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Aircraft Accident Investigation Bureau AAIB

# **Investigation Report No. u2005**

## **by the Aircraft Accident Investigation Bureau**

concerning the accident  
to the Beechcraft B90 King Air aircraft, registration G-OJRO  
operated by Trans Euro Air under flight number TRJ 927P  
on 27 September 2007  
at Zurich Airport

## General information on this report

This report contains the AAIB's conclusions on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with Annex 13 of the Convention on International Civil Aviation of 7 December 1944 and article 24 of the Federal Air Navigation Law, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent future accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the accident investigation. It is therefore not the purpose of this investigation to determine blame or clarify questions of liability.

If this report is used for purposes other than accident prevention, due consideration shall be given to this circumstance.

The definitive version of this report is the original in the German language.

All times mentioned in this report, unless otherwise indicated, follow the coordinated universal time (UTC) format. At the time of the accident, Central European Summer Time (CEST) applied as standard time (local time – LT) for the region of Switzerland. The relation between LT, CEST and UTC is: LT = CEST = UTC + 2 h.

For reasons of protection of privacy, the masculine form is used in this report for all natural persons, regardless of their gender.

Within 30 days after receipt of the investigation report, the Federal Office, in case of Swiss military aircraft being involved the Airforce, and any person giving proof of a well-founded interest in the investigation result may request the report be examined by the Review Board for completeness and conclusiveness (art. 22 para. 1 VFU).

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# Investigation Report

Owner	Trans Euro Air Ltd, London Southend Airport Southend-On-Sea, Essex, UK
Operator	Trans Euro Air Ltd, London Southend Airport Southend-On-Sea, Essex, UK
Aircraft type	Beechcraft B90 King Air
Country of registration	United Kingdom
Registration	G-OJRO
Location	Zurich Airport
Date and time	27 September 2007, 12:38 UTC

## Synopsis

On 27 September 2007 the Beech B90 aircraft, registration G-OJRO, under flight number TRJ 927P, took off at 10:15 UTC from Southend (UK) on a cargo flight to Zurich (CH) under instrument flight rules. The pilot was alone on board. After an uneventful flight, the pilot received radar vectors for an approach on runway 14 from Zurich approach control.

The pilot subsequently asked if he could reduce his speed to 160 KIAS. To the later question about how long he could maintain this speed on approach the pilot responded as follows: *"Three miles"*. The speed of 160 KIAS was above the maximum permitted speed for extending the landing gear.

The pilot intended to make a so-called long landing. The aircraft touched down on runway 14, 1452 metres after the runway threshold, with its gear retracted, crossed the right edge of the runway after a further 615 metres, rotated about its vertical axis through 90 degrees clockwise and came to a standstill approximately five metres from the runway edge.

The pilot was able to vacate the aircraft unaided. The aircraft was badly damaged.

## Investigation

The accident took place at 12:38 UTC. The Aircraft Accident Investigation Bureau (AAIB) was informed at 12:42 UTC. The investigation was opened the same day at approximately 13:30 UTC.

The accident is attributable to the fact that the pilot forgot to extend the landing gear under self-imposed pressure of time.

The fact that the pilot decided to maintain, for an excessive period, a speed which made it difficult for him to establish the final approach configuration in good time contributed to the accident.

## 1 Factual information

### 1.1 Flight preparation and history of the flight

#### 1.1.1 General

The recordings of radio communication, the radar data and the statements of the pilot and air traffic controllers were used for the following description of the flight preparation and history of the flight.

The flight took place under instrument flight rules.

#### 1.1.2 Flight preparation

The documentation for flight preparation provided by the operator was very comprehensive and was handed over to the pilot in a 'crew briefing information packet'. The documents included the corresponding weather documentation, NOTAM and ICAO flight plans for all three flights scheduled for that day, from Southend (UK) to Zurich (CH), from Zurich to Coventry (UK) and from Coventry back to Southend.

In addition, these documents included a reporting form to be completed by the pilot (limited flight brief + voyage report), which also provided information on the maximum permitted flying duty times.

#### 1.1.3 History of the flight

On 27 September 2007 the Beech B90 aircraft, registration G-OJRO, under flight number TRJ 927P, took off at 10:15 UTC from Southend (EGMC) on a cargo flight to Zurich (LSZH). The pilot was alone on board. After an uneventful flight, the pilot of TRJ 927P made contact with the Zurich Arrival East air traffic control unit at 12:14:56 UTC.

The air traffic controller (ATCO) informed the pilot that he should expect a radar vectored approach on runway 14 and instructed him to continue the flight in accordance with the last clearance and maintain flight level (FL) 90.

At 12:23:38 UTC the air traffic controller asked the pilot for his speed. The ATCO then instructed the pilot to maintain the reported speed of 180 KIAS.

At 12:25:00 UTC the pilot requested clearance to start his descent. The pilot immediately received clearance to descend to 7000 ft QNH and the information that he was still in Class E (Echo) airspace and would be orientated as soon as he entered Class C (Charlie) airspace.

At 12:26:09 UTC, the ATCO informed the pilot that he still had a flight path of 32 NM ahead of him. About one minute later, the ATCO instructed the pilot of flight TRJ 927P to turn right onto a heading of 270 degrees and to descend to 6000 ft QNH. At 12:27:25 UTC the ATCO informed the pilot that he was now in Class C airspace.

