampered with during the tests, were then returned to the UK, where they were subjected to additional tests, under AAIB supervision, at the component maintenance company where they were serviced. These tests were aimed at estimating the charge pressure and utilised the same rig that was used for charging the units during servicing. In this process, the damper was mounted in a specially designed fixture, with the piston ram end screwed into an integral fitting that was pressurised from a nitrogen supply. A charging plug on the end of the ram could be unscrewed by means of a handle and operating spindle that was located within the fitting and which was equipped with gas-tight seals. The process of partially unscrewing the plug exposed a hole in the threads that linked the gas chamber within the ram to the pressurised supply. Thus, by reference to the gauge, the damper could be charged to the required pressure before re-tightening the plug.

The test involved pressurising the supply line to the approximate charge pressure and then closing an isolating valve immediately upstream of the gauge, thereby trapping the gas in the short length of tubing between the damper and the isolating valve. Unscrewing the damper plug allowed equalisation of the pressures in the damper and tubing, which resulted in a change in the gauge reading. In the case of the forward dampers, the lines were charged to approximately 340 – 350 psi (it was noted that the combination of small gauge size and parallax error realistically limited the accuracy of the reading to ± 10 psi). Opening the damper plug caused the indication to drop to around 320 psi in both cases. If it is assumed, for a first approximation, that the gas volumes in the damper and charging lines were similar, then the gauge would indicate an average of the two pressure values. Thus the damper pressure would have been in the region of 290 - 300 psi. Whilst this figure does not represent an accurate assessment, the fact that the needle dropped confirmed that the damper pressure was lower than the specified value, albeit by a small amount.

The aft dampers were subjected to the same test. In the case of the right hand unit, the gauge reading increased slightly when the damper plug was loosened, indicating that the internal pressure was around 720 psi. The left unit was found to be low, probably below 600 psi.

The overall conclusion was that three of the dampers were likely to have been below their specified charge pressures, with the left rear unit approximately 14% down. These results were thus in complete disagreement with the conclusions drawn from the tests at the helicopter manufacturer.

An additional test was conducted in which a damper was placed in a fixture that was equipped with a hydraulic jack, a gauge and a hand pump; operating the pump caused the damper to compress. The internal dimensions of the jack were not known, although a pressure of 100 psi would have generated a load of between 500 and 1,000 lbf. A serviceable front damper (no rear ones were available) was installed in the fixture and the jack pressurised to 50 and 100 psi, and the compression of the damper was measured.

The process was repeated for one of the front dampers from G-CEAW, using the same applied pressures. The deflections were found to be nominally the same for both units.

Discussion

The available evidence indicated that the helicopter entered a ground resonance condition while landing. The N_R was too low for the pilot to lift into the hover and he did not close the throttle. The ground resonance rapidly increased in severity and the helicopter broke up. The helicopter manufacturer's tests suggested that the forward landing gear dampers were out of limits, in that the internal gas pressures were too high. However, subsequent tests in the UK suggested that the pressures in three of the units were slightly below the specified value, with one of the rear units being more significantly (possibly around 14%) below. It was not possible to reconcile this contradiction in the conclusions of the two series of tests.

The helicopter had successfully completed 121 flying hours since the 1,200 hour inspection, when the landing gear dampers had been recharged and the main rotor dampers adjusted. The operator experience suggests that some aircraft have a greater tendency than others to display symptoms of ground resonance. It is likely that changes to the landing gear and main rotor dampers, either singly or in combination, could account for such tendencies.

ACCIDENT

Aircraft Type and Registration:	Jabiru UL-D, G-CDKP
No & Type of Engines:	1 Jabiru Aircraft Pty 2200B piston engine
Year of Manufacture:	2005
Date & Time (UTC):	23 July 2010 at 1500 hrs
Location:	Damyns Hall Aerodrome, Essex
Type of Flight:	Training
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Left wing, landing gear
Commander's Licence:	Student pilot
Commander's Age:	52 years
Commander's Flying Experience:	35 hours (of which 30 were on type) Last 90 days - 10 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted on behalf of student pilot by his instructor

The student was conducting solo circuits on Runway 03 at Damyns Hall Aerodrome. Adjacent to the left side of the grass runway was a field of corn. The reported surface wind was from the north-west at less than 5 kt. It was reported that, whilst positioning the aircraft for landing, the student had allowed the aircraft to become low on the approach and, as the aircraft touched down, it bounced before touching down again. The aircraft then reportedly veered to the left, before coming to a stop in the adjacent field. The pilot was uninjured and exited the aircraft through the cabin door. The left wing and undercarriage were damaged.

