INCIDENT

Aircraft Type and Registration:	Boeing 757-2T7, G-MONE
No & Type of Engines:	2 Rolls-Royce RB211-535E4-37 turbofan engines
Year of Manufacture:	1985
Date & Time (UTC):	17 March 2006 at 1945 hrs
Location:	On approach to Gibraltar Airport
Type of Flight:	Public Transport (Passenger)
Persons on Board:	Crew - 8 Passengers - 186
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	45 years
Commander's Flying Experience:	11,772 hours (of which 8,381 were on type) Last 90 days - 112 hours Last 28 days - 47 hours
Information Source:	AAIB Field Investigation

Synopsis

Following a surveillance radar approach (SRA) to Runway 09 at Gibraltar Airport, the flight crew lost visual contact with the runway after passing the Visual Decision Point (VDP). During the subsequent go-around, the crew did not follow the correct missed approach procedures but ATC provided effective heading control to avoid the high ground. The lowest altitude of the aircraft when over the land was 2,100 ft. The highest point on the land, just south of the airfield, is 1,420 ft.

Following the incident, ATC and the aircraft operating company made changes to procedures to reduce the chances of a similar occurrence. Additionally, it was considered that the airport lighting should be improved and a recommendation has been made to that effect.

History of the flight

The crew were operating a flight from Luton Airport to Gibraltar Airport. This was their first flight of the day. Company regulations required the landing at Gibraltar to be flown by nominated captains only, hence the commander was the handling pilot. Prior to flight, the crew checked the destination weather, which indicated that the current and forecast weather was within the required JAR-OPS limits of 1,000 ft cloud ceiling and 5,000 m visibility but that there was a possibility of the visibility deteriorating temporarily below limits at the expected arrival time. Due to the forecast, the crew decided to take an extra 1,000 kg of fuel. Before departure, the first officer inserted the route into the Flight Management Computer (FMC), including the

approach to Runway 09; the commander then checked the route and modified the final approach to provide a vertical profile.

The flight was initially uneventful apart from occasional moderate turbulence. Once within radio range of Gibraltar, the crew checked the latest weather. This indicated a surface wind of 060º at 10 kt and visibility of 5,000 m with the lowest cloud scattered (SCT) at 1,000 ft. The commander then briefed the first officer on the SRA approach and associated missed approach procedure for Runway 09 .

During the subsequent descent, the aircraft was transferred to 'Gibraltar Approach' and cleared eventually to 1,500 ft with radar vectors towards point 'Victor'; a navigation point some 9 nm south of Gibraltar. The crew also asked for an update on the weather, which was reported as visibility 5,000 m in rain, cloud 'FEW' at 1,000 ft, 'SCT' at 1,800 ft and 'BKN' (broken) at 3,000 ft. During the westerly track to 'Victor', the crew configured the aircraft for landing and completed the landing checks. The aircraft was being flown on autopilot with the autothrottles engaged and each pilot had 'Map' displayed on his horizontal situation indicator (HSI). Prior to descent, the first officer had checked the accuracy of the map information and the commander later made a further check of the accuracy using the Gibraltar DME. Using the heading selector in response to ATC instructions, the aircraft positioned on a northerly heading past 'Victor'. The accuracy of the aircraft map display was consistent with radar information provided by ATC and the aircraft was cleared to commence descent at the '5.0 nm Radar Fix'. The commander selected a vertical descent speed of 700 ft/min and an indicated airspeed of 135 kt. It was drizzling but the aircraft was clear of cloud and the crew could see the lights of ships on the surface but no lights from the land. As the aircraft approached the VDP at 1,000 ft, the accuracy of the map display was confirmed and the commander saw the runway strobe lights in the expected position. He confirmed that the first officer could also see the strobe lights and when the 'Talk-Down' controller asked if the crew were visual with the runway, the first officer replied in the affirmative. The commander selected 090º on the heading selector and the aircraft started a right turn at approximately 20 to 25º angle of bank. With the angle of bank steady, the commander disconnected the autopilot and autothrottles, selected his flight director off and maintained the existing angle of bank and descent rate of about 700 ft/min. As he was doing so, he continued to check that he could still see the runway strobe lights. The first officer monitored the heading selection and pre-selected the 'Tower' frequency in preparation for an expected frequency change. He also monitored the airspeed and was then aware of ATC asking if they were still visual with the strobe lights. At about the same time, the commander lost sight of the strobe lights and asked the first officer if he still had them in sight. At this stage, the commander considered that he was maintaining a constant heading. The first officer was not visual with the strobes so the commander called "GO-AROUND, FLAP 20". The commander applied manual go-around thrust but did not select the 'Go-Around' switch on the thrust levers. When a positive rate of climb was achieved, the gear was retracted. The first officer informed ATC that they were going around and noted that his ADI was not annunciating 'GA'. He advised the commander who then selected the 'Go-Around' switch; 'GA' was annunciated and the flight directors commanded a climb on the existing aircraft track. About then, ATC instructed the aircraft to turn right onto a track of 180º. The first officer selected the heading to 180º and, as the aircraft turned, noted high ground depicted on the left side of his HSI display; prior to the approach, the EGPWS 'TERRAIN'

