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ADDENDA and CORRECTIONS

(ALL TIMES IN THIS BULLETIN ARE UTC)

ACCIDENT

Aircraft Type and Registration:	Airbus A321-211, G-DHJH
No & Type of Engines:	2 CFM56-5B3 turbofan engines
Year of Manufacture:	2000
Date & Time (UTC):	17 February 2008 at 1527 hrs
Location:	Manchester Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 7 Passengers - 220
Injuries:	Crew - None Passengers - None
Nature of Damage:	Nose landing gear damaged
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	18,000 hours (of which 7,000 were on type) Last 90 days - 150 hours Last 28 days - Not known
Information Source:	AAIB Field Investigation

Synopsis

Whilst manouvering the aircraft using a towbarless tug, the aircraft's nosewheels became disengaged from the tug's hydraulic powered 'grab and retention' mechanism, which allowed the tyres to contact the ground. The nosewheel steering motors, which are mounted on the nose landing gear leg, contacted the structure of the tug.

History of the flight

At the start of the pushback everything appeared to be normal to the cockpit crew but, as the aircraft started to turn, tail moving to the left, 'clonking' noises could be heard from the area of the nose landing gear. The crew likened the noises to those associated with a loose pin on a tug-and-towbar arrangement. The tug in use was a towbarless unit. As the pushback progressed the noises increased in magnitude and frequency, which culminated in a loud bang and the pushback stopped. The cockpit crew saw that the towbarless tug was at an acute angle to the aircraft. The tug crew asked the cockpit crew to set the aircraft's park brake, informed them that considerable damage had been caused to the aircraft and asked if they could call their engineering department to send someone to inspect the damage. The passengers and crew deplaned using external steps and were transported back to the terminal.

Engineering examination

The operator's engineers found that the nosewheels had fallen from the towbarless tug's hydraulic-powered

'grab and retention' mechanism and were in contact with the apron surface (Figure 1). Both of the nosewheel steering motors mounted on the landing gear leg had been damaged by the tug's structure, which required the complete nose landing gear to be changed prior to the next flight.

Examination and testing of the towbarless tug by the operator, in the presence of AAIB and a manufacturer's representative, could find no fault with the equipment and it has not been possible to reproduce the problem.

Courtesy of Thomas Cook

Figure 1

Nosewheels after falling from the 'grab and retention' mechanism (looking forward)

Other information

The aircraft operator had performed a ramp maintenance task on the aircraft just prior to the pushback. Part of this maintenance task was to change one of the two nose landing gear wheels. This was undertaken and both tyres were inflated to the specified pressure. Following the accident the tyre pressures were not checked but the engineer, who deflated them to enable the tug to be separated from the aircraft, stated that both tyres appeared to be pressurised normally.

Previous occurrences

During the investigation AAIB were informed by the airport authorities that there had been four previous nosewheel damage events involving this particular towbarless tug with four different tug operatives. Two of the events were as a result of human error and equipment failure. No reasons could be found for the other two events.

Design of towbarless tugs

Inspection of another manufacturer's towbarless tug found that it had a safety feature that would not allow the aircraft nosewheel tyres to contact the ground if the hydraulic 'grab and retention' mechanism released the tyres whilst manouvering an aircraft (Figure 2).

There are a number of national and international guideline and 'recommended practice' documents that relate to aircraft towbarless tugs, although none of them refer directly to requiring a safety mechanism to prevent the nosewheel tyres from contacting the ground whilst manouvering the aircraft. Extracts from these are reproduced below.

In the UK and EU, BS EN 12312-7:2005 Part 7 titled '*Aircraft movement equipment*'.

Para 5.6.3:

> *'The aircraft pick-up point (eg wheels, towbar attachment point) shall be designed in such a way that unintended disengagement of the aircraft from the aircraft holding device of the movement equipment is prevented by positive mechanical locking eg a latch.'*

Figure 2

Another manufacturer's towbarless tug

Para 5.6.4:

> *'The geometry of the aircraft holding device shall be designed to prevent interference with the aircraft.'*

In the EU, Directive 98/37/EC titled '*Mechanical Equipment'*.

Para 3.4.6:

> *'Towing devices'. 'All machinery used to tow or to be towed must be fitted with towing or coupling devices designed, constructed and arranged to ensure easy and safe connection disconnection, and to prevent accidental disconnection during use.'*

In the USA, SAE ('*The Engineering Society For Advancing Mobility Land Sea Air and Space'*) ARP (Aerospace Recommended Practice) 4852 Revision B titled '*Design Specifications for Towbarless Push-Back Tow Vehicles.*'.

Para 5.15.3:

> *'While in the fully engaged position, the nose wheel must remain stabilized in the locking mechanism under all dynamic conditions. The nose wheel must be retained above the axle to prevent escape in the upwards direction.'*

SAE ARP 5283 titled '*Nose Gear Towbarless Tow Vehicle Basic Test Requirements'*.

Para 4.2 titled '*Retention Features*':

> *'The nose wheels shall be held by the vehicle in such a way that pitch-up of the aircraft shall not cause the wheel to disengage from the pickup device at any nose gear steering angle. A positive wheel retaining feature must be provided. If the nose gear is "canted", a turning maneuver will cause uneven loading on the nose gear (i.e., for an aft canted gear, the vertical load on the inboard nose wheel will tend to increase and conversely, the vertical load on the outboard nose wheel will tend to decrease). The retention feature must allow for uneven tire displacement without imposing additional loads on the nose gear.*
>
> *The geometry of the holding device shall be such that no interference with aircraft structure may occur (e.g., torque links, weight and balance sensors, tires, water spray deflector, etc.) at all wheel steering angles up to the limits defined by the airframe manufacturer's documentation, and the full range of shock strut extensions and tire deflections. Surface contact area between pick-up device and tire surface should be sufficient to preclude unacceptable tire loading (refer to tire manufacturer for bearing pressure specifications).'*

International Standard ISO 20683-1 titled '*Aircraft ground equipment – Design, test and maintenance for towbarless towing vehicles (TLTV) interfaced with nose landing gear*.' Part 1 titled '*Main-line aircraft*'.

Para 4.3 titled '*Nose wheels retention*':

Para 4.3.1:

> *'The nose wheels shall be held by the vehicle in such a way that pitch-up of the aircraft shall not cause the wheel to disengage from the pick-up device at any nose gear steering angle. A positive wheel retaining feature must be provided. If the nose gear is "canted", a turning maneuver will cause uneven loading on the nose gear (ie for an aft-canted gear, the vertical load on the inboard nose wheel will tend to increase and conversely, the vertical load on the outboard nose wheel will tend to decrease). The retention feature must allow for uneven tire displacement without imposing additional loads on the nose gear.'*

Conclusion

In summary, during this investigation it was established that there are a number of technical specification documents defining standards regarding the design, manufacture, operation or maintenance of aircraft ground support equipment generally, and specifically aircraft towbarless tugs. These are not, however, matched by national or international aviation regulatory requirements.

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 737-3L9, G-OGBE
No & Type of Engines:	2 CFM CFM56-3C1 turbofan engines
Year of Manufacture:	1995
Date & Time (UTC):	6 February 2009 at 0737 hrs
Location:	Birmingham Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 5 Passengers - 100
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	39 years
Commander's Flying Experience:	5,398 hours (of which 4,300 were on type) Last 90 days - 121 hours Last 28 days - 25 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

The aircraft was scheduled to operate a commercial air transport flight from Birmingham to Edinburgh. The weather was poor and the crew had the aircraft de-iced prior to departure. The stabiliser trim was not set at the usual time due to the ongoing de-icing procedure and the omission was not noticed after start because the crew became preoccupied with the flap setting. G-OGBE started its takeoff run with the incorrect stabiliser trim setting, the first officer was unable to raise the nose at V_R and the captain decided to reject the takeoff. The thrust levers were closed at 155 kt and the aircraft stopped without further incident.

A number of distractions, combined with unusual demands imposed by the poor weather, led to a break down of normal procedures and also allowed a missed action to go unchecked. Concerns about the weather featured strongly in the captain's decision to reject the takeoff above V_1.

History of the flight

Prior to this incident, G-OGBE had been left overnight with the stabiliser in the full nose-down position, selected using the electric trim switch in accordance with company procedures. On the morning of the incident, the aircraft was scheduled to operate a commercial air transport flight from Birmingham to Edinburgh. The weather conditions were surface wind

of 350°/6 kt, visibility 2.5 km in snow, broken cloud at 2,600 ft and a temperature of 0º C. The crew asked for G-OGBE to be de-iced and the work was carried out by the handling agent using Type 2 de-icing fluid. The process started at 0659 hrs, finished at 0713 hrs and the holdover time was between 30 and 65 minutes.

It was normal practice during pre-flight preparations for the first officer to set the stabiliser trim to the takeoff position when the crew checked information from the loadsheet. On this occasion, however, G-OGBE was being de-iced at the time and the trim could not be set. During the after-start checks the crew focussed on leaving the flap up, as they expected slushy conditions while taxiing. The trim setting was not checked.

While taxiing towards the runway, the snow became "moderate to heavy" according to the captain and his attention turned to the holdover time. He decided to reduce the holdover time to between 35 and 40 minutes giving a last takeoff time of 0739 hrs. The crew selected flaps for takeoff when G-OGBE arrived at the holding point and the aircraft began its takeoff run at 0737 hrs.

