**ACCIDENT**

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| **Aircraft Type and Registration:** | Skystar Kitfox Mk 7, G-FBCY |
| **No & Type of Engines:** | 1 Rotax 912ULS piston engine |
| **Year of Manufacture:** | 2015 (Serial no: PFA 172D-14696) |
| **Date & Time (UTC):** | 5 August 2018 at 1730 hrs |
| **Location:** | Field near Rugby, Warwickshire |
| **Type of Flight:** | Private |
| **Persons on Board:** | Crew - 1 Passengers - 1 |
| **Injuries:** | Crew - 1 (Minor) Passengers - 1 (Minor) |
| **Nature of Damage:** | Propeller, engine, nosewheel strut and right wing |
| **Commander's Licence:** | Private Pilot's Licence |
| **Commander's Age:** | 64 years |
| **Commander's Flying Experience:** | 246 hours (of which 49 were on type)<br>Last 90 days - 4 hours<br>Last 28 days - 1 hour |
| **Information Source:** | Aircraft Accident Report Form submitted by the pilot and subsequent AAIB enquiries |

## Synopsis

While returning to its home airstrip, the aircraft experienced a loss of engine thrust coincident with an uncommanded increase in engine speed. The pilot made a forced landing in a ploughed field during which the nosewheel collapsed, resulting in substantial damage to the aircraft. Subsequent examination of the propeller hub revealed that the threads on the lead screw within the propeller pitch-change mechanism had been stripped. This had caused the propeller blades to move to a very fine pitch setting, leading to the loss of thrust.

## History of the flight

The aircraft was operating a flight from Old Warden Aerodrome to Peter Hall Lane farm strip near Coventry. Shortly after reducing engine power to descend in preparation for landing, the pilot heard a loud "pop" and a red warning light illuminated on the engine monitor. Coincident with this, the engine speed increased from 5,200 to 7,000 rpm. The engine appeared to be running well, however it was apparent that no thrust was being produced. The pilot spent some time trying to diagnose and troubleshoot the problem. He considered that either the drive to the propeller, or the automatic propeller pitch control had failed, and he attempted to manually select the propeller pitch to the fully coarse setting, but this had no effect.

The aircraft was overhead a built-up area at this time, so the pilot turned towards open ground and selected a field in which to make a forced landing. The field had been ploughed

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and had a slight uphill gradient. After touching down, the nosewheel collapsed and the propeller struck the ground (Figure 1). The pilot and his passenger suffered only minor injuries and were able to exit the aircraft unaided.


**Figure 1**
G-FBCY after landing

## Aircraft information

The Skystar Kitfox Mk7 is a kit-built aircraft and the build project for G-FBCY commenced in 2007 and was completed in 2015. G-FBCY was equipped with a Rotax 912 ULS engine and a three-bladed Arplast PV50 electrically-controlled 'in-flight adjustable' propeller, which was purchased new in 2008. A Smart Avionics CSC-1/P constant speed controller (CSC) was also fitted so that the propeller could be operated as a constant speed/variable pitch propeller. The CSC can be operated in manual mode, where the pilot selects the propeller pitch or in automatic mode, where the propeller pitch-change mechanism continually makes small adjustments to maintain a constant propeller speed, appropriate to the phase of flight. The owner of G-FBCY, who was also the accident pilot, reported that he routinely used the CSC in automatic mode.

G-FBCY received its initial Permit to Fly in August 2015, and since then had accrued 65 flying hours. In June 2017, at 45 flight hours, the owner had re-lubricated the propeller hub which he reported included removing, inspecting and lubricating the lead screw from the propeller pitch-change mechanism. This task was signed off by his LAA Inspector, but the Inspector did not specifically inspect the lead screw. The last permit renewal took place on 25 May 2018.

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In July 2018, the propeller was removed to facilitate removal of the engine gearbox for overhaul. It was subsequently refitted by the pilot and inspected by his LAA Inspector on 4 August 2018. The accident flight was the first flight following reinstallation of the gearbox.

