

# Cessna Citation 550, VP-CTJ

<b>AAIB Bulletin No:</b>	<b>10/99</b>	<b>Ref:</b>	<b>EW/C99/3/3</b>	<b>Category:</b>	<b>1.1</b>
<b>Aircraft Type and Registration:</b>	Cessna Citation 550, VP-CTJ				
<b>No &amp; Type of Engines:</b>	2 Pratt & Whitney JT15D-4 turbofan engines				
<b>Year of Manufacture:</b>	1979				
<b>Date &amp; Time (UTC):</b>	30 March 1999 at 2000 hrs				
<b>Location:</b>	St Mawgan Airport, Cornwall				
<b>Type of Flight:</b>	Private (Corporate)				
<b>Persons on Board:</b>	Crew - 1 - Passengers - 7				
<b>Injuries:</b>	Crew - None - Passengers - None				
<b>Nature of Damage:</b>	See text				
<b>Commander's Licence:</b>	Commercial Pilot's Licence (USA) with Cayman Islands validation				
<b>Commander's Age:</b>	54 years				
<b>Commander's Flying Experience:</b>	2,232 hours (of which 579 were on type)				
	Last 90 days - 67 hours				
	Last 28 days - 27 hours				
<b>Information Source:</b>	AAIB Field Investigation				

## History of flight

The aircraft left Lisbon Airport, Portugal at 1750 hrs for a flight to St Mawgan Airport, Cornwall; it was a single pilot operation. The commander contacted St Mawgan ATC when he was about 200 nm from the Airport and was given the current weather. The surface wind was 160°/10 kt and Runway 13 was in use. However, the commander asked for an ILS approach to Runway 31 because he considered that a coupled ILS approach even with a tailwind was a better option than a PAR approach to Runway 13.

The commander reported that he flew an uneventful coupled approach. He was cleared to land at 4 nm when the surface wind was given as "170 degrees 12 knots which is a 7 knot tailwind". He disconnected the autopilot when he became visual with the runway at, he estimated, 280 feet agl. He told the Tower controller that he was visual "about 200 feet" and was asked if he wanted the runway lights turned down; he replied that he did not.

The commander thought that the visual part of the approach was normal until, at about 140 feet agl, he was "temporarily blinded by the landing lights reflecting from light mist drifting through my vision". He was about to initiate a missed approach when the runway became visual again.

However, a higher than normal rate of descent had developed and the aircraft sank rapidly into the glare of the approach lights.

The commander's own words graphically describe the final stage of the approach:

" ..... I was well below the glideslope. I applied full power, pulled back on the control column, felt a light bump and landed on the runway."

The aircraft landed at 2000 hrs and it was subsequently confirmed that it had struck and damaged both the AR15 surveillance radar marker and PAR reflector. On the final approach into St Mawgan the aircraft was below the cover of the radar sites from which recorded data is normally available, consequently no confirmation of the approach path was possible. The PAR was set up for Runway 13 so the approach was not monitored.

### **ATC recording**

The following extract from of the ATC tape intercommunication channel gives a firsthand description of the event as seen from the Tower:

"WE COULD SEE HIS LIGHTS COMING DOWN OUT OF THE FOG AND THEN HE JUST SEEMED TO GO VERY VERY SHARP RATE OF DESCENT AND AT ONE POINT HIS LANDING LIGHT DISAPPEARED BELOW THE LEVEL OF THE THRESHOLD LIGHTS

THAT'S HOW LOW HE WAS AND HE BUT HE WAS STILL AT THIS STAGE I WOULD SAY THE OTHER SIDE OF THE ROAD WE THOUGHT HE'D GONE INTO THE FIELD AT ABOUT QUARTER OF A MILE FINALS."

### **Meteorology**

The weather the commander received initially was the 1850 hrs METAR:

Surface wind 160°/10 kt

Visibility 3,500 metres in mist

Cloud 4 oktas at 200 feet

8 oktas at 400 feet

QNH/QFE 1010 mb/997 mb

Temp/Dew point +10°C/+10°C

The approach started at about 1950 hrs and the METAR at that time was:

Surface wind 150°/10 kt

Visibility 2,500 metres in drizzle

Cloud 2 oktas at 100 feet

6 oktas at 200 feet

7 oktas at 300 feet

QNH/QFE 1010 mb/996 mb

Temp/Dew point +10°C/+10°C

### **Radar markers**

The photograph at Figure 1 was taken looking back up the approach path to Runway 31 and shows in the foreground the PAR reflector and, nearer to the road, the AR15 marker. The first impact was with the 8 feet high AR15 marker. It is located on the runway centreline, 10 metres inside the airfield perimeter fence and 75 metres from the centre of the public road that runs parallel to the fence at this point. The distance from the marker to the start of the paved surface is 266 metres. The distance to the glidepath origin is 566 metres; on a normal approach path, an aircraft would be about 100 feet agl at this point. Assuming a groundspeed of about 120 kt and that the aircraft was on the glideslope when the autopilot was disconnected at 280 feet agl, the rate of descent between that point and the impact must have exceeded 950 fpm.

The PAR reflector is also located on the centreline, 46 metres from the AR15 marker and between it and the runway; it is 7 feet high.

