FINAL REPORT

AAIU Synoptic Report No: 2009-011
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In accordance with the provisions of SI 205 of 1997, the Chief Inspector of Air Accidents, on 2 September 2008, appointed Mr. Frank Russell as the Investigator-in-Charge to carry out a Field Investigation into this Accident and prepare a Synoptic Report.

Aircraft Type and Registration:	Rollason Condor D.62B, EI-BXT
No. and Type of Engines:	1 x Rolls Royce Continental 0-200-A
Aircraft Serial Number:	RAE 626
Year of Manufacture:	1967
Date and Time (UTC):	2 September 2008 @ 13.55 hrs
Location:	Colehill, Co. Longford
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - Serious Passengers - Serious
Nature of Damage:	Aircraft Destroyed
Commander's Licence:	ATPL
Commander's Details:	Male, aged 27 years
Commander's Flying Experience:	2,153 hours, of which 84 were on type
Notification Source:	An Garda Síochána, Longford
Information Source:	AAIU Pilot Report Form submitted by Pilot. AAIU Field Investigation

SYNOPSIS

Shortly after take-off from Abbeyshrule Airfield (EIAB), the Pilot experienced a control problem with the ailerons, as the aircraft climbed. They did not respond to his normal pilot input for a correction of bank to the right. Control so disimproved that he had no option but to attempt a forced landing with the right wing dipping uncontrollably to the right. It was in this attitude that the aircraft struck the ground and embedded in an earth bank near a minor roadway. Both occupants were seriously injured. There was no fire.

FINAL REPORT

1. FACTUAL INFORMATION

1.1 History of the Flight

This was the Pilot's third flight in EI-BXT since its return to service in July 2008. The previous day he flew a dual/re-familiarisation flight with an Instructor, which included circuits, stalls and full spins to the left. After this flight the maintenance provider made a slight adjustment to the right brake. The Pilot then flew the aircraft solo for 25-30 minutes and expressed himself quite satisfied with the aircraft; he said that it handled very well.

On his third and final flight, on the day of the accident, an aircraft technician, who was a passenger, accompanied the Pilot. This passenger made a voluntary submission to the Investigation outlining his recall of events. The Pilot carried out normal pre-start and after-start checks on the Airfield ramp, including a flight control function check. All were satisfactory, he said. He then backtracked the aircraft on Runway (RWY) 28, using the differential brakes and rudder. Pre take-off checks were then completed at the RWY 28 threshold. The final engine check and magneto checks were all satisfactorily completed. After a final radio call the parking brake was released and full power applied, the aircraft accelerated normally and the rudder maintained directional control on the runway. There was a slight crosswind from 230/240 degrees at 5-8 kts.

Between 50-55 kts the aircraft became airborne and commenced climbing normally straight ahead at 400-500 ft/min. The aircraft over flew two pilot witnesses who were standing underneath the take-off path a short distance from the Airfield. They both commented to the Investigation on what they perceived to be over usage of the rudder. However, the Pilot subsequently confirmed that the rudder or its operation were not of concern to him at that point in the climb out. At about 300 ft, the Pilot noticed that the aircraft banked to the right, and he applied left aileron to compensate. However, the aircraft continued to bank to the right and he said the aileron control felt quite loose. He then mentioned this to his passenger that they had a problem. Application of left rudder also did not alleviate the right bank. As the Pilot felt that the aircraft was now uncontrollable, he picked a possible landing field to the right of the climb-out track for a forced landing. However, as the aircraft was now in a continuing descending bank to the right, he failed to reach that particular field and, instead, the aircraft came down to earth sooner than the Pilot intended, with its right wing 90 degrees low and it struck the ground in that attitude. The aircraft effectively cart wheeled on its right wing, which snapped off at its root and disintegrated. The propeller then struck the ground, broke off and embedded itself deep in the ground. Finally, the aircraft came to rest, inverted, against an earth bank at the edge of a grass area. There was no fire but the two occupants were seriously injured and trapped inside the shattered cockpit until rescued.

A local resident, who viewed the aircraft approaching from head on through his front patio door, witnessed the final part of this right wing low approach. Initially, he thought that the aircraft was coming straight in the direction of his house; however, he said that it turned to the right, flying between two tall trees across the road from him. It continued on its way and crashed in the grass area alongside the road, more than 100 metres from his house. This witness immediately ran to the accident site, where he found the aircraft partially buried in the branches of evergreen trees growing on the earth bank. He immediately rang the emergency services. He could see that the two people on board were injured and trapped.

