

## ACCIDENT

<b>Aircraft Type and Registration:</b>	Supermarine Aircraft Spitfire Mk 26, G-CIEN	
<b>No &amp; Type of Engines:</b>	1 Isuzu V6 piston engine	
<b>Year of Manufacture:</b>	2014 (Serial no: PFA 324-14492)	
<b>Date &amp; Time (UTC):</b>	12 August 2021 at 2010 hrs	
<b>Location:</b>	Newtownards Airport, County Down	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Damage to landing gear, left wingtip, propeller, and engine cowlings	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	47 years	
<b>Commander's Flying Experience:</b>	712 hours (of which 1 was on type) Last 90 days - 42 hours Last 28 days - 8 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

## Synopsis

After landing, the aircraft suddenly veered to the right causing the left wingtip, propeller, and engine cowl to scrape the runway. Examination of the left landing gear leg revealed a failed weld that had allowed the lower part of the leg to rotate and consequently affect the wheel alignment. It is possible that the weld was damaged during a previous heavy landing, but due to the design of the leg it had not been possible to inspect the weld. The LAA has issued a warning to owners and is reviewing the design of the landing gear.

## History of the flight

The pilot had recently purchased the aircraft and conducted a Permit to Fly revalidation check flight after various modifications had been embodied. The flight passed without incident and the pilot landed on Runway 21 at Newtownards Airport. The aircraft was slowing down on the runway centreline when it suddenly veered to the right. The pilot first applied left rudder and then full left brake but could not prevent the left wingtip, propeller and lower engine cowl scraping the runway. The aircraft came to rest off the runway with damage to both landing gear legs (Figure 1).



**Figure 1**

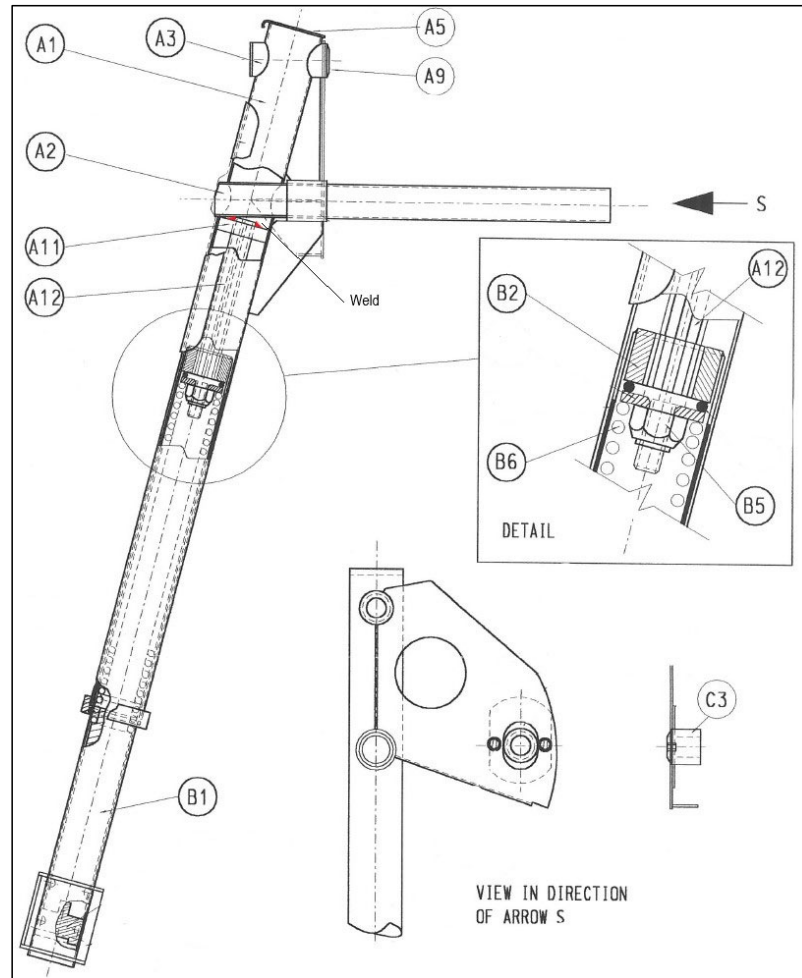
Landing gear damage  
(Photograph used with permission)

### **Aircraft information**

The Supermarine Spitfire Mk 26 is a kit build, 80% scale replica of the classic warbird, and is powered by an Isuzu V6 engine and a three-bladed propeller. There are fifteen Mk 26 aircraft registered in the UK with the oldest being 15 years old.

The landing gear consists of two retractable main gear legs and a steerable tail wheel. Each leg is sprung without any damping and is fitted with a disc brake and an aerodynamic fairing. The main gear legs are raised and lowered by an electrically powered actuator and locked in position by manually operated locking pins. Lights in the cockpit indicate to the pilot when the undercarriage is UNLOCKED, IN TRANSIT and LOCKED.

Each main gear leg has a large diameter upper steel tube (Figure 2 - A1) fitted with a pintle pin (A2), an attachment for the extension / retraction actuator (C3), and a locator for the locking pin (A3 & A9). Inside the upper tube, underneath the pintle pin, is a thick washer (A11) welded to the tube, and a splined shaft (A12) that is welded (shown) to the top surface of the washer. A thin metal disc (A5) is welded to the top of the upper tube to close it. A smaller diameter steel lower tube (B1) slides inside the upper tube, and a coil spring (B6) supports the weight of the aircraft. Another thick washer (B2), which has an internal spline that matches the splined shaft, is welded to the top of the lower tube. This arrangement allows the lower tube to slide and compress the spring but not rotate relative to the upper tube. A nut (B5) on the end of the splined shaft retains the lower leg. The brake and wheel axle are attached to the bottom of the lower leg.



