ACCIDENT

Aircraft Type and Registration:	Piper PA-28-140 Cherokee, G-BRWO
No & Type of Engines:	1 Lycoming O-320-E3D piston engine
Year of Manufacture:	1973
Date & Time (UTC):	26 September 2009 at 1445 hrs
Location:	Humberside Airport, North Lincolnshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Serious) Passengers - N/A
Nature of Damage:	Right wing detached and forward fuselage severely damaged
Commander's Licence:	Private Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	858 hours (of which 756 were on type) Last 90 days - 21 hours Last 28 days - 7 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft was making an approach to land on Runway 26. During the flare the aircraft rolled uncontrollably to the right and struck the ground. The aircraft came to rest inverted beside the runway, close to the fire training facility. The most probable reason for the uncommanded roll is that G-BRWO had flown through the wake vortex generated by a Sikorsky S76 which had landed immediately before it. One Safety Recommendation has been made as a result of this investigation.

History of the flight

After being identified on radar, the pilot of G-BRWO was given instructions by ATC to join on left base leg for Runway 26, and was informed that he was number two on the approach behind a Sikorsky S76 helicopter. A Cessna 150 had landed on Runway 20 and it was given clearance to backtrack and exit at Taxiway Echo. The S76 was given clearance to land at 1542:44 hrs and it subsequently descended into a low hover above Runway 26, before being given the following clearance "THE CESSNA 150 VACATING AT TAXIWAY ECHO, GIVE WAY TO HIM, CUT THE CORNER IF YOU WISH, VACATE CHARLIE FOR HELIPORT".

The pilot of G-BRWO was then given the wind conditions, 250º at 8 kt, and told to expect a late landing clearance. At 1543:33 hrs the S76 reported that it was

clear of the runway and at 1543:47 hrs G-BRWO was cleared to land, which the pilot acknowledged. One minute and ten seconds after the acknowledgment of the landing clearance, ATC requested a position report from G-BRWO. After several unacknowledged transmissions and requests to other traffic regarding the whereabouts of the aircraft, the AFRS were put on local standby for a possible incident within the airport boundary. At this point the pilot of a Robinson R22 helicopter, operating on the airfield, asked if the controller wished him to check the approach to Runway 26. This offer was accepted and the R22 was cleared to fly towards the fire training facility. At 1547:32 hrs, the pilot of the R22 confirmed that there was an aircraft inverted close to the fire training facility. The AFRS were deployed to the accident site, arriving at the accident site at approximately 1549:30 hrs, where they proceeded to make the aircraft safe.

The pilot reported that the final approach was normal but after crossing the runway threshold, in the flare, the aircraft rolled uncontrollably to the right and the right wing then made contact with the runway surface. The right wing structure then failed and the aircraft became inverted. The cockpit door had become jammed by the remains of the right wing, but with the use of considerable force, the pilot was able to open the door and escape from the aircraft unaided before the AFRS attended the scene. The pilot received first aid before being transported to hospital. There was no fire.

Investigation

As part of the investigation, transcripts of the ATC communications, together with reports from the airport operator, ATC staff and AFRS were examined. These showed that after communication was lost with G-BRWO, the aircraft was misidentified as a Cessna 172 with two persons on board. During the emergency, several aircraft were in communication with ATC, including a commercial flight, which was given clearance to land on Runway 20 approximately one and a half minutes after the AFRS had been deployed to the accident. The reports show that during the initial phase of the AFRS response, the airfield's fire category remained unchanged and was not downgraded from Category 6 to Category 4[1] until four minutes after their deployment.

The fire training facility is positioned close to the threshold of Runway 26 and obstructs the view of the runway, immediately beyond the threshold, from the ATC tower, Figure 1. This prevented the ATC controller from directly observing the accident site. G-BRWO probably crossed the runway threshold approximately one minute after its pilot received clearance to land and the aircraft was located by the R22 pilot approximately three minutes after the accident. Approximately two minutes after being given the command to deploy to the location the AFRS units were at the scene of the accident.

