SERIOUS INCIDENT

Aircraft Type and Registration:	Europa, G-FLOR	
No & Type of Engines:	1 Rotax 912-UL piston engine	
Year of Manufacture:	1999 (Serial no: PFA 247-12793)	
Date & Time (UTC):	23 June 2021 at 1415 hrs	
Location:	Brinkworth, Wiltshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Left door, gas strut and hinges missing, minor damage to left tailplane	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	60 years	
Commander's Flying Experience:	19,864 hours (of which 4 were on type) Last 90 days - 85 hours Last 28 days - 20 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent AAIB enquiries	

Synopsis

The pilot was on a local flight from Cotswold Airport with a passenger. The aircraft was flying at approximately 100 kt and 2,500 ft amsl when, without warning, the left cockpit door detached. After checking that the aircraft's control responses appeared normal, the pilot returned to Cotswold where the aircraft landed without further incident. Subsequent inspection of the left tailplane identified minor damage to the leading edge and upper surface consistent with it having been struck by the door.

This was the eighth event involving the inadvertent opening of cockpit doors fitted to Europa aircraft operated in the UK. The LAA have developed and issued a modification to the Europa to prevent the door latch lever reaching the closed position when the door is not properly latched.

History of the flight

The pilot had purchased G-FLOR seven days before the accident, and it was the first Europa aircraft that he had flown. The passenger had not flown in a Europa before. The pilot advised that he had been briefed by the aircraft's previous owner of the need to "double check" the security of the cockpit doors.

Having completed external checks of the aircraft, the pilot and passenger seated themselves in the cockpit's left and right seats respectively and closed the cockpit doors.

The pilot checked the correct latching of the front of both doors by pushing on them. He then leaned across to check the rear of the right door was latched by pushing against it but noticed that it moved outwards slightly. The pilot then opened and reclosed the right door and, having moved the locking lever back to its closed position, confirmed that the door was correctly latched.

The pilot asked the passenger to similarly check that the rear of his left door was latched by pushing on it, but the passenger was unable to reach, and so the pilot pushed on the door area adjacent to his left shoulder. He advised that he did not feel or see the left door move outwards or notice a gap between the rear of the door and its frame. Prior to takeoff, the pilot rechecked the doors again and stated that they "appeared secure".

The takeoff and climb to 2,500 ft amsl appeared normal but, at a speed of about 100 kt, the left door suddenly detached from the aircraft without warning; the aircraft was 5 nm south-east of Cotswold Airport. The pilot maintained control of the aircraft and, having checked that the control response appeared normal, returned to Cotswold and landed without further incident.

The left tailplane was subsequently found to have been damaged (Figure 1), in a manner consistent with it having been struck by the door. The door was not recovered.

Figure 1
Damage to G-FLOR's left tailplane

Aircraft information

The doors are of a gull wing arrangement with each door hinged in two places along its top edge (Figure 2). Each hinge is attached to the fuselage using Araldite 420 adhesive mixed with flox[1], and two bolts that are secured using AN970-3 washers and nuts fitted from the inside of the fuselage (Figure 3). The large diameter 'penny' type washers assist in spreading the load and also prevent the nuts from embedding into the composite structure as they are tightened.

The door is held closed by two tapered shoot bolts which extend out longitudinally from the lower corners of the front and rear sides of the door, between 10 to 12 mm into guides in the door frame (Figure 4). The push rod for each tapered shoot bolt is attached to the door locking lever with a bolt, washers, and an anchor nut fitted to the push rod. The tapered shoot bolt tips are secured to the push rods using roll pins.

The door locking lever assemblies are protected by covers, which are intended to prevent inadvertent operation, such as snagging clothing that could inadvertently move the lever to its open position. The covers fit tightly around the mechanism, such that if the push rod bolts were to come loose, it would be unlikely for the bolt to be able to completely disengage from the push rod anchor nuts because of close contact with the inside of the covers.