At 12:30:32 UTC, the ATCO gave the pilot the following instruction: "*Tango ro-meo juliet nine two seven papa descend now to four thousand feet cleared ILS approach runway one four report established*". The pilot confirmed this instruction at 12:31:13 UTC and at the same time requested: "... *request to reduce speed one-sixty.*"

The ATCO immediately cleared the pilot to reduce his speed to 160 KIAS. At 12:31:23 UTC the ATCO asked the pilot how long he could maintain a speed of 160 KIAS on final approach. According to the ATCO's statement, this question was asked because of a following Cessna Citation executive aircraft. The pilot answered: "*Three miles*", i.e. up to three nautical miles, corresponding to 5.5 km from the threshold of runway 14. Since this response was immediate and calm, the ATCO assumed that this did not cause the pilot any problems. The maximum permitted speed for landing gear extension on the Beech B90 aircraft is 156 kt calibrated air speed (KCAS).

At 12:33:27 UTC the pilot reported: "... *established localizer one four*". According to his statement he did not use the autopilot for the entire approach. Two minutes later, the ATCO requested the pilot, as had been discussed, to maintain 160 KIAS until three nautical miles to the runway threshold and to switch to the Zurich Tower frequency.

The pilot of TRJ 927P reported to aerodrome control (ADC) at 12:35:39 UTC as follows: "*Zurich Tower tango romeo juliet nine two seven papa established ILS for one four, one-sixty miles up to three miles final*". The ATCO confirmed this report and made the pilot aware of a helicopter which, in relation to his aircraft, was approximately in the 11 o'clock position and some three nautical miles distant, flying north.

According to radar recordings, at approximately 3 NM the aircraft was on the glidepath at a speed of approximately 160 kt and at a height of approximately 1000 ft above the ground. The pilot then reduced speed for landing. He intended to make a so-called 'long landing'<sup>1</sup>, in order to be able to leave the runway without delay after landing. The pilot was unable to recall afterwards whether he had heard the acoustic warning for non-extended landing gear at any time during the approach.

At 12:37:02 UTC the ATCO gave the pilot of the Beechcraft B90 wind information and landing clearance for runway 14. The landing clearance was confirmed immediately by the pilot.

According to the pilot's statement, during the flare shortly before touchdown, approximately half a metre above the ground, he realised that the gear was not extended. He immediately pushed the throttle levers forward to initiate a go-around. The aircraft touched the ground at the same moment and the pilot then brought the throttle levers back to idle.

At approximately 12:38 UTC the aircraft touched down with its gear retracted and drifted first to the left and a little later to the right. It finally left the runway on the right side, turned clockwise through 90 degrees about its vertical axis and came to a standstill approximately 5 metres from the runway edge.

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<sup>1</sup> *Long landing*: a landing in which the aircraft touches down on the runway significantly after the official touchdown zone. In terms of traffic management, this procedure has the advantage that smaller aircraft in particular, with a shorter landing roll in relation to the available runway length, can vacate the runway more quickly. This applies especially when, as in the case of runway 14, taxiways for exiting the runway are located mainly at the end of the runway.

On a crossway before the threshold of runway 14 there was an airport authority vehicle, callsign "Gusti 1", ready for a routine runway check. The landing aircraft attracted the attention of the driver of this vehicle because of its striking livery and he watched the landing. Since the landing seemed odd to him, he picked up his field-glasses to get a better view. He observed that the aircraft had landed without its landing gear down and at 12:38:30 UTC informed the GRO workstation in the tower by radio as follows: "*Turm Gusti 1, dä Flüger jetz uf dä Pischte 14 hät s'gear nid dusse gha.*" [Tower Gusti 1, the aircraft now on runway 14 had not extended its landing gear].

The ATCO in the ADC position heard this transmission to the GRO workstation. At 12:38:45 UTC he therefore asked the pilot: "*Tango seven papa confirm operation normal?*" At 12:39:08 UTC, the pilot replied as follows, among other things: "... *I made a gear up landing I got an incorrect ... gear indication on er... my gear could you please send someone*".

The pilot responded in the negative when asked if a fire had broken out. The pilot was able to vacate the aircraft unaided and uninjured.

## 1.2 Injuries to persons

Injuries	Crew	Passengers	Total number of occupants	Others
Fatal	---	---	---	---
Serious	---	---	---	---
Minor	---	---	---	---
None	1	---	1	---
Total	1	---	1	---

## 1.3 Damage to aircraft

The tips of the propeller blades were badly deformed. Subsequent damage analysis revealed a major requirement for inspection and repairs in the following areas:

- engine sudden stoppage inspection
- propeller replacement
- several panel and stringer repairs
- structure repair and landing gear door replacement

The necessary cost of repair, with the persisting uncertainties concerning the condition of the engines, was assessed by the relevant insurance company as uneconomical (beyond economical repair – BER). In insurance terms, this means a "constructive total loss (CTL)".

## 1.4 Other damage

There was minor damage. Traces of gouging by the propeller blades were visible on the runway. A runway light on runway 14 was torn off by the aircraft when it crossed the runway edge. No kerosene leak was detected.