ACCIDENT

Aircraft Type and Registration:	Mainair Blade 912, G-MZOR
No & Type of Engines:	1 Rotax 912-UL piston engine
Year of Manufacture:	1998
Date & Time (UTC):	12 September 2010 at 1850 hrs
Location:	Over the sea near Deal, Kent
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	None
Commander's Age:	29 years
Commander's Flying Experience:	33 hours (of which approximately 4 were on type) Last 90 days - 20 hours Last 28 days - 6 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

After a flight lasting over four hours, the engine stopped and the aircraft ditched. The engine was probably starved of fuel.

History of the flight

The aircraft took off from grass Runway 02 at Maypole Airfield in north Kent some time between 1400 and 1440 hrs[1] with two people on board. The airfield manager reported that there was a "stiff wind from the north". The pilot informed the airfield manager that he was going to fly to Peterborough and back, which would have involved a track of approximately 325°M. After takeoff, however, the aircraft turned right and departed towards the east.

At approximately 1857 hrs[2], the aircraft ditched alongside a dredger just off the coast near Deal, Kent. There was one person on board who was rescued by the crew of the dredger and transferred, unhurt, to a coastguard vessel.

Footnote

[1] The pilot believed that he took off at about 1400 hrs but the airfield manager estimated it was between 1430 and 1440 hrs.

Footnote

[2] Based on the emergency radio call from the dredger, which occurred at 1858 hrs.

Additional information

The pilot began flying training in June 2010 but had not flown solo before the accident flight.

The aircraft's most recent permit to fly expired on 23 April 2010. Insurance cover for the aircraft ceased on 22 April 2009.

Information provided by the pilot

The pilot stated that he had bought the aircraft recently and was not aware that the permit to fly had expired.

During an initial discussion with the AAIB, the pilot recalled taking off at approximately 1400 hrs for a flight in the local area. He recalled clearly that the aircraft had 45 litres of fuel in the tank before departure and he believed that it consumed approximately 10 litres per hour. Once airborne, he encountered "very bumpy" flying conditions and decided to fly over the sea to wait for conditions at the airfield to become suitable for landing.

During a subsequent discussion, the pilot stated that he had taken off with a passenger with the intention of flying to Peterborough and back. After takeoff, he judged that he was unlikely to be able to return before dark and so decided to fly in the local area. He stated that shortly after takeoff he landed at a private site near Dargate, Kent in order to drop off the passenger after which he took off again. Dargate is 6.5 nm from Maypole Airfield on a track of 259°M.

The pilot reported that later while flying over the sea, and with no prior warning, the engine stopped. He judged that the aircraft would not reach land and instead he flew a circuit around a nearby ship in preparation for ditching alongside. He slowed the aircraft to between 30 and 40 mph, removed his helmet and gloves and released his harness. Just before ditching, he allowed the speed to build slightly so that when he pushed the control bar fully forward the nose would rise and the back end of the aircraft would hit the water first. Just before impact, he moved as far to the side of the seat as possible and, when the aircraft hit the water, was thrown clear.

Survival aspects

The pilot was reportedly very fit and yet, after only approximately five minutes in the water, he was extremely tired. A flotation aid was thrown to him from the dredger and a rope ladder was lowered over the side. Although he could reach the lower rung of the ladder with his hands, he did not have the strength to pull himself up to put a foot on the rung and climb aboard the ship. The crew of the dredger deployed a manned life raft to rescue him.

Aircraft performance

Fuel consumption for the aircraft, quoted on the manufacturer's website, is 9 to 14 litres per hour at a cruising speed of 52 kt.

