FINAL REPORT

AAIU Formal Report No: 2006-023
AAIU File No: 2005/0060
Published: 12/10/2006

Operator:	Private
Manufacturer:	Avions Robin
Model:	Jodel DR 250 - 160
Nationality:	Belgian
Registration:	OO-TYP
Location:	Lydican, Oranmore, Galway, Ireland
Date/Time:	19 September 2005 @ approximately 12.38 hrs (Local Time)

SYNOPSIS

Approximately 5 minutes after OO-TYP took-off from Galway Airport, for a VFR[1] flight to Saint-Ghislan, in Belgium, a member of the public reported to An Garda Síochána (Irish Police Force) that an aircraft had crashed in the Galway Cricket Grounds at Lydican, Oranmore, Galway. The aircraft was later identified as OO-TYP. The aircraft's two occupants, Belgian Nationals, suffered fatal injuries.

Eyewitness reports, and analysis of the wreckage distribution, determined that the aircraft had spun out of cloud with a significant portion of its starboard wing missing.

The Investigation concluded that a possible attempted recovery manoeuvre by the Pilot, following loss of control due to disorientation from an intentional or inadvertent flight in Instrument Meteorological Conditions (IMC)[2], sufficient to overload the wing structure, was most likely the cause of the wing failure. Once the wing section had separated from the main body of the aircraft, the aircraft was unflyable and it spun to earth.

NOTIFICATION

At approximately 13.00 hrs (Local), the Station Manager, Shannon Air Traffic Control (ATC), reported to the AAIU that an aircraft (OO-TYP) had crashed near Oranmore, Galway. An AAIU go-team, consisting of Jurgen Whyte and Graham Liddy, Inspectors of Air Accidents, arrived at the accident site at approximately 16.00 hrs and commenced the Investigation.

In accordance with the provisions of S.I. 205 of 1997, the Chief Inspector of Air Accidents, on 19 September 2005, appointed Jurgen Whyte as the Investigator-in-Charge (IIC) to conduct a Formal Investigation into this occurrence.

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[1] VFR flight. Flight conducted in accordance with the Visual Flight Rules (**See Appendix A**).
[2] (IMC) Instrument Meteorological Conditions expressed in terms of visibility, the distance from clouds, and the ceiling, less than the minimums specified for visual meteorological conditions.

As the aircraft was registered in Belgium and both persons onboard were Belgian Nationals, the Belgian Air Accident Investigation Authority, Bureau Enquêtes – Accidents (BEA) appointed Mr Richard Taverniers, Chief Inspector of Air Accidents, as an Accredited Representative to the Irish Investigation, in compliance with the provisions of the International Civil Aviation Organisation (ICAO), Annex 13.

1. FACTUAL INFORMATION

1.1 Background

On the 17 September 2005, OO-TYP took-off from Saint-Ghislan (EBSG), in Belgium, at 12.15 hrs with 2 persons onboard for a VFR flight to Galway (EICM). At approximately 12.40 hrs OO-TYP landed back on at EBSG. Information from the airport staff at EBSG, indicated that this return was due to a malfunction of the Global Positioning System (GPS) which was carried onboard OO-TYP. A re-connection of the antenna cable resolved the problem.

The Pilot refuelled[3] the aircraft, reactivated the original flight plan and departed again from EBSG at approximately 13.58 hrs for EICM. The flight plan estimated elapse time (EET) was 4 hrs 30 min with endurance filed as 5 hrs 30 min. There was nothing to suggest that the en-route segment of the flight was anything other than uneventful. At 18.35 hrs, OO-TYP first reported on Galway Tower frequency that he was approaching overhead. While a flight plan had been filed with Shannon ATC, the flight plan details had not been forwarded by Shannon to EICM. In addition, while EICM is classified as a Prior Permission Required (PPR)[4] airfield, no prior permission was sought by the Pilot of OO-TYP. As a result, OO-TYP's arrival over EICM was unexpected.

A review of the full EICM ATC Transcript for the 17 September 2005 revealed that OO-TYP did not respond correctly to ATC instructions with regard to downwind positioning and runway in use. ATC assisted OO-TYP to position for the correct runway, diverting other traffic in the process. At 18.41 hrs OO-TYP reported to ATC, *"O-YP I need to land, short of fuel."* ATC replied, *"O-YP Runway 26 in use, are you requesting priority landing."* No response was forthcoming from OO-TYP. At 18.43 hrs OO-TYP reported, *"Galway Tower, Runway 26, finals O-YP."* OO-TYP was clear to land RWY 26 and was recorded landing at 18.45 hrs. Further difficulties were experienced by OO-TYP in following ATC instructions to the parking area. Eventually, OO-TYP was told by ATC to hold his position and the aircraft was then ground marshalled to the correct parking stand. On shutdown, the Pilot of OO-TYP was requested to report to the Control Tower. When challenged by the Tower Controller, re his non-compliance with ATC instructions, the pilot apologised, stating that he was unfamiliar with the airport and that he had concern for his low fuel, which he stated was 10 litres remaining (16 min approx).

[3] Aircraft initially uploaded 97 litres and then after the diversion uploaded a further 37 litres. Total fuel onboard for flight to Ireland could not be determined.

[4] Prior Permission Required (PPR). Irrespective of submitting a Flight Plan through the ATC System, a Pilot is required to seek permission to use/land at a PPR airport prior to commencing the flight.

In general conversation, the pilot informed the Controller that, they were going fishing for the weekend and that they would be flying back out on Monday morning the 19 September 2005. The ATC Controller subsequently remarked to the Investigation that the Pilot's English was poor.

1.1.1 History of the Flight

At approximately 10.30 hrs on the morning of the accident, the Pilot and passenger arrived at EICM and went about refuelling the aircraft. When the refueller truck arrived, the Pilot asked to refuel the aircraft himself (**See Section 1.1.5**). The Pilot then went to the terminal building and paid for his fuel and landing charges (11.07 hrs). At approximately 11.20 hrs, the Pilot arrived at the control tower with a prepared flight plan for filing. The Controller advised the Pilot that it would require at least 1 hour for the flight plan to go through the system. In addition, as no en-route height/flight level was entered on the flight plan, the Controller asked the pilot what level he would be returning to Belgium. The Pilot replied, "FL 065" (6,500 ft). The flight plan was thus amended and filed for a departure out of EICM at 12.30 hrs (Local) for a VFR flight at FL 065 to EBSG, in Belgium.

The Pilot then requested and was given the Local Area Forecast (LAF) for Galway and the Controller also downloaded weather for Dublin, Cork and Cardiff. The Controller asked the Pilot if he required weather for Belgium and the Pilot replied, *"Belgium is CAVOK."* [5] The Controller was of the opinion that the Pilot had no hard copy written weather as he entered the control tower. A follow-up enquiry to the Irish Meteorological Service determined that no record was found of the Pilot seeking a weather forecast for the flight on the day of the accident.

At 12.27:15 hrs, OO-TYP requested taxi information for the VFR flight to EBSG. An extract of the ATC audiotape transcript of OO-TYP's communications with the Control Tower on the day of the accident is presented as **Appendix B** to this Report. OO-TYP was cleared to Bravo holding point for departure from RWY 26. A QNH[6] of 1017 hPa and a Squawk[7] of 0234 was given by the Tower Controller and this was acknowledged by the Pilot. On arrival at Bravo holding point, the Pilot carried out power checks on the aircraft. OO-TYP was then cleared for take-off RWY 26, left turn out (*For Birr*), wind 210 degrees 15 kts. Birr is located approximately 40 nm east-south-east of Galway on a heading of approximately 115ºM.

OO-TYP was advised airborne at 12.35 hrs and, as the Tower Controller observed that the aircraft was nearing the cloud base that was reducing to between 700 and 800 ft southwest of the field, he instructed OO-TYP to continue Special VFR[8] and report 10 miles (The Galway Control Zone Boundary). This was acknowledged by the Pilot with a request to repeat the QNH, which was provided again by the Tower Controller.

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[5] CAVOK is a generic term for Ceiling and Visibility OK. The term is used if the visibility is 10 km or more and the cloud base is above 5,000 ft.
[6] QNH - Term used for atmospheric pressure reduced to sea level pressure as calculated.
[7] Squawk number. Term used to set a designated code/number on the radar beacon transponder.
[8] Special VFR. A VFR Flight cleared by Air Traffic Control to operate within Class B, C, D and E surface areas in meteorological conditions below Visual Meteorological Conditions (VMC)

The Tower Controller then lost sight of OO-TYP. OO-TYP's last transmission was recorded at 12.35:18 hrs, *"Continue Special VFR."* The estimate for OO-TYP to reach the 10 nm southeast Boundary for Birr was approximately 12.45 hrs.

When the Boundary was not called, the Tower Controller initiated calls to OO-TYP at 12.45:15 hrs, 12.45:28 hrs and 12.45:32 hrs respectively, but with no response. The Tower Controller then called Shannon Low Level, in the event that OO-TYP was working them, however, this proved not to be the case.

