

Rutan Varieze, G-BEZE

AAIB Bulletin No: 7/2003	Ref: EW/G2003/04/02	Category: 1.3
Aircraft Type and Registration:	Rutan Varieze, G-BEZE	
No & Type of Engines:	1 Continental Motors Corporation O-200-A piston engine	
Year of Manufacture:	1985	
Date & Time (UTC):	4 April 2003 at 1210 hrs	
Location:	Biggin Hill Airport, Kent	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Skid worn on nose and minor internal damage to mechanism	
Commander's Licence:	Basic Commercial Pilot's Licence	
Commander's Age:	74 years	
Commander's Flying Experience:	9,027 hours (of which 5 were on type)	
	Last 90 days - 40 hours	
	Last 28 days - 18 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent telephone enquires	

Synopsis

The aircraft was being flown to assess the engine and aircraft performance following the recent installation of an overhauled engine. After an initial take-off, circuit and go-around, the aircraft was set up for a full stop landing. On landing, the nose landing gear (NLG) collapsed. Subsequent inspections found that the NLG extend/retract worm gear mechanism was damaged, and that this damage could have been due to the NLG not being fully extended to the 'down and locked' position prior to the flight.

History of Flight

Following the installation of a recently overhauled engine, the aircraft was to be flown to assess the engine and aircraft performance and to carry out parts of the test flight required for the renewal of the Permit to Fly. The pilot intended to fly two circuits, which were to include one go-around followed by a full stop landing.

The aircraft had been parked with the NLG retracted and the front of the aircraft resting on the ground upon its nose bumper, which is normal practice for the Rutan Varieze. After the pilot had boarded the

aircraft, the nose was raised to allow the pilot to extend the gear for the flight. He wound the NLG extend/retract handle in the cockpit in the 'extend' direction, until he felt the gear was fully extended and it was possible to stow the handle in one of the handle locking slots. He also confirmed that the landing gear warning light had extinguished, and was satisfied that the gear was fully extended and locked in that position. As the intended flight was to be short, the pilot deemed that there was no need to retract the NLG after takeoff and so he had no reason to, and did not touch, the NLG extend/retract handle during the flight. The aircraft was then taxied, without incident, to Runway 03 for a normal takeoff.

The first circuit and go-around were flown without incident. After the subsequent circuit, a normal approach was flown, with the use of the airbrake. Upon landing, the NLG collapsed, after which the aircraft continued to travel down the runway on its nose bumper until it came to a halt. The pilot then exited the aircraft unhurt.

Aircraft Description

The Rutan Varieze is a canard aircraft with swept wings and a rear mounted engine which drives a pusher propeller. It is also equipped with a retractable NLG but has fixed main landing gears. When the aircraft is parked, the NLG is retracted and the aircraft rests on the bumper at the front of the aircraft, in what is described as the 'kneeled' position. Extension of the NLG requires the front of the aircraft to be physically raised, after which the NLG extension system is operated from the cockpit. To begin the NLG extension, a handle in the cockpit is turned in the extend direction. This handle is connected to a shaft that turns a worm gear and crown wheel, and the rotation of the crown wheel drives the actuating arms of the NLG in the down direction. When the NLG is extended, an extra 1.5 turns of the handle causes the crown wheel to drive the actuating arms over-centre, which locks the gear in the fully down position. If the actuating arms are not over-centre, the NLG is only held in the down position by the mesh of the gear teeth between the crown wheel and worm gear. On G-BEZE, the NLG extend/retract handle mechanism in the cockpit had various locking positions in which the handle could be stowed away after operation; this was a modification to this aircraft.

A microswitch operates when the NLG actuating arms are at the over centre lock position, which illuminates the light in the cockpit to indicate that the NLG is fully 'down and locked'. A warning system is installed such that if the NLG is not 'down and locked', a warning lamp will illuminate, its signal being obtained from the open microswitch. In addition, when the throttle is moved to select an engine speed below 1000 rpm, with the NLG not locked down, an aural warning sounds.

Aircraft examination

Following the accident the worm gear and crown wheel on G-BEZE were inspected. The crown wheel was found stripped of most of its gear teeth, around approximately 120° of its circumference, indicating that an unusually high load had been transferred from the NLG actuating arms through the crown wheel. The teeth had then failed as a result of their reaction against the worm gear.

Discussion

It is possible that, during the original lowering of the NLG, that the actuating arms were not in the fully over-centre locked position, despite the fact that the NLG 'not down and locked' warning light had extinguished and the extend/retract handle was stowed away. The system is such that if the warning light was extinguished, then the 'down and locked' light should have illuminated, as both are signalled through the same microswitch, even if the microswitch had not been rigged to operate at the correct point. The pilot stated in his report of the accident that, if the NLG 'not locked down' warnings had operated, he had not been aware of them. Subsequent testing of the warning system did not reveal any faults. With the actuating arms not over-centre, this would mean that all NLG loads would have been supported by the crown wheel reaction against the worm gear, which was prevented from moving by its inherent geometry and the stowed operating handle. It was considered that gear teeth were probably strong enough to react the loads experienced by the NLG during taxi, but not

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strong enough to support the much higher, but normal, loads during landing. As there was then no means of locking the NLG down, it would retract.

Following the incident the extend/retract handle stow/lock modification has been removed.