ATR72-202, G-BWTL

AAIB Bulletin No: 7/98 Ref: EW/C97/12/5 Category: 1.1

Aircraft Type and Registration:	ATR72-202, G-BWTL
No & Type of Engines:	2 Pratt & Whitney Canada PW-124B turboprop engines
Year of Manufacture:	1995
Date & Time (UTC):	21 December 1997 at 1906 hrs
Location:	Enroute from Jersey
Type of Flight:	Public Transport
Persons on Board:	Crew - 4 - Passengers - 50
Injuries:	Crew - None - Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	59 years
Commander's Flying Experience:	15,161 hours (of which 3,101 were on type) Last 90 days - 165 hours Last 28 days - 47 hours
Information Source:	AAIB Field Investigation

History of flight

The crew reported for duty at 1005 hours. Their first scheduled sector was an 1120 hrs departure for Cork, returning to Gatwick at 1515 hrs. This was to be followed by a 1545 hrs departure for Jersey, returning to Gatwick at 1815 hrs. For operational reasons the first sector was changed to an 1140 hrs departure for Amsterdam, returning to Gatwick at 1450 hrs. The late arrival of some of the passengers delayed departure until 1320 hrs; the aircraft arrived back at Gatwick at 1640 hrs.

The aircraft eventually took off at 1740 hrs for Jersey; the first officer was the handling pilot. The flight progressed normally and the aircraft was transferred to Jersey Zone control at 1801 hrs. At that time the RVR on Runway 09 was greater than 1,500 metres. The aircraft was transferred to Jersey Approach control at 1808 hrs and was given radar vectors for the ILS approach to Runway 09.

By 1811 hrs the RVR had reduced to 750 metres at touchdown, 600 metres at midpoint and 650 metres at the stop end; the required minima was 800 metres. The commander decided to hold at the 'JW'. Before the aircraft reached the beacon, there was a temporary improvement to 800 metres but no sooner had the commander decided to make an approach than it deteriorated to 550 metres. The aircraft continued towards the 'JW' and descended to 3,000 feet.

At 1818 hrs the RVR increased to 900 metres and once again the commander decided to attempt an approach. The crew reported that they could see most of the island except for the area around the airport. At 1820 hrs, the RVR reduced to 350 metres. The approach was discontinued from the downwind position and the aircraft entered the hold at SHARK at 2,000 feet.

The RVR remained constant at 400 metres for some time and, at 1831 hrs, the commander told ATC that he could hold for a further 15 minutes before having to return to Gatwick. He then requested the RVR on Runway 27; this was 1,500 metres at touchdown, 450 metres at midpoint and 400 metres at the stop end. He decided to make an approach to Runway 27, however, the RVR reduced to 600 metres, the minima for Runway 27. It deteriorated further to 350 metres but then improved to 1,500 metres. The commander decided to continue the approach but by the time the aircraft had reached the base leg, the RVR had reduced to 400 metres. The approach was discontinued and the aircraft headed towards the 'JSY' VOR to take up the hold. The commander made the decision to divert to Gatwick at 1847 hrs; he reported that the fuel remaining at that time was 1,160 lb.

The commander called London Area Control at 1900 hrs and was told there were delays of 30 to 35 minutes at Gatwick; he was given a direct routing to Goodwood and told to expect a WILLO 3C arrival. The commander acknowledged this and requested "---- A PRIORITY LANDING AS WE'VE BEEN HOLDING DOWN AT JERSEY----". The controller asked how much holding fuel he had and was told about 15 minutes.

At 1903 hrs, the controller advised the commander that he would be asked on the next frequency if he was declaring an emergency. He explained that it was the only way ATC would be able to give him a priority approach. The commander then told ATC that he would be able to hold for about 5 minutes. He confirmed that he would be declaring an emergency and the controller suggested that he "MIGHT AS WELL DECLARE YOUR EMERGENCY NOW". The commander confirmed this at 1905

hrs and was subsequently told that he would be given radar vectors for a WILLO 3C arrival followed by a straight in approach.