There was a strong smell of fuel, he said. He and another man, who also arrived quickly, stayed and talked to the injured until the arrival of the Ballymahon Fire Brigade Units. They cut the crew out of the wreckage, and applied foam to contain any possibility of fire. This witness stated that the weather was bright and sunny at the time of the accident.

In all, EI-BXT travelled only 2,400 metres from Abbeyshrule Airfield. The flight lasted approximately 50 seconds. Once the Pilot and passenger were removed, local Gardaí secured the accident site pending the arrival of two Inspectors of Air Accidents.

1.2 Injuries to Persons

Both the Pilot and his passenger suffered multiple body injuries. They were transported by ambulance, initially to the Midland Regional Hospital, Mullingar, and subsequently to Tullamore General Hospital for specialist treatment**.**

1.3 Damage to Aircraft

The aircraft was destroyed on impact with the ground. The starboard wing disintegrated completely, it being that part of the aircraft that initially struck the ground. During the first 12 metres of the debris trail, the following parts were found:

Starboard wing tip, box spar timbers, pieces of fabric, parts of the canopy frame and Perspex pieces, RH aileron, fire extinguisher and propeller embedded in the ground.

The rear fuselage from No. 3 main frame (from the cockpit rear bulkhead aft) was found at 26 metres, intact but inverted. The port wing, which was mainly intact, had separated and was found, complete with its landing gear, on the right of the fuselage. The LH canopy door was to the left of the fuselage. The canopy ceiling (top) along with the RH flap was found on the right side of the wreckage. No. 2 fuselage frame had partly separated from the main spar. The control column had separated from the aileron rockshaft, which controls aileron movement. Both forward aileron turnbuckles were attached to this rockshaft.

The remainder of the aircraft, including the instrument panel, the fuel tank and the engine were found at 30 metres, buried in an earth bank bordering the grass verge where the aircraft first impacted.

Ballymahon Fire Brigade informed the Investigation that some of the aircraft control cables had been cut by their personnel in order to extricate the badly injured persons from the wreckage.

1.4 Other Damage

The aircraft initially impacted on a roadside grass verge, which was about 15 metres wide and which, unusually for the rural area, extended dead straight for hundreds of metres in either direction from the accident site. This road is known locally as the Long Avenue. An earth bank and some evergreen trees bordered the grass verge. Any debris was contained within 40 metres alongside the road. Some vegetation was destroyed at the spot where the propeller separated; a portion of the earth bank was removed in order to recover the embedded engine.

1.5 Aircraft Information

1.5.1 General

The original Rollason D62 Condor is a British two-seater light monoplane of wooden construction based upon the French Druine D62 Condor. The Rollason D62 Condor is a low-wing cantilever monoplane with a side-by-side seating cockpit powered by a Rolls-Royce/Continental O-200-A four-cylinder horizontally opposed air-cooled engine providing a top speed of 204 km/hr and a normal range of 560 km. This modified model, the Rollason D62B Condor started production in 1964 with a slight reduction in overall length, a reduction in weight and a different propeller.

The aircraft is considered to be a classic and vintage aircraft. This enables the aircraft to operate within the State without a Certificate of Airworthiness. The IAA issued it with a Flight Permit on 20 August 2008. Servicing of the aircraft is carried out under the CAA LAMS/A/1999 Maintenance Schedule and the Aircraft Maintenance Schedule (Chapter 16 of Maintenance Manual). Accordingly, servicing is therefore scheduled at:

- 50 flight hours or 6 months,
- 150 hours,
- 300 hours or Annual Inspection
- 600 hours/or 2 years.

The main structure has a fabric covering on the rear portion of the wing and the control surfaces. The undercarriage is of orthodox tail wheel pattern with two fixed independent main wheel units. The total fuel (Avgas) capacity is 15 Imperial gallons. The fuel tank is installed between the instrument panel and the engine. The propeller is a metal McCauley 1A101.DCM.6948

The flying control systems are quite normal in their layout. All cables are 10 cwt., adjusted by the standard type turnbuckle and running over pulleys, where change of direction takes place. Elevator and aileron cables should have a tension of not less than 17 lbs and not more than 30 lbs. The rudder cables are unloaded, except when pilot's feet are resting on the pedals. Any slack is taken up by return springs. The trimmer wire controls should be just on load throughout the trimmer range. The trimmer control wheel is in the centre of the seats, with conventional movement forward for nose down and rearward for nose up.

