

## FINAL REPORT

AAIU Synoptic Report No: 2010-001

State File No: IRL00909040

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**In accordance with the provisions of SI 205 of 1997, the Chief Inspector of Air Accidents, on 4 June 2008, appointed Mr. Thomas Moloney as the Investigator-in-Charge to carry out a Field Investigation into this Accident and prepare a Final Report. The sole purpose of this Investigation is the prevention of aviation Accidents and Incidents. It is not the purpose of the Investigation to apportion blame or liability.**

<b>Aircraft Type and Registration:</b>	Beech Duchess 76, EI-BUN
<b>No. and Type of Engines:</b>	1 x Avco Lycoming O-360-A1G6D 1 x Avco Lycoming LO-360-A1G6D
<b>Aircraft Serial Number:</b>	ME 371
<b>Year of Manufacture:</b>	1980
<b>Date and Time (UTC):</b>	04 June 2009 @ 15.48 hrs
<b>Location:</b>	Weston Airport (EIWT), Co Kildare
<b>Type of Flight:</b>	Training
<b>Persons on Board:</b>	Crew - 2      Passengers - 1
<b>Injuries:</b>	Crew - Nil      Passengers - Nil
<b>Nature of Damage:</b>	Significant
<b>Commander's Licence:</b>	Air Transport Pilot Licence (Aeroplanes) issued by the Irish Aviation Authority
<b>Commander's Details:</b>	Male, aged 37 years
<b>Commander's Flying Experience:</b>	11,500 hours, of which 250 were on type
<b>Notification Source:</b>	Weston Airport Manager
<b>Information Source:</b>	AAIU Pilot Report Form submitted by Pilot. AAIU Field Inspection.

### **SYNOPSIS**

The aircraft was engaged on a training exercise with an experienced instructor and a student who was flying a twin-engined aircraft for the first time. A second student was seated in the rear of the aircraft. At the conclusion of the flight the aircraft landed at EIWT but, very shortly after touchdown, the nosewheel retracted fully and the main landing gear commenced retraction. The aircraft slid for some 250 metres on its nose and main gear along the runway. The propellers on both engines were damaged by strikes on the runway surface. There were no injuries.

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## 1. FACTUAL INFORMATION

### 1.1 History of the Flight

The aircraft departed from EIWT at 14.51 hrs on a training detail. There were three persons on board, an instructor in the right hand seat, a student in the left hand seat and a second student who was seated in the rear. The flight was a first instructional flight on a twin-engined type for the two students and the intention was to give each of them an individual one-hour introductory lesson.

Following departure, the aircraft flew to a training area to the west of the Dublin Control Zone where general handling exercises were carried out. The aircraft then returned to EIWT and carried out a touch-and-go landing on Runway (RWY) 07, flown by the student. This was followed by a left hand circuit and an approach and go-round exercise on RWY 07. Following another left hand circuit, the third approach was flap-less and this was intended to lead to a full-stop landing on RWY 07, again with the student as handling pilot. That was to be the conclusion of his portion of the training detail.

The student stated to the Investigation that he selected landing gear down at the end of the downwind leg, checked for and called "*three greens*". The observer in the rear seat told the Investigation that, while he couldn't see the gear down lights from his position, he did recall the student calling "*three greens*". The instructor informed the Investigation that the approach and touch-down were normal for a flap-less landing, the approach being somewhat flatter than a standard approach. The instructor stated that the aircraft speed, over the displaced threshold, was between 90 and 95 kts and was 85 kts over the runway threshold and that these speeds were very similar to a normal approach with flaps deployed.

The instructor informed the Investigation that the landing, which was only the student's second landing on type, "*was very smooth, was not a hard impact whatsoever and pretty much on the centreline*". However, a short number of seconds after the touchdown, the propeller blade tips came into contact with the runway and the nose of the aircraft descended onto the runway surface. The student told the Investigation "*I know I didn't select the gear up*". He also said "*when it actually happened, I was pulling back as far as I could on the control column to keep the weight of the nose off the ground*".

The instructor stated to the Investigation that he did not hear the landing gear warning horn during the landing sequence. The student, while less certain, was unable to recall the horn sounding. He did state that he had turned the Master switch off very early in the accident sequence and that this would have cancelled the horn.

The aircraft skidded along RWY 07 on its main landing gear and nose for approximately 250 metres until it came to a halt. During this skid the student turned the mixture controls to OFF, switched the magnetos OFF and turned the Master switch OFF. The three occupants, who were uninjured, exited the aircraft after it had come to rest. The instructor exited through the right hand door while the other two occupants exited through the left hand door. The instructor stated to the Investigation "*On reflection, getting out of the aircraft, the landing gear selector was in the UP position*".