Wake Turbulence

Every aircraft, including helicopters, produces wake vortices, which can be considered as two counter-rotating air masses trailing aft from the aircraft, Figure 2.

The vortices form when the weight of the aircraft or helicopter is supported by its wing, or rotors. In stable airflow these vortices will tend to drift slowly downwards and if in close proximity to the ground,

Footnote

[1] The fire fighting and rescue categories for airfields are determined by the maximum length and width of the largest aircraft using the airfield, and are defined in CAP 168 Licensing of Aerodromes Chapter 8 Table 8.1. Category 6 allows the operation of aircraft with a fuselage length of under 39 metres and a maximum width of 5 metres, Category 4 allows the operation of aircraft with a fuselage length of under 24m and a maximum width of 4 m

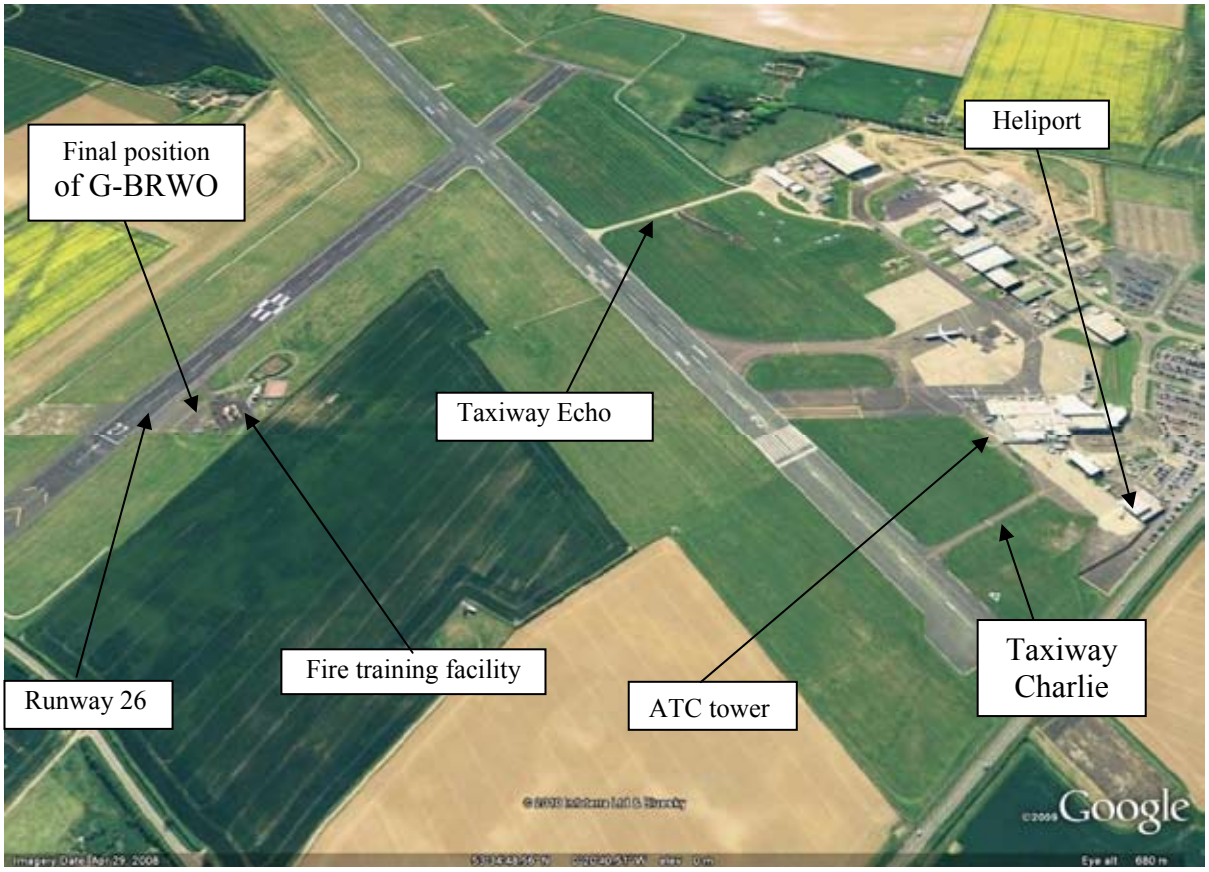

Figure 1

Humberside International Airport

(**Note**: At the time this picture was taken, Runway 26 was designated as Runway 27 hence the markings of '27'; the runway designation changed due to magnetic variation)