## 1.5 Information on persons

1.5.1	Pilot	
	Person	Danish citizen, born 1979
	Licence	Commercial pilot licence aeroplane, (CPL), according to joint aviation requirements (JAR), first issued by the Statens Luftfartsvaesen/CAA-Denmark on 07.11.2003, valid till 18.06.2012
	Ratings	Class rating for single engine piston land – SEP(L), valid till 31.05.2008
		Type approval for BE90/99/100/200, valid till 31.08.2008
		Radiotelephony in Danish and English
		Comments: JAR FCL ATPL theory
	Instrument ratings	Instrument flying, aeroplane IR(A) ME, valid till 31.08.2008
	Last proficiency check	BE90/99/100/200 on 25.08.2007
	Medical fitness certificate	Class 1, without restrictions, valid till 23.10.2007
	Last medical examination	23.10.2006
	Commencement of pilot training	2001
1.5.1.1	Flying experience	
	total	986:15 hours
	on the accident type	150:05 hours
	during the last 90 days	128:45 hours
	of which on the accident type	128:45 hours
1.5.1.2	Duty times	

The following duty times (block times) were taken from the pilot's logbook:

Date	Route	Block OFF/ON	Block time	Rest time <sup>2)</sup>
25.09.2007	Southend (EGMC) Wroclaw (EPWR) Wroclaw (EPWR)	17:05 20:25 22:45	3:20 h	
26.09.2007	Ostend (EBOS) Ostend (EBOS) Coventry (EGBE) Coventry (EGBE) Southend (EGMC)	01:40 02:25 03:45 18:50 19:50	2:55 h 1:20 h 14:20 h	13:40 h
27.09.2007	Southend (EGMC) Zurich(LSZH)	10:15 12:38 <sup>1)</sup>	2:23 h	

<sup>1)</sup> In the pilot's logbook, the arrival time was indicated as 12:25 UTC.

<sup>2)</sup> The rest times take into account the regulations in the operator's OM A with regard to pre-flight and post-flight duties.

## 1.6 Aircraft information

### 1.6.1 General

Registration	G-OJRO
Aircraft type	Beechcraft B90 King Air
Characteristics	Twin-engined cargo aircraft with propeller turbine, with deactivated pressurised cabin, constructed as cantilevered low-wing aircraft, completely metal construction with retractable landing gear in nosewheel configuration
Manufacturer	Beech Aircraft Corporation
Year of construction	1967
Serial number	LJ-327
Owner	Trans Euro Air Ltd, London Southend Airport Southend-On-Sea, Essex, UK
Operator	Trans Euro Air Ltd, London Southend Airport Southend-On-Sea, Essex, UK
Engine	2 Pratt & Whitney PT6A-20 engines
Propellers	Hartzell HC-B3TN-3B/T10173B-8
Operating hours, airframe	Total hours since manufacture 21 602:14 hrs. The last check was carried out on 06.08.2007 at 21 479:14 hours. The next check was scheduled for 22.11.2007 at 21 650 operating hours.
Operating hours left engine	Total hours since manufacture 13 074:58 hrs. Since last periodic check: 1729:28 hours. This took place on 07.10.2005 at 11 345:30 operating hours.
Operating hours right engine	Total hours since manufacture 18 287:17 hrs. Since last periodic check: 3476:57 hours. This took place on 07.06.2002 at 14 810:20 operating hours. The time between overhaul – TBO is 3600 hrs.
Max. permitted take-off mass	4377 kg
Max. permitted landing mass	4158 kg
Mass and centre of gravity	According to the flight plan the mass of the aircraft at the time of the accident was approximately 3650 kg. Both mass and centre of gravity were within the prescribed limits.
Technical limitations	In the DDR (deferred defect record), the item <i>LH no fuel transfer light</i> was outstanding; it involved no operational limits.

Fuel grade	JET A1 kerosene
Fuel reserve	According to the flight plan, take-off fuel was 2519 lb (1142.6 kg). Among other things, this included trip fuel of 1314 lb (596 kg). The minimum quantity for the planned flight had been calculated as 1818 lb (824.7 kg).
Registration certificate	Issued by the United Kingdom Civil Aviation Authority on 13.09.2007, valid till revoked.
Airworthiness certificate	Issued by the United Kingdom Civil Aviation Authority on 13.09.2007, valid till 12.09.2008.
Certification	According to AOC No. GB 2254 (Ops Spec Issue No. 7): as a passenger and cargo aircraft
	The aircraft was put in service for the first time by the owner on 16.09.2007. At this time, the aircraft had 21 567:33 hours of operation and 19 419 cycles. Since the last overhaul, the left engine had completed 1693:17 operating hours and the right engine 3440:34 operating hours

#### 1.6.2 The landing gear

A 28 volt (V) DC motor on the front of the central main spar activates the gear extension and retraction mechanism. Spring-loaded friction clutches between the gearbox and the torque shaft protect the system in the event of a mechanical defect and a resettable 50 amp (A) fuse next to the pilot's seat provides protection against electrical overload.

A direct link from the rudder pedals enables the nose gear to be turned 14 degrees to the left and 10 degrees to the right. When this rudder control is supported by the brakes, the nose gear can be deflected 48 degrees to the left and right. When the gear is retracted it is automatically centred and control via the rudder is deactivated.