A final call was made to OO-TYP at 12.49 hrs, with no response. The Watch Manager at Shannon contacted the Tower Controller (Galway) at 13.00 hrs and said that they had received a report that an aircraft had crashed at the Galway Cricket Grounds. This was subsequently confirmed in a telephone conversation between the Tower Controller and An Garda Síochána at Mill Street, Galway. The Tower Controller immediately initiated the callout procedures for an aircraft accident.

1.1.2 Witness Report No 1.

This witness was standing in her kitchen with another person who was measuring the window for blinds. Without any prior warning they both heard a very loud bang followed by white bits flying past the window. After a short while, they went out to the back garden, looked over towards the cricket grounds and saw that something had crashed in the field. Two men, one of whom she recognised as a local, were standing by the wreckage. The lady ran back into the house and made a 999 call (12.43 hrs) to An Garda Síochána reporting that something had crashed into the Cricket Grounds. Prior to the loud bang the lady had not heard or seen anything relating to the crashed aircraft. She described the weather conditions at the time of the accident as, *"Bad, very very grey and misty, with drizzle."* When ask about the cloud conditions she replied, "*Lots of cloud, the sky was full of cloud."*

1.1.3 Witness Report No 2

Both these witnesses were Electricity Supply Board (ESB) line contractors who were working on an electricity pole approximately one-quarter mile south of the accident site. Initially they heard the sound of an aircraft engine above cloud, but they could not see the aircraft. The engine revved up, then down, then up again. In their opinion they believed that the engine sounded OK, like it was responding to power changes. It did not sound like it was in trouble. Moments later they saw the aircraft, *"Spin nose down out of the cloud, like a drill, very fast."* They noticed that one wing was missing, but they did not see the missing wing fall to earth. The aircraft continued to spin down until it went out of view below a hill. This was followed by a loud bang. Both individuals got into their company jeep and raced in the direction of the accident site. Eventually they came across some people standing in the middle of the road who believed that they were part of the emergency services due to the flashing yellow lights on their vehicle. They were directed to the main gate of the Cricket Grounds which was pad locked. The ESB crew cut the lock and entered the grounds. At the far end of the cricket pitch they saw some people standing by the aircraft wreckage. They decided not to go over to the impact site, as it was obvious to them that there was nothing further they could do. They reported hearing no other aircraft in the area at the time.

1.1.4 Witness Report No 3

A local and a friend ran in the direction of a loud bang and eventually found the accident site within the Cricket Grounds. On arrival it was obvious that the impact was such that nothing further could be done for the two individuals onboard.

1.1.5 Witness Report No 4

A local man, whose house was located approximately 400 metres east of the accident site, heard a very loud bang and then a couple of seconds later saw what appeared to be part of a wing fly past his window. He went outside and found an aviation map in his garden. Part of a wing had landed in a field, fenced-off for horses, which was located behind a large farm shed near the end of his garden.

1.1.6 Witness Report No 5

Both these witnesses were handling ground operations at Galway Airport, which included ramp duties and aircraft refuelling. On the morning of the accident, they received a request at approximately 10.40 hrs to go out and refuel a light aircraft. They both went to the hangar where the AVGAS (aviation fuel) refueller truck was located, they checked the fuel[9], and then brought the fuel truck out to OO-TYP. On arrival the Pilot asked to refuel the aircraft himself. Both individuals watched the Pilot refuel four separate tanks on the aircraft. He first refuelled both wing tanks and then two tanks in the fuselage. He spent time ensuring that each tank was full. The Pilot then signed for the 176 Litres of fuel and then went across with one of the Ground Operations Personnel to pay for the fuel and landing charges. This individual observed, in general chat with the Pilot, that he was in good spirits, he had staggered English, but appeared to understand what was being said. When making a general comment that the weather was not that good, the Pilot responded, *"Weather good around here."*

1.2 Injuries To Persons

Both the pilot flying and the passenger were fatally injured in this accident.

Injuries	Crew	Passengers	Total in aircraft	Others
Fatal	1	1	2	0
Serious	0	0	0	0
Minor	0	0	0	
None	0	0	0	

1.3 Damage To Aircraft

The aircraft was destroyed on impact. A section of the starboard wing was located 422 metres due east of the main wreckage site.

[9] A sample of fuel is taken and tested to ensure that no water/moisture is present in the fuel.

1.4 Other Damage

The vertical impact forces were such that a significant portion of the aircraft penetrated the ground/earth to a depth of approximately 5 feet. A JCB digger was brought to the site in order to assist in the recovery of the wreckage. Following the recovery, the impact site was filled in and levelled. Whilst every effort was made to prevent further damage, areas of the cricket grounds did suffer tyre-rutting damage due to vehicular traffic transiting to and from the impact site.

During the actual impact, all four fuel tanks, containing approximately 198 Litres of AVGAS, ruptured and the resultant fuel spray was wind blown across the grass surface in a northeasterly direction. A significant area of the prepared grass surface was damaged as a result of fuel contamination.

1.5 Personnel Information

1.5.1 (Commander/Pilot Flying)

Personal Details:	Male, aged 56 years
Licence:	PPL Single engine (Land) VFR
Last Periodic Check:	20 September 2004
Medical Certificate:	Class 2 -Valid until 1 February 2006

1.5.2 Flying Experience:

The Pilot was first issued with a PPL (Land) by the Belgian Civil Aviation Authorities on the 5 August 1985.

The Pilot's logbook No. 2 was recovered from the accident site and it was found to cover the period 13 Jan 1992 to 20 June 2005. The last entry recorded in the logbook was on the 20 June 2005, the nature of which was an engine run-up by the PF after a 100 hr inspection. The total flying hours recorded up to the 7 June 2005 (last recorded entry in Pilot's logbook) was 882 hours. The nature of the flights logged was mainly local and navigational flying. Virtually all the recorded time was as PF on the accident aircraft type. No record was found that the PF had engaged in actual or simulated instrument flying.

A request was made by the Investigation to the Belgian BEA to source any flying logbooks belonging to the Pilot that covered the period 5 August 1985 to 13 Jan 1992. No flying logbooks were found. It was determined that the Pilot had flown a total of 5 flights between the period 7 June 2005 and the 17 September 2005. These flight were conducted as follows:

Date	Flight	Time	Total
19 July 2005	Local Flight EBSG	40 min	
3 Sept 2005	Local Flight EBSG	30 min	
6 Sept 2005	NAVEX EBSG/EBKT	30 min	
6 Sept 2005	NAVEX EBKT/EBSG	30 min	
17 Sept 2005	NAVEX EBSG/EICM	4 hours 30 min	6 hrs 40 min

Therefore, the total flying experience for the Pilot up to the day of the accident was approximately 888 hours.

1.6 Aircraft Information

1.6.1 Leading Particulars

Aircraft type:	Jodel DR 250-160
Manufacturer:	Avions Robin.
Constructor's Number:	81.
Year of Manufacture:	1966.
Certificate of Registration:	Valid and issued by the Kingdom of Belgian CAA on 30 December 1991.
Certificate of Airworthiness (COA):	Valid and issued by the Kingdom of Belgian CAA on 9 June 2005
Last Inspection:	Renewal COA/100 hr 07 June 2005
Total Airframe Hours:	On 9 June 2005 recorded as 1,888.28 hours.
Engine:	1 x Avco Lycoming 0-320-D2A (160 hp) with 1,888.28 hours on the 9 June 2005
Maximum authorised take-off weight:	960 kg
Estimated take-off weight:	881 kg
Estimated weight at time of accident:	879 kg
Centre of Gravity limits:	Within Limits

1.6.2 General Information

The DR 250 was first flown in April 1965 and it entered production later the same year. It was available with either a 150 hp or 160 hp Lycoming O-320-D2A four-cylinder horizontally opposed air-cooled engine. OO-TYP was equipped with a 160 hp engine. The aircraft is primarily constructed of wood. The standard fuel capacity of 150 litres is contained in two wing-root leading-edge tanks. However, the installation of auxiliary tanks in the fuselage increases the capacity to 200 litres, as was the case with OO-TYP. The aircraft has a large cabin, accommodating up to 4 persons. The instrument panel is large enough to accommodate full equipment for Instrument Flight Rules (IFR)[10] flight.

[10] IMC - Instrument Flight Rules – flight conducted according to instrument flight rules in or near cloud

Robin DR 250-160

1.6.3 General Aircraft Specification

DIMENSIONS, EXTERNAL:	
Wing span	8.72 m
Length overall	6.98 m
Height overall	1.86 m
Wheel track	2.59 m
AREA:	
Wing, gross	14.15 m²
WEIGHTS AND LOADING:	
Empty weight	552 kg
Max T/O weight	960 kg
Max wing loading	68 kg/m²
"G" Limits	+ 3.8g – 1.52g
PERFORMANCE (AT MAX T/O WEIGHT):	
Max level speed at Sea Level (S/L)	171 mph (148 kts)
Max cruising speed (75% power) at S/L	152 mph (132 kts)
Economy cruising (66% power) 10,000 ft	155 mph (135 kts)
Rate of climb at S/L	780 ft/min
Fuel capacity (4 tanks)	200 litres
Service ceiling	16,400 ft
Endurance	5 hours 30 minutes
Range	1,000 miles
Stalling Speed:	
Flaps up	59 mph (51 kts)
Flaps down	54 mph (47 kts)

1.6.4 Equipment/Instrumentation

The aircraft was fitted with the following equipment:

4 x Fuel Gauge Indicators, Suction Indicator, Airspeed Indicator, Turn and Bank Indicator, Artificial Horizon, Climb and Descent Indicator, Altimeter, Compass, Hobbs (Jaeger) Meter, RPM Gauge, Oil Temperature Gauge, Amp Meter.