**Aircraft examination**

Following the accident, LAA Engineering participated in an inspection of the aircraft and strip examination of the propeller hub. Initial examination of the propeller pitch-change mechanism indicated that the propeller blades had been in the full coarse setting at impact. The gearbox and clutch were examined and tested at the original overhaul facility and both were found to operate as expected. This indicated that there were no issues with the engine drive to the propeller.

Further examination and disassembly of the propeller pitch-change mechanism identified that the screw thread was stripped on the lead screw within the motor, such that the blade pitch was free to move at will (Figure 2). It was considered that this had allowed the propeller blades to migrate beyond the electrical fine pitch limit microswitch, into a super-fine pitch regime, leading to a loss of thrust. Following a period running at excessive speed, the engine would have begun to fail. As the engine stopped developing power and the rpm dropped, it is likely that aerodynamic loading on the propeller blades caused them to move back towards a coarse pitch setting.

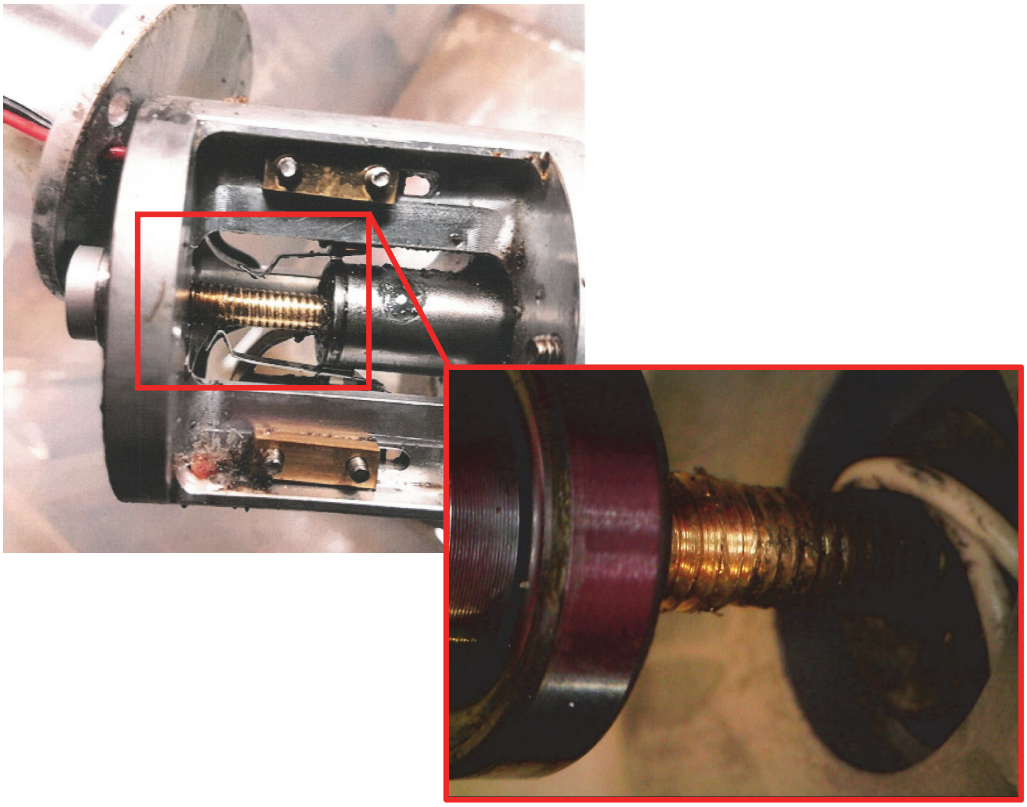

**Figure 2**

Motor from G-FBCY's propeller pitch-change mechanism showing the stripped thread on the lead screw *(Photographs courtesy of pilot / LAA)*

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**Previous incidents**

In 2008, the LAA published a '*Safety Spot*' article in their monthly magazine regarding a similar accident which occurred on a Europa aircraft equipped with an Arplast PV50 propeller. In that case, the propeller pitch-change mechanism also failed in such a way that it allowed the propeller to set itself to a very fine pitch setting, resulting in the propeller producing insufficient thrust to sustain flight and necessitating a forced landing. It transpired that the lead screw within the propeller pitch-change mechanism had failed as a result of lack of lubrication and the fine pitch stops, which should have prevented the blades going into this super-fine regime, had been incorrectly set.