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## 1.2 Technical Information

The Beech Duchess 76 is an all-metal, low-wing, twin-engine aircraft with a retractable tricycle landing gear. Two Avco Lycoming engines are installed, one O-360-A1G6D (clockwise rotating) on the left wing, and one LO-360-A1G6D (counter clockwise rotating) on the right wing. The aircraft is equipped with two Hartzell constant-speed, full-feathering, two-blade propellers.

EI-BUN was equipped with two adjustable pilot seats and two rear seats. The front seats may be adjusted by pulling on a release knob located beneath the left forward seat corner and then sliding the seat forward or aft to the desired position.

The retractable tricycle landing gear is manufactured from magnesium castings and aluminium forgings. Retraction and extension of the gear is accomplished through the use of an electrically driven hydraulic pump and hydraulic system terminating in a hydraulic actuator assembly mounted in each wheel well. The landing gear may be hydraulically extended or retracted, and may also be lowered manually in an emergency.

The landing gear is controlled by a two-position selector handle located on the left sub-panel, (**Photo No. 1**). The handle must be pulled out of a safety detent before it can be moved to the opposite position.



**Photo No. 1: Location of Landing Gear Selector**

The landing gear position indicator lights are located above the selector handle. Three green lights, one for each wheel, are illuminated whenever the landing gear is down and locked. The red light illuminates whenever the gear is in transit or in any intermediate position. All of the lights are extinguished when the gear is up.

The two main landing gear legs retract upwards and inwards (towards the fuselage) into recesses in the respective wings while the nose gear retracts forwards. Retraction operation is protected by a time-delay relay, which will disengage electrical power to the hydraulic pump motor after 30 seconds of continuous pump operation.

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To prevent inadvertent retraction of the landing gear on the ground, a safety pressure switch is installed in the pitot system, which deactivates the hydraulic pressure pump circuit when the impact air pressure is below 59 to 63 kts (Flight Manual figures). When the aircraft speed is above this threshold the safety switch is closed and supplies an electrical ground to the landing gear motor thus completing the circuit so that it can operate. Below the speed threshold, the switch opens and removes the ground to the motor so that it can no longer operate. The Flight Manual incorporates the following warning *“Never rely on the safety switch to keep the gear down during taxi, take-off roll or landing roll. Always make certain that the landing gear switch handle is in the down position during these operations”*.

A landing gear warning horn is also installed in the aircraft. If either or both throttles are retarded below an engine setting sufficient to sustain flight and the landing gear is retracted, the warning horn will sound intermittently. Also, when the flaps are extended beyond approximately 16°, the horn will sound if the landing gear is not down and locked.

Two circuit breakers are associated with the landing gear. The GEAR MOTOR circuit breaker and the GEAR CONTROL circuit breaker are located on the right sub-panel. The breakers are of the push-pull type and will pop out under overload conditions.

The brakes on the main landing gear wheels are operated by applying toe pressure to the tops of the rudder pedals.

### **1.3 Pilot Information**

The instructor, who holds an Air Transport Pilot Licence, had total flying time of 11,500 hrs at the time of the accident, of which 250 were on the Beech 76. He held a valid Type Rating on the Beech 76 as well as an Instrument Rating on type. He also held a Flight Instructor Rating for single-engine and multi-engine piston types. He informed the Investigation that he had renewed his Instructor ratings in November 2007 and had been teaching part-time since then.

The student, who holds a Commercial Pilot Licence, had a total flying time of 213 hours at the time of the accident, all on single-engine fixed landing gear types.

### **1.4 Weather Information**

The Weston Automated Terminal Information Service (ATIS) for 15.30 hrs gave RWY 07 as the active runway with a wind of 090° at 4 kts. Visibility was 10 km with scattered cloud at 2,500 ft.

### **1.5 Maintenance**

The aircraft was maintained by a Licensed Aircraft Engineer based at Weston Airport. The most recent Certificate of Release to Service following scheduled maintenance was issued by him on 15 May 2009 when the total airframe hours were 5538, following an Annual Inspection on the airframe and engines. Also on 15 May 2009, the Irish Aviation Authority issued a Certificate of Airworthiness and an Airworthiness Review Certificate for the aircraft. The aircraft logbook shows a total flying time of 5548 hrs on the 4 June 2009.