Analysis

If it is assumed that the aircraft took off between 1400 and 1440 hrs, and ditched at 1857 hrs, the flight lasted for between 4 hours 17 minutes and 4 hours 57 minutes, less any time spent on the ground to drop off the passenger. Assuming that the aircraft contained 45 litres of fuel before departure, its endurance would have been between 3 hours 12 minutes and 5 hours using the manufacturer's fuel consumption figures. Given that the pilot reported no problems with the engine before it stopped, it is likely that the aircraft ran out of fuel.

ACCIDENT

Aircraft Type and Registration:	Pegasus XL-Q, G-MWLM
No & Type of Engines:	1 Rotax 462 HP piston engine
Year of Manufacture:	1990
Date & Time (UTC):	17 April 2010 at 1550 hrs
Location:	Hunsdon Airfield, Hertfordshire
Type of Flight:	Training
Persons on Board:	Crew - 1 Passengers[1] - 1
Injuries:	Crew - None Passengers - 1 (Serious)
Nature of Damage:	Damage to nosewheel main strut, control bar, wing, pylon and front strut
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	43 years
Commander's Flying Experience:	110 hours (of which 106 were on type) Last 90 days - 10 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries made by the AAIB

Synopsis

The commander, who was not a qualified flying instructor, allowed a student pilot with 26 hours total flying experience to operate the controls throughout the flight. The aircraft dropped from a height of approximately 10 ft onto the runway while landing, resulting in serious injuries to the student pilot.

History of the flight

The student, who had 26 hours total flying experience, was hoping shortly to undertake a General Skills Test and had gone to his flying club on the day of the accident to practise general handling. He described the weather conditions as "good" with a light westerly wind of about 5 kt and a temperature of 10°C. His usual instructor was not present but another was available to provide supervision.

The student first undertook a solo flight in his aircraft, returning to the airfield after about an hour for an uneventful landing. The supervising instructor then suggested that the student take one of the club's qualified pilots with him on a second flight. This pilot, who occupied the rear seat, was not an instructor and

Footnote

[1] The "passenger" was a student pilot, but could not operate in that capacity because the commander was not a qualified flying instructor.

was intended to accompany the student only to provide advice, but was nevertheless the nominated commander of the aircraft. Although the aircraft was fitted with training bars, allowing it to be flown from either seat, the student reported that only he (the student) handled the aircraft during the flight.

The aircraft departed at 1450 hrs and the student again practised general handling before returning to the airfield. He reported that he flew a powered approach to Runway 26 at an airspeed of 55-60 mph and began flaring at a height of about 10 ft. The aircraft then suddenly dropped, landing heavily on its rear wheels and quickly rotating onto its nosewheel with a force sufficient to break the structural base tube between the two pilots' seats. The rear seat occupant and engine then fell forwards onto the student, causing multiple fractures to one of the student's legs and dislocating an ankle. The rear seat occupant was uninjured.

The student believed he encountered a change in wind direction or "pocket" of turbulence, causing the aircraft to drop.

Oversight

Student pilots can only operate an aircraft whilst accompanied by a suitably qualified instructor, or solo when they have been deemed sufficiently competent. Instructors undergo training not only to provide proper guidance to students, but also to recognise problems and take corrective action before they develop too far. A student flying with a pilot who is not a suitably qualified instructor might expect a level of oversight that an accompanying pilot may not be able to provide, and the absence of appropriate intervention may result in undesirable consequences.

INCIDENT

Aircraft Type and Registration:	Thruster T600N 450, G-CBWJ	
No & Type of Engines:	1 Jabiru Aircraft PTY 2200A piston engine	
Year of Manufacture:	2002	
Date & Time (UTC):	2 August 2010 at 1530 hrs	
Location:	Bradley Lawn Farm, Heathfield, East Sussex	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Propeller detached	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	47 years	
Commander's Flying Experience:	n/k hours (of which n/k were on type) Last 90 days - 55 hours Last 28 days - 11 hours	
Information Source:	AAIB Field Investigation	

Synopsis

At approximately 300 ft agl, just after takeoff, the propeller blades, hub and mounting flange detached from the engine, forcing the pilot to land in a nearby field. Forensic examination of the failed flange mounting screws identified high cycle fatigue, possibly due to relative movement between the flange and crankshaft following loss of clamping load.