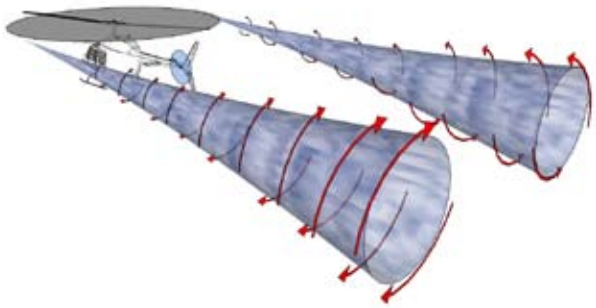

Figure 2

Typical helicopter wake vortices

move outwards from the track of the generating aircraft. The strength of the vortices generated increase with the weight of the aircraft and decrease as the aircraft's speed increases (for a given configuration). There is evidence from several research programs, primarily conducted on behalf of the US Federal Aviation Administration in the 1980s, to show that the vortices generated by helicopters are more powerful than that generated by a fixed wing aircraft of equivalent weight and speed, particularly during the final decelerating flare to a hover during landing. In July 1992 a Piper PA28 lost control during the initial stages of a go-around as a result of wake turbulence generated by a preceding Sikorsky S61N helicopter. This resulted in fatal injuries to the occupants of the PA28 and was investigated and reported in AAIB Air Accident Report AAR 1/93.

The dangers associated with wake turbulence are detailed in UK CAA CAP 493, *Manual of Air Traffic Services* (MATS), Section 1 Chapter 3 Sub Section 9, Aeronautical Information Circular (AIC) P64/2009 and CAA Safety Sense Leaflet 15c, entitled '*Wake Vortex*'. These documents describe the problems associated with wake turbulence, methods of wake avoidance and, in the case of CAP 493 (MATS) and AIC P64/2009, separation minima. The CAP and AIC split aircraft, including helicopters, into five categories; Heavy, Upper Medium, Lower Medium, Small and Light, dependant on their Maximum Take Off Weight (MTOW), and lay down separation minima between the different categories. The Piper PA28, G-BRWO is classified as 'Light'. Most helicopters, including the S76 are also categorised as 'Light' and therefore, according to CAP 493 (MATS) and the AIC, there was no requirement to increase the separation between the two aircraft, either during final approach or departure.

AIC P64/2009 Paragraph 3.4.1 states:

> *'...There is some evidence that for a given weight and speed a helicopter produces a stronger vortex than a fixed-wing aircraft. The initial acceleration manoeuvre, the landing flare and air taxiing may generate higher rotor wash velocities than those produced in stabilised hover.'*

CAP 493 (MATS) Section 1 Chapter 3 Sub Section 9.11 states:

> *'...9.11.2 When hovering or air taxiing, a helicopter directs a forceful blast of air downwards which then rolls out in all directions. To minimise this effect controllers should:*
>
> *a) instruct helicopters to ground taxi rather than air taxi when operating in areas where aircraft are parked or holding;*
>
> *b) not air-taxi helicopters close to taxiways or runways where light aircraft operations (including light helicopter operations) are in progress...*
>
> *9.11.3 Caution should be exercised when a helicopter or fixed-wing aircraft of lower weight category is cleared to land on a runway immediately after a helicopter of higher weight category has taken off from that runway's threshold. Additionally it should be borne in mind that the downwash and associated turbulence generated by a hovering helicopter can drift a substantial distance downwind and may therefore affect an adjacent runway.'*

However, there is additional advice given regarding the effect that this stronger vortex system from helicopters may have on following aircraft. CAA Safety Sense Leaflet 15c, section 6 provides the following additional advice:

> *'When following a helicopter, pilots of light aircraft should consider allowing a greater spacing than would normally be used behind a fixed wing aircraft of similar size, perhaps treating each helicopter as being one category higher than that listed in the AIC.'*

If this were the case, the S76 would be classified as 'Small' and accordingly there should have been a 4 nm separation between the two aircraft on approach.

