FINAL REPORT

AAIU Synoptic Report No: 2006-005
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In accordance with the provisions of SI 205 of 1997, the Chief Inspector of Accidents, on 12 August 2005, appointed Jurgen Whyte as the Investigator-in-Charge to carry out a Field Investigation into this occurrence and prepare a Synoptic Report.

Aircraft Type and Registration:	Cessna P210N, N6593W with a Supplementary Type Certificate (STC).
No. and Type of Engines:	1 x Allison 250-B17F/2.
Aircraft Serial Number:	P210000801.
Year of Manufacture:	1982.
Date and Time:	12 August 2005 @ 15.01 hrs local approximately.
Location:	Brittas House Airfield, Co. Limerick.
Type of Flight:	Not resolved (See Section 1.7.2).
Persons on Board:	Crew - 1 Passengers - 3
Injuries:	Crew - Nil Passengers - Nil
Nature of Damage:	Extensive to left wing.
Commander's Licence:	USA CPL-IR Single/Multi-engine airplane with Instructor rating.
Commander's Details:	Male, aged 49 years.
Commander's Flying Experience:	1,059 hours of which 98 were on type.
Information Source:	Report submitted by Aircraft Commander AAIU Field Investigation.

SYNOPSIS

Shortly after becoming airborne from a private grass airfield, all four occupants onboard the aircraft heard a "thump". Following some troubleshooting, the Pilot Flying (PF) concluded that the aircraft had suffered a bird strike and subsequently reported this to Shannon Air Traffic Control (ATC). The aircraft continued its climb to FL195 en-route to Lisbon, Portugal. Sometime later, the PF observed on his fuel gauge that the port wing tip tank was registering empty, while some fuel still remained in the starboard tip tank. As the PF was now no longer fully sure of his actual fuel contents, he decided that it would be prudent to divert to Jersey Airport. After an uneventful landing at Jersey (17.07 hrs), an inspection of the aircraft found that the entire wingtip tank and a portion of the port wing/aileron assembly were missing. Subsequently, it was determined that the aircraft had struck a tree on departure from Brittas House Airfield. There was no fire or reported injuries.

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NOTIFICATION

At 16.10 hrs on the day of the accident the Station Manager, Shannon advised the AAIU that N6593W had suffered a suspected bird strike on take-off from Brittas House, Co Limerick, but was continuing the flight to Lisbon. Approximately 10 nautical miles (NM) from reporting point TIVLI, N6593W reported to Shannon ATC that the aircraft had lost fuel from the left auxiliary tank and requested a direct routing to Lisbon. It was subsequently reported that the aircraft was diverting into Jersey in the UK. A telephone call from the aircraft Operator to the AAIU reported that the aircraft had suffered impact damage and was grounded in Jersey. The Jersey Authorities also reported to the AAIU that N6593W had arrived from Ireland having suffered impact damage. The AAIU contacted the Air Accident Investigation Branch (AAIB) in the UK and it was agreed between both parties that, as the impact occurred in Ireland, the AAIU should conduct the Investigation. At 12.00 hrs the following morning, the Investigator-In-Charge (IIC) arrived at Brittas House Airfield and commenced the Investigation.

1. FACTUAL INFORMATION

1.1 History of the Flight

At 15.00 hrs on the day of the accident, N6593W lined up for take-off on runway (RWY) 15 at Brittas House Airfield, Co Limerick for a flight to Lisbon, Portugal. A total of four persons were onboard. The Commander and Pilot Flying (PF) was seated in the left-hand seat. The forward right-hand seat was occupied by a friend of the PF and while he was the holder of an Irish Private Pilot's Licence (PPL) with 200 hours approximately, he did not form part of the flight crew. A second passenger was seated in the right-hand seat of the second row and a third passenger was seated in the left-hand seat of the third row. The left-hand seat of the second row had been removed to accommodate two tool kits belonging to the rear seat passengers.