History of the flight

The pilot successfully completed a flight to Popham airfield, Hampshire and was on the return leg to his departure farm strip at Bradley Lawn Farm. During the last 5 miles of the flight, the pilot noticed a low frequency vibration, but landed without incident at around 1100 hrs. The propeller blades had recently been replaced, so the pilot checked that the blade pitch angle had not changed. He could find nothing wrong with the aircraft to explain the vibration.

The next flight conducted by the pilot[1] in the aircraft was at 1530 hrs the same day. This was to be a cross-country navigation exercise with a student. The student handled the aircraft and completed the pre-departure checks, with no abnormal indication from the engine. The aircraft lined up on Runway 22 and the student opened the throttle fully and accelerated along the runway at full power. After the aircraft rotated into the air and climbed through 100 ft, the pilot reported that he felt

Footnote

[1] The pilot was a qualified microlight instructor.

heavy vibration through the airframe and took control from the student; he then reduced the engine speed from 2,850 rpm to 2,600 rpm (under normal circumstances, full power is maintained to 700 ft). He commenced a right turn in an effort to fly a low-level circuit to land again; however, with the aircraft at approximately 300 ft agl, the propeller hub and blades detached from the engine, narrowly missing the wing. The pilot shut the engine down and performed a successful forced landing in a field. Despite numerous searches, the propeller could not be located.

Aircraft description

The aircraft is a fixed wing microlight constructed with a steel and aluminium frame, a glass-fibre cabin pod, tricycle landing gear and fabric covered wings and rear fuselage. The engine is mounted on a pole extending forward from the top of the cabin pod and braced by an A-frame. The propeller hub is bolted to a flange, which is secured by cap screws to the front of the engine crankshaft. The incident aircraft was fitted with two individual composite propeller blades, secured in the hub by separate retaining bolts.

Aircraft inspection

The pilot recovered the aircraft from the landing site to a hangar at the farm strip, prior to inspection by the AAIB. No damage was evident on the airframe. The engine propeller hub, flange and blades were detached, though the remains of the shanks from the six flange mounting screws were still present in the engine crankshaft (Figure 1). Replicas of the screw fracture surfaces were taken for forensic analysis and the remains of the screws, following extraction, were submitted for metallurgical examination. Aircraft documentation showed that a manufacturer approved