Analysis

The position of the fire training facility prevented direct observation of the area of Runway 26 immediately beyond the threshold from the control tower. This resulted in a delay of approximately three minutes before ATC confirmed that G-BRWO had been involved in an accident and deployed the AFRS. The AFRS were on scene approximately two minutes later. After ATC's confirmation that an accident had occurred, aircraft movements were allowed to continue despite the deployment of the AFRS to the accident. This temporarily reduced the ability of the AFRS to respond to any subsequent incidents and the airfield Fire Category was not downgraded to reflect this until four minutes later.

Whilst the exact time could not be determined from the ATC transcript, there was approximately 1 nm separation between the S76 and G-BRWO crossing the runway threshold. The wind conditions at the time of the accident would have resulted in a wind speed of approximately 7.9 kt down the length of the runway and a cross-runway component of approximately 1.4 kt. In view of these conditions, it is unlikely that the wake vortex produced by the S76 would have dissipated prior to the arrival of G-BRWO over the runway threshold. In accordance with the minima defined in CAP 493 (MATS) and AIC P64/2009 there was no requirement for ATC to increase the separation between the two aircraft. However, there is information available which shows that the wake vortex system generated by a helicopter is more powerful, particularly in the transition to the hover, than that generated by a fixed wing aircraft of the same weight. The information contained in CAA Safety Sense Leaflet 15c suggests that pilots of light aircraft, following helicopters should, for separation purposes, treat the helicopter as being in one weight category higher than that listed in the AIC. This advice is not included in either CAP 493 (MATS) or AIC P64/2009. Therefore:

Safety Recommendation 2010-026

It is recommended that the Civil Aviation Authority review CAP 493 Section 1, Chapter 3 and AIC P64/2009 and provide clear advice regarding the potential hazards to fixed wing aircraft when following a helicopter in the same wake turbulence weight category.

Safety action taken

The response to the accident was reviewed by the airfield ATC Safety Management Committee to determine what changes could be made to improve the airport's response to a similar event and to minimise the possibility of a similar incident occurring. As a result of the review a CCTV camera has been installed on the site of the airfield's DME which provides a means for staff in the ATC Tower to view the threshold and approach path to Runway 26 and several changes

have been made to the airfield operational procedures. The Emergency Orders section of the Aerodrome Manual have been amended to ensure that when the AFRS has been deployed, the airfield fire category is reduced to zero and all aircraft movements are suspended until advised otherwise by the fire officer in command. After consultation with the NATS facility at Aberdeen, Humberside ATC issued Temporary Operating Instruction 09/09 which states:

> *' ... Light wake turbulence helicopters of AS365 Dauphin size or larger are to be considered in the small category when operating as the lead aircraft.*
>
> *When operating as the following aircraft these helicopters will continue to be treated as light category aircraft.*
>
> *When an arriving light aircraft is likely to fly through the vortex wake of a departing helicopter and there is less than 3 miles distance between them, a warning is to be passed 'Caution dissipating wake turbulence from the departing helicopter'.*
>
> *If controllers have any doubt whether a particular helicopter falls into this group then they should err on the side of caution and adopt the procedures above.'*

Conclusion

The uncontrollable right roll experienced by the pilot of G-BRWO was probably the result of the aircraft flying through the wake turbulence generated by the preceding Sikorsky S76. The airfield's response to the accident was delayed as the view of the accident from the ATC tower was obstructed by the airport fire training facility. However, the AFRS arrived at the accident site within two minutes of being given confirmation of the accident and its location, but aircraft movements continued at the airport despite the AFRS' deployment to the accident. The prompt safety actions implemented by the airport operator as a result of their review of the findings from this accident have addressed the airport-related issues highlighted in this investigation.