The first officer expressed his reservations about the commander's decision to declare an emergency in order to continue the diversion to Gatwick; he considered that Southampton was the preferred option as the weather was better and it was not fuel critical. He continued to express his reservations even after the commander had made his decision.

At 1920 hrs, the commander called Gatwick Director and reported that they were descending to FL70 on course to Goodwood. Over the next two minutes the following transmissions were exchanged between the commander and ATC:

Aircraft "----HOW ARE YOUR QUEUES NOW WE BY DECLARING AN EMERGENCY WE WERE TOLD WE WOULDN'T BE DELAYED WE COULD HOLD FOR TEN MINUTES OR SO AND CANCEL THE EMERGENCY IF THE DELAYS WERE ONLY TEN MINUTES OR SO".

Controller "--- THEY'RE STILL IN EXCESS OF TWENTY MINUTES".

Aircraft "---OH STILL IN EXCESS OF TWENTY MINUTES".

Controller "---YOU WISH TO CONFIRM THAT YOUR EMERGENCY STILL EXISTS".

Aircraft "----IT LOOKS AS IF WE REALLY OUGHT TO GO TO SOUTHAMPTON AND NOT DECLARE THE EMERGENCY ORIGINALLY WE WERE TOLD HALF AN HOUR WHICH WAS IMPOSSIBLE FOR US AND WE DON'T REALLY WANT TO DECLARE AN EMERGENCY ALTHOUGH IT'S A BIT LATE FOR THAT NOW".

Shortly after this the commander spoke to the Company Operations. The first officer monitored this conversation which initially went normally but then he became aware that the commander was not responding. He reported that when he looked across at the commander, he was slumped in his seat, his head was down and his eyes appeared to be "unfocused". There were beads of sweat starting to appear on his forehead. The first officer talked to him and shook his arm, however, he got no response.

Just before 1926 hrs the first officer made the following transmission:

"---WE DO DEFINITELY WANT TO CONTINUE TO GATWICK NOW MY SKIPPER IS NOT THAT WELL CURRENTLY I'LL KEEP YOU INFORMED I THINK HE'S STILL WITH ME"

At about 1927 hrs, the commander appeared to suddenly recover from his incapacitation. Initially, he was very animated and after a short period of confusion he continued in the role of non-handling pilot. The crew executed a standard Category 2 approach; the commander took control at decision height and carried out a normal landing. The aircraft was on the ground at 1938 hrs.

A Local Standby had been initiated by ATC. The AFS attended the aircraft and followed it to the stand. The commander had apparently fully recovered and declined to be examined by the paramedics who attended; both crew members were interviewed by Airport Police before they left the stand area.

Meteorology

There was a ridge of high pressure extending south west across England and Wales from a centre over Scandinavia. The Weather was very misty with local fog patches, particularly over the sea and coast in the west. The visibility was generally 2,000 to 3,000 metres but locally reduced to 700 to 1,000 metres. The cloud was broken, base 800 to 1,000 feet, locally 100 to 300 feet; it was overcast at 1,500 feet.

Relevant METARS

EGJJ (Jersey)

1750Z 12007KT 0700 R09/1000 8BCFG SCT000 BKN001 07/07 Q1012 TEMPO 1200

1820Z 11005KT 0300 R09/0500 FG BKN000 08/08 Q1012 TEMPO 1200

1850Z 11006KT 0400 R09/500 FG BKN000 07/07 Q1012 BECMG 1200

EGKK (London Gatwick)

1850Z 10003KT 1000 R26L/1100 BR OVC001 06/05 Q1013 TEMPO 0700 BCFG

1920Z 06004KT 1500 R26L/P1500 -DZ BR BKN001 OVC040 05/05 Q1014

TEMPO 0700 BCFG

1950 080004KT 040V150 1800 -DZ BR FEW001 BKN005 BKN035 05/05 Q1014

TEMPO 1500 BKN003

EGHI (Southampton)