The aircraft was fitted with the following Radio/Navigation Instrumentation:

Audio KING KMA 20 TSO, NARCO MK 12 D TSO NAV/COM with VOR/ILS, KING NAV/COM KX 175 B TSO with VOR Indent, NARCO Transponder AT 150 TSO, ADF, Blind Encoder, Intercom Telex PC 4. A Skyforce Skymap II Global Positioning System (GPS) was found within the wreckage.

1.6.5 State of Manufacture

Following a query by the AAIU to the State of Manufacture, France, regarding previous similar events on type, it was determined that there was no record of a Jodel DR250-160 suffering a catastrophic wing failure such as that which occurred to OO-TYP.

1.7 Meteorological Information

1.7.1 Met Éireann, the Irish Meteorological Service, Aviation Services Division, Shannon, provided the following meteorological information after the accident.

1.7.2

General Situation:	A depression east of Iceland maintained a moist south-westerly flow over the area. A cold front with waves was moving slowly eastwards at the time of the accident. The frontal line, as indicated by the wind veer, was approximately 40 nautical miles west of Galway.	
Wind:	2000 ft Surface wind	240º 35 kts (True) 210º 15-18 kts
Weather:	Occasional rain/drizzle	
Visibility:	Generally 5000m but occasionally 1500-3000m	
Cloud:	Scattered (SCT) 500 ft, Broken (BKN) 1,000 ft - Occasionally BKN 700 ft, BKN 1,000ft.	
Temperature/Dew-Point:	15/15 deg Celsius	
MSL Pressure:	1017 hPa[11]	

1.7.3 Met Report Galway Airport

A Met Report for Galway Airport at 12.35 hrs (Local) on the day of the accident was as follows:

[11] hPa. Hectopascal – A unit of measurement of atmospheric pressure equall to one millibar.

Surface Wind:	200 degrees 15 kts
Visibility:	4500 m
Weather:	RA (Rain showers)
Cloud:	BKN 700 ft BKN 1200 ft
QNH/QFE[12]:	1017 hPa/1014 hPa

1.7.4 General Route Conditions Galway to Belgium

At the time of the accident, the associated warm front was located between 65 and 68 degrees North. The rain band from the cold front extended into the Irish Sea, but cloud and visibility conditions would have improved to visual meteorological conditions (VMC) in the east midlands of Ireland. There would have been a risk of some fog in the Irish Sea, but apart from that, conditions would remain good for visual flight rules (VFR). Conditions between Galway and the midlands of Ireland would have been generally below VMC.

1.7.5 General Comment on Weather Conditions

- Gusts in excess of 25 kts at surface would not have been expected.
- The gradient wind speed was insufficient to produce severe mechanical turbulence.
- The radar imagery did not suggest any significant CB activity in the area at the time.
- Upper air and satellite analysis did not suggest the presence of severe mountain waves.
- There was no indication of any other extreme weather conditions in the area at the time of the accident.

1.8 Aids to Navigation

1.8.1 General

A Non-directional radio beacon (NDB) and Distance measuring equipment (DME) were available and serviceable at Galway airport at the time of the accident.

The aircraft was equipped with VHF omni-directional radio range (VOR), Instrument landing system (ILS) and Automatic direction-finding equipment (ADF).

A Skymap II Global Positioning System (GPS) was found within the wreckage site.

Shannon International Airport, located approximately 35 nm south of Galway Airport, is a 24 hour airport with all associated facilities, including, ILS, Surveillance Radar Element of precision approach radar system (SRE) and Secondary Surveillance Radar (SSR).

1.8.2 Radar Information

The Shannon SSR tapes were impounded by the AAIU on the day of the accident and were viewed some days later by the IIC. The most likely "track made good" and the aircraft ground speed, as depicted by the radar returns, are reconstructed with map overlay and presented as **Appendix C** to this Report.

[12] QFE - Term used for the atmospheric pressure at the aerodrome elevation or the runway threshold

Prior to departure, OO-TYP was issued with a transponder Squawk of 0234, which was acknowledged by the Pilot. By setting a squawk number on the aircraft transponder, the same number will appear on the radar operator's screen thereby identifying the specific aircraft to the controller.

Two modes are generally associated with the transponder. Standard Mode A (Alpha) is primarily a pulse format for an identification code interrogator (gives identification/position). Mode C (Charlie), if selected, will provide a pulse format for an altitude information interrogator (gives identification/position and altitude).

A review of the radar type showed that OO-TYP was Squawking A0000, indicating that the Pilot had not selected the Squawk of 0234. Mode Charlie was not present on the radar return. Therefore no radar height/altitude information for the aircraft was available to the Investigation.

Factors such as the distance between Galway and the radar head position at Shannon and the effects of terrain masking, will normally determine the minimum heights at which the radar returns first appear flying out of Galway and those that disappear when flying into Galway.

A flight test was conducted in the vicinity of Galway Airport and the accident site, in order to determine at what height radar contact would be acquired and lost. The test concluded that radar contact was acquired at Galway Airport (climb out) at approximately 500 ft and was lost over the accident site at approximately 600 ft.

1.8.3 Radar Data

The radar initially depicted OO-TYP at 12.35:30 hrs (Local) in a climbing turnout as cleared, onto an east south easterly heading for Birr. The ground speed as derived by radar, is a measurement of the time that the aircraft takes to go from one radar return to the next. The recorded ground speed can have a vertical element associated with it.

The aircraft continued in a gentle climbing turn towards the northeast and onwards towards the north. The horizontal speed, (ground speed with possible +/- vertical element) remains relatively constant in a shallow climb. The heading continues to turn through north and onward to the northwest, followed by an orbital turn back towards the east. In this particular turn the ground speed reduces significantly from 106 kts down to 42 kts and increases to 91 kts and then 106 kts as the heading increases to the northeast and north-northeast. The radar then depicts a sudden direction change to the northwest with the horizontal speed reducing from 94 kts to 32 kts. This is followed by a heading reversal with the horizontal speed reducing further to 24 kts. Horizontal speed increases from 24 kts to 46 kts and onward to 65 kts with the aircraft on a near easterly heading. The final radar return is recorded over the accident site at time 12.38 hrs (Local) on a near easterly heading, approximately 1.5 nm northeast of Galway Airport. The last radar return disappeared off screen virtually over the accident site.

1.8.4 Height Information

The approximate height in which the aircraft first appeared out of Galway Airport was 500 ft. While not an exact science, a calculation of the ground speeds from the first radar contact to the point just prior to where the aircraft commenced its excessive manoeuvring indicates that the additional height gained would have been in the region of 800 ft. Total height reached just prior to excessive manoeuvring was approximately 1,300 ft. The maximum height achieved during the following upset cannot be determined but would have been in excess of 1,300 ft.

1.9 Communications

Normal two-way communications existed between the Galway ATC and OO-TYP on Freq 122.5 Mhz. Only one other aircraft (Helicopter EI-IHL) was working the frequency at the time, clearing the zone south abeam of Craughwell, enroute to Shannon. No MAYDAY call, transmission, or carrier wave was heard or recorded on the ATC tape.

1.10 Aerodrome Information

Galway Airport (531805N 0085621W), which is a Licensed Public PPR airport, is located 4 nm east north east of Galway City. Its runway (RWY) 08/26 is 1,350 m in length and 30 m in width. Radio Navigation and Landing Aids consist of a Non-directional radio beacon (NDB) and Distance measuring equipment (DME) to each end of RWY 08/26.

The Galway Control Zone is a circle radius out to 10 nm from the airport. During promulgated hours of operation, Galway Control Zone is classified as Class C airspace. Outside promulgated hours of operation of Galway Control Zone, the airspace coterminous with Galway Control Zone is classified as Class G airspace.

Category (CAT) 4 Rescue and Fire Fighting Services are available for scheduled flights, otherwise CAT 2 pertains.

1.11 Flight Recorders

1.11.1 Cockpit Voice Recorder

Not fitted, nor was it required to be.

1.11.2 Flight Data Recorder

Not fitted, nor was it required to be.

1.12 Wreckage and Impact Information

1.12.1 General

A general aerial view of the accident site is presented as **Appendix D** and a general layout of the wreckage is presented as **Appendix E** to this Report.

The aircraft impacted into the Cricket Grounds in a near vertical attitude on a heading of approximately 103º magnetic.