The first officer was the handling pilot and, at rotation speed, he used a "normal pull" on the control column to rotate the aircraft. He "doubled his effort" after his first attempt had no effect and then called to the captain to inform him of the situation. The captain was aware there was no rotation and decided to stop the aircraft. Four seconds after the first attempt at rotation, the thrust levers were closed and the crew carried out the rejected takeoff procedure. The speed was under control with 900 m of runway remaining, which allowed braking to be reduced, and the aircraft vacated the runway at the upwind end. The fire service inspected the brake units and reported that it was safe for the aircraft to proceed back to stand.

During the taxi back to stand, the crew noticed the stabiliser trim was set to 3 units and not 4.5 units as was required for the takeoff. When on stand, the fire service inspected the brakes again and informed the captain that their temperature posed no further threat. No evidence was found that the controls were restricted as a result of icing.

Flight data recorder (FDR) information

The FDR showed that the pitch trim was set to 2.3 units. During the takeoff, at an airspeed of 135 kt, the control column was pulled aft by 7º. The pitch attitude increased by 1º, which was sufficient for the nosewheel air/ground switch to change to air mode, but the nose dropped back again almost immediately and the switch returned to ground mode. The takeoff was rejected from an airspeed of 155 kt.

Takeoff performance

The speed V_1 is used during takeoff to aid decision making in the event of an engine failure or other significant problem. Below V_1, the aircraft is able to stop within the runway emergency distance available, whereas above V_1 it is unable to do so. Attempting to stop above V_1 is considered hazardous due to the possibility of overrunning the end of the runway

If takeoff mass is not limited by runway length, however, V_1 may be increased, subject to certain restrictions, and the aircraft would still be able to stop from the higher speed if necessary. In normal circumstances, crews do not consider the range of possible values for V_1 but use a single value obtained from the Regulated Takeoff Mass (RTOM) tables provided by the operator.

The takeoff mass for G-OGBE indicated on the loadsheet was 46,776 kg. The crew calculated the wet runway takeoff performance using the next higher mass on the

RTOM table, which was 48,500 kg. This gave a V_1 of 126 kt, a V_R of 132 kt and a V_2 of 139 kt.

Operations Manual – Technical

The technical section of the airline's Operations Manual states that, for the Boeing 737-300:

> *'the green band range of the Stabiliser Trim Indicator shows permissible take-off trim range (1.0 to 6.3 units). An intermittent horn sounds if take-off is attempted with the stabiliser trim NOT in the green band range.'*

The trim can be set using a manual trim wheel or an electric trim switch. The nose-down limit using the electric switch is 2.5 units.

Simulator trial

The operator carried out a trial in a simulator to reproduce the conditions present during the actual takeoff. The results showed that a more forceful pull on the the control colum than normal was required to raise the nose at rotation speed. However, the results also showed that rotation was achievable and that the aircraft could have climbed away safely.

Human factors

It is the usual practice in many airlines for crews to operate a sector each as handling pilot. In this case, the decision was made for the captain to fly the return sector into Birmingham because of the poor weather forecast and so the first officer planned to operate the outbound sector. The first officer stated to the operator when interviewed that he had been less comfortable about the weather than the captain. The captain, however, was not sufficiently aware of the first officer's concerns to decide to operate the outbound sector himself.

The usual flow of pre-flight activities contained triggers for certain actions, such as the first officer setting the stabiliser trim as part of the procedure for checking the loadsheet. This flow was disrupted by the de-icing procedure and the stabiliser trim was not set. The trim setting would normally be checked as part of the after-start checklist but this check was not made because the crew was distracted by the unusual requirement to leave the flaps up while taxiing.

As G-OGBE taxied out for departure, the deteriorating weather increased the crew's workload and subsequently introduced a takeoff time constraint that had to be met. The captain believed he and the first officer became pressurised by the need to meet the revised holdover time. This was compounded by the ATC taxi clearance that required them to taxi the longest route to the holding point and caused the aircraft to be at the back of the queue on arrival. While they focussed on selecting takeoff flap prior to departure, they did not notice the incorrect trim setting.

The takeoff commenced just inside the revised holdover time limit and the captain was "very aware of this situation at the point at which the decision was made to reject". He said he was very aware of snow and potential ice-accretion coupled with holdover times. Consequently, when the first officer said he could not rotate the aircraft, the captain quickly made the decision to reject the takeoff having judged there was sufficient runway remaining to do so and believing the aircraft was not capable of flying.

Analysis

The crew was subject to a number of distractions and unusual situations before takeoff which led to a break-down of normal procedures and also allowed a missed action to go unchecked. This was compounded

because the trim setting, although incorrect, was within the green band range and so there was no warning horn to alert the crew.

Both crew members were concerned about the weather conditions and were taking off at the limit of the de-icing holdover time. When the first officer was unable to rotate the aircraft he believed there was a problem with the aircraft control surfaces. When the captain saw the lack of rotation, his concerns about possible ice accretion were reinforced and he made the decision to reject the takeoff even though the speed was, by then, well above V_1.

The aircraft was well below its runway limited takeoff mass and it is likely that a range of V_1 speeds existed although they were not calculated. Self-evidently, G-OGBE had sufficient runway to stop from 155 kt, as the captain had judged to be the case when he made his decision to reject the takeoff.

Subsequent actions by the operator

Crews were reminded that a configuration warning will not sound to prevent a takeoff with the trim set to the full nose-down position by the electric trim switch. The standard operating procedure and checklist action for setting the stabiliser trim is being reassessed, as is the de-icing procedure, to ensure they do not interact in such a way as to make a recurrence of this incident likely. This incident will be discussed with all crews as part of their technical refresher training and advice will be given regarding decisions to reject a takeoff. Crews will be reminded that weather conditions might sometimes preclude first officers from operating a sector.

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 767-39H, G-OOAN
No & Type of Engines:	2 General Electric Co CF6-80C2B7F turbofan engines
Year of Manufacture:	1993
Date & Time (UTC):	13 December 2008 at 1017 hrs
Location:	Runway 23L, Manchester Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 11 Passengers - 254
Injuries:	Crew - None Passengers - None
Nature of Damage:	Thin layer of paint scraped from tailskid
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	46 years
Commander's Flying Experience:	11,534 hours (of which 3,926 were on type) Last 90 days - 135 hours Last 28 days - 61 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquires by the AAIB

Synopsis

The aircraft was scheduled to fly from Manchester Airport to Montego Bay, Jamaica. During the takeoff roll, the V_1 call was delayed by the commander, who was the pilot not flying, by about 10-15 kt due to a "sluggish" acceleration, as he thought the aircraft might be heavier than calculated. During the rotation the TAILSKID message illuminated momentarily indicating that the aircraft had suffered a tailstrike during the takeoff. The commander applied full power and shortly afterwards the stick shaker activated briefly. The aircraft continued to climb away and accelerate before the flaps were retracted and the after-takeoff check list completed. The Quick Reference Handbook (QRH) was subsequently actioned, fuel dumped and the aircraft returned to Manchester for an overweight landing without further incident.

The zero fuel weight (ZFW) had been incorrectly entered into the operator's Computer Take Off Programme[1] (CTOP) instead of the takeoff weight (TOW). This generated significantly slower takeoff speeds than required for the actual weight of the aircraft.

History of the flight

The aircraft was scheduled to fly from Manchester Airport, to Montego Bay, Jamaica. The operating crew

Footnote

[1] The CTOP is a computer based programme used by the crew to calculate the takeoff speeds.

were based at London Gatwick Airport and the co-pilot was the pilot flying. At the time, there was work in progress (WIP) on some of the taxiways at Manchester Airport.

Prior to boarding the aircraft, the crew telephoned the handling agent and passed the trip information required to complete the loadsheet. Once on the aircraft, the dispatcher asked for the figures that had been telephoned through earlier. Before the loadsheet arrived at the aircraft, the crew entered all the required information into the CTOP with the exception of the TOW; this was required from the load sheet. The load sheet arrived at the standard time of departure. The incorrect TOW was then entered into the CTOP and the calculated takeoff speeds and thrust reduction then entered into the Flight Management Computer. The aircraft pushed back 15 minutes late.

As the aircraft taxied out it started raining heavily. Due to the ambient temperature engine anti-ice was now required to be selected ON for takeoff. The co-pilot re-calculated the takeoff speeds, using the CTOP, whilst taxiing, and advised the commander there was no change to the speeds.

During the takeoff roll, the commander delayed the V_1 call by about 10-15 kt due to a "sluggish" acceleration, as he thought the aircraft might be heavier than calculated. When the aircraft was rotated the co-pilot did so slowly. During the rotation the TAILSKID message on the Engine Instrument and Crew Alerting System (EICAS) illuminated momentarily indicating that the aircraft had suffered a tailstrike during the takeoff. The commander applied full power and shortly after that the stick shaker activated briefly. The co-pilot responded by reducing the aircraft's pitch while still maintaining a positive rate of climb.