A gas strut is fitted to the rear of each door to support them when in the open position. When closing the door from the cockpit, the pilot pulls on the door handle locking lever, which is positioned towards the front of the door. Due to resistance of the gas strut, combined with some flexing of the door and a need to also compress the door seal, the rear of the door may not always fully close.

If the door is not fully closed at the rear, it is possible to move the door locking lever to the closed position with only the front tapered shoot bolt engaged in its guide. This gives the false impression that the door is closed and fully latched but with the rear tapered shoot bolt resting against the outside of the fuselage skin adjacent to the door frame. If this occurs, a small gap may be evident near the lower rear area of the door.

The door design was discussed with the LAA and as to whether it could appear to be latched correctly, such that movement would not be apparent when pushing against the rear of the door even though the shoot bolt was not correctly engaged into its guide. It was considered that for this to occur, the end of the shoot bolt would need to press against the door frame next to the guide. This would require the rear push rod to either bend, or that the mechanism had not been correctly set up. However, the push rods were relatively short, and it was considered that they were unlikely to bend sufficiently. Had the mechanism also not been set correctly during the manufacture of the aircraft, it may have been expected that this would have been identified early in the operating life of the aircraft, but G-FLOR had been in service since 1999. There was no record of any maintenance work caried out on the left or right door since the aircraft was manufactured.

Footnote

[1] A mixture of cotton fibre and epoxy.

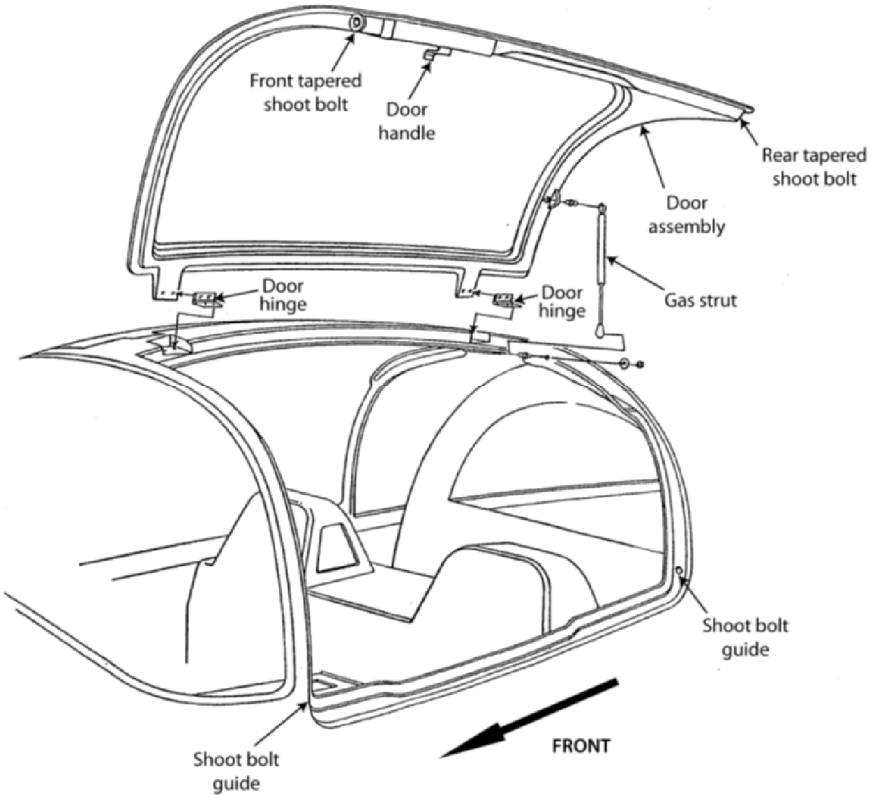

Figure 2

Door arrangement (image used with permission)

