



Air Accident Investigation Unit Ireland

SERIOUS INCIDENT REPORT
Steen Skybolt, EI-SAT
Foynes, Co. Limerick
5 June 2011



**An Roinn Iompair
Turasóireachta agus Spóirt**

Department of Transport,
Tourism and Sport

AAIU Report No: 2012-016

State File No: IRL00911051

Report Format: Synoptic Report

Published: 25/09/2012 In accordance with Regulation (EU) No. 996/2010 and the provisions of SI 460 of 2009, the Chief Inspector of Air Accidents, on 5 June 2011, appointed Mr Leo Murray as the Investigator-in-Charge to carry out a Field Investigation into this Serious Incident and prepare a Report. The sole purpose of this Investigation is the prevention of aviation Accidents and Incidents. It is not the purpose of the Investigation to apportion blame or liability.

Aircraft Type and Registration: Steen Skybolt, EI-SAT

No. and Type of Engines: 1 x Avco Lycoming IO-360-A1A

Aircraft Serial Number: 1

Year of Manufacture: 1977

Date and Time (UTC): 5 June 2011 @ 15.30 hrs approximately

Location: Foynes, Co. Limerick

Type of Operation: General Aviation, Aerobatic Flight

Persons on Board: Crew - 1

Injuries: Crew - Nil

Nature of Damage: Substantial

Commander's Licence: Private Pilot Licence(A) issued by the Irish Aviation Authority (IAA)

Commander's Details: Male, aged 41 years

Commander's Flying Experience: 3,500 hours, of which 1,500 hours aerobatic

Notification Source: Other display pilot present at festival

Information Source: AAIU Field Investigation
AAIU Incident Report Form submitted by Pilot



SYNOPSIS

The Pilot was engaged in an aerobatic display as part of a local weekend festival at Foynes on the southern bank of the River Shannon. Approximately 4 minutes into the display routine, sections of fabric tore loose from the top surface of the upper left wing and across its centre section resulting in serious control difficulties for the Pilot. He carried out a successful forced landing to the best available field, with no additional damage to the aircraft.

1. FACTUAL INFORMATION

1.1 Notification

The accident was notified to the AAIU by a friend of the Pilot, who also flew an aerobatic sequence that afternoon. The on-call Inspector of Air Accidents travelled to the scene that same day and commenced a Field Investigation.

1.2 History of the Flight

The Owner of EI-SAT gave permission for his aircraft to be used by the Pilot for the scheduled aerobatic display. On the day of this occurrence, the aircraft positioned from a private airfield in east Co. Limerick to the display area. The aircraft was one of several performing on the last afternoon of a festival. Weather on the day was good, with little cloud and a moderate westerly wind. The Pilot commenced his display and performed a prepared sequence of aerobatic manoeuvres. Approximately 4 minutes into the routine, as it passed from left to right along the display line, in near level flight with a slight left bank, sections of fabric detached from the upper surface of the top left wing. The Pilot was observed to make a shallow left turn, followed by a further shallow right turn as he descended to carry out a forced landing in a field. The aircraft was being observed by spectators at the Festival, several of whom made photographs and video of the flight available to the Investigation (**Photo No. 1**).

Another display pilot who was airborne at the time heard the Pilot make a distress call. This pilot then flew over the area where the aircraft had landed, to ascertain that the Pilot was safe and to help identify his location for the Emergency Services to respond. The Emergency Services were quickly on scene, the Pilot did not require any assistance.



Photo No. 1: Sections of fabric separating from the upper wing (Peter Diffley)

1.3 On-site Investigation

Several sections of fabric were recovered from an island in the River Shannon and were made available to the AAIU Inspector on arrival. The aircraft was initially inspected in the field where it had been secured and it was found that almost 2/3 of the fabric on the upper surface of the upper wing was missing (**Photo No. 2**).



Photo No. 2: Fabric damage to the upper wing.

Three ribs on the left upper wing were damaged; most damage occurred to the second (No. 2) rib, numbered sequentially from the left wingtip. This rib had shattered into fragments between the main spars and some fragments remained attached only by lacing cord (**Photo No. 3**). The first (No. 1) rib was broken but components were still in-situ. The seventh (No.7) rib was missing its trailing edge section.