The aircraft continued to climb away safely and accelerate before the flaps were retracted and the after-takeoff checklist completed. ATC were informed and advised the flightcrew that no debris had been discovered on the runway. The QRH checklist for TAILSKID message was actioned, fuel was dumped and the aircraft returned to Manchester for an overweight landing without further incident.

The aircraft sustained minor damage to the paint on the tail skid. After engineering checks, lasting 20 minutes, the aircraft was declared fully serviceable.

Pilots' comments

The commander commented that he had flown about six empty sectors in a Boeing 767 prior to this flight. As such the slow takeoff speeds did not trigger an alert to him. Also, as he was not based at Manchester he was particularly attentive to the taxi routing due to the WIP. This diversion of his attention was compounded while the co-pilot checked the takeoff speeds. He commented that the delay in pushing back led to a time pressure which may also have distracted him from noticing the unusual takeoff speeds.

The co-pilot concurred with the commander's comments about the attention required during the taxi out to the runway. After landing he checked the CTOP and immediately realised that the ZFW had been entered as the TOW. He commented that the aircraft's Flight Management Computer would have correctly calculated the TOW by independently summing the ZFW and fuel onboard data entries. This would have at least ensured that the flap manoeuvring speeds were correct.

Takeoff speeds

When the ZFW was entered into the CTOP, the calculated speeds were equal to the ones the crew used

during the incident. These were about 20 kt less than those produced if the correct TOW was entered. Table 1 shows the incident and correct speeds.

	Data entered into the CTOP	Actual data
Take off weight (kg)	117,951	172,351
V_1 (kt)	124	143
V_R (kt)	133	154
V_2 (kt)	138	160

Table 1

Safety actions

As a result of this incident the crew received additional training on the CTOP and successfully completed a line check. The operator also issued the following notice to all its pilots:

'Subject: **[All]** ***Computerised Takeoff Performance***

Operational Changes

With immediate effect both pilots, when conducting the performance calculation, must independently extract the ATOM [Actual Take Off Mass] *from the loadsheet. Masses written on the OFP* [Operational Flight Plan] *must not be used as this introduces the potential for error. There are no other changes to the CDU* [Control Display Unit] *Preflight Procedure, loadsheet checking and performance calculation procedures.*

Clearly it remains good practice for both pilots to check the loadsheet for gross errors.'

Operations Manual Amendment

OMA 8.20.2.6 Before Start Procedure will be amended as follows at the next revision cycle:

Computerised Takeoff Performance (C-TOP)

General procedures and instructions for use of C-TOP are contained in OMB [Operations Manual Part B] *Section 4.*

Following completion of the CDU Preflight Procedure, the OFP and the loadsheet should be readily accessible to both pilots. Both pilots should independently extract the ATOM from the loadsheet and perform the C-TOP calculation. PF should call out any further assumptions made e.g. surface wind, runway conditions, use of anti-ice etc.'

Supporting Information

A recent incident has highlighted the potential for error whilst conducting the performance calculation using the CTOP/LPC programme. Inadvertently the crew used the ZFM [Zero Fuel Mass]*, rather than the ATOM, to calculate the takeoff performance. This oversight was influenced by other factors on this occasion, all of which induced pressure on the crew.*

On occasions procedures, however carefully written, can break down. Pilots are encouraged to review relevant pre-flight procedures in OMA and OMB.

Commercial/time pressures are often present in our day to day operation; however, these must not be allowed to compromise safety. Our Pilot Skills List gives guidance on how to manage these issues.'

ACCIDENT

Aircraft Type and Registration:	Hawker Hurricane 2B, G-HHII
No & Type of Engines:	1 Rolls-Royce Merlin 29 piston engine
Year of Manufacture:	1940
Date & Time (UTC):	11 March 2009 at 1139 hrs
Location:	North Weald Airfield, Essex
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Propeller and undercarriage doors damaged
Commander's Licence:	Private Pilot's Licence
Commander's Age:	52 years
Commander's Flying Experience:	6,000 hours (of which 45 were on type) Last 90 days - 52 hours Last 28 days - 15 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The aircraft tipped forward onto its nose whilst landing on Runway 20 at North Weald. The pilot, who was uninjured, reported that the approach and touchdown in a three-point attitude, were normal. When the mainwheels contacted the runway, the aircraft's tail lifted uncontrollably, causing the propeller to strike the ground. The pilot was able to maintain the runway centreline.

Subsequent inspection of the pneumatically-operated wheel brake system identified a defect in a brake control valve. This had allowed air to leak into the brake activation bags, causing the brakes to be partially applied prior to the landing.

ACCIDENT

Aircraft Type and Registration:	Shorts SC.7 Skyvan, G-BEOL
No & Type of Engines:	2 Honeywell TPE331-2-201A turboprop engines
Year of Manufacture:	1977
Date & Time (UTC):	27 July 2008 at 1555 hrs
Location:	Runway 21, Oxford Airport, Kidlington
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Right main landing gear collapsed. Damage to right wing strut, lower fuselage and nosewheel strut attachment structure
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	3,384 hours (of which 2,239 were on type) Last 90 days - 137 hours Last 28 days - 53 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft landed heavily at Weston-on-the-Green and, after confirmation of damage to the right main landing gear, diverted for an emergency landing on grass Runway 21 at Oxford. Examination showed that the right gear shock absorber had separated from the main landing gear and the retaining nut showed no evidence of having been correctly wirelocked at maintenance, probably some years previously.

History of the flight

The pilot reports that he was making an approach to Weston-on-the-Green after a flight from Manston. The aircraft developed a rapid rate of sink in the final stages and this resulted in a heavy landing. The aircraft then veered abruptly to the right and the pilot executed a 'go-around'. Believing that the aircraft may have been damaged in the heavy landing, the pilot performed a 'flyby' inspection at Weston and it was confirmed that the aircraft had sustained heavy damage to the right main landing gear, which was now folded aft.

The pilot then diverted to Oxford Airport, where a Full Emergency was declared and the aircraft was held from landing until the emergency crews had deployed into position. The aircraft then landed on Runway 21, which has a 900 metre grass surface, and the pilot was able

to maintain reasonable directional control during the touchdown on the folded right main landing gear. There was no fire and no injury.

Engineering examination

Examination of the right landing gear showed that the shock absorber had become disconnected from the lower trunnion on the landing gear and that the retaining nut was missing.

Examination of the screw threads at the end of the trunnion on which the retaining nut (Figure 1) is fitted showed no evidence of deformation or stripping. There was a large area of impact damage on one side of the threaded part of the trunnion, consistent with what would have occurred during the final landing, but the threads on the undamaged side were in very good condition. There was no locking wire present. The retaining nut was found at the initial impact