1850Z 00000KT 3000 HZ SCT006 BKN012 05/04 Q1013

1920Z 06001KT 2500 HZ SCT006 BKN012 05/04 Q1014

ATIS Information OSCAR at London Gatwick was:

"THIS IS GATWICK INFORMATION OSCAR THE ONE EIGHT FOUR FIVE HOURS WEATHER RUNWAY IN USE TWO SIX LEFT BE ADVISED GATWICK LOW VISIBILITY PROCEDURES ARE IN OPERATION DEPARTING AIRCRAFT USE CATEGORY THREE HOLDS AT ALPHA FIVE WIND ONE ZERO ZERO DEGREES AT THREE KNOTS VISIBILITY ONE THOUSAND METRES WEATHER MIST CLOUD OVERCAST AT ONE HUNDRED FEET AIR TEMPERATURE PLUS SIX DEW POINT PLUS FIVE QNH ONE ZERO ONE THREE MILLIBARS QFE ONE ZERO ZERO SIX MILLIBARS ON FIRST CONTACT WITH GATWICK REPORT INFORMATION OSCAR RECEIVED AND STATE YOUR AIRCRAFT TYPE".

The commander had recorded this information on the flight log.

Fuel planning

Company policy

The Flight Planning and Performance section of the Route Manual specifies the planned Minimum Fuel Requirement. This includes 'Fuel from destination to the DA/MDA at alternate'. To this is added 5% contingency. Also included is 'Reserve fuel based on 45 minutes holding at the alternate'. A standard amount, 350 kg, is quoted for the ATR 72.

Under the heading EN-ROUTE FUEL REQUIREMENTS it states:

> 'In flight the fuel expected to remain at the Missed Approach Point (MAP) of the intended destination should not be less than the sum of the alternate fuel, including contingency and the holding fuel. This sum to be described as the Company Minimum Reserve (CMR).'

Under the heading FINAL RESERVE FUEL (FRF) it states:

> 'As a general rule, an emergency exists when the fuel remaining is estimated to have reduced to an amount where an approach to land should be started without delay.'

and:

> 'If at any time it becomes apparent that the aircraft MAY land with less than FRF then a PAN call to ATC may be appropriate, reporting fuel remaining in minutes.
>
> If at any time it is evident that the aircraft WILL land with less than FRF then a MAYDAY must be declared.'

CAP 360 advises that the FRF should, at the least, be the sum of:

a) fuel to carry out an approach to Decision Height/Altitude or Minimum Descent Height/Altitude;

b) fuel to carry out a go-around, visual circuit and landing;

c) fuel, that although indicated on the gauges, is unusable;

d) 5% of the sum of a), b), and c).

The company Route Manual quotes a standard FRF for the ATR 72 of 450 kg.

Fuel calculations

The fuel on board before start was recorded as 1,870 kg. The fuel required for the Gatwick to Jersey, alternate Gatwick sector was calculated to be 1,395 kg. When at 1847 hrs the decision was made to divert, the fuel state was 1,160 kg.

On the Gatwick to Jersey log the figure of 451 kg had been ringed on the diversion fuel table; this was the fuel required for a diversion to Gatwick in a 20 kt headwind and included 5% contingency. This had been rounded to 450 kg for ease of calculation. The fuel calculation is summarised below:

Fuel on board 1,160 kg

Diversion Fuel (LGW) 450 kg

Standard Hold 350 kg

CMR 800 kg

Extra fuel 360 kg (equivalent to about 45 min hold)

The commander had made subsequent fuel calculations on the Jersey to Gatwick log. A calculation, which he had made at about 1900 hrs, recorded the fuel remaining as 930 kg. Using a fuel flow of 240 kg per engine, this calculation is summarised below:

Fuel on board 930 kg

Fuel to Gatwick 240 kg

Fuel overhead 690 kg

690 kg is sufficient fuel to hold for about 1:26 hrs , however, to land with the Company FRF, 450 kg, this time would be reduced to about 30 minutes.

