**ACCIDENT**

| | |
|---|---|
| **Aircraft Type and Registration:** | Vans RV-9A, G-RPRV |
| **No & Type of Engines:** | 1 Lycoming O-320-B2C piston engine |
| **Year of Manufacture:** | 2003 |
| **Date & Time (UTC):** | 23 August 2016 at 1200 hrs |
| **Location:** | Nympsfield Airfield, Gloucestershire |
| **Type of Flight:** | Private |
| **Persons on Board:** | Crew - 1 Passengers - None |
| **Injuries:** | Crew - 1 (Minor) Passengers - N/A |
| **Nature of Damage:** | Substantial damage to nose landing gear, propeller, canopy, upper fin/rudder assembly and right wingtip |
| **Commander's Licence:** | Private Pilot's Licence |
| **Commander's Age:** | 66 years |
| **Commander's Flying Experience:** | 727 hours (of which 10 were on type)<br>Last 90 days - 28 hours<br>Last 28 days - 22 hours |
| **Information Source:** | Aircraft Accident Report Form submitted by the pilot and further enquiries made by the AAIB |

**Synopsis**

The aircraft landed on an undulating grass runway and had slowed down to an estimated groundspeed of 20 kt when the nose landing gear collapsed and the aircraft inverted. The pilot exited the aircraft through a hole he cut in the damaged canopy, using a fire axe.

**History of the flight**

Before flying to Nympesfield from Kemble Airfield, the pilot viewed a briefing document on the resident gliding club's website, noting it '*is a less than smooth grass field with various slopes along its length and width…*' The document includes an aerial photograph marked with an '*unlandable'* area, adjacent to a track used by glider winch vehicles, and the club recommends that landings are made midway between the track and the northern airfield boundary.

Weather conditions were good and the surface appeared dry when the pilot touched down normally and reduced speed, on a north-easterly heading. There were no markings to indicate the extent of the '*unlandable'* area but the pilot assessed he remained clear, to the north of it. However, he was aware of going over a hump on the runway surface and he believes it is possible that he instinctively moved the stick forward at the top of the hump, rather than keeping it fully back, while moving on rough ground. He estimated his ground speed had reduced to approximately 20 kt by this stage.

Without warning, the nose of the aircraft dropped, the propeller hit the ground and the aircraft flipped upside down. The pilot was uninjured and turned off the electric master switch before reaching for the fire axe. The canopy had been damaged and the pilot used the axe to cut a hole, through which he was able to crawl out of the aircraft.

A check of the landing surface did not reveal any specific holes or troughs which might have been encountered but it was apparent the nose landing gear leg had failed and bent back on itself, reducing the propeller's ground clearance.

### Gliding club comment

The gliding club explained that, along a portion of the airfield, the grass slopes steeply either side of the track used by glider winch vehicles, which is why this area is marked as '*unlandable.*' This area extends approximately 10 metres to the north of the track but might appear more extensive on the photograph in the club's document. The club confirmed that the accident aircraft did not encroach the '*unlandable'* area and updated its briefing information for visiting pilots following this accident.

### Previous AAIB investigations

The AAIB has published reports on 13[1] previous occasions where the nose landing gear of a Vans RV-6A, 7A, 8A or 9A has failed. Seven of these occurred while landing on soft or undulating grass and one occurred during takeoff from a sloping grass runway. Of these, three of the aircraft also flipped inverted. The remaining five incidents occurred while landing on asphalt runways, with four from bounced or heavy landings.

### Light Aircraft Association (LAA) oversight

The aircraft involved in this accident was being flown on a Permit to Fly administered by the LAA, which is aware of historical nose landing gear issues on certain aircraft types, including the Vans RV series. It is also aware of research which suggests that, under some circumstances, rough ground can cause the nose landing gear leg to resonate, inducing a harmonic resonance that can lead to failure. This can, in turn, lead to a situation where the nosewheel fork assembly can impact the runway surface.

One modification aimed at overcoming this resonance is an 'Anti Splat' kit, which has been designed to alter the harmonics of the nose landing gear leg and restrain it from tucking under. This modification is approved by the LAA and is detailed in its Type Acceptance Data Sheet (TADS) for applicable Vans types, including the RV-9A[2], The LAA has also approved the fitment of a modified fork assembly to facilitate an increase in tyre size which, when fitted, increases the distance from the fork to the runway surface. According to the LAA's records, the Vans RV-6A, G-RVSA which inverted on 30 August 2008 (AAIB Bulletin 12/2008) was fitted with both these modifications.

**Footnote**

1 G-IIRV AAIB Bulletin 9/2014, G-CGXR AAIB Bulletin 10/2013, G-RVCH AAIB Bulletin 1/2013, G-RVPW AAIB Bulletin 9/08, G-RVSA AAIB Bulletin 11/2006, G-CCZY AAIB Bulletin 5/2007, G-EDRV AAIB Bulletin 2/2007, G-RVCG AAIB Bulletin 2/2005, G-BVRE AAIB Bulletin 8/2001, G-HOPY AAIB Bulletin 12/1999, G-RVSA AAIB Bulletin 12/2008, G-CDMF AAIB Bulletin 1/2008 and G-CDRM AAIB Bulletin 10/2007.

2 See http://www.lightaircraftassociation.co.uk/engineering/TADs/320%20VANS%20RV9-9A.pdf

The TADS for the Vans RV-9A includes the following,

> *Problems have been experienced with the RV-9A noseleg, especially when operating off grass, with instances of the nosewheel bending back and the strut digging into the ground, causing a rapid stop and further damage. In order to avoid this risk, it is important to maintain the correct nosewheel tyre pressure, and to trim the spat to ensure generous clearance between the tyre and the wheel aperture in the spat (circa half an inch). It is also important to maintain suitable preload on the nosewheel axle bearings, torquing up the axle nut gently as required in the absence of a conventional spacer between the bearings. It is also important to land the aircraft on the mainwheels first and hold the nosewheel off the ground during the initial part of the landing roll, rather than landing on all three wheels together which encourages wheelbarrowing and overloading the nosewheel.*

The final sentence reflects a programme initiated a few years ago by the LAA, to educate pilots of types which might be susceptible to this phenomena, to delay nosewheel contact as long as possible when landing. The LAA believes this has led to a reduction in the number of nose landing gear failures on light aircraft in recent years.