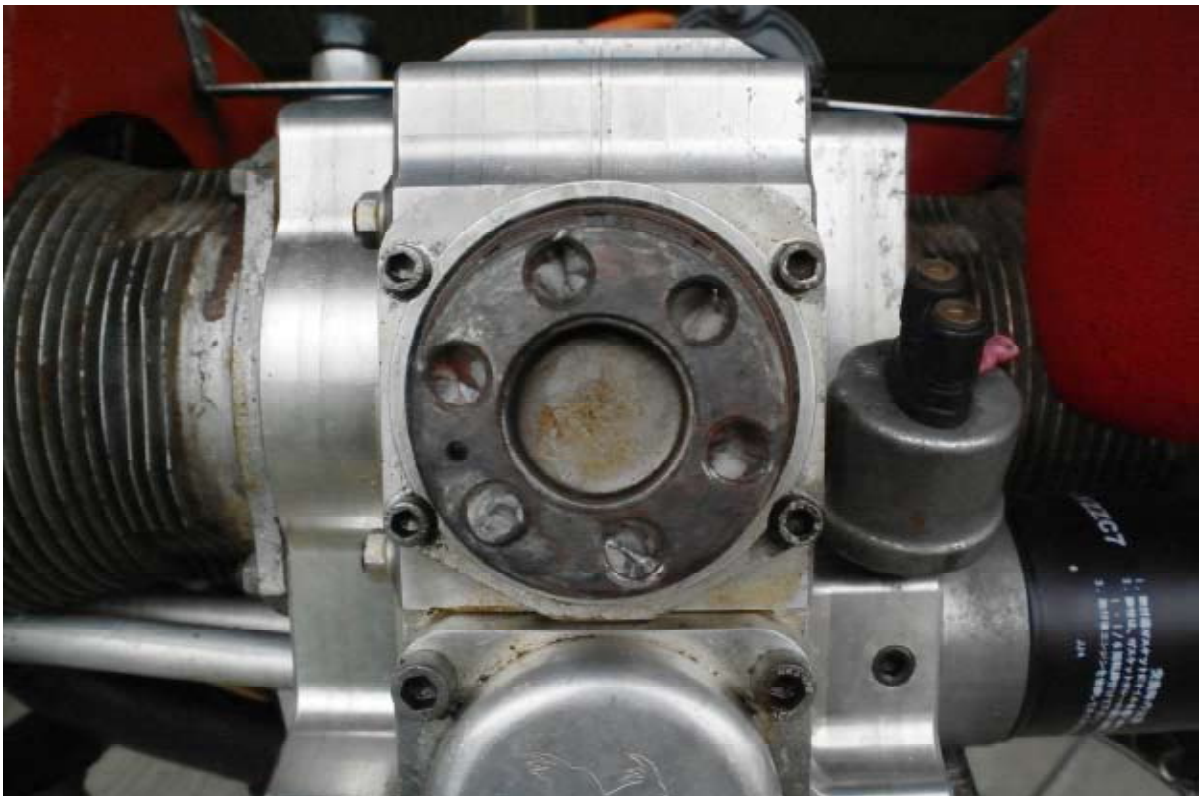

Figure 1

Front face of crankshaft showing shanks of failed screws still in-situ.

propeller hub and blades had been fitted, though it was not possible to confirm this physically due to the loss of these components in the incident.

Manufacturer's documentation

The manufacturer issued service bulletin JSB 022-1 on 28 July 2008. This stated that there had been a number of in-service propeller loss events due to failure of the flange mounting screws, resulting from incorrect installation procedures. The service bulletin highlights the importance of using the correct technique (use of a bonding agent and a specified torque load) to install the screws, and recommends the refitting of any propeller flanges, that are suspected of having been incorrectly installed, within 50 hours.

Service bulletin JSB 014-1 details important information regarding the installation and inspection of propellers and mounting flanges.

Service bulletin JSB 012-1 recommends the replacement of the flywheel mounting bolts, due to the possibility of damage from high propeller vibration due to propeller strikes or the incorrect fitting of the propeller.

Consultation with the engine manufacturer confirmed that they recommend checking the torque of the flange mounting screws every 100 hours for approved propeller types. This advice is included in the maintenance manual, though in a generic manner which covers all propeller related bolts and screws. The maintenance manual also recommends full overhaul of the engine at 2,000 hours, with a 'top end' overhaul at 1,000 hours. Replacement of the flange screws is recommended at full overhaul.

Maintenance history

The pilot advised that the aircraft was normally stored with an engine cover fitted, in an open hangar (roof, but no walls) and typically could be stored for up to a month at a time during the winter period.

At the time of the incident, the aircraft had flown 615.6 hours since new. A manufacturer approved repair organisation had extensively repaired the engine at 424.8 hours since new, due to an oil pump gear attachment failure that damaged the camshaft and timing gear. The invoice for the engine repair did not list new flange screws among the items fitted. The propeller blades were replaced approximately 12 flying hours prior to the incident due to a crack in the collar of one of the blades. There was no evidence from the engine logbook to suggest the failed flange screws had been replaced in-service, so it is likely they were original from first build of the engine.

The engine logbook identified that the repair organisation carried out service bulletin JSB 012-1 during the engine repair in 2006. There was no record of service bulletin JSB 022-1 being completed on the engine.