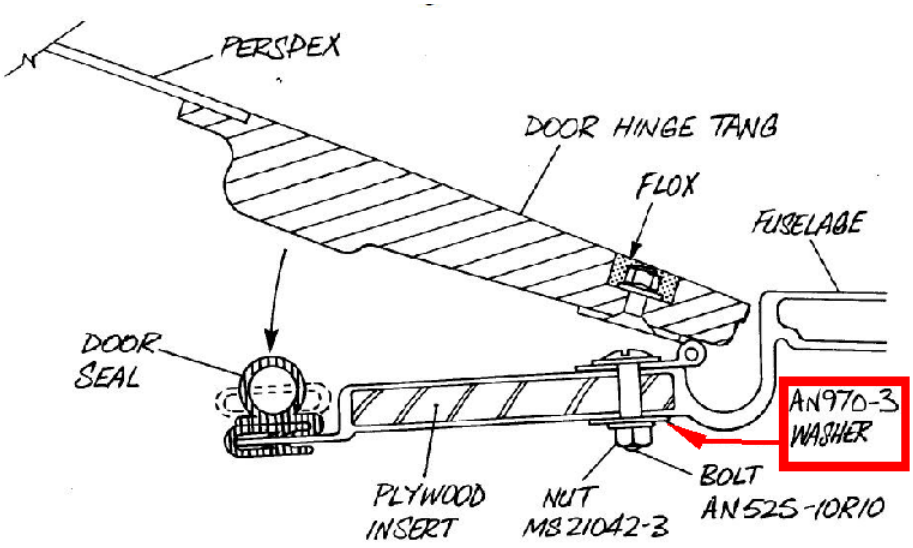

Figure 3

Door hinge fastening (image used with permission)

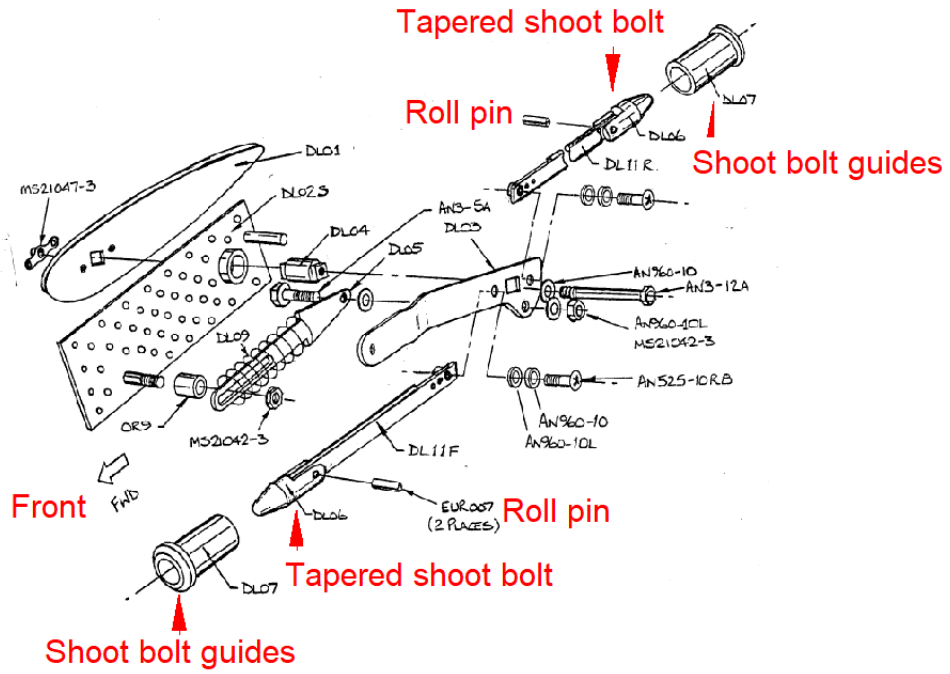

Figure 4

Door locking mechanism (image used with permission)

Aircraft examination

The rear tailplane sustained minor damage to its leading edge and upper surface.

The left door's forward hinge leaf had remained attached to the fuselage with the hinge knuckles having failed due to overload. The rear hinge was missing (Figure 5), with damage consistent with it having been pulled from the fuselage. The damage was consistent with loads exerted by the door when it had opened in flight.

