ACCIDENT

Aircraft Type and Registration:	Cessna 421C Golden Eagle, N421CA
No & Type of Engines:	2 Continental TCM GTS10 piston engines
Year of Manufacture:	1976
Date & Time (UTC):	30 September 2005 at 1817 hrs
Location:	Northrepps Airfield, Cromer, Norfolk
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - None Passengers - None
Nature of Damage:	Substantial to landing gear, engines, wings, and fuselage
Commander's Licence:	Private Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	2,475 hours (of which 255 were on type) Last 90 days - 182 hours Last 28 days - 35 hours
Information Source:	AAIB Field Investigation and video evidence provided by a member of the public

History of flight

Northrepps Airfield has a single grass runway, orientated 18/36, and 1617 ft (493 m)[1] long, with a down slope of 1.8% on Runway 18. On the day of the accident, the short grass was wet and an aftercast indicated that the wind at Northrepps was from approximately 210º at 10 to 13 kt. The pilot first flew an approach to Runway 18 and touched down close to the threshold; he subsequently reported that, looking at the slope of the runway ahead of him, he decided to go around and re-position for a landing on Runway 36, to take advantage of the up-slope on that runway.

The pilot stated that, during the approach to Runway 18, he had assessed that the braking effect of the wind would be insignificant in comparison to the braking effect that would be afforded by the uphill slope when landing on Runway 36. The pilot recalled seeing a "shortened" and "non-standard" windsock mounted on a caravan adjacent to the Runway 18 threshold, but he did not believe that it could be relied upon for an accurate wind strength determination. He did not recall having seen the airfield's other, larger, windsock.

The approach for a short field landing on Runway 36 was normal and the pilot closed the throttles just before

Footnote

[1] In this report, all distances are in feet, since the aircraft manufacturer's Flight Manual data is presented in feet.

the threshold. The aircraft touched down close to the threshold, and the pilot immediately retracted the flaps.

The pilot reported that he had lost two thirds of his touchdown speed by about the mid-point of the runway, and that the braking was within his expectations. He subsequently stated that he "seemed to get to a point… when I realised that I was effectively getting no braking at all from the wheels and the uphill slope had petered away"; he then experienced a sensation which he described as being similar to aquaplaning, with all braking authority seemingly lost.

The aircraft continued along the runway, crossed the grassed overshoot area, ran over an earth bank beyond the end of the runway and came to rest on a public road just north of this bank. The pilot shut the aircraft down and all three occupants vacated the aircraft without difficulty.

Video evidence

A member of the public recorded portions of the flight including both the touchdown and go-around on Runway 18 and the approach and landing on Runway 36, from a position adjacent to the northern end of the runway. The moment of touchdown on Runway 36 was not recorded, as the southern end of the runway was obscured from view by the slope of the terrain.

Background to the flight

The pilot had bought the aircraft two weeks prior to the accident, and had flown 17 hours in the aircraft in that time. Previously, he had flown over two hundred hours in an aircraft of the same type, ceasing that flying some two and a half years before the accident. He had not received any refresher training on the aircraft.

Although the pilot had considerable experience of operating from 'short' grass strips including the aircraft's base (which has a grass runway 2,532 ft long), he had not flown to Northrepps before. He had however, consulted a proprietary flight guide and made telephone enquiries from the airfield operator and had decided that the operation into Northrepps was feasible. He did not inspect the aircraft flight manual to determine landing distance or ground roll required, but reported that he considered that it would be "easily within (the aircraft's) capabilities of landing with the arresting force of grass and up hill" in the distance available at Northrepps.

Performance information

The aircraft Flight Manual, approved by the FAA, provides information on landing distance and ground roll, presented in tabular form, and for various weights, temperatures, and pressure altitudes. To achieve the given landing performance, the Flight Manual states that the throttles should be fully closed at 50 ft above the runway and the aircraft should be fully stalled at touchdown.

Given a temperature of +20ºC, in still air, at a weight of 6,000 lb, and at an airfield at mean sea level, the quoted landing distance was 2,070 ft, and the associated ground roll was 500 ft.