function had been selected. Once level at the missed approach altitude, the commander made the decision to divert to Malaga Airport because he considered that low cloud may have resulted in the crew losing sight of the runway strobe lights. The diversion was uneventful and the crew reported the incident when they arrived back at Luton Airport the next morning.

The 'Talk-Down' controller noted that the radar had been producing intermittent returns within about 7 nm range. However, prior to the approach by G-MONE other aircraft had carried out successful approaches to Runway 09. During the approach by G-MONE, the controller noted that there were no primary radar returns from the aircraft at the VDP but checked that the crew were visual with the runway and then cleared the aircraft to land. Thereafter, he monitored the approach using intermittent secondary radar returns. However, at just under two miles range the controller noted that the aircraft appeared to be right of the required track. Two further secondary returns and a very faint primary radar return also indicated that the aircraft was right of track and the controller asked the crew to confirm that they were still visual with the runway. The crew responded that they were not visual and were going around. The controller monitored the aircraft track and noted that the aircraft was apparently in a right turn. He considered that it was turning towards the 'Rock'; high ground immediately south of the airfield at 1,420 ft. He issued a warning about the proximity of the 'Rock' together with an instruction to tighten the turn. When he was confident of the aircraft position from improved radar returns, the controller instructed the crew to turn onto a heading of 180º. Once the aircraft was clear of the land, the controller asked for the crew's intentions and then co-ordinated the diversion to Malaga.

Recorded information

Both ATC and the flight crew reported the incident to their respective organisations but the AAIB was not informed until 22 March. By then the Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) had been overwritten. Nevertheless, the aircraft Quick Access Recorder (QAR) data was available and provided useful information. Additionally, the R/T had been recorded and was also available.

QAR data

The flight path of the aircraft during the incident period was constructed from data recorded on the QAR. This flight path is presented in Figure 1. It commences as G-MONE tracked north on 001ºM towards the VDP. At the VDP, the aircraft was at an altitude of approximately 1,000 ft, at a computed airspeed of 133 kt, and was descending at just under 900 ft/min. G-MONE then entered a descending turn to the right, achieving a maximum recorded bank angle of just over 26º.

Thirty seconds after the aircraft commenced the turn, the engine thrust increased for the 'Go-Around'. At this point G-MONE was descending through 650 ft at 134 kt, with a bank angle of 8º to the right and turning through a heading of 077ºM. The aircraft descended a further 100 ft to 550 ft before it entered a climb. It then achieved a climb rate of about 3,000 ft/min whilst turning onto a heading of 140ºM. It remained on this heading for 12 seconds before turning left onto a heading of 134ºM for a further 12 seconds, followed by a turn to the right onto a heading of 180ºM. As G-MONE turned onto the heading of 180ºM, it was overland and climbing through 2,100 ft.