Inspection of the remaining left door forward hinge and both the right door hinges, showed that the AN970-3 washers were not fitted.

There was no evidence of significant damage to either the left door's front or rear shoot bolt guides, the surrounding door frame or fuselage. However, there was superficial damage to the paintwork adjacent to both the left door's front and rear guides (Figure 6 and Figure 7). The damage was similar and was consistent with having been caused by the tapered shoot bolt coming into contact with the fuselage skin and the door frame. Possible causes for this included:

- The shoot bolt had rested against the fuselage skin because it had not engaged into its guide when the door was closed, and the locking lever moved to its closed position.
- The shoot bolt had rested against the fuselage skin because the door had been inadvertently closed with the locking lever in the closed position.

- The shoot bolt had rubbed against the inside of the door frame because the door had been opened and/or closed with the locking lever not in the fully open position.
- The shoot bolt had rested against the inside of the door frame when the locking lever was in the closed position.

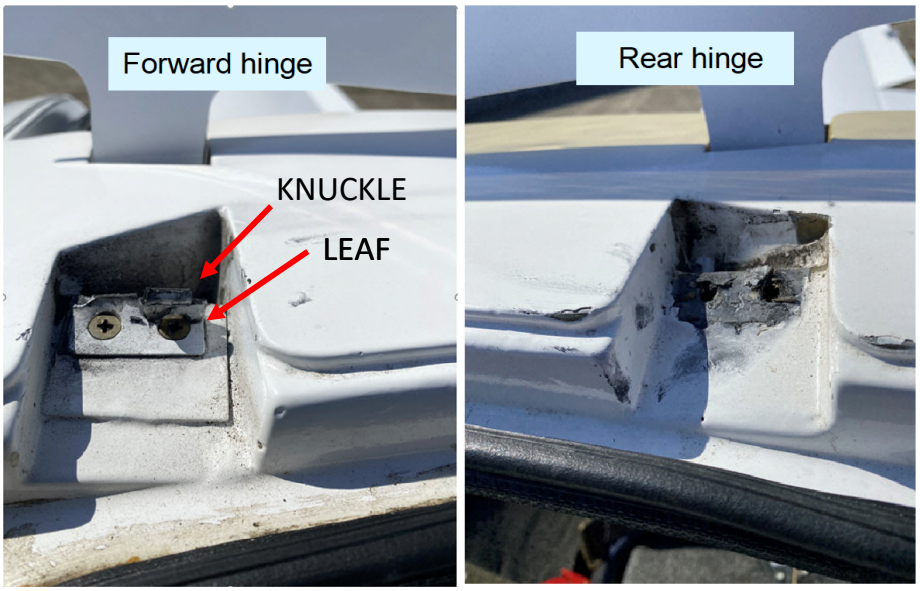

Figure 5
Left door forward and rear hinges

Figure 6
Front shoot bolt guide

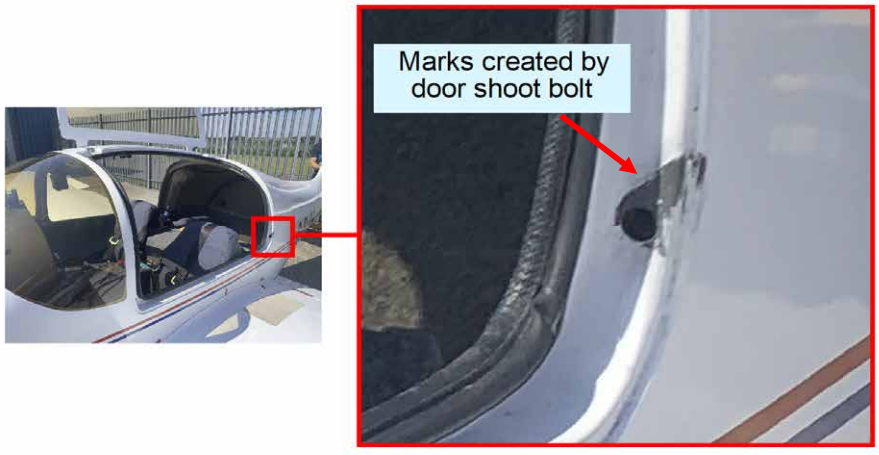

Figure 7

Rear shoot bolt guide

Previous events involving Europa doors

Since 2003, there have been eight occurrences in the UK involving inadvertent opening of cockpit doors fitted to Europa aircraft. Table 1 provides details for the seven previous cases that occurred between 2003 and 2020.