1.5.2 Aircraft Servicing

In March 2003, at 4,572 flight hours, an Aircraft Inspector inspected the aircraft with specific qualifications in the servicing and repair of wooden and fabric covered aircraft. He identified some delaminating at the trailing edge of the port wing and other areas throughout the aircraft that needed attention. It was decided to strip and completely recover the aircraft. All repairs were carried out using approved materials and to approved standards using birch plywood, Sitka spruce and appropriate resin.

An Annual Inspection as per the LAMS/A/1999 Maintenance Schedule commenced in April 2003. This Annual check included a 50-hour/6 month check and a 150-hour check. The 150-hour check requires that maintenance personnel consider "*the need for removal of flying cables and control system components for detailed inspection"* at the next Annual check. The Annual check requires that all flight control cables be checked for correct tension and that the values be recorded. This was carried out and the values recorded were within specification IAW "Flight Controls" Chapter 7 of the Maintenance Manual. A duplicate inspection was carried out on complete runs of all flight controls. A heavy landing check, which is a 50-hour inspection requirement, was carried out prior to the test flight of 40 minutes duration, which took place on 15 July 2008. The aircraft was released for service on 18 July 2008 and its first flight in service took place on 23 August 2008. In all, there were six separate flights conducted, totalling 3 hours duration, prior to the accident flight.

Considerable work had been carried out on the engine in 2004 and in 2008. The cylinders were removed for refurbishment in September 2004. The pistons were removed for shot blasting and reinstalled with new piston rings. The engine was inhibited in October 2004. In June 2008, the engine was reinspected and a 500-hour inspection was carried out on both engine magnetos. A new exhaust was fitted and the engine de-inhibited.

1.5.3 Aileron Detail

A photograph (**Photo No. 1**) of a correctly assembled aileron control system and a sketch (**Sketch No. 1**) of the control system from the aircraft illustrated parts catalogue (IPC) is shown for reference at **Appendix A**. The one-piece pilot control column is attached to a torque shaft (C19), which protrudes through the No. 2 fuselage frame and main spar. At its rear end, this shaft is bolted to the rockshaft (Sketch No. 1 - C22). The aileron control cables port and starboard are attached to this rockshaft through turnbuckles. The plug (Sketch No. 1 - C20) is designed to be a slide fit into the internal bore of the torque shaft. It is pushed into the shaft so that the bolt holes in the plug, torque shaft and rockshaft are aligned to take a ¼ inch bolt, slotted nut and split pin (Sketch No. 1 - C22). The plug is designed to stiffen and strengthen the coupling of the two shafts together. This bolt (Part No. AGS/17E) is supplied without a hole for the split pin. The hole is then drilled for the split pin following assembly of the two shafts together.

1.6 Meteorological Information

Aviation Services Division, Met Éireann, supplied the following data for 14.00 hrs UTC:

Meteorological Situation: A trough over the southern part of the country had moved eastwards leaving the area in an unstable NW airflow.

Wind:	Surface 30012-15Kt gust 20-25 KT 2000FT-32025-30KT
Cloud:	SCT015 SCT020 OCNL BKNO18CB
Visibility:	10 km risk isolated 5000m in showers
Weather:	Occasional light rain showers isolated moderate/heavy showers

Freezing Level: FL060

MSL Pressure: 995 hPa

Turbulence: Occasional moderate turbulence likely near surface from Cb Downdrafts

Temp/Dew point: 13/11 degrees Celsius

1.7 Aerodrome Information

Abbeyshrule Airfield (EIAB) has one runway (RWY 10/28) of 790 metres in length, with a tarmacadam surface.

1.8 Wreckage and Impact Information

1.8.1 Inspection of Aircraft Flight Control System

1.8.1.1 General

The aircraft wreckage was brought under escort to the AAIU facility at Gormanston, Co. Meath. The aircraft was partly reassembled to allow further examination to take place. All the flight control cables had been severed either due to aircraft impact forces or during extraction of the injured occupants by the Fire Brigade Unit. Control tensions could not therefore be measured. The flaps were found in the retracted position.