The position of the gear can be verified visually via various lights. Three green lights labelled GEAR DOWN light up when the gear is extended and locked. The landing gear handle lights up red when the gear is either in transition or not locked. It also lights up when the landing gear warning horn is activated. All indicator lights can be checked for functioning.

If one or both throttle levers are reduced below a specific minimum power, an intermittent warning tone sounds if the gear is not extended. If the throttle levers remain in this position, the warning tone can be deactivated by pressing the WARN HORN SILENCE pushbutton, as long as the landing flaps are in the UP position. The warning tone then remains suppressed until either the flaps are extended or the throttle levers are pushed and then pulled back again.

### 1.6.3 Findings after the accident

After the aircraft had been raised slightly by a crane, it was apparent that the landing gear doors were closed. The landing gear handle in the cockpit was in the "DOWN" position. The flaps were in the APPROACH position (35%). When the battery was switched on, the intermittent landing gear warning tone then sounded and the landing gear handle lit up red. The noise of the landing gear motor was audible at the same time. The battery was then switched off immediately. From the outside it was apparent that the landing gear doors had now opened slightly.

The aircraft was raised further and brought to a position over runway 14. In this position, the battery was switched on again. As a result, the landing gear extended. The three green landing gear lights lit up and indicated that the gear was extended and locked. A mechanical check on the landing gear confirmed this condition. The landing gear warning tone was no longer audible after the gear was extended.

## 1.7 Meteorological information

### 1.7.1 General

The information in chapter 1.7.2 to 1.7.5 was provided by MeteoSwiss and that in chapter 1.7.6 by skyguide.

### 1.7.2 General weather situation

*A low-pressure area centred over southern Germany and northern Italy determined the weather in Switzerland. Less humid air was temporarily conveyed from the east towards the area of the Alps.*

### 1.7.3 Weather at the time and location of the accident

<i>Cloud</i>	<i>1/8 at 2900 ft AMSL, 6-7/8 at 3900 ft AMSL</i>
<i>Weather</i>	<i>---</i>
<i>Visibility</i>	<i>about 20 km</i>
<i>Wind</i>	<i>south-west at 6 kt</i>
<i>Temperature/dewpoint</i>	<i>10 °C / 06 °C</i>
<i>Atmospheric pressure</i>	<i>QNH LSZH 1004 hPa</i>
<i>Position of the sun</i>	<i>Azimuth 206°, elevation 38°</i>
<i>Hazards</i>	<i>Moderate icing above FL060</i>

### 1.7.4 Forecasts and warnings

The following TAF was issued for Zurich-Kloten airport (LSZH):

*LSZH 270900Z 271019 28005KT 9999 FEW010 SCT015 BKN030 TEMPO 1014  
4500 RA BKN010 T10/12Z T12/15Z*

### 1.7.5 Measured and observed values

METAR Zurich-Kloten (LSZH) airport for the period before and during the accident

*LSZH 271220Z 23005KT 190V260 9999 FEW015 BKN025 10/06 Q1004 NOSIG=  
LSZH 271250Z 21006KT 170V240 9999 FEW015 BKN025 10/06 Q1004 NOSIG=*

### 1.7.6 Zurich airport ATIS reports

Before and during the accident, the following ATIS reports were being transmitted:

#### ***INFO LIMA***

*LDG RWY 14 ILS APCH  
QAM LSH 1150Z 27.09.2007  
200 DEG 6 KT  
VIS 20 KM  
  
CLOUD FEW 1200 FT. BKN 2900 FT  
+10/+06  
QNH 1004 ZERO FOUR  
QFE THR 14 954  
QFE THR 16 954  
QFE THR 28 953  
  
NOSIG*

#### ***INFO MIKE***

*LDG RWY 14 ILS APCH  
QAM LSH 1220Z 27.09.2007  
210 DEG 7 KT  
VIS 20 KM  
  
CLOUD FEW 1500 FT. BKN 2500 FT  
+10/+06  
QNH 1004 ZERO FOUR  
QFE THR 14 954  
QFE THR 16 954  
QFE THR 28 953  
  
NOSIG*

### 1.8 Aids to navigation

Instrument landing system (ILS) 14 was being used as a navigation aid. ILS 14 is CAT IIIB compatible and equipped with distance measuring equipment (DME).

All system components of ILS DME 14 were in normal operation at the time of the accident and were available without restriction.

### 1.9 Communications

Radio communication between the pilot and the air traffic controllers involved took place normally and without difficulties up to the time of the accident.

## 1.10 Aerodrome information

### 1.10.1 General

Zurich Airport is located in north-east Switzerland. The airport reference point (ARP) has coordinates N 47 27.5 / E 008 32.9 and an aerodrome elevation of 1416 ft AMSL.

The dimensions of Zurich airport runways are as follows:

Runway	Dimensions	Elevation runway thresholds
16/34	3700 x 60 m	1390/1385 ft AMSL
14/32	3300 x 60 m	1405/1402 ft AMSL
10/28	2500 x 60 m	1391/1416 ft AMSL

### 1.10.2 Runway equipment

Zurich airport is characterised by a system of three runways, two of which (16 and 28) intersect at the airport reference point. The approach corridors of two other runways (16 and 14) intersect approximately 850 metres north-west of the threshold of runway 14. Runways 16 and 14 are equipped with a Category IIIB instrument landing system (ILS), runway 34 with a CAT I system and runway 28 with an "uncategorised" ILS.