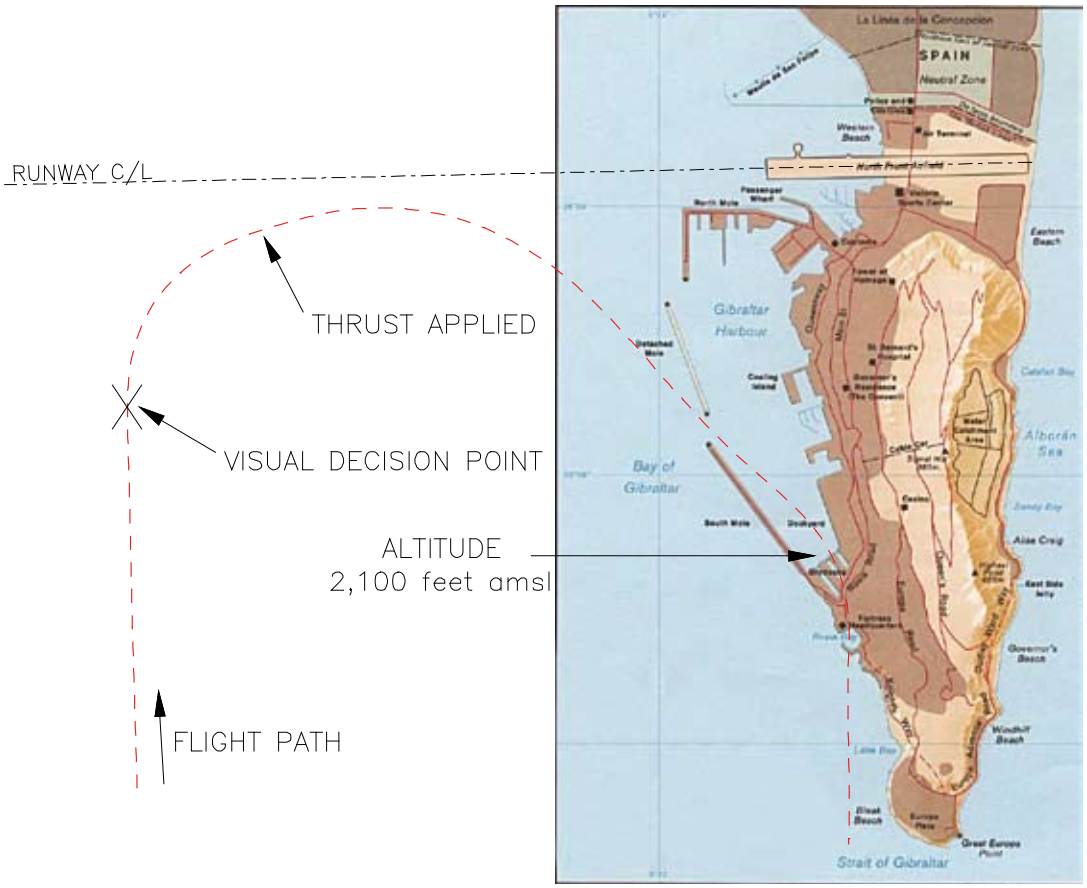

Figure 1

Reconstructed flight path of G-MONE

R/T information

Both 'Approach' and 'Talkdown' frequencies were recorded. G-MONE was transferred from 'Approach' to 'Talkdown' at 1940 hrs and, by 1945:19 hrs the aircraft was heading 360ºM at 1,500 ft amsl and 5.5 nm from touchdown. The controller gave G-MONE clearance to commence descent for a 3º glidepath at 5 nm range and thereafter provided advisory altitudes. At 4 nm range, G-MONE was cleared to land and at 3 nm range (VDP), at 1946:30 hrs, the crew were asked for confirmation that they were visual with the runway. With no immediate response from the crew, the controller transmitted a further request for confirmation and then, with the crew confirming that they were visual, G-MONE was cleared to continue visually for landing. Forty seven seconds after G-MONE passed the VDP, the controller transmitted that the aircraft appeared to be south of track and asked for confirmation that the crew were visual with the runway. The crew replied that they were not visual and were going around. The controller responded with an instruction to tighten the turn and 15 seconds later, informed G-MONE that contact had been regained and instructed the aircraft to turn right onto 180º. At 1948:15 hrs, the controller advised the crew that the aircraft was now passing to the west of Europa Point (the south easterly point of Gibraltar). At 1949:28 hrs, the crew requested a diversion to Malaga Airport.

Operational information

Operating company information

The company assessed Gibraltar as a Category 'B' airport, which required nominated captains to be the handling pilot for the landing. The associated written brief for the airport included information additional to that within the Jeppesen charts. Following this incident the company reviewed the brief and added further information.

Both crew members had previously flown into Gibraltar, and had utilised the SRA approach to Runway 09.

The crew duties for a standard missed approach procedure were detailed in the company Operations Manual Part B. This required the pilot flying to announce "GO AROUND FLAP 20", advance the thrust levers and to press the '*Go-Around*' switch. Thereafter, the crew would retract the gear once a positive rate of climb had been achieved and would monitor the annunciation of 'GA' on the ADI.