In his submitted Air Accident Pilot Report Form, which was subsequently re-iterated during interview, the PF recounted the following events: "*The wind was approximately out of 280° at about 7 kts. I judged that if anything we would have a tailwind component of 2 kts or less and preferred this to the uphill slope of RWY 33. The aircraft was correctly configured for take-off and I am not aware of any errors I might have made in the settings. I commenced the take-off roll, applying power gradually. It is not possible to apply full power before commencing take-off roll in the turbine* (Cessna) *210 due to the strong left yaw, which is encountered before full rudder authority is gained. I may, however have delayed slightly too long the application of maximum power during the roll. As we approached the midpoint of the runway I was aware that the airspeed was slightly low, and I applied all safe extra power. I believe I had successfully lifted the aircraft over the hedge at the end* (of the runway), *but the stall warning came on and I lowered the nose to gain airspeed and avoid the possibility of a departure stall. Just after lift-off there was a slight sound of a "thump", similar but not as strong as the sound when the gear comes up. There was no sensation of hitting anything, no yaw, and no feeling of alteration of the flight of the aircraft. I saw nothing. As I climbed out, I postulated that possibly a wheel had grazed something off the end of the runway. The aircraft performed normally on climb-out and I discussed the situation with my friend in the right-hand seat. He thought that he had seen a flash of something black in his peripheral vision rise up under the wing on take-off and he thought that we might have hit a bird. This seemed plausible and we reported a suspected bird-strike to Shannon ATC. We decided to continue with the flight and monitor the aircraft as we climbed. We slowed down to check the gear during flight, it lowered normally and appeared undamaged.*

Later in the climb-out, I noticed that the left wing tip tank indicator was showing zero, while some fuel remained in the right tip. On looking out of the cockpit to the left everything appeared normal on the wing. As there was no abnormal handling characteristic or asymmetry in flight I concluded that there was a gauge problem. Our intended destination was Lisbon. However, during the cruise I gradually concluded that my earlier decision to continue the flight was questionable and that it would be prudent to divert and check the aircraft on the ground.

On landing normally at Jersey we were astonished to discover that we had in fact lost the entire tip tank and a small section of wing inboard thereof. Remnants of pine tree caught in the metal made it obvious that we had in fact impacted the tree, which is slightly to the left of centreline on departure and about 50 ft high".

1.1.1 Passenger Number One

This passenger, who was seated in the right-hand front seat, reported to the Investigation that the aircraft commenced its take-off run at approximately 15.00 hrs. The run was to the southeast. The grass was not long and there appeared to be a gentle down-slope in the direction of take-off. As the aircraft accelerated there appeared to be a swing to the left side. This swing was stopped. However, the aircraft appeared to be to the left of the centre of the runway. Shortly after take-off, I heard a thump from the left side. At the same time I noticed something black flash past in my peripheral vision. I informed the pilot of what I had seen. The noise was not loud and there was no apparent movement in the aircraft. There was no physical sensation or vibration. The climb appeared normal. There was no damage visible from inside the aircraft. There was no undue alarm inside the aircraft at any time. Later the pilot informed all the passengers that he was diverting to Jersey, as he wanted to check for damage. The approach and landing at Jersey was normal. Only after engine shutdown did we notice that there was considerable damage to the aircraft.

1.1.2 Passenger Number Two

This passenger was seated in the right-hand seat of the second row. During the take-off run he was looking out of his right side window watching the right-hand main wheel. Just after becoming airborne, he heard a substantial bang. The undercarriage had just retracted and he associated the bang with the travel and locking of the undercarriage. He had not flown in a light aircraft prior to this flight. He considered the atmosphere after the event as calm. He had no concerns and saw nothing untoward. He then fell asleep, only to awake sometime later to be informed by the PF that they were diverting to Jersey to check out the aircraft.

1.1.3 Passenger Number Three

This passenger was seated in the left-hand rear seat. Just after take-off he heard a bang. He did not see anything or feel anything. While he had never flown in a light aircraft before, he considered that the bang originated from the undercarriage being retracted. He noted that the pilot did not seem concerned. The flight continued for about an hour. The pilot then took off his headset and told them that they were diverting to Jersey to check out the aircraft because they had lost fuel. During the flight he saw no damage on the port wing, but did see some wire trailing from the port wing, which he considered to be a bonding lead that had come loose. On landing at Jersey he was surprised to see damage on the aircraft.

1.2 Damage

The tree sliced through the port wing at a point approximately 30 cm in from the line of rivets, which joined the tip tank to the original wing. The impact with the tree cut through the leading edge and outer spar section and ripped the aileron in half, causing the outer hinge bracket to rupture. Both the wing tip tank and the outer portion of the aileron separated from the aircraft. **Photo No 1** shows the line of impact through the wing structure. Analysis of the damage indicates that the aircraft's impact angle with the tree was approximately +20 degrees. The damage to the wing was extensive and will probably require its complete replacement on the aircraft.

Photo No 1. Indentation made by tree

Photo No 2.

