



**UNITED REPUBLIC OF TANZANIA**

**CIVIL AIRCRAFT ACCIDENT**

**REPORT ON THE ACCIDENT TO CESSNA U206 F  
AIRCRAFT REGISTRATION 5H – CTL WHICH  
OCCURRED ON 27 OCTOBER 1997  
AT MSIMBAZI VALLEY NEAR SEGEEA,  
DAR ES SALAAM.**

MINISTRY OF COMMUNICATION AND TRANSPORT

ACCIDENT INVESTIGATION BRANCH

CIVIL AIRCRAFT ACCIDENT NO. CA139/197

REPORT ON THE ACCIDENT TO CESSNA U206F AIRCRAFT  
REGISTRATION 5H-CTE WHICH OCCURED ON 27 OCTOBER  
1971 AT MSIMBAZI VALLEY NEAR SREGERA ROAD (06°22.09'S  
039° 10.65'E)

**MINISTRY OF COMMUNICATION AND TRANSPORT**

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**CIVIL AIRCRAFT ACCIDENT NO. CAV/ACC/13/97**

**REPORT ON THE ACCIDENT TO CESSNA U206F AIRCRAFT  
REGISTRATION 5H-CTL WHICH OCCURED ON 27 OCTOBER  
1997 AT MSIMBAZI VALLEY NEAR SEGEREA ROAD (06<sup>0</sup>52.09'S  
039<sup>0</sup> 10.65'E)**

THE UNIVERSITY OF CHICAGO  
DEPARTMENT OF CHEMISTRY

RESEARCH REPORT

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**TANZANIA ACCIDENT INVESTIGATION BRANCH**

**AIRCRAFT ACCIDENT NO. CAV/ACC/13/97**

AIRCRAFT TYPE AND MODEL : CESSNA U206F

REGISTERED OWNER : M/S COASTAL TRAVELS LTD

OPERATOR : COASTAL TRAVEL LTD  
P.O. BOX 3052  
DAR ES SALAAM.

NATIONALITY : TANZANIAN

REGISTRATION : 5H-CTL

PLACE OF ACCIDENT : 1.4 Nautical miles from  
Dar es Salaam International  
Airport, Near Segerea Road  
(Msimbazi valley)  
Latitude: S 06<sup>0</sup> 52.09'  
Longitude: E 039<sup>0</sup> 10.65'

DATE AND TIME : 27th October 1997 05:48

CREW : 1

PASSENGERS : 5

ALL TIMES UTC

## SYNOPSIS

The accident was notified to Accident Investigation Branch by the Dar es Salaam Air Traffic Services at 06:50 hours on 27th October 1997. The investigation began the same day.

The aircraft was operating a scheduled passenger flight from Zanzibar to Dar es Salaam, with a pilot and five passengers on board when, as the flight was on short finals for runway 14 of Dar es Salaam International Airport, the engine coughed and started to lose power. The pilot immediately switched on the electrical fuel pump initially in the low position and then in the high position. However, the engine kept on losing power until it stopped.

The pilot then on realising that the aircraft would not be able to make it to runway 14, decided to make an emergency landing in a rice field. The aircraft landed and came to rest at approximately 150 meters from the touch down point. All the six occupants evacuated the aircraft with no injury.

Just before the aircraft stopped, it tipped nose down, the nose landing gear sunk in soft ground and the aircraft swayed to the left. During investigation it was found out that the probable cause of this left sway was due to the application of left rudder control to avoid a bush ahead. The starboard wing tip hit the ground as a result of the swaying and pivoting on nose gear causing substantial damage to both its tip and root.

The investigation identified the following causal factors:

- (i) An engine failure due to fuel starvation
- (ii) The sudden aircraft left sway immediately before stoping was due to the left rudder application by the passenger seated on the co-pilot position.
- (iii) The starboard wing tip and root damage was due to the pivot actioning when the aircraft nose wheel sunk in the ground.
- (iv) Non-adherence to the company's operations manual policy on fueling.

Six safety recommendations are made as a result of this investigation.