1.8.1.2 Elevator Control

Both control cables had severed aft of the seatback where the turnbuckles are attached to the elevator rockshaft. In the case of the "elevator down" cable the turnbuckle had fractured at its centre. The "elevator up" cable had broken just aft of its turnbuckle. When the appropriate ends were temporarily joined, movement of the control column confirmed operation in the correct sense. The elevator was checked for freedom of movement. Cables were in good condition and the push-pull rod operated satisfactorily.

1.8.1.3 Rudder Control

The rudder control cables were found severed and frayed at the cockpit rear bulkhead where the cables enter the rear wing spar through two fairleads. When the appropriate ends were temporarily joined, movement of the rudder pedals confirmed operation in the correct sense. The two pulleys were free to move. Both return springs had separated at impact and were found elongated. The brake adjustment to the port rudder pedals was found stretched.

1.8.1.4 Aileron Control

The aileron control cable was found severed in three places. The cable to the starboard aileron was broken and frayed 2 feet from the aileron rockshaft. The starboard balance cable was cut at the starboard wing root frame and again at the balance cable turnbuckle port side.

The cable at these latter points may have been cut by the Fire Brigade personnel in extricating the injured persons. Both pulleys at wing rib No. 7 port and starboard were free to move. Pulleys between rib No. 1 and No. 2 port and starboard were also free to move. When the appropriate ends were temporarily joined, movement of the ailerons confirmed operation in the correct sense.

1.8.2 Inspection of Aircraft Instruments

On inspection of the wreckage at Gormanston the following was noted:

Cabin Air-In:	Off
Mixture Control:	In – Rich
Carb Heat:	Out – On
Stall Warning:	Bulb broken
Ignition Switches:	Up
Airspeed Reading:	Zero kts
Turn & Slip:	Indicating left turn
Vertical Speed Indicator:	+ 500 ft/min
Artificial Horizon:	20 degrees right
Engine oil pressure & Temperature:	Both zero
Engine RPM:	Zero
Generator Switch:	On
Fuel Pump Switch:	On.

1.9 Survival Aspects

Both the Pilot and his passenger were each wearing a 4-point upper body restraining harness. This was very probably instrumental in their survival, as neither suffered a head injury**.**

1.10 Tests and Research

The aileron torque shaft and its attachment to the rockshaft were examined in more detail. The pilot's control column torque shaft had separated from the main spar and from the aileron rockshaft. The ¼ inch bolt, slotted nut, washers and split pin used to couple the two shafts were not found in the crash debris **(Appendix B).** Using a metal detector, the Investigation carried out an intensive second search of the crash site but failed to find the 1.7 inch long bolt. However, the indentation marks left by the washers could be seen on the rockshaft. The inside surface of the tubular portion of the rockshaft had some longitudinal scratch marks coincident with the boltholes. There were no circumferential scratches in the tube. There was no indication of ovality in any of the boltholes of the rockshaft to torque shaft assembly. The plug (C20) was found pushed further into the bore of the torque shaft such that the ¼ inch bolt could not have connected with this plug **(Appendix C**). A metallurgical Consultant examined the aileron control assembly, particularly the shaft boltholes, and subsequently issued his Report.

This Report concluded:

There are two possibilities for the absence of the bolt following the crash-

1) The bolt failed (through shear) in the crash and was lost from the assembly.

2) The bolt worked its way out of the assembly in the 3 hours flying since the aircraft was overhauled / refurbished.

As there is no evidence of ovality of the boltholes or circumferential marking to support failure of the bolt in the crash it would appear that the bolt worked its way out of the assembly. This implies that the nut and / or split pin had not been fitted when the components were last assembled.

2. ANALYSIS

The Replacement/Inspection of parts of this aircraft and the removal and replacement of the outer fabric took place over a 5-year period. Following its release to service in 2008, six separate flights, lasting 3 hours in total, were made. This included a 45-minute flight during which stalls and spins were conducted. It would be reasonable to conclude that during these flights, the controls, including the aileron control, reacted to the pilots inputs correctly and in the correct sense. It would also be reasonable to conclude that movement of the aileron torque shaft and rockshaft were coupled in unison at all times during these manoeuvres.