The impact force was such that the rotating propeller, the entire engine assembly, the firewall and the instrument panel penetrated the soft earth to a depth of approximately 5 feet. The propeller was severely damaged by the ground impact. It suffered rotational damage and markings, which indicates that the propeller was rotating at impact.

The mainplane (excluding the starboard wing outboard of the undercarriage structure), the tail plane and the main undercarriage assembly remained on the surface, but in an extremely disrupted condition. A number of items, separate to the aircraft structure, such as overnight bags, a "Coke" can a fire extinguisher were found in close proximity to the main impact site. These items penetrated the earth vertically, indicating that they had been expelled from the aircraft at some height, as it spiralled in its vertical descent. Continuity of control cable runs to the LH aileron and to the elevator and rudder controls was established. The cable to the RH aileron failed where the right wing outer section had separated. Some of the engine and flight instruments were punched through the instrument panel and were imbedded in soil between the rear of the panel and the engine firewall. Some other instruments were found loose within the wreckage. The destruction of these instruments was such that none could be tested for functionality. However, certain observations could be made on some of the instruments (**See below**).

The four fuel tanks carrying approximately 198 litres of AVGAS ruptured on impact sending a wind blown spray across the cricket grounds. Fuel traces were found in the fuel filter.

The starboard wing section was recovered virtually intact and was subsequently brought to the AAIU facility at Gormanston, Co. Meath for examination (**See Section 1.16 Test and Research**)

1.12.2 Engine RPM/Tachometer

The Engine RPM/Tachometer was found lodged in a reversed position between the rear of the instrument panel and the engine firewall. Its glass face had shattered and the instrument was caked in soil. The RPM needle showed that at the time of impact the engine RPM was registering 1,850 RPM. This is an indication that the engine was running, albeit at a reduced speed setting, at the time of impact.

The Jaeger engine hour's meter provides a time count on engine usage. It was recovered from the wreckage, however, the damage to the instrument, in particular the drum counter, was such that it could not be used for engine usage analysis.

1.12.3 Altimeters

1.12.3.1 General

Maintenance records and statements received through the Belgian BEA confirm that only one altimeter was fitted to the aircraft. However, two altimeters were found within the wreckage at the accident site.

1.12.3.2 Altimeter No 1.

This altimeter (No. 1) was found loose within the wreckage. It was noted that a cardboard blanking cover had been placed over the face of the altimeter and secured by the mounting screws that would have held it in place on the instrument panel.

Two of the three mounting screws were found on the altimeter. However, these had sheared at the back plate of the mounting attachment. The casing was broken at the static line attachment port and the altimeter had significant deposits of soil on it. The pressure sub scale was set at 1013 hPa.

Further research on the altimeter determined the following:

The altimeter was identified as a Kollsman 671RK-010 Type C-12 AF43-178206. It had been overhauled by an American Company and documentation confirms that it had received an Authorised Release Certificate on the 27 July 2002. The altimeter had subsequently been released by the Belgian CAA, under an Authorised Release Certificate (Form 1), on the 10 June 2003.

In correspondence with the Belgian Authorities and the Maintenance Company who serviced OO-TYP, it was determined that, when altimeter (No. 2) was deemed unserviceable, it was replaced with the overhauled altimeter (No. 1) and then fitted to OO-TYP. The last person to work on the aircraft confirmed the installation of a serviceable altimeter (No. 1) without the cardboard cover over its face. He was not aware of the whereabouts of the unserviceable altimeter (No. 2). Other persons familiar with the aircraft at EBSG were also not aware of the cardboard cover on the altimeter.

1.12.3.3 Altimeter No 2.

This altimeter (No. 2) was found loose within the wreckage. The glass face had shattered and the casing was broken at the static line attachment port. The pressure sub scale was set at 1019 hPa. No Part or Serial Number was found.

The altimeter was free of soil deposits and the four front face attachment screw holes showed no signs of damage. No attachment screws were found on the altimeter.

A red unserviceable label had partially detached itself from the altimeter and was lying on the ground within the wreckage. The other part of this label was still attached to the altimeter casing (**See Appendix G**). No Part or Serial Number was found on this label. However, it did reveal a Work Order No 01030603 and a note on the label identifying that it was, *"Out of Tolerance"* and therefore unserviceable. It was later identified as a Kollsman, however, the part number and serial number were missing. Further research on the Work Order Number determined the following:

In June 2003, a 2-yearly bench check (Examination) had been carried out on the altimeter and on a Blind Encoder (NARCO AR-850 No 33553). The bench check revealed that the part and serial number was missing and that the altimeter was, *"Out of Tolerance"* at the higher altitudes and therefore unserviceable.

It was noted by the Investigation that out of tolerance errors were recorded at altitudes in excess of 10,000 ft and up to 20,000 ft with virtually no errors recorded below these altitudes. The Blind Encoder was found to be serviceable.

1.12.4 Global Positioning System (GPS)

A Skyforce Skymap II Global Positioning System (GPS) Unit (Version 1.00 Jan 1996) with monochrome screen was found separate within the wreckage site. The Unit was extensively damaged and the internal battery for the memory source had been disconnected. As a result of this, no data could be retrieved from the Unit.

The Sky data module (Data Chip V3.02) contained within the GPS Unit was marked EUR 07/98.

The Unit was powered by internal batteries and not powered by the aircraft electrical system. Additional batteries and a carrying case were found in the pilot's navigational bag.

An aluminium bracket with spring loaded retaining clips was found loose in the wreckage. The makeup and dimensions of this bracket indicated that the bracket was mounted somewhere on or in the area of the instrument panel and that the GPS Unit had been clipped/secured on this mounting bracket during flight.

1.13 Medical Information

1.13.1 Pilot

The Post Mortem Report recorded that the cause of death of the Pilot was multiple injuries, consistent with extremely violent impact sustained in an aviation accident. Toxicology results revealed that there were no drugs or ethanol (alcohol) detected in the Pilot’s system.

1.13.2 Passenger

The Post Mortem Report recorded that the cause of death of the Passenger was multiple injuries, consistent with extremely violent impact sustained in an aviation accident. Insufficient samples were available to conduct toxicology tests on the passenger.

1.14 Fire

There was no fire.

1.15 Survival Aspects

A 12.43 hrs, a 999 call was received from a woman in Lydican, Oranmore, Galway, reporting that an aircraft had just crashed in the Galway Cricket Grounds. This call was immediately transferred to An Garda Síochána at Mill Street in Galway City. At 12.50 hrs An Garda Síochana arrived on scene, followed by 1 ambulance and 2 fire engines. Additional rescue personnel and equipment arrived from Galway Airport. The impact forces were such that the accident was un-survivable.

1.16 Tests and Research

1.16.1 Wooden Structure Examination

The services of a certified aircraft maintenance engineer (AME) with specialist knowledge and experience in the construction and maintenance of wooden aircraft was secured by the AAIU to examine the wreckage of OO-TYP. The aircraft was inspected at the AAIU facility at Gormanston, Co. Meath on the 28 September 2005.

The centre wing box section had the LH wing still attached to the fuselage when the main body of the aircraft struck the ground. The nose and engine penetrated the ground. The LH wing and the remaining inner section of the RH wing halted further ground penetration. Consequently, these wing sections experienced severe impact when the aircraft hit the ground. This impact shattered much of the wing, particularly the LH wing. Thus, a detailed examination of the LH wing, as a complete structure, was not possible. However, an inspection of the fragments revealed no material or glue defects.

The outer RH wing section had separated in flight (**Appendix F**). Because of its bulky but light construction, it floated somewhat gently to ground. It struck a fence, but remained largely intact with its aileron still attached. Examination of this wing section showed it to be well constructed and the materials used as per the approved materials and practices in force today. No evidence was found of any significant repairs or water penetration, which might have weakened any part of the wing.

The materials used in the wing were British Colombian Sitka Spruce, Birch Plywood and Gaboon Plywood. Gaboon Plywood is normally the plywood used in French built aircraft. The glue used was Resorcinol-Phenol Resin possibly Aerodux Resin 500+ Hardener 501 made by Ciba Geigy or Dynochem, which is an approved aircraft wood adhesive. All wood components were sealed with a Rhodius varnish and the entire structure looked fresh and did not show any signs of ageing. The fabric used was a synthetic material possibly Ceconite or Diatex.

A comparison on the dimensions of the wood used, with drawings of a similar Jodel spar, found no significant differences. The moisture content of the wood was tested in various places and it ranged from 12.25% to 15.5%. The accepted range is 10% to 15 %. The plywood moisture content ranged from 10.5% to 14% with the accepted range being 8% to 14%.

A rough fibre test was carried out on the spar boom material and it was comparable with a recent certified piece of Sitka Spruce. There was no sign of disease or brittleness. The wing suffered severe impact, yet most of the breakages in the boom were splits with ratios of up to 20 to 1 and there was no evidence found of glue failure. In conclusion, the wing was well constructed and maintained. There was no evidence to suggest that any pre-existing defects existed within the wing structure prior to its failure. Therefore it is likely that the wing failed in upload following a gross overload of the wing.