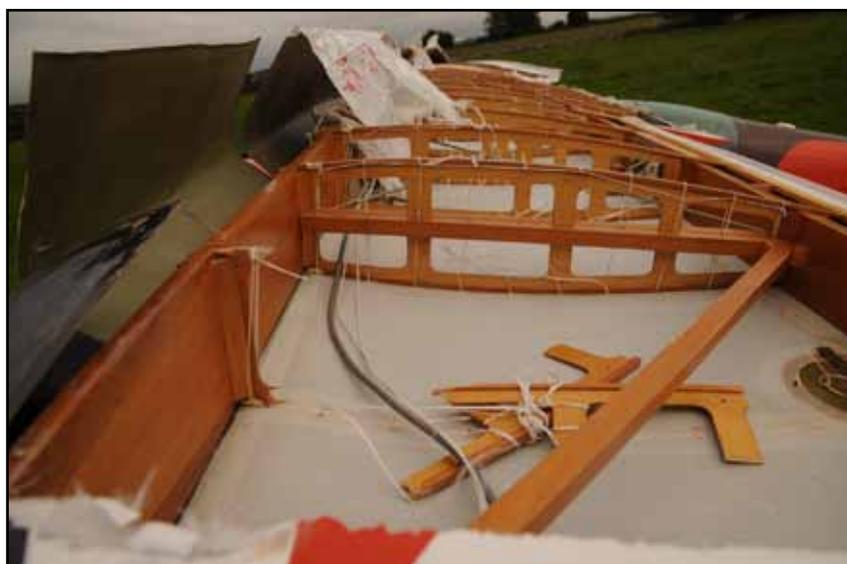


Photo No. 3: Damaged No. 2 rib with associated fragments.



Inspection by Ultra Violet (UV) light revealed some biomass residue on the wing leading edge, evidence of a possible bird strike at some time. There was some damage to the fabric in the vicinity of the No. 2 rib on the underside. Inspection by UV light revealed no biomass residue present. In addition, the aluminium leading edge had detached from the upper wing spar. The pitot tube, which was secured to the underside of the leading edge, was found angled downwards from its normal position. Damage to the aircraft was confined to the upper wing. An accelerometer was fitted to record maximum values of positive and negative G. The instrument had recorded a maximum positive value of 5.6G, which was within the aircraft design limitations.

1.4 Pilot Interview

The Pilot was interviewed by the Investigation the day following the occurrence. He gave some background on the aircraft which had been out of service for some time. After a major overhaul, it received a Fitness for Flight Certificate from an Irish Light Aviation Society (ILAS) Inspector for one month or 10 hours flying time, which he had completed on behalf of the owner. An Irish Aviation Authority (IAA) Permit to Fly was issued on the previous Friday and also an Air Display Permit, which was valid for three days. The aircraft was flying fine, he said, and only needed some minor adjustments after the post maintenance flights. On the day of the occurrence, he flew from Abbeyshrule Airfield to Brittas House Airfield in East Limerick, and then on to the Foynes area, with a short hold there to await his slot in the afternoon's flying programme. His display commenced around 15.30 hrs with a roll-off-top and then some stall turns, basic aerobatic manoeuvres for the aircraft. The flight was normal until about the 10th manoeuvre of the display.

After levelling off, *'something changed dramatically in the flying characteristic'* and the Pilot saw bits of fabric flying off close to the left wingtip. His immediate concern was the left aileron attachment brackets which were fluttering badly. With control severely compromised, he considered use of his parachute, but low altitude (approximately 500 ft) ruled out that option. Spectator safety was also a consideration in the event of using that option. A distress call was made to Shannon ATC who offered immediate landing but the performance of the aircraft was such that the runway at Shannon could not be reached. He looked down at the beach area and asked ATC for a wind check. He was given 270/15 kts. As the wing fabric had now detached from the upper surface and the leading edge had also detached, his control of the aircraft was severely compromised, he recalled. Severe vibration could be felt through the stick as a result of aileron buffeting. Despite the application of full power, the aircraft was descending at approximately 200-300 ft/min. Ditching the aircraft was ruled out as the shore was not suitable due to visible and submerged rocks.