It is possible that the ¼ inch bolt failed in shear on aircraft impact with the ground. The fact that the bolt was not retained through the plug would make it more plausible that all parts of the severed bolt and nut were lost from the assembly in the accident.

However, having considered the metallurgist's Report, the Investigation is of the opinion that had the two shafts been locked together by the bolt and secured by the slotted nut and safety split pin, the impact of the crash would not have been sufficient to separate the parts of this assembly, even in the absence of the plug. If this had occurred then the holes would have shown some evidence of ovality, elongation or in other ways been damaged. If the bolt had been inserted in the aligned holes of the two shafts without the security provided by the slotted nut and pin, then it is possible that the bolt could have worked loose during the recent 3 hours of flight. Again, the bolt is manufactured without a pinhole and the bolt/nut combination could have been installed without the security of a split pin. The slotted nut would then be free to eventually migrate from the bolt. In either case, final departure of the bolt from all aligned holes would be without warning leading to the pilot's instant loss of aileron control.

3. CONCLUSIONS

(a) Findings

1. The Pilot was properly licensed and medically fit in accordance with Joint Aviation Authorities (JAA) requirements.

2. Weather conditions in the Abbeyshrule area were bright and sunny with light winds and were not a factor in the accident.

3. The aircraft had a Flight Permit, issued by the Irish Aviation Authority (IAA), and dated 20 August 2008. The accident flight was the seventh since it returned to service in 2008.

4. The Pilot carried out a satisfactory 'full and free movement check' of the aircraft controls on the ground prior to take-off.

5. During the climb out of Abbeyshrule Airfield, the Pilot lost control of the aircraft's aileron system.

6. An examination of the flight control system determined that the bolt and the associated slotted nut and split pin, which locks the aileron rockshaft and the control column torque shaft together, was missing from the assembly.

7. The Investigation could not determine if the bolt had been fitted with the slotted nut and the split pin.

8. As the bolt was not recovered by the Investigation it was not possible to determine whether the bolt had been drilled for the split pin.

9. The Investigation found that the plug was pushed too far into the bore of the shaft, such that the holes in the plug were not aligned with the holes in the torque shaft, prior to assembly of the aileron system.

10 The evidence suggests that the bolt, which locks the aileron rockshaft and the control column torque shaft together, probably came adrift and migrated from the assembly during the final climb out.

11. The Pilot was compelled to carry out an immediate forced landing in the extreme circumstances of having no aileron control. It was entirely fortuitous that both he and his passenger survived the accident.

12. The wearing of a four point upper body restraining harness by both the Pilot and his passenger greatly contributed to preventing further serious injuries.

(b) Probable Cause

The failure of the locking mechanism between the torque shaft and the rockshaft of the aileron control assembly led to the Pilot's loss of all aileron control.

(c) Contributory Factor

The possible migration, during a number of flights, of the bolt, which locks the aileron rockshaft and the control column torque shaft together, thereby allowing the flight control assembly to come adrift during the final climb out.

4. SAFETY RECOMMENDATIONS

This Report does not sustain any Safety Recommendation.