## 1. **FACTUAL INFORMATION.**

### 1.1. **History of the flight**

The aircraft was being operated by Coastal Travels a public transport operator based at Dar es Salaam. Their usual fleet comprised of one Piper PA34, one Cessna C340, two Cessna C206, two Cessna C172 and one Cessna C404. The company operated scheduled routes Dar es Salaam - Zanzibar - Mafia - Selous - Ruaha - Arusha. They also undertook charter services.

The aircraft was operating a scheduled flight between Dar es Salaam and Zanzibar. It took off from Dar es Salaam International Airport at 04:39 hours with five passengers. The flight to Zanzibar was uneventful and the cruise altitude was 3500ft.

Shortly before take off to Zanzibar, the aircraft was refuelled with sixty (60) litres of Avgas, (30 litres in each tank). According to the pilot, this added to the fuel remnants of the previous day totalled to two hours endurance.

The day before the accident, this aircraft under the same commander flew a number of scheduled flights to various destinations logging a total of 7.9 flying hours. 514 litres of fuel were uplifted that day. 140 litres were uplifted before the last scheduled flight of the day which was Dar-Raskutan-Mafia-Dar.

The flight to Zanzibar took 25 minutes and according to the pilot, cruised on left tank and had selected the right tank for landing. The turnaround at Zanzibar airport took 20 minutes during which five passengers boarded for the Dar es Salaam flight. One passenger occupied the front right hand seat alongside the commander. This passenger was a pilot by profession.

The aircraft took off at 05:24 hrs and climbed to flight level 25. The estimated time of arrival at Dar es Salaam International Airport was 0550 hrs. The commander of the aircraft maintained communications contact with Zanzibar Control Tower and later Dar es Salaam Approach and Tower. During the enroute climb and cruise, the aircraft performed well with no indication of any malfunction.

During descent to land at Dar es Salaam International Airport, at short finals to runway 14, the commander noted that the engine was losing power. According to the commander, his initial reaction was to apply the electrical fuel pump in the low position with no improvement. When he selected the high position, the engine came to life with a surge momentarily and stopped. The commander reported the engine failure to the Dar es Salaam Tower at 0547:06 hours.

The commander realised that the aircraft won't be able to glide to runway 14, he initiated a right turn to land on what used to be a rice field. The commander managed to manoeuvre the aircraft so as to avoid power lines and other obstructions and landed the aircraft in the uncultivated field. The aircraft came to rest at approximately 150 meters from the touchdown point. The pilot testified that he did not apply brakes after touch-down because the ground looked muddy. However, the front right hand seat passenger, testified that at the end of ground run, just before the aircraft came to a standstill, he (the passenger) applied left rudder to turn the aircraft to the left. This according to him was to avoid crashing into bush a head.

The passengers who were interviewed said that the commander did not brief them on the emergency procedures after the engine failure, and before emergency landing. However, they confirmed to a briefing before departure from Zanzibar. No emergency procedure briefing cards were found on board the aircraft for each passenger.

The commander exited from the aircraft after it stopped and ran out to the right side to open the passenger door which had jammed. The passengers exited through the pilot's door and ran away from the plane. The commander returned to the aircraft shortly afterwards and transmitted to the Dar es Salaam Control Tower that he had landed in a field short of the runway and that all occupants were uninjured.

## 1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	-	-	-
Minor/None	1	5	-

### 1.3. **Damage to aircraft**

The starboard wing was damaged at the tip and root. Starboard passenger door window glass cracked. The door due to the damage could not open as it had jammed.

### 1.4 **Other damage**

There was no third party damage observed or found due to this accident.

### 1.5. **Personnel Information**

Commander: Male, aged 43 years

Licence: Commercial Pilot's Licence

Aircraft Rating: Cessna 150, Cessna 172, Cessna 182, and Piper PA 34.  
Piper PA 23 in Group 2 due to lack of Instrument rating.

Medical Certificate: Expired in August 1997.

Instrument rating: None. Expired on 27.1.1996

Last base check: 25.4.1997

Last route check: 25.4.1997

Flying experience: Total all types: 5088.40 hours  
Total on single engine: 1592.35 hours  
Total on multiengine: 3290.25 hours  
Total on C206: 60 hours

Duty time: Approximately 2 hours

Co-pilot: Not required. However, the passenger on the fateful flight who sat in the co-pilot's seat was a professional pilot with the following details:

Licence: Commercial Pilot's Licence

Aircraft Rating: Piper PA32 and PA34

Cessna C210

Cessna C402 (Group II)

Flying experience: 2200.0 hours

Cabin Attendant: Not required and not carried.