The column in which this calculation was made is designed for the determination of extra fuel available for holding at destination and requires the CMR to be calculated. The commander had entered the single figure of 605 kg on the DIV + RES line. The figure of 255 kg had been ringed on the diversion fuel table; this was the fuel required for a diversion to Southampton from Gatwick in a 20 kt headwind and included 5% contingency. It would be usual to add the standard holding fuel, 350 kg to this to obtain CMR. This would appear to be the derivation of the 605 kg.

This figure has been subtracted from 690 kg leaving 85 kg as fuel available to hold. This calculation is summarised below:

Diversion Fuel255 kg

Standard Hold 350 kg

CMR 605 kg

Extra fuel 690 - 605 = 85 kg (equivalent to about 10 min hold)

When interviewed, the commander recalled being concerned that 690 kg of fuel was less than he would like to have remaining on arrival at Gatwick. He had no recall of why he had deducted the CMR for Southampton but it is clearly the 85 kg which resulted from this which formed the basis of his declaration to ATC at 1904 hrs that he could only hold for about five minutes at Gatwick. The calculation implies that the commander was considering a further diversion to Southampton, should he not be able to land at Gatwick.

The basic calculation for a diversion from Jersey to Southampton, under the same conditions is summarised below:

Fuel on board 1,160 kg

Diversion Fuel (SAM) 332 kg

Standard Hold 350 kg

CMR 682 kg

Extra fuel 478 kg (equivalent to about 60 min hold)

Human factors

The commander was 59 years old, had been flying for 37 years and had over 15,000 hours, most of which were in the environment in which the incident occurred. The first officer was 29 years old, had been flying for 10 years and had about 3,000 hours; he joined the company in May 1997 and this was his first experience in multi-crew public transport environment. For many young pilots this type of operation is a stepping stone on the route from private pilot to commercial multi-jet captain and for many older pilots it is a way of extending their career to the age of 65. This situation is a fact of life in the aviation industry and is unlikely to change in the foreseeable future. A solid grounding in, and deep understanding of crew resource management (CRM) is essential for pilots at both ends of the age/experience spectrum if recognised safety standards are to be maintained. It should be appreciated that in this environment a commander will also have an informal training role even though he may have had no instructor training and may be given no recognition for this aspect of his work.

Gatwick was the primary alternate from Jersey and the preferred option for both the commander and the company was to bring the passengers back to Gatwick, the point of departure. He was concerned for the passengers whom he felt had been severely inconvenienced from the outset. He also thought that it might have been difficult to refuel and return to Gatwick before his crew had exceeded their duty time. However, Southampton was the better option as the weather was good and it was not fuel critical. By electing to continue to Gatwick, the commander had effectively created the emergency situation.

CRM training rightly encourages a first officer to play an active part in the decision making process, however, there is a fine dividing line between what a particular commander may perceive as positive and helpful, and what he may perceive as irritating and unhelpful. It is possible that the first officer took his questioning of the commander's decision to divert to Gatwick into the realm of irritation; the commander did perceive it as undermining his authority. On the other hand the commander may have been less than positive in his reaction to the first officer's observations; the possibility exists that he may already have entered the early stages of incapacitation.

When the first officer realised that the commander was incapacitated, he handled the situation exceptionally well and made the correct decisions to ensure the safety of the aircraft and its occupants. In subsequent interviews with the AAIB he displayed a commendable loyalty to his

commander and appeared genuinely concerned about his welfare. He was open and honest about his concern over the commander's decision to declare an emergency in order to continue to Gatwick and he was aware that he may have been over persistent in his questioning of that decision. Otherwise, at no time did he criticise the way the commander had conducted the flight before or after the latter's incapacitation.