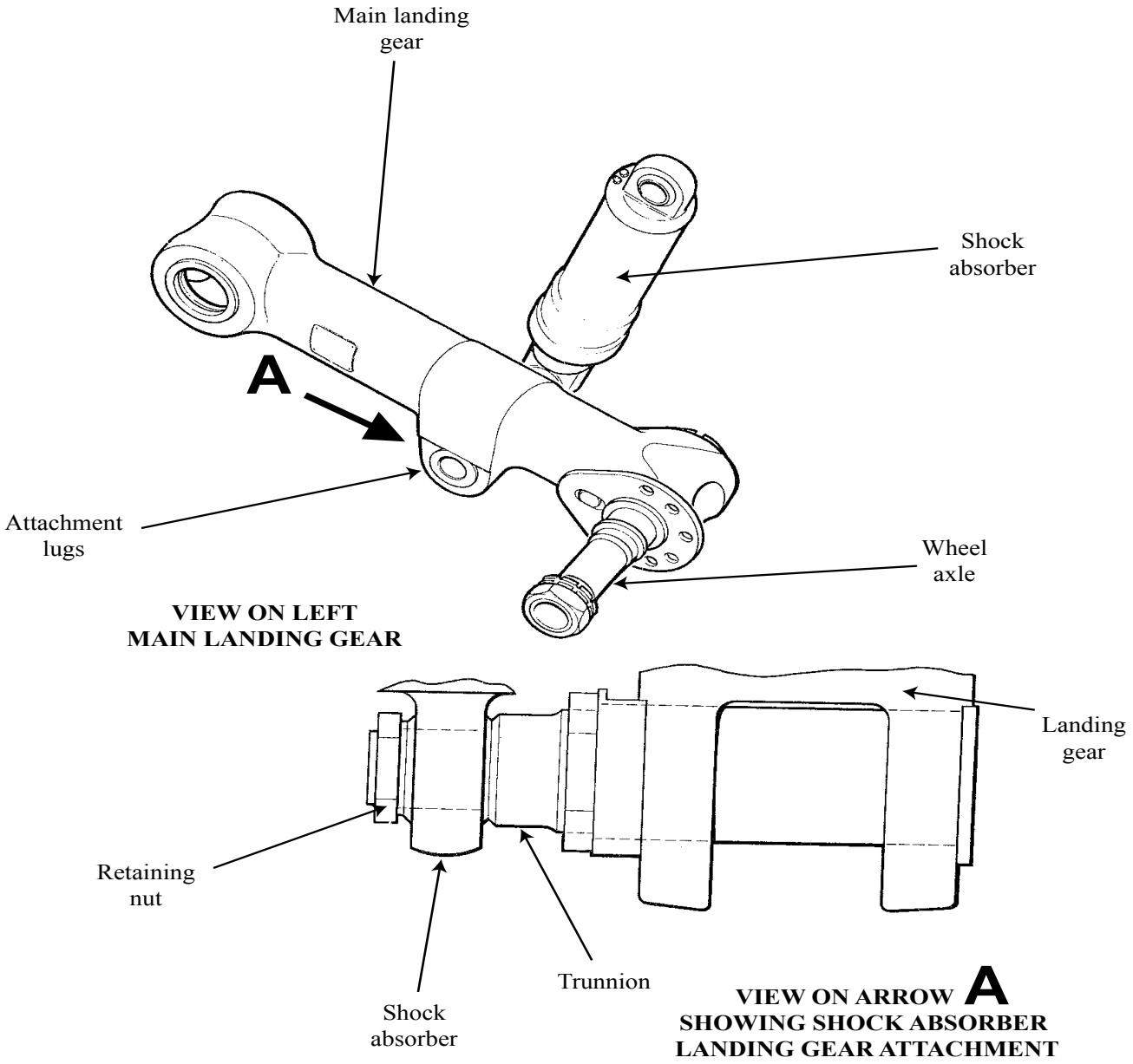

Figure 1

Landing gear shock absorber attachment

point, by the right landing gear, on the grass runway. Examination showed no deformation, damage or stripping of the screw threads and there was no locking wire present. The holes in the retaining nut, through which the locking wire should have passed, were clogged with hardened grease and general debris associated with landing gear areas, and this appeared to have accumulated over a long period of time.

Examination of the lower shock absorber retaining nut on the left landing gear showed that it was secure and correctly wirelocked.

Maintenance requirements

The manufacturer's Aircraft Maintenance Manual and the shock absorber's Overhaul Manual require that, following fitting of the lower shock absorber, the retaining nut should be torqued and wirelocked.

Maintenance history

The aircraft's logbooks and worksheets were examined in detail and the last recorded time that the main landing gear shock absorbers were recorded as being disturbed was in March 2000, when Dowty Rotol Mandatory Service Bulletin 32-14M was carried out. This Service Bulletin required the removal of the main landing gear shock absorbers to check for cracking of the lower shock absorber attachment trunnion. The aircraft had flown 2,414 hours over 4,985 flights since the Service Bulletin had been carried out. It appears likely that the recorded maintenance work, or subsequent undocumented maintenance work, did not include completion of the wirelocking task.

ACCIDENT

Aircraft Type and Registration:	Beech 76 Duchess, G-BODX
No & Type of Engines:	2 Lycoming LO-360-A1G6D piston engines
Year of Manufacture:	1979
Date & Time (UTC):	16 April 2009 at 1745 hrs
Location:	Bournemouth Airport
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Both props bent, engines shock-loaded, damage to underside. Aircraft beyond economic repair
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	45 years
Commander's Flying Experience:	1,812 hours (of which 180 were on type) Last 90 days - 58 hours Last 28 days - 13 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

History of the flight

The aircraft was on an instrument rating training flight with a student pilot in the left seat, an instructor in the right seat, and another student observing from the rear. Following a series of instrument approaches and go-arounds, the student flew an asymmetric approach and go-around, followed by a visual circuit to land.

The landing gear was not selected down during the visual circuit, and the flaps were not selected beyond 15º (the operator had not established formal Standard Operating Procedures, but students were taught to select full flap once below asymmetric committal height). The flare resulted in a prolonged 'float', and the aircraft touched down on its underside approximately 800 metres beyond the threshold. The instructor later stated the 'float' was probably a consequence of the absence of drag from the landing gear. The aircraft slid to a halt and the occupants vacated without difficulty; there was no fire.

The instructor attributed the accident to "instructor error", and stated that contributory factors included the student's diligence during the previous approaches, and the fact that it was the last landing of the last flight of the day. His report also mentioned a discussion of asymmetrical committal height during the circuit, which may have been a distraction. He stated that the landing gear warning horn had not sounded.

The landing gear warning horn in the Beech Duchess sounds intermittently if a throttle is retarded below an engine setting sufficient to sustain height with the landing gear not down, or if the flaps are set beyond 16º and the landing gear is not down, regardless of throttle position. If full flap had been deployed for landing, it is probable that the landing gear warning horn would have sounded to alert the crew to their configuration discrepancy.

ACCIDENT

Aircraft Type and Registration:	Bolkow BO 208C Junior, G-AVLO
No & Type of Engines:	1 Continental Motors Corp O-200-A piston engine
Year of Manufacture:	1967
Date & Time (UTC):	19 February 2009 at 1230 hrs
Location:	Knockin Airstrip, near Oswestry, Shropshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Nose landing gear, propeller and engine cowling damaged
Commander's Licence:	Private Pilot's Licence
Commander's Age:	74 years
Commander's Flying Experience:	1,044 hours (of which 630 were on type) Last 90 days - 11 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

Whilst on base leg, the pilot noted that the aircraft was higher and faster than usual. On final approach, 250 m from the runway threshold, the aircraft was still 15 kt faster than its normal approach speed of 65 kt. The pilot became concerned that the aircraft's excess speed might result in an overrun and attempted to touch down shortly after crossing the runway threshold. Whilst he was monitoring the aircraft's speed, it touched down on an up-sloping section of the runway, which resulted in the collapse of the nose landing gear and the propeller striking the ground. The pilot and his passenger were uninjured. The pilot attributed the accident to his preoccupation with the aircraft's speed to the detriment of his positional awareness. In hindsight, he considers that it would have been more appropriate to go around rather than continue with the approach.

ACCIDENT

Aircraft Type and Registration:	Cirrus SR22, Perspective N770CP
No & Type of Engines:	1 Teledyne Continental Motors IO-550N piston engine
Year of Manufacture:	2008
Date & Time (UTC):	4 November 2008 at 1436 hrs
Location:	East of Staverton Airport, Gloucestershire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Serious) Passengers - 1 (Minor)
Nature of Damage:	Substantial; aircraft beyond economic repair
Commander's Licence:	Private Pilot's Licence
Commander's Age:	20
Commander's Flying Experience:	218 hours (of which 61 were on type) Last 90 days - 53 hours Last 28 days - 16 hours
Information Source:	AAIB Field Investigation

Synopsis

Shortly after takeoff, the aircraft lost power and a forced landing was carried out. The aircraft struck a tree before landing heavily in a field causing substantial damage. No cause has been established for the power loss.

History of the flight

The pilot was to deliver the aircraft back to its home base, following a 100 hr maintenance inspection at Gloucestershire. During the pre-flight inspection, he noted that there was approximately 30 USG of fuel in the left tank and 35 USG in the right tank, and that the engine contained 7 quarts of fresh oil; he also drained clean samples from the fuel tanks.

The pilot elected to fly the aircraft from the right seat, and his passenger, who was also a qualified private pilot but had not flown a Cirrus aircraft previously, sat in the left. The aircraft taxied to the runway holding point, where the pilot carried out a power check, noting that each magneto produced a drop of about 60 rpm, and the engine idled smoothly at about 750 rpm. The Multi-Function Display (MFD) on the right side of the instrument panel was set to the engine page for the duration of the flight.

The pilot completed the pre-flight check and the aircraft entered the runway. The pilot increased power to 2,000 rpm against the brakes, noted that all the engine

indications were correct, and released the brakes. He reported that he then applied full throttle and the engine responded "flawlessly"; the MFD showed that normal takeoff power was being produced. He rotated the aircraft at 65 kt and allowed the aircraft to accelerate through 85 kt, when he retracted the flaps. He then allowed the aircraft to accelerate to 100 kt for the initial climb, assessing that the aircraft's performance until this time was normal.

The pilot described how, as he reached across to switch off the electric fuel pump, at approximately 150 ft aal, there was a "loud metallic bang", and the power reduced rapidly but smoothly. He pitched the nose down to keep a safe flying speed, identified a possible landing field ahead and transmitted a MAYDAY call. His selection of a landing site was made difficult by the presence of the motorway and power lines in front of the aircraft. The pilot reported that he had considered deploying the Cirrus Airframe Parachute System (CAPS) parachute, but recognised that there was insufficient height to do so safely.

The pilot traded speed for height, stretching the glide to cross the motorway, and avoided banking the aircraft as he was aware that the aircraft was close to the stall. The aircraft struck a tree, which caused a "heavy deceleration", and it landed heavily in a field in a fully-stalled condition.

The pilot reported that he had not attempted to diagnose the cause of the engine problem when it occurred, as there was insufficient height to do so. He stated that he had not moved any cockpit control immediately before the engine note changed, nor had he been wearing loose clothing which could have snagged on a control. The passenger in the left seat stated that he had not moved any cockpit control.

The passenger sustained a spinal injury in the landing but was able to open his door and pull himself out onto the wing. The pilot switched off various services in the cockpit, including the battery switches but power remained applied. He then pulled all of the circuit breakers, which removed power from the aircraft's systems and attended to his passenger. Other aircraft in the aerodrome circuit assisted ATC in identifying the accident site, and the Aerodrome Fire and Rescue Service (AFRS), and other emergency responders, arrived promptly.