The propeller manufacturer's service instructions required the lead screw to be removed, cleaned, inspected and lubricated every 50 hours, but these service instructions had not been correctly followed, leading to a lack of adequate lubrication. As a result of that incident, on 6 February 2008 the LAA published Airworthiness Information Leaflet (AIL) MOD/PROP/08-007 titled *'Arplast – variable pitch propeller essential in-service inspection',* requiring inspection and lubrication of the propeller lead screw on the Arplast PV50 propeller. The inspection was to be accomplished at installation, after the first 25 hours and then each subsequent 50 hours. In addition, the AIL required checking and, where necessary, adjustment of the mechanical fine pitch stops on the propeller in accordance with instructions produced by the then UK sales agent for the propeller.

The LAA reported that the AIL was sent to owners of all aircraft fitted with the Arplast PV50 propeller at that time but was not subsequently posted on the LAA website, or otherwise made available to owners of similarly equipped aircraft coming on to the LAA system after that date.

In the intervening period between 2008 and the accident to G-FBCY, the LAA reported that it was not aware of any other incidents or failures involving this propeller type.

The LAA advised that it currently relies on its paper-based Inspector's manual, known as 'SPARS' to promulgate safety information about propellers to all its Inspectors. Inspectors are required to keep the manual updated and to sign-off each aircraft as compliant with the requirements of SPARS at each permit renewal. The importance of having correctly adjusted pitch stops is discussed in the '*propeller*' section of SPARS, and in particular for the Arplast PV50 it states:

> *'Propeller pitch stops must be checked to ensure that the pitch range available does not exceed that which allows safe flight.'*

**Discussion**

Although G-FBCY's build had been ongoing since 2007, it was not completed until 2015 and the aircraft had only amassed 65 flying hours at the time of the accident. As G-FBCY was undergoing build when the LAA issued the AIL in 2008 detailing the inspection and adjustment of the mechanical pitch stops on the Arplast PV50 propeller, the AIL was not sent to G-FBCY's owner. As the AIL was not made available on the LAA website thereafter,

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despite searching for any relevant information, the owner was not aware of the AIL or the requirement to adjust the mechanical fine pitch stops. Nonetheless, information relating to the pitch stops on the Arplast PV50 had been promulgated in the LAA SPARS document.

Following the loss of thrust, presented with the unusual and confusing situation in which the engine seemed to be operating normally, albeit overspeeding, the pilot considered that he may have spent too much time trying to diagnose and manage the situation before making the decision to execute a forced landing. He subsequently estimated that the engine may have been running for more than one minute in excess of 7,000 rpm. The aircraft lost height and speed during this time and as a result the forced landing was more hurried than he would have liked, which may have contributed to the nosewheel collapse after touchdown.

**Conclusion**

This accident highlights the importance of promptly selecting a suitable landing site and establishing a glide approach following a loss of engine power or thrust, and only thereafter attempting to diagnose or fix the problem if time and height are available.

**Safety actions**

Prior to this accident, the LAA had embarked on a long-term project to transfer aircraft, engine and propeller information from SPARS to a web-based Type Acceptance Data Sheets (TADS) system, in order to make this information, including AILs, easily available to its members. This activity is ongoing and the transfer of aircraft-specific data is almost complete, and it is planned that the transfer of engine and propeller information will follow. It is envisaged that the propeller TADS will include any relevant limitations or modifications for each propeller type and the LAA considers that this will provide a useful reference for aircraft owners when deciding what propellers to fit to their aircraft.

The LAA also intends to reissue the AIL originally issued in 2008 for the Arplast PV50 propeller and is currently identifying all LAA aircraft to which this propeller is fitted. Owners of projects still under construction who may have this propeller but who have not yet identified the propeller type to the LAA, will be identified when an application for an initial permit to fly or modification is made.

The LAA published a '*Safety Spot*' article in the November 2018 issue its '*Light Aircraft*' magazine, to alert owners to the issues arising from this accident.

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