The Investigation did receive a communication from the Belgian BEA indicating that they had heard that the pilot might have experienced a bird strike on the aircraft a few weeks prior to the accident.

A follow up by the Belgian BEA did not provide any further details of this possible event. However, this was taken into account during the examination of the wreckage. No evidence was found that the aircraft suffered a recent bird strike, nor was there any evidence to suggest that a recent repair had been made that could be associated with a bird strike.

1.17 Organizational and Management Information

Nil

1.18 Additional Information

1.18.1 Acceleration of Gravity ("G").

"G" is used as a unit of stress measurement for bodies undergoing acceleration. This acceleration can be acting along any of the aircraft's axes, but usually it refers to the one acting along the normal vertical axis, or from head to toe (top to bottom). Positive (+) "G" acts from head to toe and negative (-) "G" acts from toe towards the head. In this usage, "G" is the centrifugal force experienced by a body or aircraft and is expressed as a number, which is that number times the actual weight of the body or the aircraft. If the body or aircraft is said to be experiencing 4 g, then the pilot and aircraft are experiencing a force that is 4 times their weight. Excessive "G" pulled by an individual who is not tolerant to high "G" loading, may cause that individual to "grey out" or "black out".

1.18.2 Load Factor

The load factor is the ratio of a specified load to the total weight of the aircraft. The specified load is expressed in terms of aerodynamic forces. Aerodynamically, it is the ratio of the total lift to the weight. The load factor is generally referred to as "G". In the case of manoeuvres, the load imposed on the aircraft leads to an increase in the lift and since the weight remains the same, the load factor, or "G" increases. The amount of "G" application decides the tightness of the manoeuvre. The higher the "G" loading, the tighter the manoeuvre.

The Limit Load Factor (LLF) is the maximum load factor authorized for flight on a particular aircraft and the specified load below which structural members or parts are designed not to fail. If the load factor is higher than the design load factor, either permanent distortion or failure may occur. In the case of OO-TYP this was +3.8G and –1.52G.

The ultimate load safety factor (ULF), or safety margin above the LLF, is the ratio of the ultimate load at which the structure is likely to fail to the loads imposed under normal operating conditions. Normally, the ultimate load is higher than 1.5 to 1.7 times the normal load in flight. In the case of OO-TYP, the ratio was 1.5 (See Table below).

Gross Weight	Limit -G	Structural Limit Load	Ultimate -G	Structural Failure Load
960 kg/2112 lbs	+3.8 G/-1.52G	3648 kg/8025 lbs	+5.7G/-2.28G	5472 kg/12038 lbs

1.18.3 Instrument Flying

1.18.3.1 General

When flying in cloud or in reduced visibility such as mist, smog, rain or snow, the natural horizon and ground/terrain features are difficult, if not impossible, to see.

In general, humans use their vision to orientate themselves with surroundings, supported by other bodily senses such as feel and balance, which can sense gravity. Even with one's eyes closed, a human can sit, stand and walk on steady ground without losing control. This obviously becomes more difficult if the ground becomes unsteady or if the body is subjected to some acceleration, for example being spun around.

In an aircraft, which can be accelerated in three dimensions, the task becomes almost impossible without the use of the eyes. The eyes gather information from the external ground/terrain features, including the horizon, or in cloud or poor visibility, gather substitute information from the flight instruments. By scanning the instruments, the pilot builds up a picture of the outside world, in relation to flight path, attitude and speed of the aircraft. However, without the assistance of an autopilot, the task of maintaining control in cloud or in limited visibility is constant and challenging and such a skill requires both training and practice.

1.18.3.2 Unusual Attitudes

An unusual attitude in instrument flying is any attitude not normally used during flight solely on instruments, including, among other things:

- Bank angles in excess of 30º;
- Nose-high attitudes with decreasing airspeed;
- Nose-low attitudes with increasing speed; and,
- Spinning

An unusual attitude may result from some external influence, such as turbulence or wake turbulence, or it can be self-induced as a result of;

- Disorientation;
- Distraction;
- Becoming pre-occupied with other cockpit duties;
- An over-react or under-react on the flight controls;
- Misinterpretation of instruments;
- Following a failed instrument; or,
- Loss of a primary instrument.

Whatever the cause of an unusual attitude, the immediate problem is to recognize exactly what the aircraft is actually doing and to return it safely back to normal straight and level or controlled flight.

1.18.3.3 Recovery

For non-instrument rated pilots or for pilots inexperienced in flying under IMC, there can be a tendency to over-react to an unusual attitude, by applying rapid and excessive control movement. Over-reaction can worsen the situation and, possibly, overstress the airframe. For this reason, part of any instrument training syllabus will include recovery from an unusual attitude. The purpose of this is to develop recovery techniques, for different scenarios, in order to allow the pilot, having recognized the nature of the unusual attitude, to return the aircraft to normal flight, calmly, quickly and safely. In particular, as there is a danger of overstressing the airframe at high speeds with large and sudden elevator/aileron control movements, the pilot is taught to "ease" the aircraft out of the dive with firm control pressure, rather then with sudden and large movements of the controls.

1.19 Useful or Effective Investigation Techniques

Nil.

2. ANALYSIS

2.1 Weather

The airspace classification for the Galway Control Zone on the day of the accident was Class C airspace. The General Rules for VFR Flights for Class C airspace requires a distance from cloud (horizontally) of 1500m (5000 ft), vertically 300m (1,000 ft), and a flight visibility of 5000m below (flight level) FL100 (10,000 ft).

The prevailing conditions on departure from Galway were: visibility 4500m with broken cloud at 700 ft and 1,200 ft respectively. In addition, the aftercast for the weather conditions between Galway and the midlands were reported as generally below VFR, while the weather conditions east of the midlands of Ireland were expected to improve and remain good for VFR.

The weather conditions at the time of departure were below VFR. This is confirmed by the fact that Tower Controller, observed OO-TYP nearing the cloud base, towards the south of the field and as he considered that VFR could not be maintained, he instructed OO-TYP to continue Special VFR.

It is also clear that the intended flight plan en-route level of FL065 (6,500 ft) would not have been achievable under the prevailing conditions without entering into cloud or flying through cloud.

No formal weather forecast was sought by the Pilot from the Irish Meteorological Service. However, the Pilot was aware (through a phone call home) that the weather at the destination airport was clear, and from weather provided by the Galway Tower Controller, that the weather was generally clearing east of the Irish midlands.

A final weather decision regarding an intended flight is the responsibility of the pilot and him alone. However, a route forecast from a qualified forecaster will greatly assist the pilot in coming to a final decision as to whether a flight is achievable under the laid down weather limits.

While an aviation forecaster was available (by phone) at Shannon Airport, the Pilot of OO-TYP did not avail of this service. The Investigation acknowledges that the Galway Tower Controller did have access to electronically generated weather data and this was provided to the Pilot, on request.

2.2 Technical Aspects

A review of the aircraft's technical documentation indicates that OO-TYP was well maintained and all work required under the maintenance schedule had been completed. The aircraft had a valid Certificate of Airworthiness (COA) and had completed a 100 hr inspection on the 7 June 2005.

The aircraft was primarily of wooden construction and as a result of severe vertical impact forces, the aircraft virtually disintegrated on impact. However, rotational damage and markings were found on the propeller, indicating that the propeller was rotating on impact. This is supported by the fact that the engine RPM needle had frozen at 1,850 RPM (maximum continuous is 2,700 RPM), indicating that the engine was running on impact, albeit at a reduced speed setting.

The extent of the damage to the instrument panel was such that the Investigation could not determine the functionality of the different instruments.

Continuity of control cable runs to the left hand aileron and to the elevator and rudder controls were established. The cable to the right-hand aileron failed at the point were the right wing outer section had separated from the aircraft.

An examination of the failed right hand (starboard) wing section, found no evidence to suggest that any pre-existing defects were present within the structure, prior to its failure. The likely cause of the wing failure, which occurred just outboard of the right hand fuel tank and undercarriage attachment point was that, the wing section failed in upload, following a gross single event overload of the wing in flight.

2.3 Altimeters

The Investigation had great difficulty in reconciling the altimeter configuration on OO-TYP.

Altimeter No. 2 was found loose in the wreckage with a red unserviceable label, which had detached from the altimeter, lying in close proximity to the instrument. The altimeter was certified out of tolerance, unserviceable, and therefore not suitable for use.

A post accident examination of the instrument provides a strong indication to the Investigation that the altimeter was not secured to the instrument panel prior to the final impact.

Altimeter No. 1 was also found loose within the wreckage. However, this particular altimeter had a cardboard blanking cover secured to its face, by means of the mounting screws. Following post accident examination, the general overall condition of the instrument indicated that this altimeter was secured to the instrument panel. This is supported by the fact that the mounting screws, which were still attached to the instrument, had sheared.

While not a general practice, experience has shown that when a mounted instrument goes unserviceable, and where a second similar instrument is available on the instrument panel, a cover is placed over the face of the instrument in order to ensure that the pilot does not mistakenly read the unserviceable instrument.