## 1.6. Aircraft information.

### 1.6.1 Aircraft details

Manufacturer: Cessna Aircraft Company at Wichita, Kansas, USA

Type: Cessna U206 F "stationair"

Airframe Serial Number: U206 01988

Date of construction: 1973

Maximum all-up weight: 3600 lbs

Total airframe hours: 4256.2 hours

Engine: One Continental IO - 520-F  
Serial Number 810020-R

Engine hours  
Since New: 1536.2 hours

Time between overhaul (TBO): 1700 hours

Propellers: One McCauley D 3A32C90N

Serial Number: 951233

Propeller hours

Since New: 518.8 hours

Installed on engine on 27.3.1997

Time between overhaul (TBO): 1500 hours

Certificate of Airworthiness: First issued in Private Category on 6th April 88 renewable annually up to August 1989 when the aircraft was grounded after an accident.

Re-issued in Public Transport Category on 19.8.1994. Valid up to 18.8.1998.

Certificate of Registration: First registered in Tanzania on 21.12.1987 in the name of the Society of Precious Blood.

The registration change was done on 9.6.1994 to the present owners M/s Coastal Travels Ltd.

#### **1.6.2. Loading and C of G Disposition.**

From the available evidence the aircraft was correctly loaded and the Centre of Gravity at the time of the accident was within normal loading envelope.

#### **1.6.3. Aircraft Maintenance history**

The records shows that this aircraft was certificated in Tanzania when it had a total of 1090.9 hours in March 1988. Prior to that the aircraft was on a Canadian Certificate of Airworthiness.

The aircraft was certificated and operated in private category and was maintained to the approved maintenance schedule reference Ms/TAS/1/issue 2 which required certificate of Maintenance to be issued every 75 flying hours or 90 days.

The aircraft was in 1991 maintained to approved schedule reference MAF/CES/SE issue 5 with certificate of maintenance issued every 50 flying hours or 90 days. A check III was done on 22/5/91 at 1,253 airframe hours.

As previously mentioned this aircraft was involved in an accident on 17.7.1989 in which it forced landed after an engine failure. The investigation into the accident established an anomaly to the engine during its overhaul. This engine was replaced and the aircraft damage repaired. The accident report reference CAV/ACC/3/89 refers.

The last check III was done at the approved maintenance facility on 26.3.1997.

The last scheduled maintenance on the aircraft was a check II done on 14.9.1997 and a certificate of maintenance was issued valid up to 4.11.1997.

A pilot snagged the aircraft on 9.10.1997 with a fuel leakage in a left drain (or tank). It was rectified by an installation of a new fuel cell in the left tank. A fuel flow test was carried out after the replacement and the following figures were recorded:-

By gravity - 34 gallons/hours.

On low pump - 33.3 gallons/hours.

On high pump - 60 gallons/hours

The fuel cell installation was completed on 25.10.1997. The aircraft up to the fateful day had done a total of eleven hours, after the

replacement, all under the same commander. No record indicated problem on the fuel system.

#### **1.6.4. The engine and its Maintenance History.**

The Engine, a Continental IO-520F serial number 810020-R was installed on this aircraft as new on 10.12.1995. At the time of this accident it had accumulated 1536.2 hours, 163.8 hours to the manufacturer's recommended time between overhaul (TBO). The engine was granted a TBO extension of 15% by the DCA after an application from the approved maintenance organisation. The basis for this extension was the fact that on 26.3.1997 at engine total hours of 1013.8, the subject engine was dismantled, inspected and repaired. A number of parts including one mount bracket all main bearings, four conrod bearings, two after bodies, three exhaust valves, four exhaust guides, one valve spring, piston rings, two front crankcase through studs, gaskets and seals were replaced. Apart from that, an examination in the engine logbook revealed no significant unscheduled work on the engine.

#### **1.6.5. Fuel uplift.**

The aircraft was refuelled in Dar es Salaam prior to the commencement of the flight on the morning of 27.10.1997. According to the commander, the uplifted 60 Liters (30lts in each tank) added to the fuel remains from previous day totalled to two hours of endurance.