The severed end of the wing was pushed backwards and upwards as can be seen at **Photo No 2 and No 3** below.

Photo No 3.

All persons onboard the aircraft described how they were not aware of any damage on the port wing until it was discovered on landing at Jersey. Viewed through the forward port window (**Photo No 4**.) it is clear that no damage is evident on the wing tip. The mirror, positioned halfway out the underside of the wing, is used to view the condition/position of the undercarriage. Viewed through the forward starboard window (**Photo No 5**.) the wing tip is obscured by the radar pod, thereby making it impossible to make any comparison between both wingtips.

Photo No 4. Port wing view

Photo No 5. Starboard wing view

1.3 Other Damage

Approximately 6 ft was severed from the top of a 50 ft pine tree, which was located at the left hand corner end of RWY 15/33.

1.4 Airfield Information

Brittas House Airfield is a private unlicensed airfield situated approximately 8 NM southeast of Limerick City. The grass runway (RWY) 15/33 is contained within a large field and measures approximately 650 metres in length, 18 metres in width and has a down slope of approximately -0.57 degrees. The surface at the time of the event was firm with short grass.

At the RWY 33 end of the runway a boundary hedge runs at right angles to the runway and measures approximately 25 metres either side of the extended centreline.

A tree lined boundary hedge, on the left side of the runway, runs down to the left hand corner of the boundary hedge at the end of the runway. A large pine tree measuring approximately 50 ft high (pre-impact) is located in this left hand corner of the field. The runway ends several metres short of the boundary hedge and the distance and position of the impacted tree, from the centre-end of the runway, is approximately 40 metres and offset approximately 45º left of centreline.

