Serious Incident

Aircraft Type and Registration:	Denney Kitfox MK2, G-BUKP	
No & Type of Engines:	1 Rotax 582 piston engine	
Year of Manufacture:	1992 (Serial no: PFA 172-12301)	
Date & Time (UTC):	3 September 2023 at 1300 hrs	
Location:	Near Old Buckenham Airfield, Norwich	
Type of Flight:	Private	
Persons on Board:	Crew – 1	Passengers – None
Injuries:	Crew – None	Passengers – N/A
Nature of Damage:	None	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	55 years	
Commander's Flying Experience:	99 hours (of which 28 were on type) Last 90 days – 11 hours Last 28 days – 7 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further AAIB enquiries	

Synopsis

The aircraft was flown with an underslung cargo pod on a cross country flight which may have resulted in higher than anticipated fuel consumption. The pilot recognised a low fuel situation and planned a landing at Old Buckenham to refuel. Before arrival, the engine started to lose power, so the pilot initiated a field landing. There was no damage or injuries.

History of the flight

The pilot planned a cross country flight over two days from Grove Farm, west of Lowestoft, to Wharf farm, to the west of Leicester, and return. The pilot wished to carry some additional baggage, so he planned to conduct the flight with an underslung cargo pod fitted.

The planning was conducted using statute miles because the aircraft ASI was calibrated in mph. The planned route was 133 miles each way and the pilot planned to fly at a cruise speed of 65 mph. Based on this he calculated a minimum flight time of four hours 40 minutes including 30 minutes for a potential diversion and not allowing for wind. The pilot understood the normal fuel requirement for the aircraft to be 10 litres per hour (lph), giving a minimum fuel requirement of 47 l. The pilot allowed a 25% increase in fuel to account for the additional drag caused by the cargo pod, giving 59 l required for the trip without allowing for wind. The aircraft was fuelled with 65 l and there were 5 l in the header tank, so it departed Grove Farm with 70 l total fuel on board.

During the outbound flight the pilot found that an rpm increase (from 4,900 rpm to 5,150 rpm) was needed to maintain the planned airspeed. The pilot stated there was a slight tailwind and the flight time was, as expected, two hours and five minutes.

There were no fuelling facilities at Wharf Farm. The pilot checked the fuel level prior to the return flight using the sight tube and judged it to be sufficient for the return flight.

The return flight proceeded with a light southerly wind. Just over halfway, the pilot noticed that the wing tank sight tube was reading lower than anticipated and planned a stop for fuel at Old Buckenham. North of D208, approximately 10 nm from Old Buckenham, the low fuel indicator in the fuel header tank was triggered. The pilot yawed the aircraft to encourage fuel visible in the wing tank sight tube to flow into the header tank, but the warning remained illuminated.

The pilot decided to continue to Old Buckenham and advised them of the fuel situation but planned to initiate a field landing at the first indication of rough running. As he proceeded, he continuously assessed the available fields so that a preferred field was always in mind.

Just before joining the circuit for Old Buckenham, the pilot observed a reduction in rpm and immediately initiated a landing in the current preferred field. He informed Old Buckenham of his intention and, when prompted by Old Buckenham, declared a MAYDAY. The landing was completed without damage or injury and the MAYDAY was cancelled. The aircraft had been flying for approximately 1.5 hours since departing Wharf Farm. After landing, the pilot noted that approximately 5 l of fuel remained and this drained into the fuel header tank when the aircraft was in the tail down position.

No fuel leaks or other causes of unexpected fuel consumption were identified, and fuel consumption returned to normal when the cargo pod and additional weight were removed.

Aircraft information

The aircraft uses Avgas 100LL and is approved to fly using Mogas. It has two wing tanks of approximately 50 l and 20 l capacity with a constant gravity feed to a 5 l header tank mounted behind the seats. The header tank has a sensor that detects any airgap in the tank greater than 100 ml with an associated red LED warning light.

The owners manual for the aircraft gives a fuel consumption of 7.9 lph for cruise at 65 mph. It states: '*These figures can be used as a general guide, but each builder should conduct his own flight test program to determine the exact performance of his own aircraft.*' The aircraft owner stated the aircraft normally consumed around 10 lph at 65 mph.

The larger wing tank is fitted with a sight tube visible in flight. It is uncalibrated and the reading changes depending on aircraft attitude. The pilot reported that part of the sight tube is obscured in flight in this aircraft.

The underslung cargo pod is an optional modification supplied by the manufacturer (Figure 1). G-BUKP's cargo pod was supplied to the aircraft builder with the aircraft kit and had been passed on with the aircraft to subsequent owners.

The aircraft manufacturer does not provide information regarding the effects of the luggage pod on aircraft performance.