It is considered highly unlikely that the pilot flew the aircraft without altimeter reference. Therefore the only plausible conclusion that can be reached by the Investigation is that Altimeter No 1, which was overhauled and fitted to the aircraft without a blanking cover, went unserviceable at some date prior to the flight to Ireland. In order to put this altimeter out of use, without removing it from the instrument panel, a cardboard cover was placed over the face of the instrument and secured through the instrument mounting screws. The Investigation was unable to determine whom or when the cardboard cover had been secured to the altimeter.

Altimeter No 2, was out of tolerance and unserviceable. However, as the errors were recorded at altitudes in excess of 10,000 ft, and bearing in mind that the majority of VFR flights are flown at altitudes well below 10,000 ft, it is considered possible that the pilot reinstated this altimeter somewhere within the cockpit area as a temporary measure. The location of Altimeter No 2 within the cockpit area could not be ascertained.

For VFR flights, the temporary location of an altimeter (while not good practice) would not be a particularly critical issue, as outside visual references and occasional monitoring of the altimeter would be sufficient to maintain height.

However, for IFR flight, controlled flight is maintained through sole reference to instruments, with no external references available. The location of the altimeter, or any of the other primary instruments, such as the artificial horizon, the airspeed indicator, the climb and descent, the turn and slip, and the compass, is crucial. Instrument flight requires a constant scan by the pilot on the primary instruments, in order to maintain flight path and attitude.

To reduce this scan area (distance between the instruments), the primary instruments are grouped together. If one of the primary instruments is not within the primary group, the scan distance will increase, as will the rate of scan to that particular instrument. The further the instrument is away from the primary group, the more difficult it is for the pilot to maintain a constant scan of the primary instruments and this would undoubtedly increase the workload on the pilot. In addition, if the isolated instrument is not, in general, along the same line scan as the primary instruments, for example, located above, below or to the side of the instrument panel, the pilots head movement could be such as to induce physiological sensations associated with inner ear balance.

2.4 The Accident Flight

Prior to departure, ATC gave OO-TYP a QNH of 1017 hPa and a transponder squawk of 0234. This was acknowledged by the pilot. The take-off clearance, of a left turnout from RWY 26, was as per flight plan for a routing via Birr. Following an advised airborne time of 35 (12.35 hrs), ATC instructed OO-TYP to continue Special VFR and next report 10 nm (Control Zone Boundary). The Pilot acknowledged, *"Report 10 nm"* and then asked for the QNH to be repeated, which it was.

Radar analysis determined that the transponder return on the radar screen at Shannon was showing A0000 for OO-TYP. This indicates that the aircraft's transponder was switched on, in Mode A (identification code interrogator), but that the ATC issued squawk number of 0234, which had been acknowledged by the Pilot, had not been entered or selected on the transponder box. In addition, the non-selection of Mode C (altitude encoding) on the transponder, by the Pilot, meant that no altitude information was available on the radar returns for OO-TYP. The request to repeat the QNH shortly after take-off and the non-selection of Mode C with the issued squawk of 0234 could be an indication that the Pilot was under some degree of pressure or distraction.

The radar returns show OO-TYP initially turning towards Birr, following a left turnout off RWY 26. However, the gentle left hand climbing turn is continued around the general area of the airport and onwards towards the north. The Tower Controller told the Investigation that when he saw OO-TYP nearing the cloud base, he amended the clearance to Special VFR in the Zone as he considered that under the prevailing weather conditions VFR was not sustainable. The Controller then lost sight of OO-TYP just south of the field.

The gradual climbing left turn towards the north, as recorded on the radar plot, does give the appearance that the aircraft was under control. Therefore it is possible that the Pilot was flying close to the cloud base with poor horizontal visibility, but with some visual reference with the ground. Failure to maintain the heading for Birr (115ºM) could have resulted from the Pilot concentrating on maintaining visual references and therefore not being aware of the changing heading.

As OO-TYP passes north over the R339 road, the aircraft continues its turn to the left towards the northwest. Over the N18 road, the aircraft commences a tight left turn back towards the general direction of the east. Ground speed reduces significantly during this particular manoeuvre.

With groundspeeds recorded down as low as 42 kt, 32 kt, 24 kt, and 46 kt respectively, near the end of the radar plot, it is considered likely that the aircraft was engaged in significant vertical (ascent/descent) flight. The turn back towards the general direction of the east and the vertical elements of flight as recorded through the low groundspeeds are indications that the pilot was experiencing difficulty in maintaining control. The sudden 90º left-hand turn towards the northwest and the heading reversal, with groundspeeds down as low as 32 kt and 24 kt are not representative of controlled flight. The final radar return is recorded over the accident site at approximately 12.38 hrs (Local) on a near easterly heading, approximately 1.5 nm northeast of Galway Airport.

The report of two eyewitnesses hearing an aircraft above cloud with its engine revving, prior to seeing an aircraft spin out of cloud with a portion of its right wing missing, supports the Investigation's belief that the aircraft was flying in cloud around the time that the radar plot shows the aircraft flying erratically. The revving of the engine, as reported by the eyewitnesses, is not considered to be associated with an engine problem, but rather that the throttle was being "worked" (moved forward and back) by the Pilot during an attempt to maintain or regain control of the aircraft. Wreckage analysis determined that the engine was running at 1,850 RPM on impact and that the propeller suffered rotational damage.

In addition, no radio communications or MAYDAY call was made by the Pilot indicating that he was experiencing an engine problem.

The cockpit of OO-TYP was equipped with flight instruments that would allow for IMC flight. Therefore, the possibility exists that the Pilot may have engaged in instrument flying in the past. The weather for departure from Galway was marginal VFR, with cloud base recorded as broken at 700 ft and 1200 ft respectively. While aware of the prevailing weather conditions, the Pilot confirmed to the Tower Controller and on the submitted flight plan that it was his intention to return to Belgium at FL065 (6,500 ft). The Pilot was also aware that the weather for his destination in Belgium was clear and that the weather was improving as one flew east. Therefore the possibility exists that the Pilot may have attempted to penetrate the broken cloud layer in the belief that he may become VMC on top (visual flying conditions above the broken cloud layer). The possibility also exists that the Pilot, while attempting to navigate in marginal VFR conditions, inadvertently entered cloud.

Whether the pilot intentionally or inadvertently entered cloud cannot be determined by the Investigation and therefore this must remain a matter for conjecture.

However, what is clear to the Investigation is that the aircraft was heard flying in or above cloud and, moments later, it was seen spinning down out of the cloud, with a portion of its right hand wing missing.

The Pilot was licensed to fly VFR only. He was not Instrument Rated, he had never held an Instrument Rating, and a review of the Pilot's available logbooks, did not reveal any entries associated with either official or unofficial Instrument flying.

Flight in IMC is by sole reference to instruments, with no external visual references for flight path or attitude guidance. A pilot requires training, practice and currency to master the skills of instrument flight. To officially fly in IMC, a pilot requires an IFR Rating, which is granted by the State Licensing Authority on completion of a successful flight test. To retain an IFR Rating, a pilot needs to maintain proficiency throughout the year by flying in actual or simulated flight conditions, followed by an annual renewal test.

For an instrument rated pilot, flight in IMC and identification/recovery from an unusual attitude is generally well practiced, tested, and relatively easy to accomplish. A non-instrument rated pilot, on the other hand, would experience extreme difficulties in maintaining controlled flight in IMC, identifying the initial onset of an unusual attitude and recovering from an unusual attitude, as recovery is generally achieved through sole reference to instruments.

If, as believed in this case, the altimeter was not co-located with the primary instruments, the pilot would have been severely challenged to maintain an appropriate rate of scan to maintain controlled flight while in IMC.

The possibility that the altimeter in use on the day of the accident became dislodged from its stored position cannot be ruled out.
If this happened, the lack of altimeter information would have seriously impeded the Pilot's ability to maintain flight path and attitude while in cloud and more importantly to recover from an unusual attitude.

The technical examination of the recovered wing section, shows that the wing failed in upload as a result of a single event gross over-load. The aircraft was heard flying in cloud and was seen spinning out of cloud. No other aircraft was recorded in the area around the time of the accident and no weather phenomena, such as turbulence, was present to influence the aircraft. In considering all the available evidence, the Investigation is satisfied that following entry, either intentionally or inadvertently into cloud, the Pilot became disorientated, and while attempting to recover from a high speed vertically descending/spinning dive, he overloaded the aircraft to such a degree that the starboard wing failed and it separated from the aircraft. Once the wing had failed, total control of the aircraft was lost and the aircraft plummeted to earth.

Due to the aerodynamics of a falling wing and the fact that no height information was available from the radar returns, the Investigation cannot accurately determine the height at which the wing failed. A calculation of the maximum rate of climb and the total time of the event would give an absolute achievable height of approximately 2,400 ft. With a cloud base of approximately 1,000 ft in the general area of the accident site, it is likely that wing separation occurred somewhere between 1,500 ft and 2,000 ft.