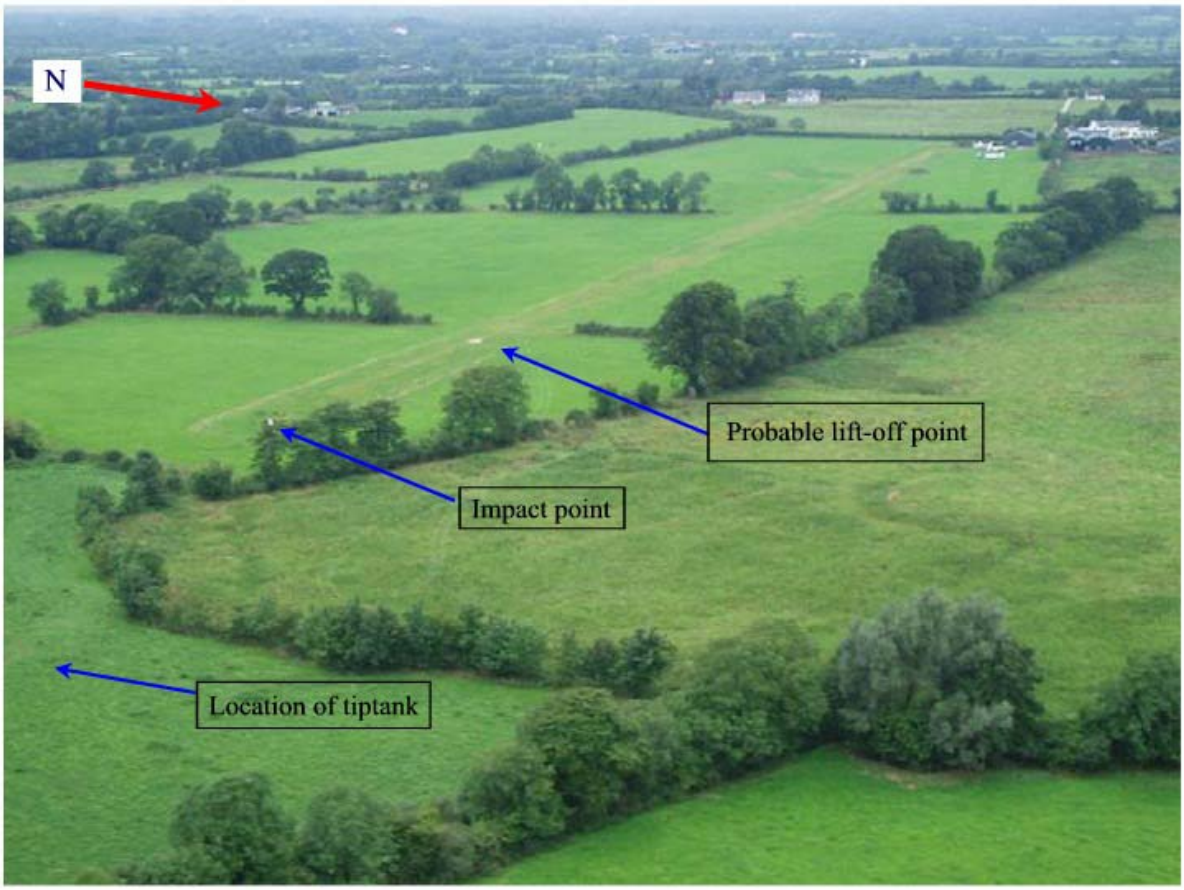

Photo No. 6 Aerial view Brittas House Airfield (Provided by Operator**)**

1.5 Meteorological Information

The following meteorological information was provided by Met Éireann, Shannon.

General Situation: The area was under the influence of a pre-frontal ridge. A low-pressure system south of Iceland and an extensive area of high-pressure southwest of Ireland maintained a west north-westerly airflow over the area.

Wind: At surface: 270-290º 08 KT
At 2,000ft: 300º15KT

Weather: Nil

Visibility: 10Km

Cloud: Scattered (SCT) 2,000ft, Broken (BKN) 5,000ft

Temp/Dew Point: 18/12 degC

(MSL) Pressure: 1020 hPa

1.6 Aircraft Information

1.6.1 General

N6593W was originally manufactured back in 1982 by Cessna as a T210 Turbo-Centurion, which was fitted with a Continental TSIO-520-R turbocharged engine and a McCauley three bladed metal constant-speed propeller.

In October 1993, the aircraft was modified under a FAA approved Supplementary Type Certificate (STC) No. SA1003NE.

The modification included, the fitting of a Rolls Royce (Allison) 250-B17F/2 gas turbine engine, which provides approximately 45% more horsepower than the previous engine during take-off and climb, a Hartzell 90-inch three bladed reversible propeller that provides for short take-off and landing (STOL) performance and a 27.7 US gallon auxiliary fuel tank in the aft baggage compartment.

In August 1997, a low fuel-warning device was fitted under STC SA00606NY and in November 2002, wingtip fuel tanks were fitted, under STC SA3226NM.

1.6.2 Leading Particulars

Engine	Rolls-Royce (Allison) 250-B17F/2 (450 shp)
Propeller	Hartzell three-blade full reversible with de-ice (2030 rpm)
Cruise Speed @ 16,000 ft	215 knots
Maximum Altitude	23,000 ft
Rate of Climb @ gross weight	2,200 feet/minute
Fuel consumption	20 gal/hr @ 23,000 feet
Range	760 nautical miles
Fuel Capacity	85 US gal
Take-off Distance	600 feet

Landing Distance	500 feet
Basic Empty Weight	2,695 lbs
Maximum Gross Weight	4,016 lbs
Seating	6

1.6.3 Weight and Balance

The aircraft was at its maximum all up weight (MAUW) of 4,016 lbs on take-off and was within centre of gravity (COG) limits.

1.6.4 Performance

When the STC was accomplished on the aircraft, the manuals were not modified to provide up-dated field performance figures. However, the upgrade to a 450 shp turboprop does provide approximately 45% more horsepower than the previous engine during take-off and climb. Performance tables for the P210N with the normally aspirated engine indicate that at a MAUW of 3,700 lbs and a temperature of 20ºC, the ground roll would be 1,125 feet/350 metres and to clear a 50 ft obstacle would be 1,865 feet/580 metres. The Investigation is satisfied that N6593W had the performance requirements to operate safely out of the chosen field.

1.7 Additional Information

1.7.1 General

The PF made a full report to ATC in Jersey and made himself available to the local UK AAIB representative. Neither passenger in the cabin were wearing head sets and were therefore unaware of the discussions that took place between the PF and the forward right-hand seat occupant during the flight.

1.7.2 Fractional Ownership Operations

The Operator of the accident aircraft is a privately owned aviation management company. Among its services, the company provides an arrangement whereby individuals or companies can have shared ownership of an aircraft for their own private use. FAA Regulations Part 91 - General Operating and Flight Rules, Sub part K covers the Fractional Ownership Operations requirements.

In general, a one-time investment payment (single share) confers fractional ownership of the aircraft and the right to use that aircraft for travel. An hourly rate is then paid when the aircraft is operating.