The pilot had not switched the fuel selector off or re-installed the safety pin in the CAPS rocket assembly but AFRS personnel carried out these tasks under the pilot's guidance.

Witnesses

A number of witnesses heard and/or saw the engine failure. One experienced air traffic controller described that as the aircraft crossed the painted numbers marking the beginning of Runway 27, the engine sound changed, indicating "an instantaneous loss of power", not "a gradual throttling back like a practice engine failure". He stated that there was no "popping or banging" following the change in note. He estimated that the aircraft's height was in excess of 150 ft aal when the engine note changed.

Another controller, on duty at the time, described that the engine noise "wound down to nothing". He cautiously estimated the aircraft's height to be about 80 ft aal at the time.

Flight recorders

The aircraft was fitted with a digital flight recorder, which was not crash-protected, but had not suffered damage in the accident. A representative of the

manufacturer downloaded data from the recorder after the accident, but the recorder appeared to have stopped recording some months earlier. The recorder was removed from the aircraft and sent to the recorder manufacturer, who confirmed that a fault had led to the recorder's ceasing to function. The manufacturer has identified the cause of the fault and has taken steps to modify all in-service recorders to prevent recurrence.

Engineering

The aircraft had been declared damaged beyond economic repair by its insurers and thus the wings could be cut off for transportation by road to the AAIB. All three landing gears had collapsed and all three propeller blades had been bent, indicating rotation but not under significant power.

After inspection and consultation with the representatives from the aircraft and engine manufacturer, it was decided that it would be possible to run the engine in the aircraft after fitting a replacement propeller. The fuselage was then strapped to a trailer and a fuel supply was jury-rigged using a plastic fuel drum connected to the exposed fuel feed and return pipes in the right wing;the drum contained fuel which had been drained from the aircraft after the accident. The damaged silencers had to be removed and a fuel leak, from the damaged gascolator drain, had to be rectified before the engine was started.

The engine started and ran at idle normally before being accelerated to full power with the two manufacturer's representatives monitoring the engine parameters in the cockpit. After about 10 minutes of running at various power levels, the engine was shut down. No abnormalities had been observed during the test run.

Analysis

The flight was unremarkable until the pilot reached to switch off the fuel pump shortly after takeoff. Although his recollection was that he had not moved the switch before power reduced, the possibility exists that he did, in fact, select the fuel pump off. If this were the case, then it is possible that a power reduction may have occurred and caused the power loss.

The possibility that the pilot inadvertently moved the throttle to the closed position, or turned the fuel selector to off, was considered. Both the pilot's and passenger's recollections were that this had not been the case, and had the pilot done so, it seemed likely that he would have attempted, quickly, to restore power. No evidence of an attempt to restore power was identified, and witness accounts did not substantiate this theory. Action by the pilot and emergency services to render the aircraft safe after the accident meant that the investigation was unable to validate the control positions in the cockpit. No conclusion has been reached regarding the engine failure.

ACCIDENT

Aircraft Type and Registration:	Flight Design CT2K, G-CBNA
No & Type of Engines:	1 Rotax 912ULS piston engine
Year of Manufacture:	2002
Date & Time (UTC):	3 January 2009 at 1515 hrs
Location:	Hook Norton, near Banbury, Oxfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to fin, crack in left wing, engine mounting broken and firewall damaged. Nosewheel assembly and propeller damaged
Commander's Licence:	Private Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	400 hours (of which 170 were on type) Last 90 days - 4 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and repair agency feedback

Synopsis

The pilot departed from a farmstrip for a local flight in cold weather. Whilst in level cruise at 2,500 ft, the engine stopped. The pilot could not restart the engine and carried out a forced landing in a field, resulting in damage to the aircraft but no injuries. The engine failure may have been due to water in the fuel system freezing, or carburettor icing.

History of the flight

The pilot departed from a farmstrip near Hook Norton at 1430 hrs for a local flight. The weather was clear with a light wind from the north and a surface temperature of -2°C. At approximately 1515 hrs, whilst in level cruise at 2,500 ft and two miles to the south of the farmstrip, the engine stopped. The pilot attempted to start the engine and despite it 'turning over' and 'firing' it would not restart. The pilot then carried out a forced landing. During the landing roll the nosewheel assembly failed due to the uneven frozen surface of the field, causing the aircraft to roll over. The pilot exited the aircraft without injury.

Engineering investigation

The aircraft was removed to a repair agency where the engine and fuel system were inspected. The engineers observed rust in the gascolator, suggesting that water had

been present in the fuel at some stage. The fuel tanks had been drained prior to transport without recording the volume remaining in each tank and no sample had been retained for analysis. The pilot reported that both tanks should have been approximately half full at the time the engine power failed and that he had physically confirmed the tank contents, using a fuel level sight glass, prior to departure. He also advised that he routinely checked the aircraft fuel drains every second or third flight and rarely, if ever, observed water in the fuel. He confirmed, though, that the fuel had not been checked for water during his pre-flight routine for the accident flight. To date, all other inspections of the aircraft have revealed no abnormalities and the repair work is ongoing.

The engine has conventional carburettors but no carburettor heat system, relying on the ambient temperature of the air beneath the engine cowls to prevent ice formation. The pilot advised that this system worked well in his experience and that the engine had not demonstrated 'rough running' symptoms, traditionally associated with ice build-up in the carburettor, prior to power failure. He also reported that he had the cabin air heat turned up high during the flight, which draws heat away from the exhaust system, potentially reducing the temperature of the ambient air around the engine.

Analysis

In the absence of a confirmed defect on the aircraft, the most likely causes of the power failure are fuel starvation or carburettor icing. The traces of rust in the gascolator suggest that water may have been present in the fuel system, which was not drained prior to the accident flight. The weather had been particularly cold in the period preceding the flight and this may have resulted in an increased formation of condensation within the fuel system. The air temperature during the flight was cold enough to cause any water in the fuel system to freeze. This may have created a partial or complete blockage in the fuel supply to the engine, causing it to stop and preventing it restarting, despite adequate fuel remaining in the fuel tanks. Ice formed from moisture in the air blocking the carburettor cannot be ruled out either, though this is considered less likely in this accident.

ACCIDENT

Aircraft Type and Registration:	Glasair IIS FT, G-LAIR
No & Type of Engines:	1 Lycoming IO-360-B1E piston engine
Year of Manufacture:	2006
Date & Time (UTC):	26 June 2008 at 1605 hrs
Location:	Woodwalton, Cambridgeshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew -None Passengers - None
Nature of Damage:	Propeller, engine cowlings, noseleg, landing gear, flaps, one wing extension section, one rudder skin, engine bearer
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	76 years
Commander's Flying Experience:	1,434 hours (of which 37 were on type) Last 90 days - 11 hours Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The pilot was carrying out a landing into the private grass strip where the aircraft was based. The strip was orientated in a southwest/northeast direction and was some 590 m in length. It was 20 m wide at the northern threshold and 15 m wide at the southern end.

The weather conditions were clear with a blustery wind of approximately 19 kt from the southwest. The pilot recalled that the aircraft bounced on landing and then during an attempted go-around the right main landing gear became caught in an adjacent standing crop of oilseed rape. The aircraft slewed through 180º and came to rest in the field. The damage was extensive but there were no injuries and the two people on board were able to vacate the aircraft unassisted.

ACCIDENT

Aircraft Type and Registration:	MW7, G-BREE
No & Type of Engines:	1 Rotax 503 piston engine
Year of Manufacture:	1992
Date & Time (UTC):	21 February 2009 at 1120 hrs
Location:	Near Bishopstone, Swindon, Wiltshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	Aircraft extensively damaged
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	40 years
Commander's Flying Experience:	176 hours (of which 40 mins were on type) Last 90 days - 4 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft's engine suffered a loss of power in flight. During the subsequent forced landing the right main landing gear sheared off and the aircraft rolled inverted, sustaining extensive damage. The pilot escaped with minor injuries and there was no fire. It transpired that the power loss was caused by one of the spark plugs becoming unscrewed from the engine's front cylinder.

History of the flight

The pilot arrived at Lower Upham Farm airfield, near Winchester for his first flight in a MW7, a home built high wing monoplane. The weather conditions were good with a westerly wind of less than 10 kt. At 1000 hrs the pilot departed on his initial uneventful flight, lasting 20 minutes, during which he established that the glide angle for the aircraft was steeper than he was used to. At 1100 hrs, after refuelling to the aircraft's maximum takeoff weight, the pilot took off once more. At 1115 hrs, while in the cruise at approximately 1,000 ft agl, the engine suddenly lost power. The engine was still running, but it was not producing sufficient power for the aircraft to maintain altitude. Therefore, the pilot established the aircraft in a descent at 50 kt, and tried to ascertain why the engine had lost power. He was unable to identify any obvious cause and selected a suitable field for a forced landing, with power. At a height of approximately 10 to 15 ft the engine stopped and G-BREE descended rapidly onto the ground. The right main landing gear sheared off on impact and the aircraft rolled onto its back. The pilot was left hanging upside down in his harness but

managed to undo it and exit the aircraft. Although fuel was pouring from the tank vent, there was no fire. The pilot, who sustained minor injuries during the accident, made the aircraft safe by switching off the electrical power. G-BREE was extensively damaged.