3. CONCLUSIONS

3.1 (a) Findings

1. The Pilot had a valid Belgian licence and was medically fit to fly.
2. The Pilot was licensed to fly VFR only.
3. The aircraft had been well maintained and had a valid Certificate of Registration and a Certificate of Airworthiness.
4. The pilot and passenger took off from Galway Airport in OO-TYP at approximately 12.35 hrs for a VFR flight at 6,500 ft for Saint-Ghislan, in Belgium.
5. The weather conditions at the time of take-off were marginal for VFR flight.
6. The Galway Tower Controller cleared OO-TYP for Special VFR through the zone, as in his opinion, the prevailing weather conditions were less than that required to maintain VFR.
7. Two eyewitnesses located in the vicinity of the accident site, heard the aircraft flying above cloud, shortly before seeing the aircraft spin out of cloud with a significant portion of its starboard wing missing.
8. An examination of the main body of the wreckage and in particular the recovered wing, determined that no pre-existing defects were identified in the structure of the wing or the flying control system.
9. There was no evidence found to support the possibility of a technical malfunction prior to the Pilot losing control of the aircraft.
10. There was no evidence found of atmospheric turbulence or any factor requiring the Pilot to carry out an evasive manoeuvre.

11. The starboard wing section, just outboard of the wing fuel tank and undercarriage attachment point, failed as a result of a gross overload of the wing section in upload.

12. No record was found of a Jodel DR 250-160 suffering a catastrophic wing failure such as that which occurred to OO-TYP.

13. The likely cause of the gross overload was the Pilot's failed attempt to recover the aircraft from an unusual attitude while in IMC.

14. Two altimeters were recovered from the wreckage. Altimeter No 1 was recovered from the wreckage and found to have a cardboard cover secured to its face. The Investigation is satisfied that this particular altimeter was fixed to the instrument panel but was not in use by the Pilot. Altimeter No 2 was found to be marked "Out of tolerance" and therefore unserviceable. The Investigation considers that this particular altimeter was not fixed to the instrument panel, but it is likely that the Pilot was using the altimeter for height reference.

15. The Investigation cannot rule out the possibility that the position and use of this altimeter may have in some way contributed to the onset of loss of control.

16. Whether the Pilot entered IMC intentionally or inadvertently cannot be determined by the Investigation and must remain a matter for conjecture.

3.2 (b) Cause

1. Failure of the starboard wing was as a result of a gross overload of the wing section in upload, following an attempted recovery from an unusual attitude in instrument meteorological conditions.

3.3 (c) Contributory Factors

1. Spatial disorientation during instrument meteorological conditions, which resulted in the pilot being unable to maintain control of the aircraft, and control of the aircraft was lost.

2. Intentional or inadvertent entry into instrument meteorological conditions, without having the appropriate rating or experience.

3. Possible use of a stand-alone altimeter that was "Out of Tolerance" and therefore unserviceable.

4. SAFETY RECOMMENDATIONS

This Investigation does not sustain any Safety Recommendation.

Appendix A

PART III VISUAL FLIGHT RULES

34. ***General Rules for VFR Flights (Appropriate extracts)***

(I) Except when operating as a special VFR flight, VFR flights shall be conducted so that the aircraft is flown in conditions of visibility and distance from clouds equal to or greater than those specified in the following table:-

*Airspace class	*A**BCDE*	FG	*FG*
		Above 900 metres (3,000 ft) AMSL or 300 metres (1,000 ft) above terrain whichever is the higher	At and below 900 metres (3,000 ft) AMSL or 300 metres (1,000 ft) above terrain whichever is higher
Distance from Cloud	1,500 metres horizontally	300 metres (1,000 ft) vertically	Clear of cloud and in sight of the surface
Flight Visibility	8 Kilometres at or above	Flight Level 100 or 10,000 ft AMSL	*5 Kilometres* *** (See below)
	5 Kilometres below Flight	Level 100 or 10,000 ft AMSL	

* Note: See Rule 26 of these Rules.

** Note: VMC minima in Class A airspace are included for guidance to pilots but do not imply the acceptance by the ATS Unit responsible of a VFR flight in Class A airspace in a particular instance;

*** Note: (a) 3 kms. Flight Visibility for aircraft operated at an indicated airspeed of 140 kts or less;

(b) lower flight visibilities to a minimum of 1500m may be permitted for aircraft operating:

(1) at speeds that, in the prevailing visibility, will give adequate opportunity to observe other traffic or any obstacles in time to avoid collision, or

(2) in circumstances in which the probability of encounters with other traffic would normally be, low, e.g. in areas of low volume traffic and for aerial work at low level;

FINAL REPORT

Appendix B

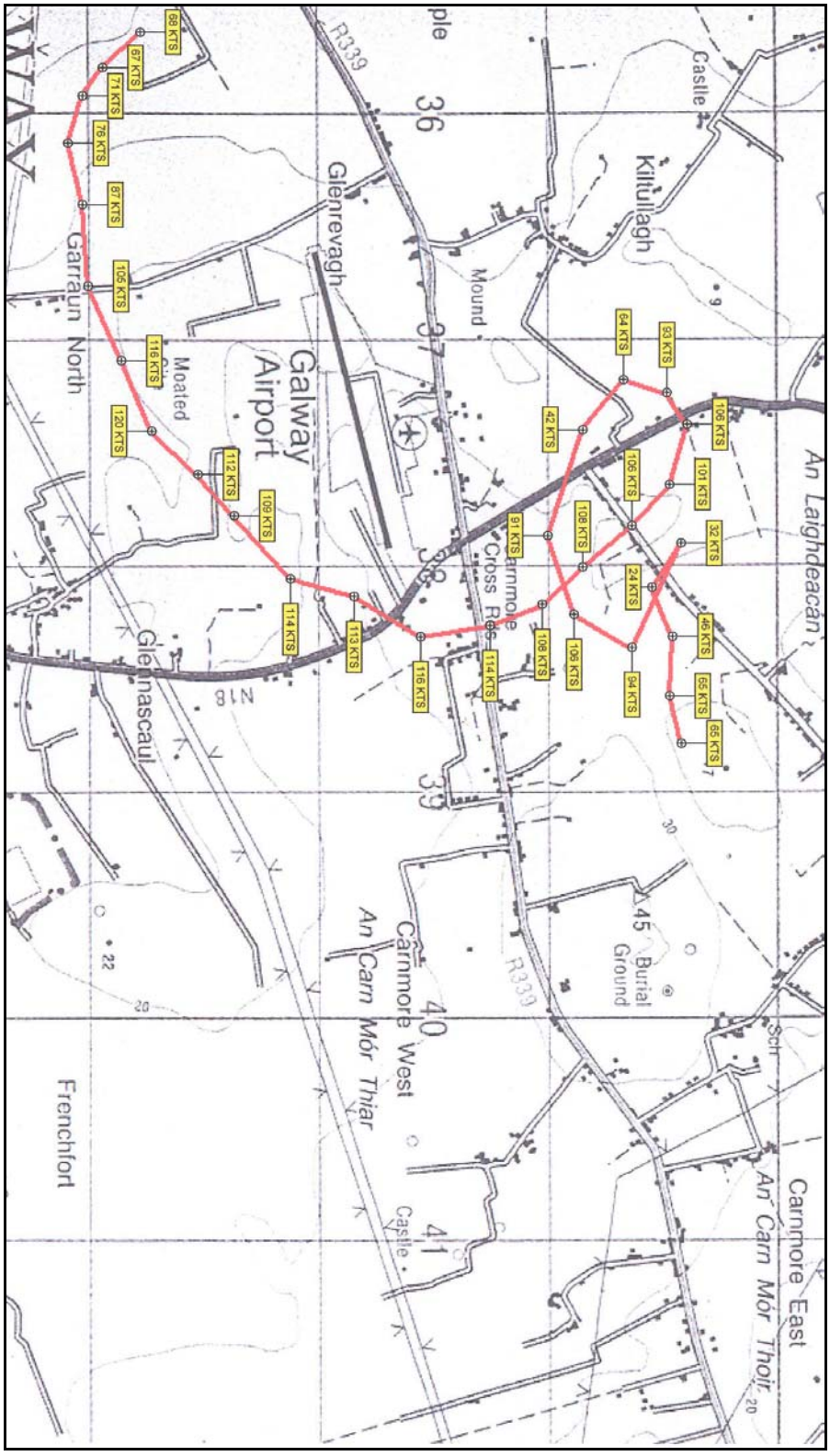
Audio Tape Transcript Galway Airport

Date: 19 September 2005
Time Period covered: 12.26:57 to 12.49:10.