### 1.10.3 Operational restrictions as a result of the accident

The alarm was raised at 12:38 UTC and runway 14 was closed to further traffic.

After salvage of the aircraft, repair of the damaged runway light and the subsequent clean-up operations on runway 14, the runway was released again on 27 September at 15:40 UTC.

## 1.11 Flight recorders

For the aircraft involved in the accident, neither a flight data recorder (FDR) nor a cockpit voice recorder (CVR) are prescribed, so these were not fitted.

However, it is possible to draw certain conclusions concerning events in the cockpit of the aircraft involved in the accident from the radio communication recordings. Thus during the approach, in the course of two reports from the pilot to the ADC ATCO, a warning tone is audible in the background, though it cannot be conclusively attributed.

A characteristic warning tone is audible in the background for the duration of the report by the pilot to aerodrome control to confirm landing clearance at 12:37:07 UTC. The same applies to the two pilot's reports to the ADC ATCO after the landing with gear not extended. It is very probable that this warning tone corresponded to the landing gear warning tone.

## 1.12 Wreckage and impact information

According to the pilot's statement, during the flare shortly before touchdown, approximately half a metre above the ground, he noticed that the gear was not extended. He immediately pushed the throttle levers forward to initiate a go-around. The aircraft touched the ground at the same moment and the pilot then brought the throttle levers back to idle. The first traces of the propeller blades on the surface of runway 14 are visible 1452 metres after the runway threshold.

The aircraft then drifted slightly to the left and a little later to the right, before crossing the right edge of the runway after 615 metres. In the process, a runway lamp was torn off. The aircraft then rotated 90 degrees to the right about its vertical axis and came to a standstill five to six metres from the runway edge (see Annex 1).

Apart from the badly deformed propeller blades, the aircraft exhibited no major external damage. There was no leakage and about 600 l of kerosene were defuelled before further investigations.

The aircraft was then lifted by a mobile crane, brought above the runway and after a brief examination it was possible to extend the landing gear normally. A mechanical check confirmed that the gear was extended and locked. It was then possible to lower the aircraft onto the runway and transport it using a towbar.

### **1.13 Medical and pathological information**

There are no indications of the pilot suffering any health problems during the flight involved in the accident. An alcohol test proved negative.

### **1.14 Fire**

Fire did not break out.

### **1.15 Survival aspects**

There was no direct danger for the pilot because the airframe remained intact, the aircraft only left the runway shortly before it came to rest and fire did not break out.

### **1.16 Tests and research**

Since a flight recorder was not fitted to aircraft G-OJRO, it was only possible to reconstruct the approach profile using the radar recordings. The radar recording of the final approach was analysed. The approach profile was then compared with the standard glidepath (see Annex 2).

Using the same radar data it was also possible to derive the approach speed. It must be borne in mind that the speed shown in Annex 2 is not the speed indicated in the aircraft but the ground speed.

### **1.17 Organisational and management information**

#### **1.17.1 The operator**

The Trans Euro Air company is an operator based in London Southend (UK) providing commercial passenger and cargo flights. The company is in possession of an AOC (Air Operator Certificate) number GB 2254. At the time of the accident, Trans Euro Air operated aircraft types Piper Seneca PA 34 III, Piper Navajo PA 31, Beech King Air B90 and Cessna Titan C404.

### 1.17.1.1 Operating procedures

Among other things, the following is stated in the airline's Operation Manual (OM) A, in chapter 8.4.1.3.10:

*All pre-landing checks should be completed before the aeroplane descends below 1000 ft above the runway threshold excepting only type specific and/or late phase items such as landing flaps, lights, windscreen wipers etc. This is in order that the final stages of the approach can be adequately monitored.*

For a normal 3° glidepath, this height of 1000 ft corresponds approximately to a distance of 3 NM before the runway threshold.

### 1.17.1.2 Work with checklists

Onboard aircraft G-OJRO there was a laminated checklist "NORMAL CHECKLIST BE-90 OY-JRO". It should be pointed out that the designation OY-JRO corresponds to the registration assigned to aircraft G-OJRO before the change of owners. It should also be noted that this checklist, publication date 01.05.2003, is designed for two-man operation. A distinction is made between CDR (commander) and F/O (first officer) and between PF (pilot flying) and PNF (pilot not flying).

In addition, a pilot's checklist by the manufacturer for normal procedures and for emergency procedures for the King Air C90B aircraft type was onboard the aircraft involved in the accident. This checklist, part number 90-590024-71B dated August 1995, is an older version of the checklist produced for the King Air C90B type. According to the aircraft manufacturer it is not applicable to the aircraft involved in the accident.

According to the aircraft manufacturer, the "Beechcraft King Air B90 pilot's checklist", part number 65-001123-27D dated 20 May 1988, is the only valid checklist for G-OJRO.

The manufacturer's pilot's checklist present on the aircraft involved in the accident explicitly required a flap setting in the DOWN (100%) position for landing, whereas the actual checklist valid for the King Air B90 model does not specify this as mandatory.