On subsequent inspection, it was evident that the loss of power had been caused by one of the spark plugs becoming unscrewed from the front cylinder of the engine. The spark plug was still attached to the high tension lead and no damage was apparent on either the spark plug or the thread in the cylinder head.

The spark plugs and the front Cylinder Head Temperature (CHT) probe were last replaced prior to the aircraft's Permit to Fly renewal, more than 6 months and 6 hrs 30 minutes flight time before the accident. The spark plug that became unscrewed, causing the loss of power, was the one that had the new CHT probe fitted beneath it. The ring from the CHT probe was missing after the accident, but the pilot thought it unlikely that the ring could have detached from the cylinder head, leaving the spark plug loosely screwed in. He considered it more probable that the threads of the spark plug may have bound on the CHT probe when the two were replaced, giving a misleading torque reading which subsequently eased. Therefore, it is possible that the spark plug was not correctly tightened up when it was installed.

ACCIDENT

Aircraft Type and Registration:	Piper PA-34-220T Seneca III, G-HCSL
No & Type of Engines:	2 Continental Motors Corp TSIO-360-KB piston engines
Year of Manufacture:	1981
Date & Time (UTC):	29 April 2009 at 1537 hrs
Location:	Runway 24, Edinburgh Airport
Type of Flight:	Aerial Work
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Right propeller damaged
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	36 years
Commander's Flying Experience:	2,754 hours (of which 805 were on type) Last 90 days - 92 hours Last 28 days - 36 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

A crosswind landing was being carried out on Runway 24 with the wind from 160° at 14 kt. The aircraft bounced on touchdown before settling on its nosewheel and right mainwheel, causing the right propellor make contact with the runway. The pilot considered that he had made a handling error.

ACCIDENT

Aircraft Type and Registration:	Piper PA-38-112 Tomahawk, G-RVRG
No & Type of Engines:	1 Lycoming O-235-L2C piston engine
Year of Manufacture:	1979
Date & Time (UTC):	23 July 2008 at 1055 hrs
Location:	City Airport Manchester, Barton, Eccles
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Serious) Passengers - None
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	37 years
Commander's Flying Experience:	Not known Last 90 days - Not known Last 28 days - 33 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft became airborne from a hump in the grass runway. The pilot continued the takeoff but the aircraft did not accelerate and climb, and stalled at about 50 feet above the aerodrome boundary.

History of the flight

The instructor was conducting an introductory flying lesson with the passenger, who had no previous experience of flying in light aircraft. While waiting for the aircraft to return from a previous detail the instructor showed the passenger another aircraft of similar type to explain its layout and the function of various cockpit controls. After boarding the accident aircraft the instructor conducted normal pre-start, engine and pre-takeoff checks and taxied the aircraft to a holding point at the beginning of the grass Runway 09R. Shortly afterwards, the aerodrome Flight Information Service Officer (FISO) transmitted the surface wind and indicated that takeoff was at the pilot's discretion.

Initially the takeoff was as the instructor expected, with normal acceleration to a point approximately 200 metres after the start of the takeoff roll but, shortly afterwards, at an indicated air speed of 53 kt, the aircraft became airborne unintentionally after passing over a hump in the runway. The instructor decided to continue the takeoff, expecting the aircraft to accelerate satisfactorily. He attempted to accelerate the aircraft close to the ground and, having some success, raised the nose again. As it approached the aerodrome boundary the aircraft had

reached approximately 50 feet and was observed to have a nose-high attitude. At that moment the pilot became concerned that the performance of the aircraft would be inadequate to pass safely over houses at the edge of the aerodrome, or a large viaduct several hundred metres beyond. He therefore decided to carry out a forced landing in open ground between the boundary fence and the houses. However, on passing the end of the runway the aircraft began to lose height and its right wing dropped. The aircraft rolled to the right and impacted the ground nose first.

First responders released the passenger and took her by road to hospital, where she was found to have no significant physical injuries. The aerodrome fire and rescue service (AFRS) released the pilot, who was taken to hospital by air ambulance.

Meteorological information

Meteorological conditions reported at the time of the accident included wind from 140° at 5 kt and air temperature of 22°C. The FISO on duty commented that the air was humid, there was no precipitation and the runway surface was dry.

Aircraft details

The aircraft had undergone a maintenance input between 11 July and 14 July 2008, during which a 150-hour scheduled inspection was carried out and the engine was replaced with a newly overhauled unit. The aircraft had completed one engineering flight, in order to conduct the engine 'bedding in' procedure as detailed in Lycoming Service Instruction 1427B, before being returned to normal service. Since the inspection and engine replacement, a total of 9 hours and 55 minutes had been flown prior to the accident flight. There were no reported defects with the engine or airframe during this period.

Following a flight earlier in the day, the aircraft was refuelled with 37 litres of Avgas 100LL to bring the total onboard to 78 litres at the commencement of this flight. The fuelling facility conducts routine daily sample checks of the fuel quality each morning and a further extra sample was taken immediately after the accident. Both of these samples were normal and no problems were reported by other aircraft that had received fuel from the same facility.

Examination of the wreckage

The wreckage was located in a slight hollow in an area of scrubland 108 metres past the upwind end and on the extended centreline of Runway 09R. The ground was soft and slightly boggy. The longitudinal axis of the main part of the aircraft fuselage was aligned on a heading of 210°(M), approximately 120° right of its original direction of travel. The damage to the aircraft indicated that it was in a 'nose low' and 'right wing low' attitude, and yawing to the right. The right wing tip impacted the ground, displacing the right wing. The left main gear was torn from its mounting and found next to the wreckage. The rear fuselage, aft of the cockpit area, was mostly detached and displaced to the left as a result of the right yaw on impact. One propeller blade was undamaged and the other was bent rearwards with some damage to its leading edge, indicating that it was rotating at low power. The nose landing gear was detached and located with the main wreckage and its mounting frame, the engine mount and lower cowling were distorted. There was no fire.

Examination of the engine controls and the primary flying controls found them all to be correctly connected and working as expected. The flap lever and the flaps were in the 'first detent' position and the elevator trim was set to a mid position. Both of these were consistent with normal operation. The airspeed indicator was

checked and found to be reading accurately and there were no apparent defects with the pitot-static system.

The engine was examined externally. The rocker covers were then removed to check valve gear operation whilst the engine was rotated by hand. The spark plugs were removed to allow a borescope inspection of the pistons, cylinders, valve heads and valve seats. No defects were noted and the condition of the components examined was consistent with normal operation and with the life of the engine.

Fuel samples were taken from both the left and right tanks. Preliminary visual examination found them to be satisfactory and free of contamination. Sixty litres of fuel were recovered from the tanks.

Initial inspection by the Fire Service indicated the fuel selector valve was in the OFF position, but a later more detailed inspection confirmed the valve was selected to the LEFT position. The fuel selector is a rotary valve that has LEFT, RIGHT and OFF positions. To prevent inadvertent selection, a spring-loaded pawl needs to be moved away before OFF can be selected. The valve is located near the base of the firewall and is connected to the selector lever at the base of the centre instrument panel by an extension rod.

When interviewed afterwards, the passenger, perhaps as a result of the briefing she received from the instructor in a similar type aircraft, demonstrated a good understanding of the function and location of the various cockpit controls. She stated that she did not recall the fuel selector being moved by either occupant before or after the accident. The valve body may have been displaced in the impact which in turn displaced the selector lever, leading to the misleading indication.

Performance

A loadsheet produced after the accident indicated that the aircraft was within weight and balance limits, with a fuel load of 78 litres and a takeoff weight of 1,658 lb. The Pilot's Operating Handbook (POH), produced by the manufacturer, indicated that at the maximum takeoff weight of 1,670 lb the stall speed of the aircraft in standard atmospheric conditions would be 53 kt. At this weight, and in the conditions reported at the time of the accident, the takeoff run would be approximately 250 metres. The manufacturer notes that published data are based on flight tests of a new aircraft in standard configuration and do not allow for physical deterioration, pilot technique or runway surface. High humidity also has a detrimental effect on the performance of normally aspirated piston engines for which no consideration is made in the POH. Nevertheless, continued successful operation of this aircraft type at Barton indicates that it is capable of achieving satisfactory performance for takeoff from Runway 09R.

Aerodrome information

Barton Aerodrome (City Airport Manchester) is situated on the western edge of Manchester and bordered to the east by a contiguous built-up area. It has four licensed grass runways, two of which are aligned east-west. One of these, Runway 09R, has a takeoff run available of 621 metres. The aerodrome is susceptible to waterlogging and has several notable humps which are locally known to be sufficient to cause aircraft close to takeoff speed to become momentarily airborne. The aerodrome operator has an ongoing program of works that attempt to maintain the manoeuvring areas in satisfactory condition.

An accident[1] in which a similar aircraft failed to become airborne safely from Runway 09L at Barton was found to have resulted from an excessive nose-up pitch input and not from inadvertent launch from one of these humps. Aircraft routinely operate from Barton without incident and there is no evidence that the presence of such humps is unduly troublesome.