It was not possible to establish the quantity of fuel in the tanks prior to the refuelling. This was a problem also noted from previous accident investigation on the same operator, after an accident in which an aircraft forced landed on a road due to insufficient fuel - Accident report no CAV/ACC/1/96. There were no records to indicate fuel remains in the tank the end of the days' flights.

The pilot said that he flew to Zanzibar on the left tank but selected right tank for landing. He eventually took off from Zanzibar on the right tank and on reaching the cruise altitude of 2500ft, he selected

left tank. The commander reported that while he was doing the Dar es Salaam airfield approach checks the fuel gauge was reading about quarter tank for each tank. This was confirmed on interview by the passenger who was in the cockpit. Nevertheless the pilot selected right tank for landing.

The above stated fuel tank selections to Dar es Salaam from Zanzibar differed from the cockpit passenger observations, who on interview said, they took off from Zanzibar on the left tank, cruised on the right and left tank was selected for approach and landing at Dar es Salaam.

The cockpit examination done by the accident inspectors after the accident, found the fuel selector on the right tank. When electrical power was applied, the fuel gauge indicated empty for left tank and half full on right tank. Physical examination of fuel in tanks confirmed that there was no fuel in the left tank and the right tank had some fuel.

#### **1.7 Meteorological Information.**

It was a clear hot day with surface wind at 150<sup>0</sup> at Dar es Salaam International Airport. The aircraft outside air temperature indicator after the accident was reading approximately 40<sup>0</sup>C.

#### **1.8 Aids to Navigation.**

Not applicable

#### **1.9 Communications**

The aircraft was in contact with Dar es Salaam Control Tower at 118.3 Mhz at the time of the accident. Both communications radios were found switched to this frequency. Tape transcripts of the communications were made available for this investigation.

#### **1.10 Aerodrome Information.**

Not applicable.

### 1.11. Flight recorders

No flight recorders were fitted, and none were required to be fitted.

### 1.12. Wreckage and site Information.

#### 1.12.1 Main accident site

The aircraft landed in a field used for rice cultivation. It made initial contact near the start of the field in the south west direction. The field was wet and muddy. The aircraft rolled in approximately a straight line and after about 150 meters it came to a stop. The aircraft prior to stopping, swayed to the left to a heading of  $210^{\circ}$ , the nose wheel sunk in the mud causing pivot in which the right wing struck the ground, causing the most severe damage to the wing tip and root. At the same time the aircraft swung in the forward direction causing two propeller blades to dig into the ground. The marks on the propeller blades indicated positively that it was not rotating.

At a distance and slightly to the left of the direction of the aircraft landing run, there were some tree plantations creating what looked like a bush.

#### 1.12.2 Examination of Wreckage

The wreckage was found facing in a direction of  $210^{\circ}$  at a point where it stopped and the commander confirmed that nothing had been disturbed.

The aircraft flaps were found extended to the  $10^{\circ}$  position. However, the flap position selector in the cockpit was found in full up position.

The rudder was found deflected to approximately  $20^{\circ}$  to the left.

In the cockpit:

- Cowl flap was in the open position
- Fuel selector: RIGHT tank

- Vacuum and standby compass reading 210°
- radio frequency 118.3 Mhz for both radios
- Throttles in the idle position
- Altimeter indication 170ft QNH 1015.

On applying electrical power, apparently everything seemed to function properly. The fuel indicator, showed empty for the left tank and half full for the right tank. A physical inspection of the fuel in the tanks confirmed this.

- No pilot's Operating Handbook was seen in the aircraft. Neither could the company's operations manual be located.

On the second day, at the operator's office at the airport, a pilot's operating Handbook for Cessna U206G 1979 model supposedly for this aircraft was produced. This manual was neither stamped by DCA nor identified to 5H-CTL aircraft.

- No passenger briefing cards.

The damage was localised to the right wing tip and root resulting from the ground strike before stoppage.

### **1.13. Medical and Pathological Information.**

Not applicable.

### **1.14. Fire**

There was no fire.

### **1.15 Survival aspect.**

There is no information to indicate if the passengers adopted the brace position prior to touch down. The pilot did not brief them of his intention to make an emergency forced landing in the field. The touch down and the ensuing landing run was executed properly.