### **Runway lighting**

Runway 31 at St Mawgan has a standard Calvert 5 bar, High Intensity Approach Light System, High Intensity Runway Edge Lights and Standard Centreline Lights. Visual Approach Slope Lights are available and are set at an angle of 3°. All lighting was serviceable at the time of the accident and the approach lights were at a medium setting.

### **Subsequent flight to Biggin Hill Airport**

The aircraft was based at Biggin Hill Airport, which was also its maintenance base. The following morning, the commander inspected the damage and decided it would be safe to ferry the aircraft back to its base for repair. He taped up the damaged composite area of the flap and planned to conduct the flight with the flap retracted.

The damage to the underside of the left wing appeared superficial, however after both wing tanks had been refuelled, the commander noticed a slight fuel leak from one of the underwing inspection panels. The left tank fuel gauge was unserviceable. Although he was confident that he had sufficient fuel for the flight, the commander decided that the safe option was to fill the right tank and feed both engines from it. The fuel state after this was estimated to be 1,500 lbs in the left wing tank and 2,400 lbs in the right wing tank. The aircraft took off from St Mawgan at 0858 hrs.

The takeoff, climb and initial cruise appeared normal, however as the flight progressed, the commander, who was hand flying the aircraft, found that he had to progressively correct a tendency to fly left wing low. By the time the aircraft had joined the visual circuit at Biggin Hill, he had to apply a considerable amount aileron to maintain a wings level attitude. As he turned downwind he noticed a significant amount of fuel venting from the left wing. He told ATC of the problem and

carried out an uneventful flapless landing at 0957 hrs. After landing the left wing tank was full, 2,400 lbs, and there was about 500 lbs in the right wing tank.

### **Aircraft fuel system**

Each wing is constructed to function as a storage tank for fuel, which is fed to its respective engine. An electric booster pump is used for engine starting and then, using motive flow pressure from the engine driven pump, a primary ejector pump in each cell picks up fuel from the sump area and delivers it under pressure to that engine. Two ejector type transfer pumps feed fuel from the aft inboard section of each tank to a sump. Under normal conditions, motive flow for these pumps is provided by the primary ejector pump output to the engine.

A crossfeed capability is incorporated which allows either engine to be supplied from the opposite tank or both engines to be supplied from the same tank. When crossfeed is selected the booster pump in the selected tank (in this case the right tank) comes on automatically and both crossfeed valves open. Three seconds later, the motive flow valve closes on the (left) engine receiving the crossfed fuel.

The motive flow for the transfer pumps in the left tank is taken from a point between the crossfeed valve and the engine, consequently crossfed fuel will not only feed the left engine but will also be fed, as motive flow, through the two transfer pumps into the left tank. As no fuel is being taken from that tank, its fuel quantity will increase.

The manufacturer confirmed that there will be an increase in fuel quantity to the fuel cell not being used during the crossfeed operation and the rate of transfer is about 950 lbs per hour.

### **Fuel system limitations**

The aircraft manufacturer supplied the following information:

1. "The Master Minimum Equipment List approved by the FAA for the model 500 which includes the model 550 states as follows:

Fuel Quantity Indicating System; One may be inoperative provided: a) Both fuel tanks are completely filled with fuel, b) fuel used or fuel remaining indicator is operative and c) both fuel flow indicators are operative."

2. "The limitations section of the Flight Manual lists a maximum imbalance of 200 lbs with an emergency imbalance of 600 lbs."

### **Damage to aircraft**

The first impact was on the forward underside of the left wing, just outboard of the main landing gear. As the aircraft moved forward one or both of the markers struck the area of the left flap which was of composite construction.

Initial visual inspection at the engineering facility indicated that damage was confined to Zone 521 and the left flap assembly; Zone 521 is forward of the wing spar between Wing Station (WS) 79.00 and WS 145.75. The left lower wing skin leading edge was dented between WS 92.00 and WS 150.00. Removal of the skin revealed that the wing rib, from the spar to the leading edge at WS

109, was buckled on the lower edge. The leading edge nose rib at WS 100.50 was buckled on the lower aft and aft edges. The lower left forward stringer between WS 79.00 and WS 109.50 was slightly bowed at the outboard section. The left flap assembly was damaged beyond economic repair.

The fuel quantity indicating system is a capacitance temperature compensated system with five probes in each wing tank. The left wing quantity indication had been intermittent prior to the accident and subsequent examination revealed a loss of contact on a wire in the left tank capacitance system. It is probable that the impact to the underside of the left wing caused this.

### **State of registry action**

The state of registry of the aircraft was the Cayman Islands and the Civil Aviation Authority of the Cayman Islands (CAA of CI) was notified of the accident when it occurred. The CAA of CI informed the AAIB that no authority for single pilot operation of VP-CTJ had been granted although, if an application had been made with proof of suitable training, they would probably have granted such authority.

The CAA of CI also pointed out that the accident invalidated the Certificate of Airworthiness and a violation of The Air Navigation (Overseas Territories) Order 1989 Articles 7, 9 and 11 had occurred because the commander had not had the damage assessed by a qualified person, who may or may not have issued a Certificate of Release to Service or, at least, applied for a Ferry Permit.

The Authority elected not to pursue a conviction at the time but issued a caution that any further violations might result in legal action. They also advised that single pilot operations should not be conducted until such time as a formal application had been submitted for consideration.