**Figure 2**

Section views of undercarriage leg

### Aircraft examination

The left main gear leg was removed from the aircraft, and the upper tube was cut between the pintle pin and the thick washer (Figure 3). This enabled the fillet weld between the splined shaft and the thick washer to be inspected. It was evident that the weld had broken, and the splined shaft had rotated. The fillet weld was measured to be approximately 2 mm (Figure 4) with minimal weld penetration on the splined shaft.

### Other information

In July 2017 the aircraft suffered a heavy landing after which both main gear legs were removed for inspection. This did not include an inspection of the weld that failed as access is only possible if the gear leg is cut as shown in Figure 3. The aircraft was reassembled and completed one flight in May 2018 before being sold to the current owner. The next flight was the accident flight.

### *Weld penetration*

The LAA and an experienced independent engineer obtained another pair of gear legs from a Spitfire Mk 26 which had also been involved in a heavy landing. They were cut at the same location and the splined shaft to thick washer welds were examined. In their opinion, there was better weld penetration on both legs when compared to the accident aircraft leg. They concluded that manufacturing variability could have been a causal factor in the failure of the welded joint.

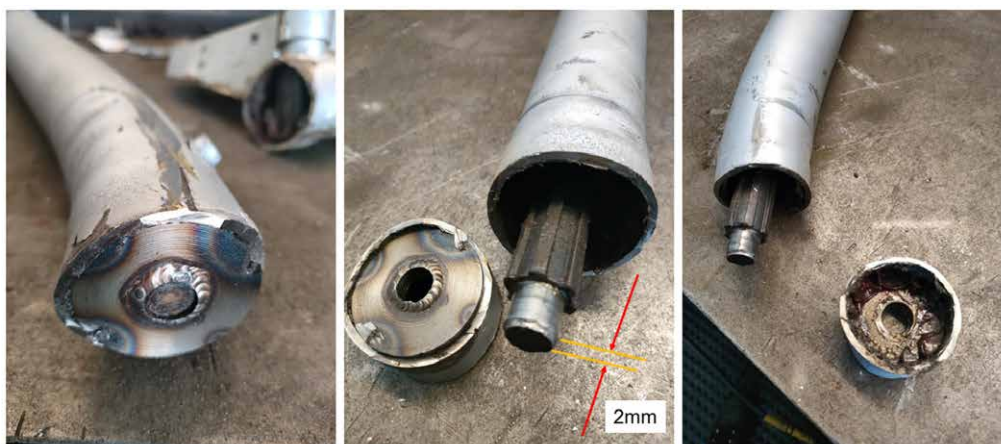
### *Manufacturing*

All Spitfire Mk 26 landing gear legs were manufactured in Australia when the manufacturer was located there. The company is now based in Texas, USA and no longer makes the Mk 26. The later Mk 26B is a 90% scale replica and uses a different design of landing gear legs with a scissor link between the upper and lower tubes to react torsional loads instead of the splined shaft. This is the only standard currently available.



**Figure 3**

The left main gear leg removed and cut



**Figure 4**

The left main gear leg with the thick washer removed

## Analysis

During the landing roll, the weld between the thick washer and the splined shaft on the left main gear leg failed, allowing the lower leg, and consequently the wheel assembly, to rotate. This resulted in the aircraft veering to the right, despite the pilot applying full left rudder and left braking. The left leg was bent as the right wing lifted and the left wingtip, propeller and engine cowl scraped the runway.

The aircraft had not been flown since 2018 when, under previous ownership, it had suffered a heavy landing. The landing gear had been stripped, however the weld that failed could not be inspected. The aircraft had flown once between the heavy landing and the accident flight.

Comparison of the failed weld from G-CIEN and another pair of Mk 26 gear legs revealed poor weld penetration. This may have been the result of manufacturing variability and would have reduced the strength of the welded joint. The heavy landing may have damaged the weld, such that it failed after a further two landings.

The Spitfire Mk 26 landing gear is no longer manufactured, having been replaced with a different design for the heavier Mk 26B. The LAA are reviewing the design and the access restrictions to inspect the weld that failed to determine if further action is needed. The LAA have also issued a warning to all owners of UK registered Mk 26 aircraft about the possibility of hidden damage to the weld following a hard landing. No similar failures have been experienced by any of the 15 UK registered Spitfire Mk 26 aircraft since the first one flew in 2006.

## Conclusion

A weld in the left landing gear leg failed during the landing, which allowed the left main wheel to rotate and the aircraft to veer to the right. Two landings prior to the accident flight, the aircraft landed heavily however, due to the design of the landing gear leg the subsequent inspection could not have detected any damage to the weld. Manufacturing variability could have resulted in poor weld penetration and therefore a reduction in strength. The LAA are reviewing the design of the undercarriage of the Mk 26 and have issued a warning to UK owners of the potential for hidden damage following a heavy landing.

## Safety actions/Recommendations

As a result of this accident the following safety action has been taken:

The Light Aircraft Association has issued a warning to all UK owners of Spitfire Mk 26 aircraft that there is potential for hidden damage to a weld following a heavy landing.

The Light Aircraft Association is reviewing of the design of the Spitfire Mk 26 undercarriage leg, including the access restriction to inspect the weld that failed.