The activation of a thrust lever '*Go-Around*' switch would result in the flight director bars appearing on each pilot's ADI, regardless of the position of the flight director switches. The flight director would then command a climb and a heading to maintain the existing ground track of the aircraft. A subsequent selection of *'HDG SELECT'* or *'L NAV'* would give the crew the option of following a selected heading or the programmed missed approach route. However, this selection would cause each pilot's flight director bars to retract from view unless the respective flight director switch was 'ON'.

ATC information

The airport has white low-intensity lights installed each side of the runway, and blue lights at the edge of the runway shoulders, in accordance with existing regulations. The sea wall is indicated by a row of omni-directional red lights and the runway threshold is indicated by a row of uni-directional green lights. PAPIs for Runway 09, set for a 3º descent, are positioned each side of the runway 91 m from the threshold. A strobe light is positioned each side of the threshold for Runway 09, and angled towards the VDP to assist visual acquisition of the runway. This was required because of the presence of other cultural lighting, the low intensity of the runway lights and the lack of conventional approach lights. The ATC procedures required these strobe lights to be '*switched off when aircraft at 2 nm unless required by pilot*'. Additionally, to help with approach guidance, there is a marker buoy with a flashing amber light positioned on the extended centre line of the runway 4,500 ft from the sea wall. There is also a strobe light on each side of the sea wall as a warning to maritime vessels.

All the lights for Runway 09 had been checked as serviceable on both the day of the incident and the following day. Additionally, the ATC assistant confirmed that he had not switched off the strobe lights during the approach of G-MONE since he was not visual with the aircraft. The crew confirmed that both had initially seen the strobe lights but had seen neither the marker buoy light nor any runway lights.

In reported weather conditions of visibility 3,700 m or less, or SCT cloud 700 ft or less, the required ATC procedure was to ask the crew if they are visual with the runway at the VDP.

The published missed approach for Runway 09 is as follows:

'Continue in radar pattern as directed climbing to 3,900' (3885'). When over the upwind end of the runway, or passing 1,900' (1,885') in IMC, climb on runway heading.'

The standard ATC instructions for a missed approach from the VDP is to turn the aircraft onto a north-easterly heading to ensure that the aircraft remains well clear of the 'Rock'.

In marginal weather conditions the ATC procedure is to keep the aircraft on 'Talkdown' frequency, and not to transfer it to 'Tower' until after landing.

The highest obstacle on Gibraltar is on top of the 'Rock' at 1,420 ft.

Weather

The Gibraltar TAF, issued at 1400 hrs and valid between 1500 and 2200 hrs was as follows: visibility of 8,000 m in haze; cloud FEW at 1,000 ft, SCT at 2,000 ft; becoming from 1700 to 2000 hrs, visibility 6,000 m in light rain; cloud SCT at 1,000 ft. There was a 40% probability of a temporary deterioration between 1900 and 2200 hrs to 4,000 m in moderate rain; there was also a 30% probability of a temporary deterioration between 1900 and 2200 hrs to 2,500 m in heavy rain and cloud SCT at 500 ft.

The METAR for 1850 hrs indicated a surface wind from 040º at 6 kt, visibility of 5,000 m in rain, cloud FEW at 1,000 ft, SCT at 1,800 ft and BKN at 3,000 ft. The air temperature was 15ºC, the dew point was 13ºC and the QNH was 1007 mb. The trend indicated no significant change.

The METAR for 1950 hrs indicated a surface wind from 070º at 06 kt, visibility of 5,000 m in moderate rain, cloud FEW at 300 ft, SCT at 1,600 ft and OVC at 4,000 ft. The air temperature was 14ºC with a dew point of 14ºC. The trend indicated a temporary deterioration of 4,000 m visibility in rain and cloud SCT at 1,000 ft.

Throughout the period from 1500 to 2300 hrs, the wind at 2,000 ft was forecast to be from 130º at 20 kt becoming 190º at 20 kt. At 1950 hrs, the wind measured near the top of the 'Rock' was from 090º at 10 kt.

ATC investigation

Immediately after the incident, Gibraltar ATC carried out a comprehensive investigation into the incident. The conclusion was that the controllers and assistants had operated correctly and in accordance with their procedures. The investigation also reviewed the present procedures and made the following recommendations:

1. Controllers to confirm with crews at the VDP that they are visual with the runway regardless of weather conditions. If the crew do not acknowledge promptly that they are visual, the controller will initiate the missed approach procedure. NB*: This recommendation was accepted and an operating instruction was issued to ATC staff on 23 March 2006.*
2. That the runway strobe lights are left on until approaching aircraft are at 1 nm range. NB: *This recommendation was accepted and an operating instruction was issued to ATC staff on 23 March 2006.*
3. An evaluation of the performance of the primary radar and consideration of the need for guidelines for controllers to indicate when the radar performance is not suitable for SRAs.