The aircraft Flight Manual did not provide a means of allowing for runway slope, but CAA Safety Sense Leaflet 7C suggests that a 2% runway down-slope increases landing distance by 10%, and states that '*Effect on ground run/roll will be greater*'. The Leaflet does not suggest a reduction in distance in the case of an upslope. However, in the following calculations this factor has been applied in the reverse sense (although it should be emphasised that this does not imply that this would provide an acceptable basis for the safe conduct

of operations). The aircraft Flight Manual stated that the distances should be reduced by 3% per 4 kt of headwind and increased by 8% per 3 kt of tailwind. The Flight Manual did not offer a means of allowing for a runway surface other than a 'level, hard surface' but the Safety Sense Leaflet states that:

> *'Very short (wet) grass may be slippery, distances may increase by up to 60%'*

Applying these factors to the landing at Northrepps, the landing distance required to land on Runway 18 was 3,343 ft, and on Runway 36, 3,879 ft. These figures are the result of calculations which would have satisfied the pilot's obligation under FAR 91.103.

The aircraft was registered in the United States of America and the relevant Federal Aviation Regulation (91.103) stated:

> *'Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. This information must include…*
>
> *'For any flight, runway lengths at airports of intended use, and…*
>
> *'For civil aircraft for which an approved Airplane or Rotorcraft Flight Manual containing takeoff and landing distance data is required, the takeoff and landing distance data contained therein'.*

Analysis

The Cessna 421C Golden Eagle is one of the largest light aircraft commonly flown by private pilots, and the runway at Northrepps, at only 1,617 ft long, is short by UK standards. A pilot operating a large aircraft onto a short runway should consult the appropriate documents (particularly the Flight Manual, information about the aerodrome, Safety Sense Leaflets, and others) to ensure that the proposed operation would be carried out safely and with adequate margins. In this case, as the aircraft was registered in the United States of America, the Federal Aviation Regulations applied and the pilot was required to comply with these regulations. The pilot was aware that the runway was short, had a grass surface which was likely to be wet, but he did not make a formal assessment of the performance aspects of the landing.

Where a runway has a significant slope, it is usual for pilots to elect to land uphill and takeoff downhill, provided that the wind is calm or favours those directions of operation. Operations from sloping runways become most complex when the wind blows up the slope for landing, or down the slope for takeoff. The combined effects of wind and slope may make it necessary to take off uphill or to land downhill, to derive the benefit of the headwind. It may even be that, for certain periods the wind prevents safe operation at all.

The landing roll information might have suggested to the pilot that the landing was possible, even with a 10 kt tailwind. However, this would require that the aircraft touched down at, or very close to the threshold, in a stalled condition, and with the throttle closed.

Although the video evidence did not show the touchdown zone, which was obscured from the cameraman's view by the runway slope, there was no suggestion that the touchdown occurred substantially late after the aircraft passed the landing threshold. There was also no evidence of the speed at touchdown. However, the aircraft did not decelerate sufficiently to stop before the end of the runway, and ran onto the road at some speed.

Several sources of wind information were available to the pilot, including the two windsocks at Northrepps, the unofficial observations and reports from the airfield operator by radio and the official observations and reports from the nearby airfields (Coltishall and Norwich). He could also have compared the indicated airspeed with the groundspeed displayed on the two GPS receivers on board the aircraft to determine headwind or tailwind component. Any of these sources of information would have shown that there was a significant tailwind component for landing on Runway 36.

Conclusion

Prior to the flight, the pilot did not use the aircraft flight manual to calculate his landing performance. Given the wind and the surface conditions at Northrepps at the time of the intended operation, performance calculations showed that a landing could only be made safely if both the precise landing parameters and adequate braking were achieved. There was no evidence regarding the point of touchdown or the associated speed; it is therefore not possible to say with any certainty whether the failure to stop was the result of an imperfectly executed landing or the lack of braking effect on the short, wet grass.