Time	TX From	Transcript
12.26:57	OO-TYP	Galway Tower from OO-TYP, how do you read? Over.
12.26:59	TWR	OO-TYP, getting you strength four.
12.27:15	OO-TYP	Ah, eh, I request to taxi information for VFR flight to EBSG.
12.27:18	TWR	O-TB (*OO-TYP*) and when ready taxi holding position Bravo, hold short Runway 26, QNH 1017.
12.27:30	OO-TYP	Runway in use, 26, 1017 for QNH and I will eh, go to the taxi bravo
12.29:06	TWR	O-TB (*OO-TYP*) Squalk 0234
12.29:11	OO-TYP	0234, O-YP (*OO-TYP*)
12.30:00	EI-IHL	And Tower helicopter HL. I'm clear of your zone now south abeam of Craughwell, en-route to Shannon.
12.30:08	TWR	HL that's copied and continue with Shannon 127.5 no traffic to effect. See you Colm.
12.30:15	EI-IHL	Shannon 127.5 Talk to you Mike.
12.31:21	OO-TYP	Galway Tower from OO-TYP, ready for departure.
12.31:25	TWR	O-YP (*OO-TYP*) enter backtrack and line up Runway 26, report ready.
12.31:35	OO-TYP	I will report ready
12.32:53	OO-TYP	Galway Tower, from OO-TYP ready for departure
12.33:05	TWR	O-YP (*OO-TYP*) clear take-off runway 26, left turn out, 210 degrees 15 kts.
12.33:15	OO-TYP	Taking-off O-YT (*OO-TYP*)
12.35:00	TWR	O-YP (OO-TYP) airborne at time 35, continue Special VFR, and next report 10 miles.
12.35:10	OO-TYP	Next report 10 miles and could you, please repeat the QNH please.
12.35:15	TWR	QNH 1017, and continue Special VFR.
12.35:18	OO-TYP	Continue Special VFR.
12.45:15	TWR	OO-TYP Galway Tower.
12.45:28	TWR	OO-TYP Galway Tower.
12.45:32	TWR	OO-TYP Galway Tower.
12.49:10	TWR	OO-TYP Galway Tower.

Appendix C

Most likely "Track Made Good" as depicted by Shannon Radar



FINAL REPORT

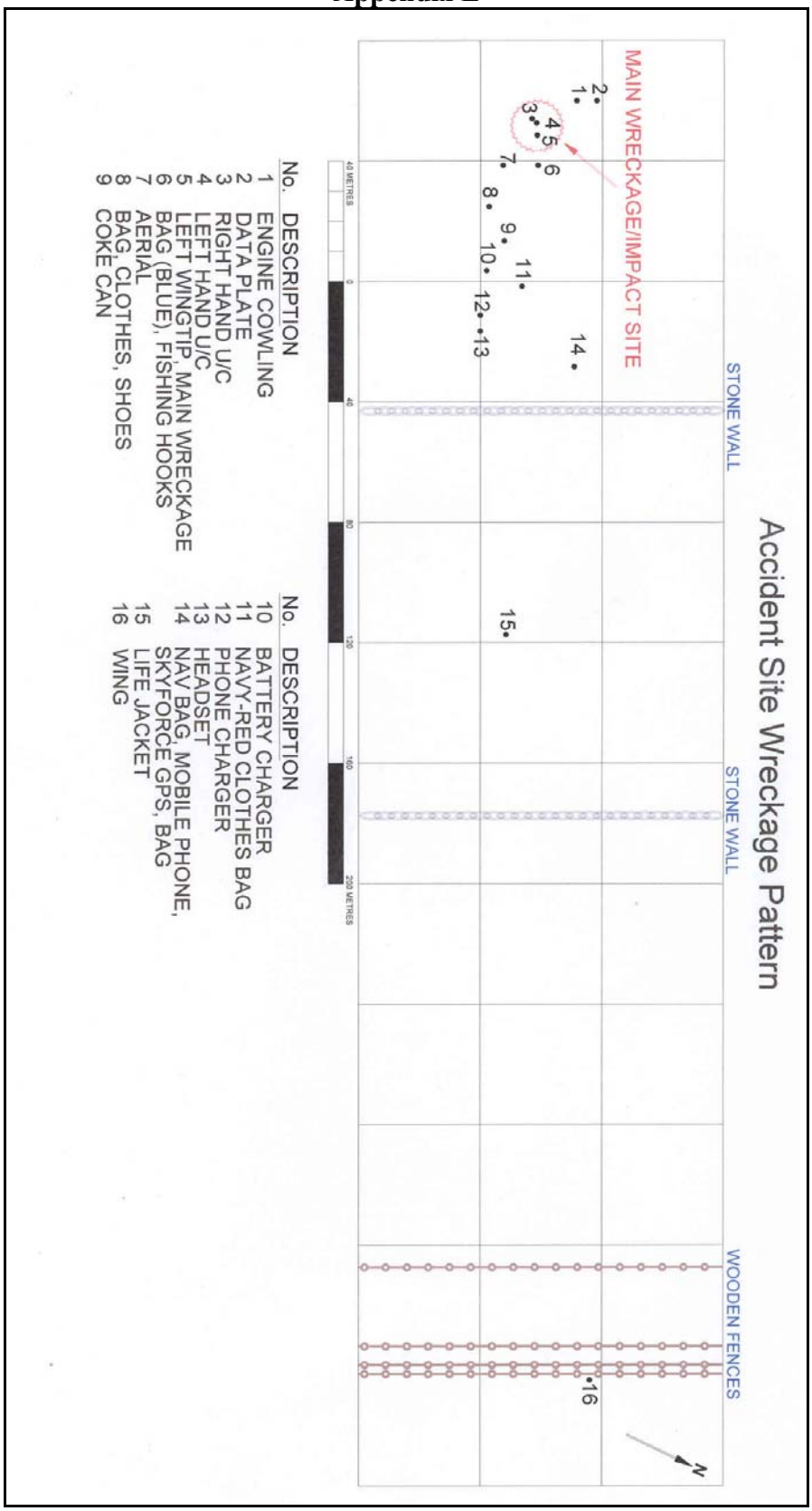
Appendix D

General Aerial View Of Accident Site

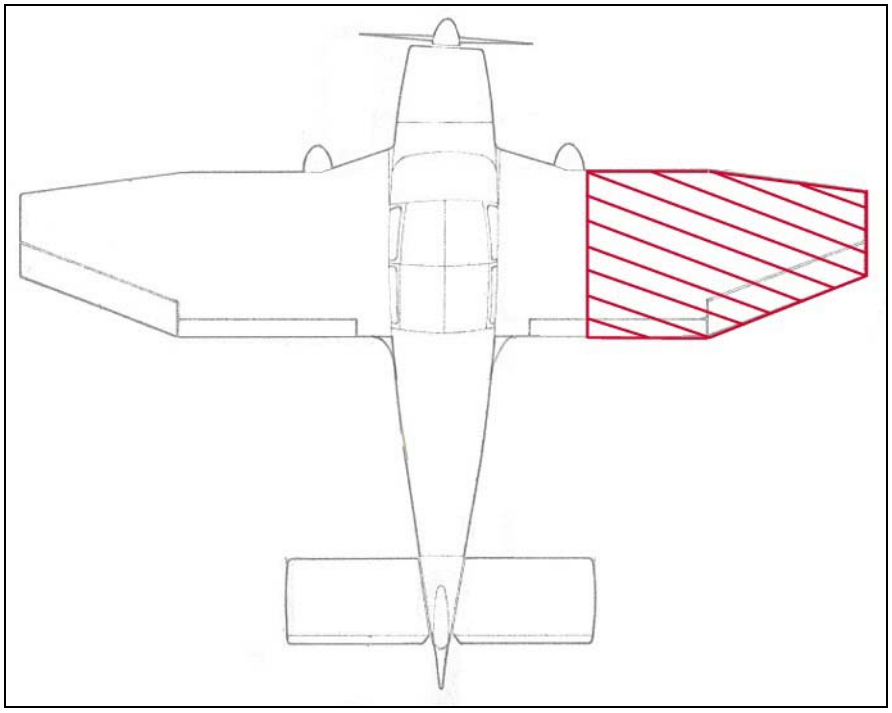
Primary Impact Site

Secondary Site Where wing section was located

Appendix E


Accident Site Wreckage Pattern
MAIN WRECKAGE/IMPACT SITE
STONE WALL
STONE WALL
WOODEN FENCES
40 METRES
0
40
80
120
160
200 METRES
N
No. DESCRIPTION
1 ENGINE COWLING
2 DATA PLATE
3 RIGHT HAND U/C
4 LEFT HAND U/C
5 LEFT WINGTIP, MAIN WRECKAGE
6 BAG (BLUE), FISHING HOOKS
7 AERIAL
8 BAG, CLOTHES, SHOES
9 COKE CAN
No. DESCRIPTION
10 BATTERY CHARGER
11 NAVY-RED CLOTHES BAG
12 PHONE CHARGER
13 HEADSET
14 NAV BAG, MOBILE PHONE, SKYFORCE GPS, BAG
15 LIFE JACKET
16 WING

Appendix F



Section of wing that separated from aircraft

Appendix G

Altimeters No. 1 and No. 2

Altimeter No. 1 with face covered

Altimeter No. 1 with broken mounting screw

Altimeter No. 2 with unserviceable label