

MINISTRY OF COMMUNICATIONS AND WORKS

DIRECTORATE OF CIVIL AVIATION

ACCIDENT INVESTIGATION BRANCH

CIVIL AIRCRAFT ACCIDENT NO. CAV/ACC/3/88

REPORT ON THE ACCIDENT TO CESSNA 402C
5H-GTS WHICH OCCURRED AT RUBONDO
AIRSTRIIP NEAR BIHARAMULO, KAGERA
REGION, TANZANIA (2° 40'S 31° 50'E)

CIVIL AIRCRAFT ACCIDENT REPORT NO. CAV/ACC/3/1988

AIRCRAFT TYPE : CESSNA 402C

NATIONALITY AND REGISTRATION MARKS : 5H-GTS

ENGINES : TWO CONTINENTAL TS10-520-VB

REGISTERED OWNER : TANZANIA GAME TRACKER SAFARIS
P.O. BOX 2782 ARUSHA, TANZANIA

OPERATOR : SAME AS REGISTERED OWNER

PILOT : ONE - KILLED

PASSENGERS : FOUR - KILLED

OTHERS : N/A

PLACE OF ACCIDENT : RUBONDO AIRSTRIP, LAKE VICTORIA
NEAR BIHARAMULO, TANZANIA

TIME : ABOUT 0915 HOURS

DATE : MARCH 30, 1988

ALL TIMES IN THIS REPORT ARE UTC

SYNOPSIS :

The aircraft was taking off from Rubondo airstrip for Arusha via Kigoma. It was carrying one pilot and four passengers. It was observed to rise momentarily above the ground and then came down hitting trees. A change of engine sound was heard followed by a loud bang. A severe fire ensued and the aircraft was completely destroyed. All the five occupants lost their lives.

FACTUAL INFORMATION :1.1 History of the Flight

The aircraft was operating a charter flight from Rubondo to Arusha via Kigoma. It was carrying a party of four passengers who had previously travelled to the Island for a photography expedition.

5H-GTS left Arusha at 0400 hours for Rubondo with the Pilot as the sole occupant. The flight to Mwanza was uneventful and the aircraft landed at Mwanza at 0530 hours. At Mwanza, the aircraft was refuelled to full tanks giving an endurance of 5½ hours. His flight plan filed with the Tower, indicated that he intended to fly three sectors : Mwanza-Rubondo (25 min), Rubondo-Kigoma (1 hr 15 min) and Kigoma-Arusha (2 hrs 15 min).

The aircraft left Mwanza at 0657 hours and landed at Rubondo about 25 minutes later. Four passengers joined the flight to Arusha and take off was initiated from runway 06 at about 0915 hours. One observer who was at the airstrip said that the aircraft was seen to rise momentarily and then came down hitting trees as it did so. A change of engine sound was heard followed by a loud bang. There was a huge ball of fire in the forest ahead and a few explosions were heard. One eye witness said that the fire was so intense that no rescue efforts were possible. The fire was localised around the area of the accident. The aircraft was completely destroyed and all the five occupants were killed.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal.	1	4	-
Serious	Nil	Nil	Nil
None	-	-	-

1.3 Damage to Aircraft

The aircraft was completely destroyed by impact and the subsequent fire.

1.4 Other Damage

Part of the forest at the crash site was burnt. A number of snakes was killed.

1.5 Personnel Information

The Pilot, a British national, was born in Kampala, Uganda on January 16, 1960. He held an Airline Transport Pilot's Licence No.HP-306 which was granted on May 24, 1988. He had the following aircraft ratings in his Licence:

Group 1 - Cessna 206, 402 and 404 and Beech Baron

Group 2 - Cessna 310 and PA 31

He also held an R/T Licence No.H-566 which was kept valid in line with the ATPL.

The two licences were granted on the strength of his Kenya ATPL and R/T licences Nos.YK-1730-AL and YK-1730RL respectively.

At the time of the accident his total flying experience was 2,875 hours of which 688 were on the type. During the last 30 days he had logged 43 hours of which 32 were on the Cessna 402.

1.6 Aircraft Information

The aircraft, a Cessna 402C serial No. 402C-0268 powered by two continental TSIO-520-VB engines was manufactured by the Cessna aircraft Company at Wichita, Kansas, USA in 1987. It arrived in Tanzania under a United States registration N268PA which was changed to 5H-GTS on June 16, 1987 in the name Tanzania Game Trackers.

The ownership had not changed since. A local Certificate of Airworthiness No. 260 was also granted on June 16, 1987 to expire on June 11, 1988.

It was being operated under "Public Transport" Category in accordance with the FAA AFM Report No. D1582R4-13PH dated January 1, 1979.

1.6.1 Loading and C of G Disposition

1.6.1.1 Position of Centre of Gravity

When inspectors arrived at the scene of the accident the bodies and some remains of the baggage had already been removed. Examination of seat belt remains showed that the five occupants had been occupying the front five seats. There was no evidence to indicate that the centre of gravity was outside the allowed limits.

1.6.1.2 Aircraft Weight at Take-off

Some pieces of aircraft equipment and passengers' baggage were moved before the investigation team arrived at the crash site. It was not possible therefore to take into consideration all things which had been in the aircraft during the attempted take-off.

Six 20-litre jerry cans were found among the debris and some of these had already been displaced. They were all open but empty. Reports from Mwanza said that no jerry cans were filled at the airport on the day of the accident. The fuel uplift at Mwanza was adequate for the planned flight to Arusha (0410 hours) with sufficient reserves for diverting to say, Tabora or Kilimanjaro plus 20 minutes hold.