Detailed inspection findings

Screw 1

Scanning Electron Microscope (SEM) inspection revealed smooth, flat fracture surfaces, which exhibited clear beach marks; these confirmed High Cycle Fatigue (HCF)[2] as the fracture mechanism (Figure 2). Initiation occurred at multiple locations around the thread roots (a region of stress concentration). A region of possible intergranular fracture was found at one of the thread root

Footnote

[2] High Cycle Fatigue is characterised by a large number of load cycles to failure (typically $>10^4$), for example due to a high frequency vibration.

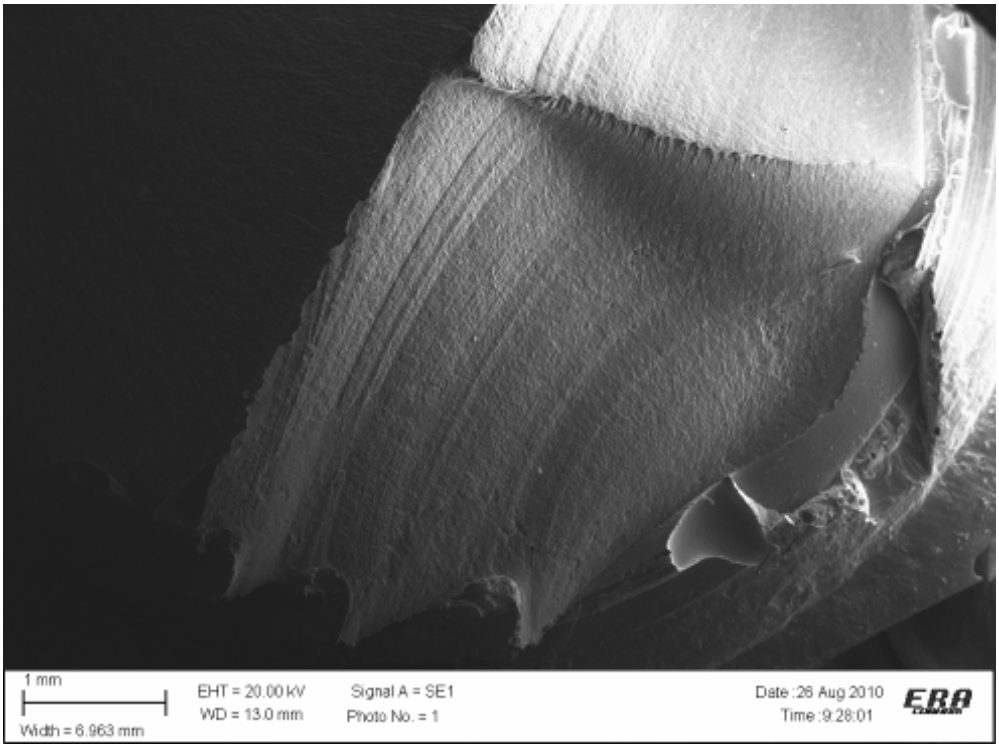

Figure 2

SEM image of beach marks indicating HCF with multiple initiations.

initiation sites, suggesting that some stress-corrosion cracking (SCC) might have contributed to fatigue initiation.

Screw 2

The screw exhibited smooth, flat fracture surfaces as with screw 1, but the beach marks were more difficult to distinguish. Some regions contained features that could have been corrosion. The fatigue appeared to have initiated from the stress concentration of the thread root. The fracture surface consisted of two large flat regions of fatigue that initiated on opposite sides of the screw, with a thin strip of final overload fracture between them.

Screw 3

The screw exhibited two main fatigue regions, which initiated diametrically opposite one another, at the thread roots.

Screw 4

This screw also suffered fatigue in two regions diametrically opposite one another.

Screw 5

In contrast to the other screws examined, there were no large flat regions on this fracture surface. SEM examination revealed some areas of overload and some areas of smeared surface, typical of contact between fracture surfaces during separation from torsional overload.

Screw 6

Beach marks, indicating fatigue, were very clear on this surface and several initiation points were obvious. Again, all initiation sites were at thread roots, with two main areas of initiation diametrically opposite one another.