Appendix A

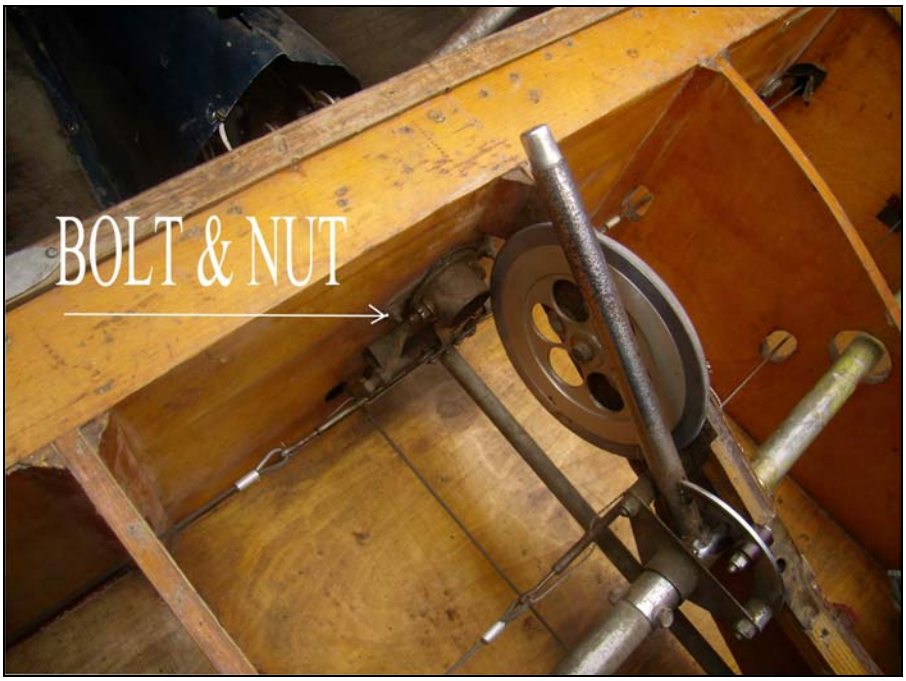
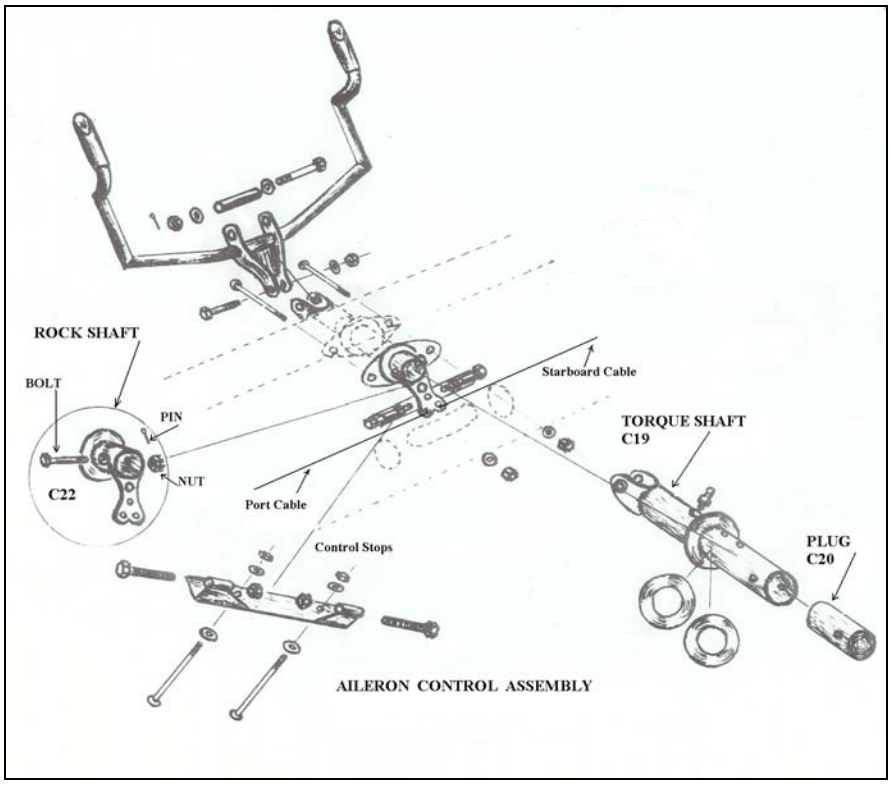


Photo No 1.

A correctly assembled aileron control system installed on a serviceable aircraft. The torque shaft from the pilot's control column enters through the main timber spar and is attached to the aileron rockshaft by a ¼ inch bolt with slotted nut, split pin and washer. (See schematic below)



Sketch No. 1

Appendix B

Photo No 2.
The aileron rockshaft of EI-BXT found at the crash site. The shaft had separated from the pilot's control column torque shaft. The aileron cable turnbuckles are attached to the rockshaft.

Photo No 3.
The pilot's control column torque shaft separated from the main timber spar, seen in the foreground, and is protruding from the No. 2 timber fuselage frame.

Appendix C

Photo No 4.

Picture of control column torque shaft taken following the accident. The plug was pushed too far into the bore of the shaft, such that the holes in the plug were not aligned with the holes in the torque shaft, prior to assembly of the aileron system.

- END -