Aerodrome standards

Civil Aviation Publication (CAP) 168 – *'Licensing of Aerodromes'* gives guidance to licence holders on the procedures for the issue and continuation of or variation to an aerodrome licence and indicates the licensing requirements used for assessing a variation or application. The section relating to unpaved surfaces (including grass runways) states, in part:

> *'Natural surfaces of unpaved runways should be prepared or treated to remove irregularities which might adversely affect the directional control, braking or riding characteristics of an aeroplane.'*

and,

> *'A simple method of assessing the evenness of a natural surface is to drive over it in a Land Rover or similar vehicle at 30 mph. If the surface is acceptably even, this test should be accomplished without discomfort to the vehicle occupants.'*

Operator procedures

The instructor, who most frequently flew from the operator's base at Liverpool Airport, had been briefed on procedures for flying at Barton and had been assessed on his ability to follow them by the operator's Chief Flying Instructor. The aircraft operator has also issued written orders to its instructors concerning operation at Barton. In particular, it requires that aircraft contain no more than 78 litres of fuel prior to departure in order to restrict maximum takeoff weight and reminds pilots to ensure that 'rotate speed and climb speed' are achieved before allowing the aircraft to become airborne.

Discussion

Based on information published in the POH and the continued successful operation of the type at Barton, it is likely that the aircraft was capable of taking off from Runway 09R in the prevailing conditions. Despite containing undulations, which are known to cause aircraft to become airborne before intended by their pilots, there is no evidence that the surface of Runway 09R has caused similar accidents to this one. When an aircraft becomes airborne at its stall speed there is no performance margin and a change in flight path or control input may result in development of the stall. Aircraft of this type generally have insufficient power to accelerate away from the stall whilst climbing.

Conclusion

The aircraft was in an airworthy condition and operating normally immediately prior to the accident, which occurred when the aircraft failed to achieve the proper takeoff speed before becoming airborne and stalled during the attempted forced landing.

Footnote

1 AAIB reference EW/G2006/09/13 published in the Bulletin 2/2007

ACCIDENT

Aircraft Type and Registration:	PZL-104 Wilga 80, G-EPZL
No & Type of Engines:	1 Wsk-Pzl Kalisz AI-14RA piston engine
Year of Manufacture:	1980
Date & Time (UTC):	14 June 2008 at 1510 hrs
Location:	Wortham, Suffolk
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - 1 (Minor) Passengers - 2 (Minor)
Nature of Damage:	Aircraft damaged beyond ecomomic repair
Commander's Licence:	Private Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	572 hours (of which 32 were on type) Last 90 days - 19 hours Last 28 days - 8 hours
Information Source:	AAIB Field Investigation

Synopsis

The tailwheel-equipped aircraft overturned on landing following the separation of the lower part of the right main landing gear. The cause of the separation could not be determined.

History of the flight

During the landing the aircraft suddenly pitched forward and became inverted. The rear seat passenger exited the aircraft through the right door, which had opened on impact. The front seat passenger released his seat belt, with assistance from the airfield owner, and also escaped via the right door. The pilot was initially trapped by the structure of the aircraft and was unable to move until helpers lifted the aircraft sufficiently to allow him to crawl out through the right door.

Subsequent examination revealed that the trailing arm of the right landing gear leg had detached during the landing; the upper part of the leg had then dug into the ground, causing the aircraft to pitch forward and become inverted.

Landing gear description

The aircraft type has a tailwheel landing gear. Each main gear comprises a fixed upper leg, to which is attached a pivoting trailing arm carrying the wheel and brake unit. The trailing arm is attached to the upper leg by a spindle with a bearing at its outer end. The spindle locates into the bore of a lateral cylinder attached to the bottom of the upper leg and is retained by a small

diameter bolt and two small welds. The trailing arm is free to pivot about the bearing.

A separate shock absorber strut is attached to the trailing arm and the upper leg. The axis of the shock absorber is not exactly perpendicular to the trailing arm pivot axis, such that compression of the strut results in an axial load component on the bearing and spindle.

Examination

It was evident that the retaining bolt and welds had failed, allowing the spindle to migrate outboard until it and the trailing arm separated from the upper leg. The failure of attachment of the spindle within the cylinder appeared, on first sight, to be consistent with a seizure of the bearing of the trailing arm. However, on dismantling the assembly, adequate lubrication was present and the bearing rotated freely.

The two fracture faces of the sheared retaining bolt had contacted each other following bolt failure, causing smearing of the fracture surfaces that obscured evidence of any pre-existing defect that might have been present. The inner surface of the cylinder and the matching surface of the spindle were corroded, but the small amount of corrosion present was not significant. Closer examination of the welds revealed considerable corrosion of their fracture faces. As this had occurred after weld failure, evidence of any failure mode that might have been present was obscured. The spindle was deformed close to its inboard end in a manner consistent with it having been subjected to diametrically-applied loading as it migrated outboard following the failure of the retaining bolt and welds.

Discussion

The evidence was consistent with the trailing arm assembly becoming detached from the upper leg by displacement of the spindle in an outboard direction. Before relative displacement between spindle and cylinder can occur, the retaining bolt and two welds must fail. To create failure loads in these elements requires either rotational or axial loading of the spindle in the cylinder. The former can only be transmitted by the trailing arm as a result of rotational seizure, but no evidence of this was found.

As the shock absorber axis is not perpendicular to the pivot axis of the trailing arm, shock absorber compression loads will generate axial loading in the spindle which must be reacted by the retaining bolt and welds. It may be possible for the loads generated in a heavy landing to produce axial loading in the spindle high enough to fail the retaining bolt and the welds, but it is more likely that the failure was the result of cumulative damage occurring over a number of landings.

ACCIDENT

Aircraft Type and Registration:	Reims Cessna F152, G-BLZE
No & Type of Engines:	1 Lycoming O-235-L2C piston engine
Year of Manufacture:	1979
Date & Time (UTC):	21 September 2008 at 1545 hrs
Location:	Farway Common Airfield, Devon
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to wings, engine and nose
Commander's Licence:	Private Pilot's Licence
Commander's Age:	31 years
Commander's Flying Experience:	135 hours (of which 130 hrs were on type) Last 90 days - 9 hours Last 28 days - 7 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

During takeoff from a grass runway the aircraft did not attain rotation speed. The pilot aborted the takeoff but was unable to stop the aircraft before it hit a hedge at the end of the runway.

History of the flight

The pilot had been carrying out a cross-country flight with numerous legs. Together with his passenger, who was also a pilot, he had departed from Redhill, landed at Manston, then landed at Bembridge where the aircraft was re-fuelled to full, and then landed at Farway Common. Farway Common is an unlicensed airfield approximately 9 nm east of Exeter airport. It has two 550 m grass runways, 10/28 and 18/36. Runway 28 has a downslope of approximately 2.5%. This was the pilot's first time at Farway Common, but the landing on Runway 10 was uneventful. After about half an hour on the ground the pilot and the passenger prepared the aircraft to depart back to Redhill.

The previously light easterly wind was now calm and the pilot elected to depart from Runway 10. The pilot reported that the pre-takeoff engine run-up checks were normal. During the takeoff roll from Runway 10 the aircraft accelerated to about 40 to 45 KIAS, but the pilot did not think he would achieve the normal rotate speed of 50 KIAS and achieve a safe climb in the remaining distance available, so he aborted the takeoff. The aircraft

came to a safe stop. In trying to vacate the runway, full power was insufficient to start taxiing, so they pushed the aircraft off the runway to make way for a landing aircraft. The pilot thought that a brake might have been stuck on and that pushing the aircraft freed it. The pilot spoke with the airfield operator who recommended that they attempt a takeoff from Runway 28 as it was downhill and the wind was calm.

The pilot reported that he applied full power while holding the brakes for the takeoff from Runway 28. The flaps were set to the recommended 10°. He said that the engine sounded normal and the aircraft accelerated to 45 KIAS but then would not accelerate any further. Again he did not think he could achieve a safe departure so he aborted the takeoff. According to a witness the takeoff was aborted about 150 to 200 m from the end of the runway. The pilot reported that one brake did not appear to be working and he could not stop the aircraft from hitting the hedge at the end of the runway. The aircraft suffered damage to its nose and right wing. The right wing fuel tank started leaking but there was no fire.

Takeoff performance

The aircraft's weight at the time of the accident was approximately 736 kg (maximum takeoff weight was 758 kg), the temperature was 18°C and the pressure altitude was 474 feet. For these conditions the aircraft's Flight Manual lists the takeoff ground roll distance as 252 m and the takeoff distance to 50 feet as 466 m. These figures assume flaps 10°, full throttle prior to brake release, and a paved, level, dry runway with zero wind[1]. The Flight Manual states that for operations on a dry, grass runway the distances should be increased by 15% of the ground roll figure. Therefore, for dry grass, the takeoff ground roll distance becomes 290 m and the takeoff distance to 50 ft becomes 504 m.

The CAA's Safety Sense Leaflet 7 on Aeroplane Performance recommends that a safety factor of 1.33 is applied to the takeoff distance calculations for all single-engine aircraft where only unfactored data is provided (such as for the Reims F152). Applying this factor increases the ground roll distance to 386 m and the distance to 50 feet to 670 m. The Safety Sense Leaflet also includes a more conservative estimate for the effect of grass on takeoff distance. It recommends adding 20% to the takeoff distance to 50 feet for dry grass up to 20 cm in length. If this factor is used instead of the manufacturer's factor, the takeoff ground roll distance increases to 459 m and the takeoff distance to 50 feet increases to 744 m (including the 1.33 factor).