According to the pilot's statement, the operator's instructor responsible for the King Air had informed him on the occasion of the operator proficiency check (OPC) that basically he did not think that the idea of using checklists for single crew operation was a good one. He would prefer all procedures, including emergency procedures, to be carried out by rote. Then, if time permitted, the manufacturer's old pilot's checklist could be used as a cross check, even if it was designed for a different aircraft type.

**1.18 Additional information**

On 9 January 2007, an incident occurred which has parallels with the accident currently under investigation. The same aircraft, at that time still registered as OY-JRO and with a different owner, was on a ferry flight from Coventry to Cardiff. The aircraft was being flown by a pilot who had a total of 8000 hours of flying experience, of which 2200 hours were on Beechcraft B90s.

During the landing approach on runway 30 in Cardiff, the air traffic controller noticed that the landing gear was not extended and ordered the approaching pilot to go around. Only during the go-around did the pilot become aware that he had forgotten to extend the gear.

The approach was made in rain showers, with a strong cross wind and turbulence. According to the pilot's statement, the autopilot was not able to keep the aircraft stabilised and had to be switched off.

The pilot's heavy workload and the stormy weather were deemed to be responsible for the fact that the pilot had not taken notice of the acoustic warning about the non-extended landing gear (UK AAIB Bulletin 8/2007).

**1.19 Useful or effective investigation techniques**

Not applicable.

## 2 Analysis

### 2.1 Technical aspects

There are no indications of any pre-existing technical defects which may have contributed to the accident.

After it had come to a standstill, the aircraft was lifted by a crane and the battery was switched on. Among other things, this resulted in the landing gear warning sounding. It can therefore be assumed that this warning was functional during the flight. This assumption is confirmed by the radio communication recordings. During the reports given by the pilot on approach and shortly before and after landing a warning tone is audible in the background, very probably corresponding to the landing gear warning tone.

The recording of the flight path based on the radar data allows the conclusion that the approach took place approximately on the nominal glidepath. In the given configuration of the aircraft, this would have required a power setting which should have caused the landing gear warning tone to sound, at least occasionally. The fact remains that this warning did not generate an adequate reaction from the pilot.

The warning also functioned in a comparable case (see chapter 1.18) but was not consciously perceived even by a pilot with much greater flying experience. This leaves open at least the question of whether a different type of warning could increase the pilot's attentiveness.

### 2.2 Human and operational aspects

#### 2.2.1 Pilot

When the arrival air traffic controller (ATCO) asked the pilot at 12:31:23 UTC how long he could maintain a speed of 160 KIAS on final approach, the latter answered spontaneously: "*Three miles*". It is understandable that the pilot wished to support optimal traffic flow by means of the resulting late reduction in speed. On the other hand it is questionable whether the pilot was aware that as a result he was putting himself under additional pressure during the final approach. In addition, the entire approach was flown without the autopilot and this further increased the workload in the cockpit. The fact that the pilot, according to his statement, was used to flying without the autopilot does not change the situation.

At approximately 3 NM the aircraft was on the glidepath at a speed of approximately 160 kt and at a height of approximately 1000 ft above the ground.

The airline's OM A states that all pre-landing checks should be carried out before the aircraft descends below a height of 1000 ft above the elevation of the runway threshold. This is intended to ensure that the final approach can be monitored adequately (see chapter 1.17.1.1). This condition was not met. The speed of 160 KIAS was above the maximum permitted speed of 156 kt calibrated air speed (KCAS) for extending the landing gear. In this speed range the indicated air speed (IAS) corresponds approximately to the calibrated air speed (CAS). Inside the aircraft, the pilot only has the indicated air speed available.

The radar data indicate that the aircraft was following the nominal glidepath between 3 NM and just before the runway threshold. The reduction in speed took place in this phase.

Shortly before the runway threshold, the pilot flattened the glidepath in order to make a long landing. This procedure is not unusual for small aircraft on large aerodromes or rather those with long landing runways, where it is a matter of leaving the runway quickly after landing. Flattening the glidepath required an increase in engine power. This must have caused the landing gear warning tone, which is audible on the radio communication recordings during confirmation of the landing clearance, to be silenced again. This warning tone was probably audible again only when the pilot brought the throttle levers back to idle during the flare for the landing. At this moment, according to his statement, the pilot realised that the gear was not extended and he wanted to go around. However, it was too late to do this. The fact that the landing gear handle was found in the DOWN position after the landing can be explained by the fact that the pilot instinctively put it in the DOWN position before he left the aircraft.

The fact that during the approach, until a distance of 3 miles from the runway threshold, a speed was maintained which did not permit the establishment of the final approach configuration made it more difficult to control the speed in the final phase of the approach and did not allow a stabilised final approach. In addition, the pilot was working without checklists. All this indicates that work was not being performed in the cockpit in a sufficiently systematic manner. The relevant instructor's principles for flying in single crew operation, as described by the pilot, reinforce this impression. It is, therefore, not surprising that in these circumstances the pilot did not react to the landing gear warning tone.

## 2.2.2 The operator

The documentation regarding flight preparation made available by the operator was very comprehensive and complete.