Metallographic examination and hardness testing

Sectioning revealed that many of the screws contained secondary fatigue cracks, usually initiating at the next thread down from the primary fracture surface. The section through screw 5 showed a crack at a thread root and possible fatigue cracking on the side of the threads. Each screw section was subjected to micro-hardness testing in three locations. The results indicated that all six screws were of similar strength. The microstructure, hardness, strength and chemical composition of the screw material were consistent with the manufacturer's recommendation for use in this application; the testing showed no evidence of manufacturing defects.

Analysis

The forensic analysis indicated that five of the six screws suffered fractures due to HCF. The remaining screw's (screw 5) fracture surface was damaged after failure, though some evidence of fatigue and overload were identifiable.

The cracks within the screws initiated in two regions diametrically opposite one another, suggesting a reversed bending load pattern. However, the orientations of each initiation relative to the crankshaft show that they all aligned tangentially. This may indicate relative rotational movement between the flange and the crankshaft.

Therefore, the most likely cause of failure of the screws was a loss of clamping load on the flange, due to reduced torque load on the mounting screws. This would allow movement between the flange and the crankshaft and create an additional load cycle on the flange screws related to the engine rpm. HCF cracks developed from initiation points in areas of stress concentration within the screw threads, until the critical crack length was reached and the screws failed in overload. The flange and propeller then released during the incident flight.

This incident highlights the importance of installing the propeller mounting flange in accordance with the engine manufacturer's guidance detailed in service bulletin JSB 022-1 and inspecting the flange screws in accordance with the manufacturer's recommended maintenance schedule. Both of these documents are freely available on the manufacturer's website.

ACCIDENT

Aircraft Type and Registration:	Zenair CH 701UL, G-EOIN
No & Type of Engines:	1 Verner SVS1400 piston engine
Year of Manufacture:	2000
Date & Time (UTC):	7 October 2010 at 1400 hrs
Location:	Private airstrip, Easter Nether Cabra, Fetterangus, Aberdeenshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Extensive
Commander's Licence:	Private Pilot's Licence
Commander's Age:	59 years
Commander's Flying Experience:	1,544 hours (of which 251 were on type) Last 90 days - 9 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft suffered a power loss shortly after takeoff. It was extensively damaged during the subsequent forced landing when it struck the upslope of a deep hollow that was not visible from the air. The power loss was thought to have been caused by an ignition system failure.

History of the flight

The pilot reported that he took off from the north-easterly runway of the farm strip, turning right after takeoff. The wind was from the south-east. When climbing downwind to the south-west, at a height of approximately 400 ft, the engine lost virtually all power. The pilot immediately commenced a descending turn to the right, crossed overhead the runway and continued to turn right to head back into wind. At this point the aircraft was at a height of between 150 and 200 ft, in a steep gliding descent, with a high rate of descent. The pilot realised he would not be able to reach the runway, but expected to achieve a satisfactory landing ahead in a freshly cultivated field. Although he commenced a rapid round out, the aircraft struck the ground heavily, coming to a sudden stop. Major damage occurred to the landing gear, engine mount, cabin floor, rudder pedals and numerous other components.

Additional information

The pilot stated that on assessing the reason for the heavy and destructive landing, he noted that his impact

point was on the upslope of a deep hollow that had not been visible from the air. The soft ground of the upslope had brought the aircraft to a rapid halt.

Initial examinations by the pilot following recovery of the aircraft did not identify any mechanical failure within the engine. However, subsequent tests revealed both ignition circuits to be apparently inoperative. The pilot stated that although the aircraft was not fitted with carburettor heat, he had not experienced symptoms of carburettor icing during his ownership and the ambient conditions at the time of the accident did not suggest a high humidity.

BULLETIN CORRECTION

Aircraft Type and Registration:	Cessna 172, OO-MQD
Date & Time (UTC):	14 June 2009 at 1700 hrs
Location:	Chatteris Airfield, Cambridgeshire
Information Source:	Aircraft Accident Report Form

AAIB Bulletin No 8/2009, page 45 refers

When originally published the registration of this aircraft was quoted as OO-MDQ. The AAIB has since been informed that it is in fact **OO-MQD**.