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On 3 June 2009, the day prior to the accident flight, the landing gear emergency extension valve was found to be leaking. It was replaced with a new valve following which normal and emergency retraction checks were carried out satisfactorily.

On 1 September 2008, maintenance had been carried out on the nose gear, involving removal of the nose leg, dismantling and inspection of the oleo, and replacement of O-rings and a high-pressure valve.

### 1.6 Damage to Aircraft

The aircraft suffered significant damage in the accident. The underside of the nose and the nose landing gear doors were badly damaged by the sliding contact with the runway asphalt surface. Propeller blade tips on either side of the aircraft had significant “curl” damage and undoubtedly both engines received consequent shock loading.

### 1.7 Technical Inspection

Two Inspectors from the AAIU arrived at Weston within an hour of the accident occurring. Other than jacks being placed under each wing for safety, the scene had been preserved for examination, (**Photo No. 2**).



**Photo No. 2: EI-BUN Final Resting Position**

The aircraft was sitting on its main landing gear and on its nose. It remained on the runway although it veered to the left during its slide and finished up with the port wing tip very close to the left hand runway edge. The nose gear was fully retracted and the nose gear doors were closed. The port landing gear leg had moved inboard by approximately 10° from the vertical while the starboard leg appeared to be in or close to the vertical position. The Investigation noted that the landing gear selector handle was in the UP position. The Investigation then placed the selector in the DOWN position and electrical power was switched on. The red landing gear in-transit light illuminated and by manually closing the main gear microswitches it was possible to illuminate the left and right “gear down” green lights. It was decided to attempt to extend the nose gear by taking the weight off the nose, using the landing gear circuit breakers to control the process. This operation was successful.

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The port landing gear leg moved back into the vertical position, the nose-gear doors opened, the nose leg extended and three greens illuminated on the instrument panel. The landing gear was visually inspected and the aircraft was subsequently towed off the runway.

After the aircraft had been recovered to a hangar, the student sat into the left hand seat, which was in the same fore/aft position as when he had been flying. It was noted that the seat position was relatively far forward and that consequently his knee was within 5 cm of the landing gear selector, (**Photo No. 3**).



**Photo No. 3: Student Seating Position**

When he moved his feet upwards onto the brakes, which are located at the top of the rudder pedals, it was possible for his right knee to come into contact with the selector. It was also noted that, while it was necessary to pull the selector out of a detent to move it from DOWN to UP, the pulling action required was minor. A deliberate upward motion of the student's knee, while seated in his flying position, did in fact move the selector handle from the DOWN position to UP.

Inspection of the runway surface showed that the first signs of the accident sequence were slash marks made by both propellers in the asphalt.

After moving approximately 7 m in the direction of the landing roll, there was evidence of light contact by the nose and nose-wheel doors with the runway surface and a further 31 m down the runway, the commencement of a "whitish" streak approximately 20 cm wide indicated where full contact between the nose and the runway commenced. This streak ran for some 212 m along RWY 07, veering slowly towards the left side of the runway, to where the nose of the aircraft had come to rest.

Following the accident, the Investigation carried out tests on the landing gear operation, including the operation of the safety pressure switch. The landing gear operated correctly when the selector switch was moved to the UP and DOWN positions. A pitot-static test set was used to generate simulated airspeed and it was demonstrated that the landing gear motor became inoperative at airspeeds less than 57 kts approximately.

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The landing gear warning horn was also demonstrated to be operational when the landing gear was retracted and the flaps were extended. However, it was not possible to demonstrate the second condition for warning horn operation in the hangar, that is when the throttles are retarded and the gear is retracted.

The Investigation spoke to six pilots who had flown EI-BUN in the months prior to the accident. None reported having encountered any significant difficulties with the landing gear.

### 1.8 Similar Accidents

The Investigation made enquiries of the aircraft manufacturers through the United States National Transportation Safety Board (NTSB) as to whether they were aware of any similar accidents in the past. The manufacturers replied that they had researched their own records, NTSB accident reports, FAA Service Difficulty Reports and NASA Aviation Safety Reports and could find no other reported occurrence of a pilot's knee inadvertently actuating the landing gear selector to the up position.

However, subsequent to that correspondence, the U.K. Air Accidents Investigation Branch (AAIB) published a report in their Bulletin 9/2009 describing a very similar accident to a Beech 76 Duchess at Bournemouth Airport, England. This report may be viewed at:

[http://www.aaib.gov.uk/publications/bulletins/september\\_2009/beech\\_76\\_duchess\\_g\\_m ult.cfm](http://www.aaib.gov.uk/publications/bulletins/september_2009/beech_76_duchess_g_m ult.cfm).