The LAA has not accepted the cargo pod as a factory standard option for use in the UK, although it can be approved by modification application. This is due to concerns about how the pod and luggage is secured and not fuel consumption. G-BUKP had not been approved to use this modification.

The aircraft was rebuilt by the owner in 2018 when LAA *Type Acceptance Data Sheet (TADS) issue 6* was in effect. Issue 6 does not list the baggage pod as a standard option but does not preclude it either. The owner of the aircraft did not consider that an approval process would be required given that the pod was a standard option offered by the manufacturer, the aircraft was fitted with factory welded mounting points for it, and the aircraft had flown with it before under prior ownership. Issue 7 of the TADS, published after the aircraft had been rebuilt and inspected, provides an additional preamble in the 'standard options' section:

> '*List of standard manufacture's options that can be installed without the need for a mod application (also applies to aircraft post-build)*'.

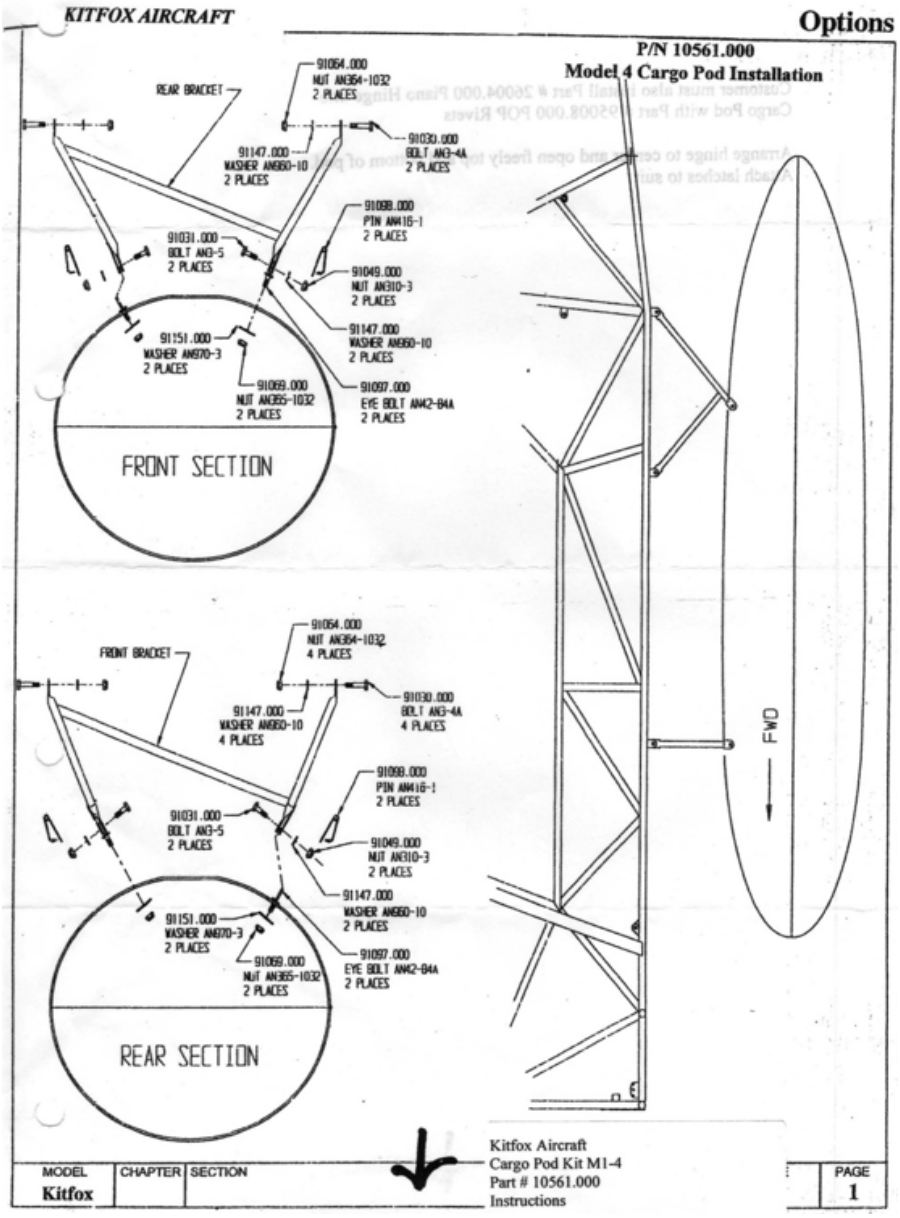

Figure 1

Illustration of the underslung cargo pod

Other information

Prior to the flight the pilot used social media to liaise with two other Kitfox owners who had used a similar cargo pod, and asked questions about the effect on performance. Both reported a small reduction in cruise speed and no significant difference in fuel consumption.