The Maintenance Company whose employees flew on the aircraft on the day of the accident confirmed, in a letter on the 5 Sept 2005, the following information to the Investigation:

- *The purpose of the flight was to bring two company employees to Lisbon, Portugal, to assist an operator whose aircraft was grounded;*

- *The aircraft* (N6593W) *was hired on a commercial basis. However due to time constraints this was agreed verbally through a telephone conversation with an agreement to be faxed to the Operator on completion of the trip;*

- *The Maintenance Company has a minority share in another of the Operator's aircraft* (N182PN), *however, the Company holds no such agreement for the aircraft involved in this incident* (N6593W); and,

- *In the recent past* (the Maintenance Company) *has used* (the Operator) *for the transportation of staff to the UK and as in previous cases* (the Maintenance Company) *acted in good faith when hiring* (the Operator) *on this occasion.*

The Operator advised the Investigation that the verbal agreement made with the Maintenance Company, included the requirement to purchase a minority share in the accident aircraft N6593W.

A further clarification was sought from the Maintenance Company regarding the verbal agreement. A response on the 27 Feb 2006 stated, *"We do not wish to add anything further to the contents of this letter (5 Sept 2005) which we believe accurately reflects the situation."*

2. DISCUSSION

Analysis of the airfield, the impacted tree site and comments made by both the PF and the front seat passenger, indicate that the aircraft initially drifted left of centreline during the take-off roll and subsequently during take-off or immediately after the aircraft became airborne.

The fitting of a turbo-shaft engine to such a relatively small aircraft does increase its horsepower and field performance significantly. However, the resultant torque effect generated by the increased horsepower is such that throttle/power must be applied gradually during the initial stages of the take-off roll until full rudder authority is achieved. The application of full power early in the take-off roll will invariably result in loss of directional control to the left.

A combination of the aircraft being at MAUW, a downhill gradient, an approximate 2 kt tail wind and an acknowledgement by the PF that, *"He may have delayed slightly too long the application of maximum power during the roll"*, most likely all contributed in some way to the aircraft speed being slightly low at the mid-point of the runway. The application of all safe extra power, just as the aircraft was becoming airborne or on being airborne may have induced a further drift to the left, which was not corrected by the PF. The relatively long nose of the aircraft, the high angle of attack after take-off and the PF's attention in the cockpit towards speed, engine torque and engine temperature (which is limited) may all have contributed in some way to the pilot not being aware that the aircraft had drifted further left of the runway.

When the impact damage to the aircraft and wingtip is considered, the question arises as to how such damage could occur and not be fully recognised or appreciated by the individuals onboard at the time of the event. While all four persons heard a thump just after take-off, it appears that the impact sound was not significantly loud enough to generate major concern within the aircraft. The rear seat passengers, both of whom were licensed aeronautical engineers, considered the noise to be associated with the retraction of the undercarriage. Neither had flown light general aviation aircraft before. The front seat passenger reported to the PF at the time that he saw something black flash past his left peripheral vision. While a qualified private pilot himself, he was not part of the flightcrew and had only flown in the aircraft once previously. The PF reasoned that he might have suffered a bird strike.

Photograph, No 2, No 3 and No 4, clearly demonstrates that because the damage was deflected upwards at the extremity of the port wing, the impact damage was not visible from inside the aircraft. The aircraft was reported to have flown normally after the event, thereby giving no immediate indication to the PF or the passengers that it had suffered impact damage.

With human nature being what it is, and bearing in mind the aeronautical background of the three passengers, the Investigation considers it very likely that if any one individual had been aware that the aircraft had suffered damage or that the safety of the aircraft and those onboard were threatened, that this concern would have been communicated to the PF.

The Commander/PF was responsible for the safety of his aircraft and of those onboard. Ultimately he was in the best position to interpret the sounds associated with the safe operation of the aircraft. Irrespective of the fact that no damage was visible and that the aircraft handled normally, the thump as heard by all onboard, was not normal.

When one considers that the intended flight was over a large expanse of water in a single engine aircraft, good airmanship should have dictated that the aircraft be immediately diverted to Shannon for examination.

Whether the flight fulfilled the requirements of the Fractional Ownership Operations, under FAR 91 sub part K, is a matter for the FAA. The question as to whether this operation required an Air Operator's Certificate (AOC) under Irish Air Law is a matter for both Irish Aviation Authority (IAA) and the Commission for Aviation Regulation (CAR).

3. SAFETY RECOMMENDATIONS

This Investigation does not support any safety recommendations.