The investigation involving G-BYJI in 2012, concluded that the rear tapered shoot bolt had not been engaged into its guide prior to takeoff, and that the rear hinge had subsequently failed in overload when the door opened in flight (Figure 8).

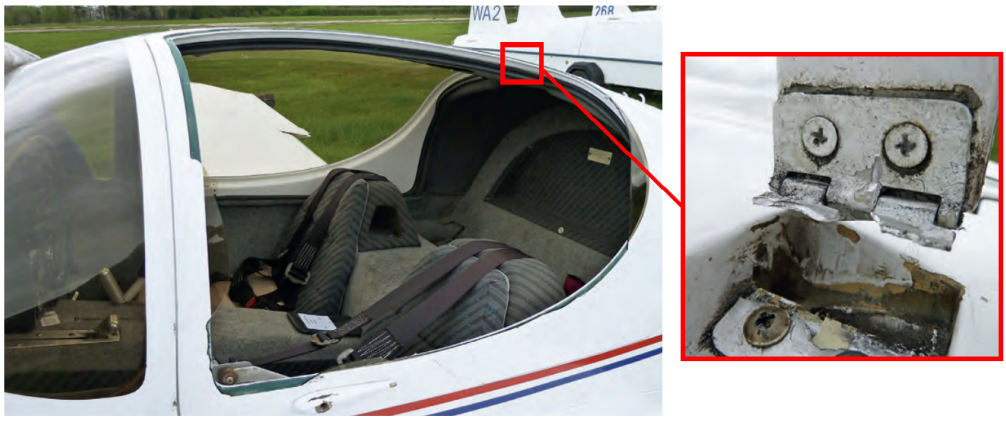

Figure 8

Damage to G-BYJI

The investigation involving G-FIZY in June 2014 also concluded that that the rear shoot bolt had had not been engaged into its guide prior to takeoff. The damage to the remaining section of the door hinges were 'fresh' and no significant damage was reported in the area of the guides but there was evidence of the rear shoot bolt rubbing on the outside of the door frame. During this accident, the door had also struck the tailplane, causing significant damage.

Date / aircraft registration	Description	Commanders flying experience
March 2003 / G-PEGY	Left door opened as aircraft was taking off. Aircraft departed runway with damage to wheel fairing, brake pipe and right wing. Pilot concluded that the door was not fully latched.	1,345 hours (of which 36 were on type).
August 2003 / G-IIGI	Left door opened at 3,000 ft amsl and perspex broke. Pilot closed door and landed safely. Evidence indicated that the rear shoot bolt was not engaged in guide.	3,500 hours (of which none were on type).
August 2008 / G-CCUL	Right door detached at 2,500 ft amsl. Landed safely.	Not available.
April 2012 / G-BYJI	Left door opened at 1,800 ft amsl and perspex broke. Door remained attached and aircraft landed safely.	270 hours (of which 10 were on type).
July 2013 / G-OURO	Left door opened on climb-out and subsequently detached at 300 ft. Door struck left wing trailing edge causing superficial damage. Landed safely.	261 hours (of which 17 were on type).
June 2014 / G-FIZY	Left door detached at 950 ft amsl. Door struck the left tailplane, causing significant damage. Evidence indicated that the rear shoot bolt was not engaged in guide.	17,670 hours (of which 5 were on type).
March 2020 / G-BLVL	Door opened during takeoff roll (report did not advise which door). Pilot pitched down and propeller struck runway.	Not available.