Before the incident flight, the pilot conducted two short flights with the pod fitted and noticed a speed reduction at the normal RPM setting but did not calculate fuel consumption.

There were NOTAMs in place for RAF Lakenheath, RAF Marham and Danger Area 208 which meant that these were not suitable alternate landing airfields and the pilot could not fly directly to Old Buckenham when he noticed that the remaining fuel was less than expected.

Relevant guidance

The CAA Skyway code[1] gives the following advice on fuel management:

> '*Fuel burn and range figures can be found in the AFM. You should have a good working knowledge of your aircraft's fuel burn at different power settings.*'

And

> '*Fuel gauges in most GA aircraft are not sufficiently reliable for the purposes of flight planning or pre-flight confirmation of fuel onboard. Physically examining the fuel levels with a method appropriate to the aircraft (such as a dipstick) is the best way of assessing the fuel onboard.*'

And

> '*Incorporate fuel burn into your PLOG calculations and/or flight plan on your VFR Moving Map device. Regularly check anticipated fuel burn against actual.*'

The Civil Aviation Authority of New Zealand's guidance document titled *'Fuel Management'*[2] contains additional guidance including an example fuel management log for use in flight. It states:

> '*It's good practice to check the fuel available before flight by at least two separate methods. We can do this by referring to the fuel gauge(s), loading a known quantity and, in many aircraft, by dipping the tanks.*'

> '*If the fuel tanks cannot be accurately or easily dipped, start the flight with the tanks either full, or filled to a fixed reference point, and keep an accurate inflight fuel log. If that's not possible, due to weight and balance or performance considerations, the only way to know exactly how much fuel is on board is to add a known quantity (ie, a reading taken from the fuel pump counter) to a predetermined reference point inside the tank.*'

Analysis

The cargo pod was not an approved factory standard option for use in the UK. To obtain approval, the aircraft owner was required to apply to the LAA for a modification but had not done so. Owners of LAA aircraft should note that only options listed in the 'standard options' section of the aircraft *Type Acceptance Data Sheet (TADS)* can be fitted without a modification application. The TADS that was current when the aircraft was rebuilt did not explicitly preclude use of the cargo pod or any other modification that was not in the 'standard options' list. This may have contributed to the misunderstanding. The next issue of the TADS was clearer but was published after the aircraft was rebuilt. The LAA has modified the TADS for this aircraft type to make it clearer that the underslung cargo pod has not been approved.

Footnote

[1] Civil Aviation Authority (2023). *The Skyway Code, version 4*. CAA Skyway Code MK4 [accessed on 12/12/2023].

[2] Civil Aviation Authority of New Zealand, *Fuel Management* https://caanz.cwp.govt.nz/assets/publications/gaps/caa-gap-fuel-management-web.pdf [accessed on 12/12/2023].

The pilot attempted to find out what effect the cargo pod would have on fuel consumption but there was no reliable information available from the manufacturer or other owners. The pilot allowed more than 25% extra fuel, but this was insufficient. If the aircraft was loaded with 70 l of fuel, allowing 10 minutes for taxiing, the engine ran for approximately 3 hours and 45 minutes and consumed 65 l of fuel, giving a consumption rate of around 17 l per hour with the cargo pod fitted. This is much higher than the normal fuel consumption figures given by the owner and the aircraft owners manual. The investigation did not verify the amount of fuel loaded, and it is not known to what extent the cargo pod or another factor may have influenced the fuel consumption.

The Civil Aviation Authorities of the UK and New Zealand both recommend accurately determining the amount of fuel available before flight with a calibrated gauge or dipstick, or by loading a known amount. They also recommend monitoring expected fuel burn against actual fuel burn in flight and keeping a record of this. In this aircraft, the uncalibrated sight tube was the only means to check fuel remaining prior to departure and in flight. Without being able to refuel, the pilot had no means to accurately check the amount of fuel on departure. There was also no accurate way to determine that the amount being consumed was much higher than expected. The aircraft owner plans to install a fuel flow sensor. This could be used in future to obtain more accurate fuel consumption figures for the aircraft with and without the cargo pod.

The pilot identified the low fuel situation early enough to make decisions about what to do in an unhurried manner but not early enough to land at a suitable airfield for fuel. The pilot's plan to land at the first sign of fuel starvation and the process of continual field selection produced a successful outcome. The aircraft's STOL capabilities and the pilot's experience of landing at short farm strips helped to increase the chance of a successful landing.

Conclusion

The aircraft was flown with a modification that had an unknown effect on fuel consumption and the pilot attempted to account for this during planning. If the aircraft contained 70 l of fuel on departure from Grove Farm, the fuel consumption was much greater than anticipated and this was not identified at a stage when it was possible to reach a suitable airfield. The pilots' decision to perform an immediate landing at the first sign of power loss rather than attempting to continue to the airfield produced a successful outcome.