The Pilot selected the best available field to carry out a forced landing. He considered that application of stick to turn the aircraft may have resulted in complete loss of control, so he kept the ailerons neutral and turned using the secondary effect of rudder, yawing and then banking to adjust the direction of flight.

As no reliable airspeed was available (the pitot tube had been displaced from the airflow), he kept the aircraft in slightly negative G to prevent the onset of a stall during the descent and approach for landing. He thought that his approach speed was about 40/45 kts in this constant negative G configuration. He mentioned, in passing, that the aircraft stalls at 1G and 55/60 kts. The forced landing was successfully accomplished into the chosen field, narrowly clearing a stone wall on final approach, with no further damage to the aircraft, or injury to himself.

The Pilot was asked as to when and where he felt was the first indication that all was not well with the flight. The Pilot stated that he was in level flight and saw a large piece of fabric detach in his left peripheral vision and, almost immediately, he sensed the vibration in the ailerons. He was not sure where the exact origin of the trouble lay but the aileron situation concerned him greatly. His best option was to find a field quickly and carry out an immediate forced landing.

1.5 Technical Information

The Skybolt is a two-place aerobatic bi-plane. The fuselage and empennage consists of a welded-steel tube structure covered with fabric. The bi-plane wings were built up around two main wooden spars, with 11 truss-type ribs on each mainplane. The wing leading edges were constructed of aluminium, being attached to the front spars by rows of steel panel pins.

EI-SAT was amateur-built to high standards in the United States under the auspices of the Experimental Aircraft Association (EAA). In accordance with the build instructions, the fuselage and wings were covered with an approved synthetic fabric, heat-tautened and protected with a UV protection coat. Further long-term protection was provided by a two-pack paint finish. Rib tapes were placed along the surface of each rib, with the fabric secured by means of lacing cords to each rib. The fabric was the original covering on the airframe.

The aircraft was purchased and registered by its Irish owner in September 1998. The aircraft was always kept in a hangar. Following a period of non-use, the aircraft was made airworthy and had flown some 10 hours without incident prior to the occurrence.

1.6 Subsequent Examination

The aircraft was recovered and subject to further technical inspections. Sections of wing fabric recovered were matched to the wing. All fabric was accounted for except for the section of fabric at the location of the No. 2 rib. The upper wing condition was inspected and showed no deterioration of the UV coating. The wing structure appeared to be in very good condition, with no evidence of any deterioration. The fabric used was of an approved type and appeared to be in very good condition.

Sections of the detached fabric were inspected. These sections of fabric revealed that the fabric sections tore free due to the pulling of the fabric away from the rib, with the lacing cords pulling through the covering tapes.

The Investigation also sought the expertise of an IAA approved Structures/Maintenance Inspector who inspected the damaged wing structure. In a detailed report submitted to the Investigation, he stated that the wing was built to a high standard using approved aircraft wood, i.e. B.C. Sitka Spruce, Birch and Gabon Mahogany plywood, sealed with a clear varnish. All glue joints were satisfactory with no evidence of the wing ever having been repaired. A moisture test was carried out which averaged 14.8%; a basic brittleness test was also satisfactory. The Inspector's report concluded: *'I do not think that there was any failure of the wood and plywood components or glue of this wing. This aircraft appears to have been well maintained.'*



2. ANALYSIS

The aircraft was amateur built but of a high standard demanded by the USA/EAA inspection process. Examination of the wing structure and fabric covering shows that the upper wing was of sound construction and built to a high standard, the wings wooden components and glued joints were in good condition with no evidence of structural deterioration or failure. The fabric covering, while still the original material, was in very good condition with adequate UV protection. The rib lacing cords were also in very good condition, and only failed when large non-standard loads were applied. Due to these loads, the fabric detached at the weakest point, with the lacing cords pulling through the rib reinforcing tapes.