The same does not apply to the two checklists found onboard the aircraft. One described only normal operation and was designed for two-man operation. The other was not revised and applied to a different aircraft type. Thus, for example, the checklists onboard required setting the flaps to the DOWN (100%) position whilst the valid checklist according to the aircraft manufacturer allows use of the flaps on the APPROACH (35%) position for landing.

Much more serious is the difference between the two checklists when, for example, one compares the emergency procedures for an engine failure or for an engine fire respectively.

The fact that invalid checklists, which in part also deviated from the aircraft manufacturer's specifications, were onboard the aircraft indicates that insufficient emphasis was placed on a systematic method of working in relation to the operation of the aircraft.

## 2.2.3 Air traffic control

About seven minutes before the landing, air traffic control asked the pilot how long he could maintain a speed of 160 KIAS. The pilot offered to maintain this speed until 3 NM before the runway threshold. This offer was accepted by air traffic control and converted into an instruction. The manner in which air traffic control came to an agreement with the pilot concerning the reduction in speed was appropriate.

### 3 Conclusions

#### 3.1 Findings

##### 3.1.1 Technical aspects

- The aircraft was licensed for VFR/IFR transport.
- The mass and centre of gravity of the aircraft were within the permitted limits at the time of the accident.
- The investigation produced no indications of any pre-existing technical defects which might have caused the accident.

##### 3.1.2 Crew

- The pilot was in possession of the necessary licences for the flight.
- There are no indications of the pilot suffering any health problems during the flight involved in the accident.
- The maximum flight duty times and the minimum rest times were complied with.
- The pilot made the decision to maintain a speed of 160 KIAS until a distance of 3 miles from the runway threshold independently and without any pressure from air traffic control.
- This decision put the pilot under pressure during the final approach.
- The decision to maintain a speed of 160 KIAS until a distance of 3 miles from the runway threshold was in contradiction to the operator's procedures, which state that all pre-landing checks should be completed by 1000 ft above ground.

##### 3.1.3 History of the flight

- After an uneventful flight, an approach on runway 14 was performed.
- In view of the traffic, the pilot was asked whether and how long he could maintain a speed of 160 KIAS.
- The pilot answered: "*Three miles*", i.e. until a distance of 3 NM before the runway threshold.
- The maximum permitted speed for extending the landing gear on the aircraft type involved in the accident is 156 KCAS.
- The pilot intended to make a long landing in order to be able to vacate the runway more quickly after landing.
- During the flare, about half a metre above the runway, the pilot realised that the gear was not extended.
- An immediately initiated go-around was not successful.
- The aircraft touched down on the runway without its gear extended, crossed the right runway edge after 615 metres and came to a standstill on the grass.
- The pilot was able to vacate the aircraft unaided and uninjured.

### 3.1.4 General conditions

- The aircraft manufacturer's checklist applicable to the aircraft involved in the accident (normal procedures and emergency procedures) was not on board.
- The weather conditions had no influence on the accident.

## 3.2 Causes

The accident is attributable to the fact that the pilot forgot to extend the landing gear under self-imposed pressure of time.

The fact that the pilot decided to maintain, for an excessive period, a speed which made it difficult for him to establish the final approach configuration in good time contributed to the accident.

Berne, 9 October 2008

Aircraft Accident Investigation Bureau

This report contains the AAIB's conclusions on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with Annex 13 of the Convention on International Civil Aviation of 7 December 1944 and article 24 of the Federal Air Navigation Law, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent future accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the accident investigation. It is therefore not the purpose of this investigation to determine blame or clarify questions of liability.

If this report is used for purposes other than accident prevention, due consideration shall be given to this circumstance.