Table 1

Events between 2003 and 2020 involving Europa cockpit doors opening

Previous safety action

Following the accident to G-FIZY, the LAA advised the AAIB that they would work with the aircraft manufacturer to design a safety modification to prevent a recurrence of doors inadvertently opening on Europa aircraft[2].

Although the modification work was started, with trial fitment of parts to one aircraft, the trial aircraft had then been subject to unrelated repairs which led to it being out of service for a prolonged period.

On 1 November 2021, the LAA approved and issued a standard modification (mod number SM 15833) for fitment to Europa aircraft to prevent the door latch from closing when the door

Footnote

[2] AAIB Bulletin 08-2021 (publishing.service.gov.uk) [accessed September 2021].

is not pulled home at the rear, and the rear pin properly engaged. The requirement for this modification has been promulgated by LAA Airworthiness Information Leaflet MOD/247/012, which has been allocated mandatory status for all Europa aircraft operating under an LAA Permit to Fly and is required to be fitted within five flying hours after that date, or next permit revalidation, whichever comes first.

The modification consists of an aerodynamically shaped stop secured to the fuselage outer surface. It is in such a position that it blocks the rear latch pin's movement if the occupant attempts to close the latch with the pin resting on the outside surface of the fuselage if the door hasn't been properly closed at the rear edge. The modification also introduces brightly coloured warning marks on the cabin door latch handles to help alert the pilot to the latch handle not being in the fully closed position.

Analysis

The evidence from this event is consistent with that of previous occurrences involving the inadvertent opening of cockpit doors fitted to Europa aircraft because the door was not correctly latched. This includes a lack of significant damage to the door guides and surrounding fuselage of G-FLOR, which would have been expected if a correctly latched door was to have detached from the aircraft. The damage to the forward hinge and airframe structure at the rear hinge location was consistent with overload failure as a result of the aerodynamic loads placed on the door as it had opened, rather than a fatigue-related failure of either hinge. The possibility that the rear hinge was also not fitted with washers, combined with higher loads that may have been placed on it as the door opened, may explain why this hinge detached from the fuselage.

A review of the events shows that although some pilots were relatively inexperienced on type, with five or less flying hours on the Europa (including the pilot of G-FLOR), several other pilots had more experience. Therefore, the cause of inadvertent opening of doors may not necessarily be attributed to a lack of familiarity on type. However, the data does indicate that at least six out of the eight events involved the opening of the pilot's left door. One possible explanation for this is that the aircraft is usually flown from the left seat, from which the pilot can check the security of the right door by leaning across and pushing on the door at both the front and rear immediately adjacent to the locking guides. However, due to the confines of the cockpit and relative position of the left door's rear shoot bolt guide, it is more difficult for the pilot to check that the rear of the left door is correctly latched. Equally a passenger may not be able to assist the pilot to check the left door or, if they can, may not have the necessary experience to correctly identify if the door is latched or not.

The pilot of G-FLOR had checked the left door twice before takeoff. Discussions with the LAA indicated that it was unlikely that the door could be incorrectly latched and still appear secure when pushed against. However, there were marks adjacent to the door guide that could have been caused by the shoot bolt pressing against it because the push rod had been bent at some point, and so the possibility remains that this could have presented a false indication to the pilot. The door has not been recovered and so a problem with the door mechanism could not be ruled out.

Conclusion

The evidence indicates that that the door opened in flight because the left door's rear tapered shoot bolt was not engaged in its guide. It was not possible to determine if this was because the door mechanism was at fault or if the pre-flight check had not identified that the door was correctly latched.

Safety action

On 1 November 2021, the LAA approved and issued a standard modification (mod number SM 15833) for fitment to Europa aircraft to prevent the door latch from closing when the door is not pulled home at the rear, and the rear pin is properly engaged. The requirement for this modification has been promulgated by LAA Airworthiness Information Leaflet MOD/247/012, which has been allocated mandatory status for all Europa aircraft operating under an LAA Permit to Fly and is required to be fitted within five flying hours after that date, or next permit revalidation, whichever comes first.