The Aircraft Type and Registration should read:

Cessna 172, OO-MQD

BULLETIN CORRECTION

Aircraft Type and Registration:	Piper PA 23, N2401Z
Date & Time (UTC):	10 August 2010 at 1553 hrs
Location:	Bournemouth Airport, Dorset
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

AAIB Bulletin No 1/2011, page 43 refers

The number of engines detailed in the report header under **No & Type of Engines** was incorrectly stated as one intead of **two**.

The **No & Type of Engines:** should have read:

2 Lycoming TI0-540 SER piston engines

BULLETIN CORRECTION

Aircraft Type and Registration:	Schweizer 269C-1, G-LINX
Date & Time (UTC):	22 September 2009 at 1103 hrs
Location:	East bank of River Wyre, near Stalmine, Lancashire
Information Source:	AAIB Field Investigation

AAIB Bulletin No 12/2010, page 72 refers

In the paragraph titled 'Organisational information' two references were inadvertently not printed as superscript. Therefore, JAR-FCL5 should read **JAR-FCL[5]** and YU-HEW6 should read **YU-HEW[6]**.

BULLETIN CORRECTION

Aircraft Type and Registration:	Thruster T600N 450, G-EVEY
Date & Time (UTC):	26 October 2009 at 1330 hrs
Location:	Near Newtownards Airfield, Northern Ireland
Information Source:	Aircraft Accident Report Form submitted by the pilot

AAIB Bulletin No 4/2010, page 82 refers

The last sentence of the report erroneously referred to 'propeller attachment bolts' when these should have been described as '**propeller flange mounting screws'**. Therefore, the last sentence should now read:

> 'Subsequent examination revealed evidence of extensive fatigue crack propagation in the **propeller flange mounting screws** (Figure 1), which eventually failed in ductile overload, causing the propeller to detach.'

In addition the description under Figure 1 should now read:

> 'Figure 1 View of the front of the crankshaft showing **failed screws** with evidence of fatigue propagation (arrowed)'

FORMAL AIRCRAFT ACCIDENT REPORTS ISSUED BY THE AIR ACCIDENTS INVESTIGATION BRANCH

2009

3/2009 Boeing 737-3Q8, G-THOF
on approach to Runway 26
Bournemouth Airport, Hampshire
on 23 September 2007.
Published May 2009.

4/2009 Airbus A319-111, G-EZAC
near Nantes, France
on 15 September 2006.
Published August 2009.

5/2009 BAe 146-200, EI-CZO
at London City Airport
on 20 February 2007.
Published September 2009.

6/2009 Hawker Hurricane Mk XII (IIB), G-HURR
1nm north-west of Shoreham Airport,
West Sussex
on 15 September 2007.
Published October 2009.

2010

1/2010 Boeing 777-236ER, G-YMMM
at London Heathrow Airport
on 28 January 2008.
Published February 2010.

2/2010 Beech 200C Super King Air, VQ-TIU
at 1 nm south-east of North Caicos
Airport, Turks and Caicos Islands,
British West Indies
on 6 February 2007.
Published May 2010.

3/2010 Cessna Citation 500, VP-BGE
2 nm NNE of Biggin Hill Airport
on 30 March 2008.
Published May 2010.

4/2010 Boeing 777-236, G-VIIR
at Robert L Bradshaw Int Airport
St Kitts, West Indies
on 26 September 2009.
Published September 2010.

5/2010 Grob G115E (Tutor), G-BYXR
and Standard Cirrus Glider, G-CKHT
Drayton, Oxfordshire
on 14 June 2009.
Published September 2010.

6/2010 Grob G115E Tutor, G-BYUT
and Grob G115E Tutor, G-BYVN
near Porthcawl, South Wales
on 11 February 2009.
Published November 2010.

7/2010 Aerospatiale (Eurocopter) AS 332L
Super Puma, G-PUMI
at Aberdeen Airport, Scotland
on 13 October 2006.
Published November 2010.

8/2010 Cessna 402C, G-EYES and
Rand KR-2, G-BOLZ
near Coventry Airport
on 17 August 2008.
Published December 2010.

AAIB Reports are available on the Internet
http://www.aaib.gov.uk