Analysis

The incident occurred when the crew lost sight of the runway strobe lights after the VDP and commenced the missed approach procedure. During the go-around, the crew did not fly the required heading and ATC became concerned that the aircraft was heading towards high ground. Effective action by the controller ensured that the aircraft's track remained clear of the high ground, even though the altitude of the aircraft was such that no collision risk existed. This analysis covers aspects considered relevant to the incident.

Airport

Gibraltar Airport was considered by the operating company as an airport with a need for particular briefing and crew qualification. The local topography can result in wind variations resulting in strong turbulence and rapidly changing visibility and cloud conditions. These aspects are well documented but must be considered in relation to the location and characteristics of the runway and the lack of approach aids. This is particularly relevant to operations at night when the low intensity of runway lighting, lack of effective approach lighting and proximity of other cultural lighting means that visual acquisition of the runway is difficult to achieve and to maintain. The airport procedures are constantly under review and changes were made shortly after the incident.

Flight crew

The crew were qualified to operate into Gibraltar and were familiar with the procedures. They were aware that the weather was marginal and carried additional fuel. In accordance with company requirements, they configured the aircraft for landing and established the correct airspeed and rate of descent prior to the VDP. This should have ensured that at the VDP the crew were able to visually acquire the runway and maintain visual contact. To enable early visual contact, the handling pilot made full use of the automatic features of the aircraft. At the VDP, both crew members saw the runway strobe lights, confirmed this fact to ATC and the commander commenced a turn to line up on the runway. Seated in the left cockpit seat, it would be difficult for the commander to maintain visual contact with the runway in the right turn. This would be particularly relevant as he would also be involved in other actions such as disconnecting autopilot and autothrottles, switching off the flight directors and transferring to manual flight. It would be easier for the pilot in the right seat to maintain visual contact with the runway but, with the limited runway lights and the ambient lighting at Gibraltar, it would be necessary to maintain continual contact. The first officer acknowledged that he preset a radio frequency during the right turn in anticipation of an expected radio change. It was therefore possible that both pilots may have been 'looking in to the cockpit' at the same time and thus both lost visual contact with the strobe lights. It was also possible that a patch of cloud may have obscured the lights. Nevertheless, it appeared that the approach briefing had not emphasised sufficiently the importance of maintaining visual contact with the strobe lights.

When visual contact was lost, the crew were required to carry out the missed approach procedure. The aircraft was now right of the centre-line and turning right, although the commander thought that he was maintaining a constant heading. This right turn continued as the commander advanced the thrust levers until he was reminded to select the 'Go-Around' switch. When he did so, the flight director bars appeared and commanded the current aircraft track, which was now approximately 140º. Neither pilot was fully aware of

this heading as their priority was to initiate a climb and reconfigure the aircraft. With the climb established the priority would then be to ensure that the aircraft was on the correct missed approach track. However, shortly after the initiation of the missed approach ATC provided heading instructions and the controller's prompt actions resolved the situation.

Without CVR and FDR information, it was not possible to determine the exact timings and actions of the crew. Nevertheless, it was apparent that the crew had not maintained continual visual contact with the runway and then did not comply fully with the go-around procedures. Following the incident, the operating company circulated an account of the incident to all their crews together with appropriate lessons. Additionally, the company crew brief for Gibraltar was reviewed and additional information included on the airport and the associated procedures.

General

During the investigation, it was apparent that an approach into Gibraltar in the minimum permitted weather conditions requires a high level of concentration and effective co-ordination by the crew and ATC. While the operating company and ATC have produced operating procedures based on the existing facilities, a critical factor would appear to be the maintenance of visual contact with the runway. With the limited airport lighting, this currently means that one crew member must continually maintain visual contact with the runway strobe lights, thereby reducing his capacity to monitor the flight parameters. Given the high intensity of the cultural lighting in the vicinity of the airport, more effective approach and runway lighting would provide more capacity for the crew to monitor these parameters. The following recommendation is therefore made:

Safety Recommendation 2006-065

It is recommended that the air regulator review the airport lighting at Gibraltar with the aim of providing, for civilian operations from the airfield, runway approach lighting and improved the runway lighting.

With the other actions taken by ATC and the aircraft operating company, it is not considered necessary to make any further recommendations.