Pilot's comments

The pilot could not explain why the aircraft did not accelerate beyond 45 KIAS. He thought that a brake problem or the medium length grass (approximately 5 to 6 cm long) may have been a factor. He reported that the brakes operated normally during the previous two landings and takeoffs which were on paved runways. He also commented that this particular F152 required full power in order to start taxiing on grass surfaces, which was more than that required on other F152s he had flown. Taxiing on paved surfaces had not been a problem. He had not noted any anomalies with the condition of the tyres.

Discussion

Based on the manufacturer's takeoff performance data, a safe takeoff within the 550 m runway distance available would have been achievable. However, the manufacturer's data assumes that the aircraft and engine

Footnote

[1] These figures also include the additional 5% increase required by the CAA's additional limitations Change Sheet 101 Issue 2 to the Reims/Cessna 152 Flight Manual.

are in good condition. The effects of runway surface condition on a grass runway are difficult to predict and applying the CAA's more conservative estimates for 'takeoff distance required' indicated that a safe takeoff may not have been achievable. However, within the distance available the aircraft should have been able to accelerate to the rotate speed of 50 KIAS and the reason for the airspeed staying at 45 KIAS could not be explained. It is possible that a slightly 'stuck' brake reduced the aircraft's acceleration. At the point where the takeoff was aborted there was probably insufficient runway remaining for a safe stop, and the downslope would have increased the braking distance.

ACCIDENT

Aircraft Type and Registration:	Robin DR400/180 Regent, G-CBMT
No & Type of Engines:	1 Lycoming O-360-A1P piston engine
Year of Manufacture:	2002
Date & Time (UTC):	6 April 2009 at 1215 hrs
Location:	Cromer Airfield, Norfolk
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to nose landing gear, wingtip, propeller and engine
Commander's Licence:	Private Pilot's Licence
Commander's Age:	66 years
Commander's Flying Experience:	670 hours (of which 102 were on type) Last 90 days - 5 hours Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The pilot had already performed a go-around from his first approach to Runway 04 at Cromer having judged the approach to be too high. The wind was 10 kt from 100º. Runway 04 has a slight dip halfway along its length and slopes down towards a railway line embankment. The second approach was satisfactory but the aircraft touched down 'fairly long', although the pilot still considered the distance remaining to be acceptable. However, after the initial touchdown, the aircraft become airborne again and the subsequent touchdown was on the downslope of the runway with insufficient distance in which to stop. The presence of the railway embankment and power cables on the airfield perimeter precluded a go-around from this position and the aircraft overran the end of the runway, coming to rest in a ploughed field. All the occupants were uninjured.

INCIDENT

Aircraft Type and Registration:	Yak-52, G-CBRU
No & Type of Engines:	1 Ivcenko Vedeneyev M-14P piston engine
Year of Manufacture:	1988
Date & Time (UTC):	15 March 2009 at 1700 hrs
Location:	Enstone Airfield, Oxfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Propeller and flaps damaged
Commander's Licence:	Private Pilot's Licence
Commander's Age:	50 years
Commander's Flying Experience:	317 hours (of which 59 were on type) Last 90 days - 1 hour Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The pilot rejoined the circuit at Enstone after a flight in the local area. Due to the number of aircraft in the circuit, the pilot was required to 'go-around' on the first two attempts to land. On the final downwind leg, when lowering the landing gear, he noticed that the flaps were still deployed, which he then retracted. After completing a normal approach, the subsequent landing appeared to be "a little bouncy" and, as the aircraft de-rotated, the propeller struck the ground. The pilot and his passenger were uninjured. The pilot believes that the he had inadvertently retracted the landing gear on the downwind leg of the final circuit, due to a loss of concentration brought about by the two previous go-arounds and the high volume of radio traffic from other aircraft in the circuit.

ACCIDENT

Aircraft Type and Registration:	Pegasus XL-R, G-MTKG
No & Type of Engines:	1 Rotax 447 piston engine
Year of Manufacture:	1987
Date & Time (UTC):	9 February 2009 at 1325 hrs
Location:	Caernarfon Aerodrome, Wales
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to nosewheel forks, wing keel and propeller
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	63 years
Commander's Flying Experience:	89 hours (of which 34 were on type) Last 90 days - 12 hours Last 28 days - 9 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The flexwing microlight aircraft landed heavily, bounced and rolled onto its side. The pilot was uninjured.

History of the flight

The pilot made an overhead join for a landing on Runway 02, which is 1,080 m long. The surface wind was from 040° at 10 kt and the aircraft was turned onto final at a height of 800 ft approximately ¼ mile from the threshold. The pilot initially commenced a glide approach, but realised that he would not reach the runway and therefore applied some power. During the later stages of the approach he realised that he was being blown off the runway centreline and so commenced a go-around. However, as the aircraft regained the centreline he decided to continue with the landing and reduced the power to continue with the glide approach. The aircraft subsequently landed heavily, bounced and rolled onto its side. The pilot was uninjured and was able to use the aircraft radio to inform the Tower of his condition.

The pilot believes that the accident occurred because he was not stable on the approach and that he should have continued with the go-around. He also informed the AAIB that he intends to take further instruction on crosswind landing techniques.

Comment

The BMAA advised the AAIB that the Pegasus XL-R has limited crosswind capabilities and poor energy

retention. However, the crosswind component at the time of the accident was low, at around 3 kt, and therefore should not have been a problem during the approach and landing. It is likely that in the later stages of the glide approach the airspeed decreased and a high sink rate developed, which resulted in the aircraft landing heavily.

BULLETIN ADDENDUM

AAIB File:	**EW/G2008/09/30**
Aircraft Type and Registration:	CEA DR400/2+2, Dauphin, G-GAOM
No & Type of Engines:	1 Lycoming O-235-H2C piston engine
Year of Manufacture:	1977
Date & Time (UTC):	19 September 2008 at **0740** hrs
Location:	Runway 12, RNAS Culdrose, Cornwall
Information Source:	Aircraft Accident Report Form submitted by the pilot, ATC recordings and further enquires by the AAIB

AAIB Bulletin No 2/2009, page 36 and 37 refers:

Since the publication of the above report, which appeared in AAIB Bulletin 2/2009, the AAIB has received a report from the pilot of the aircraft that landed before G-GOAM. This report was sent to RNAS Culdrose but was not received by the AAIB.

The time of the incident was at **0740** hrs, not 0840 hrs as published.

The pilot of the aircraft, which landed before G-GAOM, stated that after he had landed, and was approaching the first turn off the runway, he had not received any taxi instructions and could not ask for any because the tower frequency was busy. As he came to a stop on the runway, he reported that he became aware of another aircraft stopping, under extreme braking, over his left shoulder. It came to rest within 5 yards of his aircraft".

BULLETIN ADDENDUM

AAIB File:	**EW/G2008/09/08**
Aircraft Type and Registration:	DH82A Tiger Moth, G-AHVV
Date & Time (UTC):	14 September 2008 at 1320 hrs
Location:	Runway 23, Dunkeswell Airfield, Devon
Information Source:	Additional information submitted by the pilot

AAIB Bulletin No 12/2008, page 42 refers:

Since the publication of the initial bulletin further investigation has been undertaken by the operator.

The magnetos were tested and found to be faulty; one lost all sparks as the timing was advanced and the other fluctuated between nil and three sparks. At the idle position, sparks were generated normally by one magneto and intermittently by the other. A strip examination of both magnetos concluded that oil contamination and the coils breaking down with heat were the reasons for the failures.

The operator has advised that in future they will be considering the number of starts when determining the testing and maintenance requirements for the magnetos, rather than solely using hours or calendar time. The operator will also be ensuring in future that any oil contamination of the magnetos is acted upon as soon as possible.

FORMAL AIRCRAFT ACCIDENT REPORTS ISSUED BY THE AIR ACCIDENTS INVESTIGATION BRANCH

2008

3/2008 British Aerospace Jetstream 3202, G-BUVC
at Wick Aerodrome, Caithness, Scotland
on 3 October 2006.

Published February 2008.

4/2008 Airbus A320-214, G-BXKD
at Runway 09, Bristol Airport
on 15 November 2006.

Published February 2008.

5/2008 Boeing 737-300, OO-TND
at Nottingham East Midlands Airport
on 15 June 2006.

Published April 2008.

6/2008 Hawker Siddeley HS 748 Series 2A, G-BVOV
at Guernsey Airport, Channel Islands
on 8 March 2006.

Published August 2008.

7/2008 Aerospatiale SA365N, G-BLUN
near the North Morecambe gas platform, Morecambe Bay
on 27 December 2006.

Published October 2008.

2009

1/2009 Boeing 737-81Q, G-XLAC,
Avions de Transport Regional ATR-72-202, G-BWDA, and
Embraer EMB-145EU, G-EMBO
at Runway 27, Bristol International Airport
on 29 December 2006 and
on 3 January 2007.

Published January 2009.

2/2009 Boeing 777-222, N786UA
at London Heathrow Airport
on 26 February 2007.

Published April 2009.

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

Published May 2009.

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http://www.aaib.gov.uk