The pilot's decision not to apply brakes during the landing run was very proper taking into account the conditions of the field. The evacuation of the passenger was through the pilot's exit as the passenger door could not open. The jamming of the passenger door hindering rapid evacuation, would have caused a problem if there was fire.

#### **1.16. Tests and Research**

None was done.

#### **1.17 Additional Information.**

##### **1.17.1 Flap selection.**

On interview, the commander recalls selecting 20<sup>0</sup> Flaps during approach. After engine failure and during the approach to the field, he did not select more flaps for fear of undershooting. The passenger in the co-pilot's seat confirmed this but he further stated that he (the passenger), on the fear of increased drag due to flaps, selected "up" position. This passenger also asserted that the flap motor was still operating when he got out of the aircraft after it stopped. This gives a picture as to why the flap selector handle was found in the up position but the flaps in the 10<sup>0</sup> position.

### **1.17.2 Information from pilots of Previous flights in 5H-CTL**

- There was no confirmation on any engine problems or abnormal handling from pilots who previously flew this aircraft, including the commander of the accident flight.

### **1.17.3 Company's Operational Control.**

AOC data form from the operator on the pilots data indicated that the accident pilot's Licence was expiring on 21.01.1998 and his medical check up was due on 21.01.1998. However, DCA records and the Licence itself indicated an expiry date of 15.8.1997.

It is apparent that this confusion on pilot's data contributed in the pilot's failure to renew his medicals as required.

## 2. Analysis.

### 2.1. Fuel uplift.

Investigation did not establish any engine problems either prior or after the accident which could have contributed to this accident.

At the accident site, the engine could not be started and run with the fuel selector in the LEFT TANK position. However, the engine started and ran smoothly when the fuel selector was placed in the RIGHT TANK position. Physical inspection of fuel contents in the tanks, indicated a dry LEFT TANK and some fuel in the RIGHT TANK. This was confirmed by the quantity gauges in the cockpit when electrical power was applied to the aircraft at the accident site.

As there was no indication or record of any previous malfunction in fuel quantity indicator; it is possible the commander and his co-pilot passenger did not give the second glance to confirm the gauge's reading. The commander did intimate that they were chatting throughout the flight.

The fuel uplifted by the pilot for the flights on the day before accident found on record indicated that:

- 186 lts refuelled at 0710 for the flight Dar-Kiba-Arusha-Dar
- 188 lts refuelled at 12.00 for the flight Dar-Ziwandu-Dar
- 140 lts refuelled at 16:30 for the flight Dar-Raskutan-Dar

Also on record is 188 lts reported refuelled at 12:30 for the flight Dar-Ziwandu-Dar. However, on the BP delivery certificate there is a record indicating that the fuel was taken "to store". Therefore this amount was not refuelled into the aircraft tanks.

The pilot may have been right to assume from the previous flights and refuelling that there was fuel which when added to 60lts would make it two hours endurance. This assumption, not backed by any records to show fuel remnants from previous flights and no proof of a check to ascertain if there was any fuel in tanks after a night stop,

becomes unreliable. For certain, there is a problem of fuel theft in aircraft parked at most of our airports. Interview of most people at Dar Airport terminal one, confirmed this problem. From this, it was unwise to take it for granted on the amount of fuel remaining after the night stop. Assuming the worst, that there was very little fuel remaining in both tanks from previous day's flights, the 60lbs uplifted were barely sufficient according to the companies operations manuals. The companies operations manual laid down procedure for calculation of route fuel requires inclusion of fuel for run-up and taxi, enroute, 45 minutes holding at destination, 100n.m. diversion and 10% contingencies.

Calculation for 50 minutes flight at an average altitude of 2,500ft with reference to performance section of the pilots operating Handbook of this aircraft shows a requirement of at least 48 lbs. It is apparent then that 60lbs would not have fulfilled the operations manual's requirement. In respect to the above it is therefore recommended that:

**A system of recording the fuel remaining at the end of a flight particularly the last flight of the day be established to all public transport operators.**

**The commander or a responsible person in charge of fuelling, should ascertain the fuel in the aircraft tanks prior to topping up. Particular attention be given at the first flight of the day.**

The investigation could not justify the commander's different fuel tank selections for each flight phase taking into consideration of the proximity between Dar and Zanzibar. The difference between the commander's statement and the co-pilot seated passenger observations, does not simplify the matter.