The Investigation was fortunate in sourcing many photographs and video recording of the aircraft during the display sequence. The disruption of the fabric from the top surface of the upper wing was sudden and stripped the upper surface in a rapid sequence. The fragmentation of the No. 2 rib is evidence of an impact on the upper surface, probably by a small bird, which resulted in its disintegration; pulling an initial section of fabric from the area. Following this failure, the remainder of the fabric came away in two large sections probably as a result of non-standard aerodynamic loads on the upper wing, creating a force on the fabric that it was not designed to withstand. The No. 2 rib pieces situated between the main upper wing spars and the attached fabric were not recovered.

Following the sudden loss of the majority of the upper wing fabric, the Pilot was unable to maintain altitude even with full power applied. It is clear that his ability to maintain altitude was severely compromised by the tearing off of the upper wing fabric covering, which, in effect, induced severe drag and turbulence and negated the aerodynamic properties of the wing. This, in turn, immediately caused a loss of lift as the camber or curvature of the upper wing cover was destroyed and its aerodynamic effectiveness irretrievably lost. It is the wing (aerofoil) that is specifically designed to provide the lift force to support the whole of the aircraft and any interference with its structure, such as occurred to EI-SAT, can, and did, negatively impinge on its lift performance.

The Pilot was faced with a serious situation with control of the aircraft greatly compromised following the loss of fabric from the upper wing and distortion of the wing leading edge. In addition, with the pitot tube misaligned, no reliable air pressure was available to the flight instruments. As the Pilot stated, his best option was to manoeuvre the aircraft carefully to avoid further deterioration of the upper wing and position the aircraft for a forced landing. With a descent rate of 200-300 ft/min from low altitude, the choice of field could not be delayed.

The Pilot was fortunate in having considerable aerobic flight experience, a factor which no doubt led to a successful outcome of this event. Due to the handling skills exercised by the Pilot, control of the aircraft was never lost and a successful forced landing was carried out.

3. CONCLUSIONS

(a) Findings

1. The aircraft was airworthy prior to the occurrence flight. It had a valid Permit to Fly and Air Display Permission, issued by the IAA.
2. The second (No. 2) left-upper wing rib was completely destroyed, indicating that it may have been struck by an object in flight, probably a small bird.
3. The detachment of the fabric from the upper wing surface initiated in the area of the second (No. 2) rib.
4. Remaining sections of fabric then detached due to airflow and non-standard loads being exerted as a result of the initial fabric failure.
5. Remaining sections of fabric tore loose due to the rib lacing cords pulling through the rib reinforcing tapes.
6. Control of the aircraft was severely compromised due to the spoiled airflow over the wing and associated buffeting following the loss of the wing fabric. In addition the aluminium leading edge had detached from the upper wing spar, further disrupting the airflow.
7. The performance of the aircraft was compromised following the detachment of the fabric, even with prompt application of full throttle; the aircraft was descending at 200-300 ft/min.
8. The Pilot's options were limited to an immediate forced landing.
9. Due to the handling skills exercised by the Pilot, control of the aircraft was never lost and a successful forced landing was carried out.
10. The wooden structure of the upper wing was inspected by an approved structures Inspector and found to be satisfactory in all respects.
11. The fabric covering and rib lacing cords, while still the original material, was in very good condition with adequate UV protection.

(b) Probable Cause

The fabric from the upper wing detached probably due to impact with a small bird during flight, resulting in the break up and local tearing of fabric in the vicinity of the left wingtip.

4. SAFETY RECOMMENDATIONS

This Investigation does not sustain any Safety Recommendations.

- END -

In accordance with Annex 13 to the International Civil Aviation Organisation Convention, Regulation (EU) No 996/2010, and Statutory Instrument No. 460 of 2009, Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulation, 2009, the sole purpose of these investigations is to prevent aviation accidents and serious incidents. It is not the purpose of any such accident investigation and the associated investigation report to apportion blame or liability.

A safety recommendation shall in no case create a presumption of blame or liability for an occurrence.

Produced by the Air Accident Investigation Unit

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