## 2. ANALYSIS

The student, who was the handling pilot for the landing, informed the Investigation that he had selected the landing gear down, and checked and called "*three greens*" at the end of the downwind leg of the final circuit to RWY 07. The aircraft touched down on its main landing gear wheels but shortly thereafter the propeller blades on both engines came into contact with the runway surface and the aircraft nose descended towards the runway and came into contact with it.

Given the fact that the landing gear was extended at touchdown, the Investigation considers that the gear selector switch must have been in the DOWN position and that the landing gear was down and locked at the moment of touchdown. However, very shortly thereafter, the selector was moved inadvertently to the UP position. As the speed of the aircraft at that point was still above the demonstrated safety pressure switch speed of 57 kts, the landing gear started to retract. The nosewheel quickly retracted forward towards its bay, with the first effect being the propeller strikes on the runway surface as the nose dropped. The nosewheel retracted fully and the nosewheel bay doors closed. This entire process took place as the aircraft travelled for a distance slightly in excess of 38 m along the runway. The student stated that he had been pulling back on the control column as much as he could in an effort to keep the nose up. This is likely to have assisted the nose gear in retracting because the reaction between the nosewheel and the runway surface would have been reduced. The main wheels commenced their inward retraction sequence but the fact that most of the aircraft weight was on them is likely to have assisted in their staying largely in the down position.

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As the aircraft decelerated through 57 kts, the safety pressure switch opened and disabled the landing gear motor, thus halting the retraction sequence. The aircraft then continued along the runway sliding on its nose and on its main gear wheels.

The instructor stated that he did not hear the landing gear horn sounding during the accident sequence. It is possible that the warning horn did not sound as the landing gear commenced its retraction but, in any case, it is unlikely that the retraction of the nose gear could have been prevented once it had commenced.

The landing gear selector which had been in its correct DOWN position at touchdown moved into the UP position very shortly thereafter. The Investigation considers that there are only two possible explanations for this movement in the circumstances, firstly that the selector was moved by hand as an instinctive reaction after the landing, or secondly that it was accidentally moved by contact with the right knee of the student in the left seat. He stated unequivocally that he had not manually selected the gear up. The fact that he was seated relatively far forward, with his right knee within 5 cm of the selector, makes the more likely scenario that when he moved his feet upward onto the brakes, his knee made contact with the selector and moved it out of its detent and upwards into the UP position. The Investigation noted that this was the student's first training flight on the retractable landing gear Beech 76 and his first full-stop landing as handling pilot on type. It is reasonable to conclude that he may have had a lack of awareness of the proximity of his right knee to the selector and also of the possibility of his knee striking the selector as he raised his feet onto the brake pedals.

The Investigation learned of a very similar accident occurring to a Beech 76 in the U.K. Therefore this Report makes a Safety Recommendation to the aircraft manufacturers, Hawker Beechcraft Corporation.

### 3. CONCLUSIONS

#### (a) Findings

1. The instructor Pilot was properly licensed and rated for the instructional flight.
2. The flight was the student's first flight as a handling pilot on a twin-engined type.
3. The aircraft was properly maintained with a valid Certificate of Airworthiness at the time of the accident.
4. The landing gear was down and locked at the moment of initial touchdown on RWY 07.
5. In the seconds after touchdown, the landing gear selector switch was inadvertently moved from the DOWN position to the UP position, probably by the student's right knee as he moved his feet up onto the brake pedals.
6. The landing gear commenced its retraction sequence, with the nosewheel retracting fully and the main gear legs commencing their inward retraction movement.

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7. The fact that the handling pilot pulled back on the control column in an effort to keep the nose up probably facilitated retraction of the nosewheel due to a reduction in the reaction between the wheel and the runway surface.
8. The safety pressure switch activated at approximately 57 kts as the aircraft decelerated along the runway. This removed the electrical ground from the landing gear motor, thus halting the retraction sequence.

### **(b) Probable Cause**

The landing gear retracted due to the inadvertent movement of the landing gear selector switch from the DOWN to the UP position in the moments after touchdown.

### **(c) Contributory Cause**

The inexperience of the student on type is likely to have led to a lack of awareness of the relative proximity of his right knee to the landing gear selector switch when seated in his normal flying position.

## **4. SAFETY RECOMMENDATION**

Hawker Beechcraft Corporation should review the design and location of the Beech Duchess 76 landing gear selector switch so as to eliminate the possibility of inadvertent selection to the UP position. [\(SR 01 of 2010\)](#)

- END -