However from the findings it is logical to assume that left tank was used more than the right tank. The investigation could only conclude that the left tank was selected when the engine malfunctioned and that the rights tank selection was made after landing.

## 2.2. Aircraft Handling.

After the engine failure and with regard to the height of the aircraft (which was below 1000ft), there was very short time for the commander to locate a suitable landing site and plan an approach. The landing was performed successfully, thus preventing what would have otherwise been a more serious accident with probable loss of the aircraft and serious or fatal, injuries to the occupants.

It was noted that even if the pilot had enough time to do a proper troubleshooting for the engine failure, he had no reference as there were no Pilots Operating Handbook or operations manuals. The two documents are required by Regulations to be on board the aircraft. Laxity in this is probably caused by the lack of frequent in flight inspections by the DCA and therefore the absence of penalties to the defaulters. It is therefore recommended that:

**The Directorate of Civil Aviation (DCA) should strengthen its Flight Operations section to include the in flight inspections. They should ensure that operators include in their operations and training manuals all procedures as detailed in Annex 6 of the ICAO SARPS, and in particular emergency procedures. These procedures must be strictly complied with.**

It is however, noted that there were actions in the cockpit which could have resulted in a catastrophe. The interference of control by the "co-pilot" passenger without the knowledge or consensus of the commander was inappropriate and dangerous. Had it not been for the "co-pilot" passenger applying left rudder (and probably in doing so hard braking), the aircraft might have stopped without the damage it sustained on the right wing and passenger door.

In view of the above, it is recommended that:

**A preflight passenger briefing by the commander should include a caution to the "co-pilot" seated passenger to refrain from control interference or make any change to instruments, switches etc settings without the consent of the commander.**

**All public transport aircraft operators should include for every passenger, briefing card(s) for the aircraft and emergency information.**

### 3. Conclusions

#### (a) Findings

- (i) The commander was licensed but his medical certificate had expired for two months before the accident.
- (ii) The aircraft had been maintained in accordance with an approved maintenance schedule, and Certificates of Airworthiness and Maintenance were valid.
- (iii) The left fuel tank was empty at the time of the accident.
- (iv) The commander made a successful emergency landing.
- (v) Sudden swaying to the left and sinking of the nose wheel in the soft ground resulted in the aircraft pivoting causing the right wing and propeller to strike ground.
- (vi) The company does not have in place a system of calculation and recording the fuel remaining at the end of a flight or flights.

#### (b) Causes

The investigation identified the following factors:

- (i) An engine failure caused by fuel starvation.
- (ii) The sudden aircraft left sway immediately before stopping was due to the left rudder application by the passenger seated in the co-pilot position.
- (iii) The right wing tip and root damage was a result of the pivot actioning when the aircraft nose wheel sunk in ground.
- (iv) Non adherence to the company's operations manual policy on fuelling.

#### 4. Safety Recommendations

It is recommended that:

- (i) A system of recording the fuel remaining at the end of a flight (or flights) particularly the last flight of the day be established to all public transport operators.
- (ii) The commander, or a responsible person in charge of refuelling must ascertain the fuel in the aircraft tanks prior to topping up. Particular attention be given at the first flight of the day.
- (iii) The Directorate of Civil Aviation (DCA) should strengthen its flight operations section to include the in flight inspections. They should ensure that operators include in their Operations and Training manuals procedures as detailed in Annex 6 of the ICAO SARPS and in particular emergency procedures. These procedures must be strictly complied with.
- (iv) A preflight passenger briefing by the commander should include a caution to the co-pilot seated passenger to refrain from control interference or make any change to instruments, switches etc settings without the consent of the commander.
- (v) All public transport aircraft operators must include forevery passenger briefing card(s) for the aircraft and emergency information.
- (vi) All public transport aircraft opertors institute an acceptable procedure adminstered by appropriately qualified personnel on pilot licensing requirements, such as follow up on renewals, medical examinations and other operational control requirements in the company.



J. Nyamwihura

D/Chief Inspector of Accidents

Accident Investigation Branch  
Ministry of Communications  
& Transport