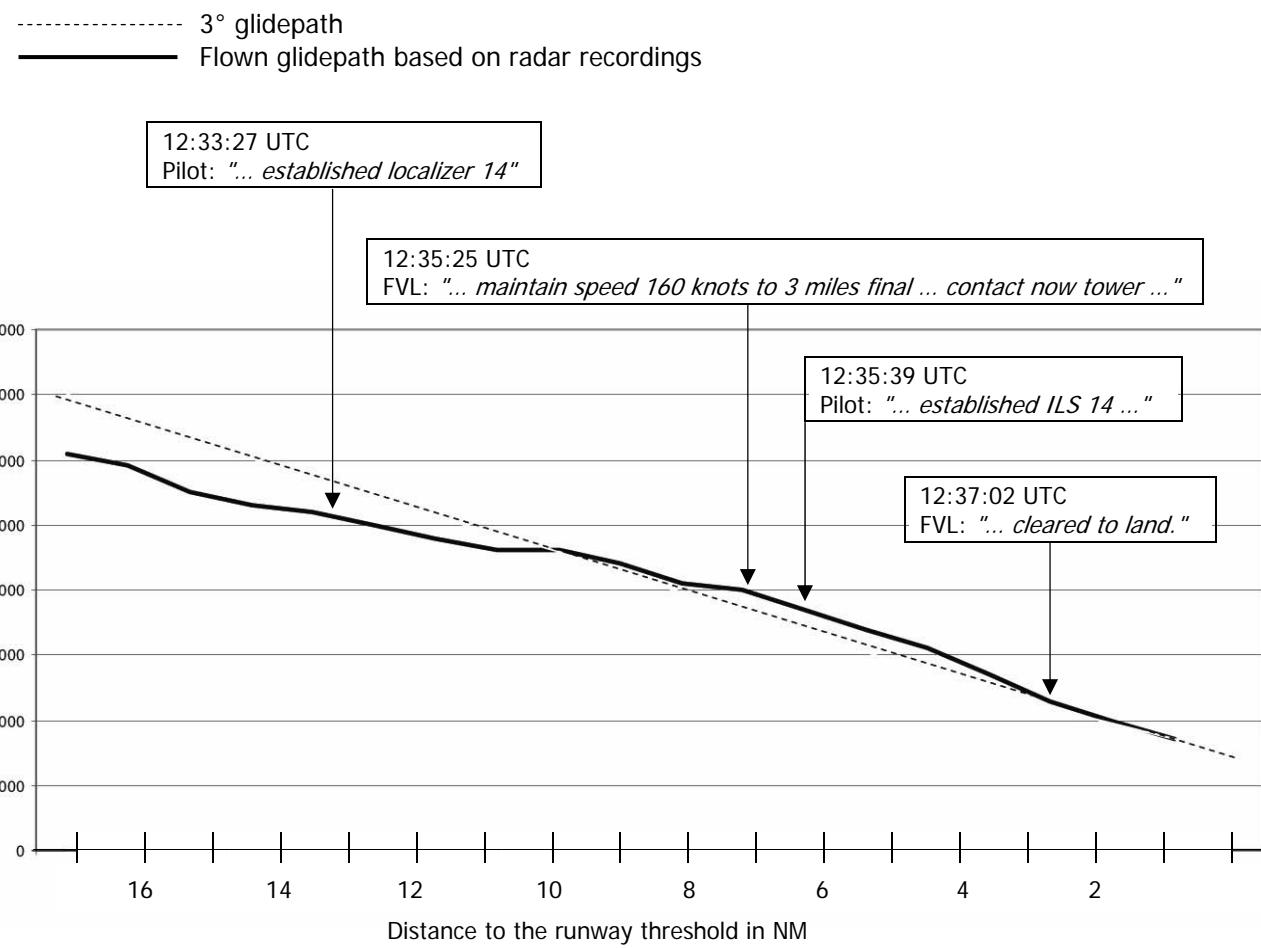
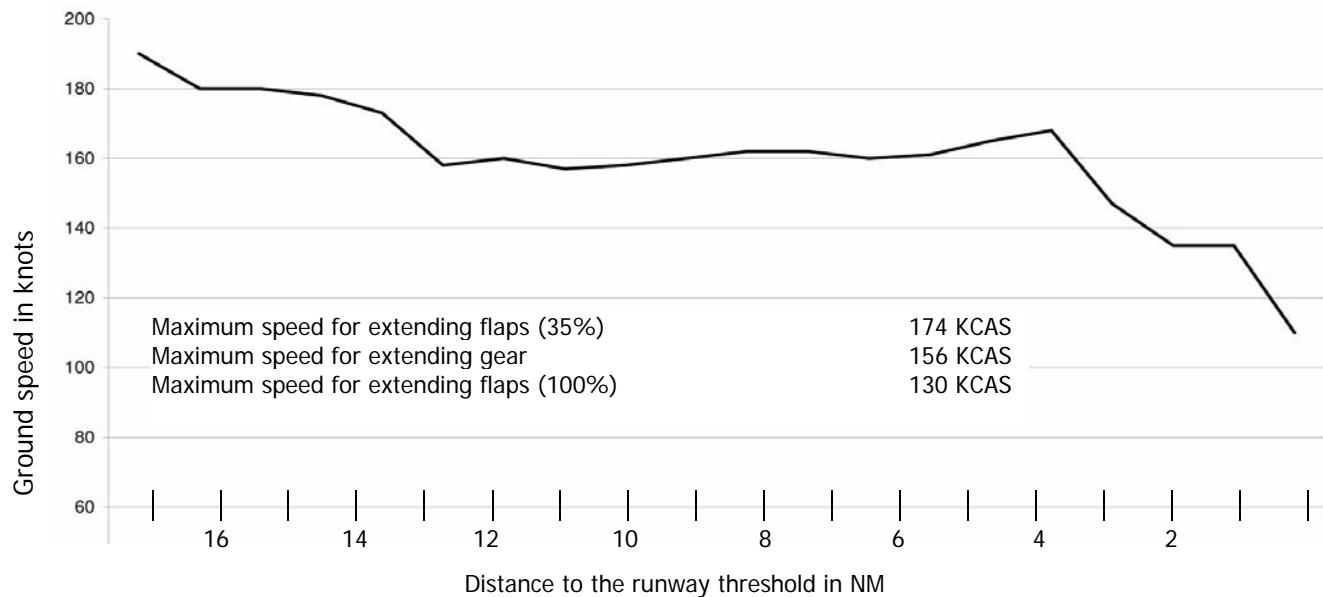
Annex 1

The aircraft after landing



## Annex 2

## Approach profile G-OJRO

Speed during the approach (ground speed)<sup>1)</sup>

<sup>1)</sup> In the current prevailing wind, the speed indicated in the cockpit was 3 to 4 knots higher