When the commander made his sudden and, apparently complete recovery, the situation on the flight deck must have been very difficult for both pilots. He was aware that the first officer had touched his arm at some stage and asked him if he was alright. He recalled that he felt hot and was sweating but he was completely unaware that he had been totally incapacitated for about four minutes. There was an initial stage of confusion when he queried the aircraft's heading but after he had become reorientated, the commander appeared to perform perfectly normally and seemed to have suffered no obvious ill effect of his incapacitation. At this stage the cross flight deck relationship could have deteriorated to a level at which safety would have been compromised and it is to the credit of both pilots that this did not happen.

Factors involved in the incapacitation.

The commander's licence has been suspended while extensive medical tests are carried out; these test are still underway at the time of writing. There is no doubt that he suffered an incapacitation with impaired consciousness for about four minutes and there may have been a subtle decline into this state.

The previous day he had flown 1:10 hrs during a duty period from 0840 hrs to 1108 hrs. On the day of the incident, he started his duty at 1005 hrs. The commander felt well rested and could think of nothing which occurred during the off duty period which could have contributed to the incident. He was asked to identify the things he found irritating and/or stressful during the day. He rated each one for level of irritation/stress on a scale of 1 (least) to 5; the rating is bracketed after each paragraph. His list was comprehensive and started with the fact that the crew were rescheduled to operate to Amsterdam rather than Cork. The frustrations experienced on the ground are evident from the history of the flight and are typical of airline operation; most of these he rated as (2).

The following started from the aircraft's arrival in the Jersey Zone and were considered by the commander to have made a major contribution:

a) The fluctuating RVR frustrated the crew's attempts to land at Jersey and the commander felt that his passengers had already been severely inconvenienced and that he had failed them. (4)

b) The commander had expected to be given some priority because he was on a diversion and was irritated by the fact that he had to declare an emergency to get that priority. (4)

c) The commander felt that the first officer had undermined his authority by persistently questioning his decision to divert to Gatwick. (5)

He included the possibility of a low blood sugar level, however, he only rated it as (1). He was asked to produce a list of the food he had eaten, and at what time, since midday on the previous day. The list is summarised below:

Saturday 20 December

1300 hrs	Packet soup: sandwich: fresh fruit
1630 hrs	Hot drink and biscuit
1900 hrs	Hot meal; glass of red wine; ice cream and stewed fruit

Sunday 21 December

0810 hrs	Bowl of cereal; 2 cups of tea
1030 hrs	Cup of hot chocolate (from vending machine)
1400 hrs	Cup of Coffee; small soft ham roll; chocolate biscuit (Penguin)
1600 hrs	Cup of coffee

Note: The incapacitation was noticed by the first officer at about 1923 hrs.

CAA medical opinion is that the normal healthy body is able to maintain its blood sugar levels naturally and, over the short term food intake in not a contributory factor. However, hunger may

cause preoccupation and reduced attention and there is a potential safety benefit to be gained from providing aircrew with adequate food.

Note: Since this incident the company has begun to supply hot crew meals on certain rotations.

Reporting of serious incidents

The incident was reported to the AAIB by Gatwick ATC.

The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996 contain the definition of a Serious Incident and detail those whose duty it is to furnish information relating to accidents and incidents.

ICAO Annex 13 Attachment D. LIST OF EXAMPLES OF SERIOUS INCIDENTS, list typical examples of incidents which are likely to be serious incidents. The list is for guidance only, however, the following are included:

Flight crew incapacitation in flight

Fuel Quantity requiring the declaration of an emergency by the pilot

Both examples were evident on this flight so clearly a serious incident had occurred. Although an MOR was subsequently submitted to the CAA, neither the commander nor the company was aware that this was a serious incident, which should have been reported to the AAIB. Consequently no action was taken to preserve the evidence on the flight recorders. The cockpit voice recorder evidence would have been particularly useful in this incident.