There was no evidence to suggest that there was fuel in the jerry cans, and in any case, the planned flight could have been accomplished by using the fuel in the wing tanks which was uplifted from Mwanza.

There were four passengers whose estimate for average weight is 150lb (68 kg) and One Pilot weighing 170lb (77 kg). The aircraft was refuelled at Mwanza to full tanks (1280 lb) for the flight to Rubondo. The fuel burn for the 25 minute flight to Rubondo was estimated at 100 lb (45 kg).

The aircraft weight at take off from Rubondo was estimated from the foregoing information as follows :

	<u>lb.</u>	
Empty Weight	4375	
Pilot	170	
Passengers (4)x150	600	
Fuel (1280-100)	1180	
Six jerry cans (empty)	30	
Baggage	220	
	<hr/>	
	6575	(2989 kg)

Given that the airfield elevation is 3720 feet (1691 metres), temperature 25°C and allowing the standard rough field factor of 5% with zero wind, the required minimum ground run as estimated from the Manufacturer's (Cessna 402C (1980) Information Manual, should be 2400 feet (730 metres). The distance to clear a 50 - feet obstacle should be 2900 feet (880m). The accelerate stop distance 4200 feet (1280m). (is

1.7 Meteorological Information :

It was a bright sunny day. The temperature was estimated at about 25°C.

1.8 Aids to Navigation :

Not applicable.

1.9 Communications :

1.10 Aerodrome Information :

Rubondo airstrip, elevation 3720 feet (1130 metres), has a single runway 06/24. Its surface is rough and it becomes soft during rainy seasons. It is located in a forest overlooking Lake Victoria.

The Rubondo airfield is not licenced with DCA. By time of the accident the regulation which restricted unlicenced airfields to aircraft below 2730 kg (6000 lb) had already been lifted. The information which was available to the investigation team (and also to the 5H-GTS Commander) gave the usable runway length as 900 metres (2950 feet). The investigators measured this runway on March 4, 1988 and found that the actual length was exactly 900 metres (2600 feet).

Visual inspection of the area beyond the runway 06 threshold showed that length of runway was about 1000 metres (2953 feet) but the last 200 metres had been outgrown by elephant grass and small trees.

Rubondo airfield is owned by the Tanzania National Parks. It is not registered with the Directorate of Civil Aviation and is therefore not controlled by the Department. Operators use the airstrip at their own risk. Information about the airfield is sent to DCA by its owners and DCA circulates the information by way of NOTAMS. The erosion of the runway length by tropical vegetation was not reported to DCA.

1.11 Flight Recorders :

Not required by regulations - None fitted.

1.12 Wreckage :

The aircraft was completely destroyed by impact and the subsequent fire. The main wreckage (the fuselage) came to rest in a palm forest about 1000m ahead of the runway 06 threshold. It was completely burnt. Some seats were found torn off the floor and one seat belt was bloodstained and broken. There was evidence that the belt broke under tension overload. A cockpit clock had stopped at 12.15 (p.m.).

The wings had detached after impact with palm trees and both engines separated. The propeller blades were found slightly twisted in the direction of rotation.

1.13 Medical and Pathological Information :

Not applicable.

1.14 Fire

Fire broke out on impact with the ground. The fire was so severe that eye witnesses failed to approach the burning wreckage. The palm trees around the accident site were burnt and several snakes in that area were killed.

1.15 Survival Aspects :

The aircraft came down at high speed and was brought to rest almost instantaneously by impact with strong palm trees. Some seats were found torn off the floor and at least one seat belt was found broken under tension. It is considered that the impact forces which were severe enough to tear seats from the floor and brake seat belts could not have been safely taken by the occupants.

In any case, the occupants could not have survived the subsequent fire. It is therefore considered that this was not a survivable accident.

1.16 Other Information :

The aircraft was carrying six German fuel cans (jerry cans) which were found among the debris. It was initially thought that the pilot had taken extra fuel in jerry cans for his planned flight because there was no fuel at Kigoma.

The six jerry cans were found open and empty. Reports from Mwanza said that no fuel was filled in the jerry cans during the refuelling stop-over at Mwanza. There is no fuel at Arusha. It was therefore not possible to establish conclusively the presence of fuel in the cans.

The ICAO Regulations classify aircraft fuel among the dangerous goods. While Tanzania is an ICAO Contracting State, the absence of fuel on many airfields has made the government re-assess compliance with this regulation. Operators can carry return fuel among aircraft baggage provided prior permission is sought from DCA.

The jerry cans were found alongside the cockpit debris located ahead of the main fuselage wreckage. It was therefore presumed that they were in the forward baggage hold.

2.

ANALYSIS :

There was nothing in the aircraft recent technical history which could have contributed to this accident. The Pilot was himself medically fit and had nothing in his medical records which would have caused his incapacitation shortly after lift off. There was also no evidence that the aircraft centre of gravity was outside the required limits.

The configuration of the aircraft during the attempted take-off and climb out could not be determined due to its complete destruction.

The positions of controls in the cockpit could not be relied upon because the wreckage had already been tampered with.

The damage to both propellers was consistent with the engines developing minimal power at impact. There was no evidence of engine failure. It is probable therefore, that the Pilot may have throttled back when he realised that impact was imminent. This theory is enhanced further by the change of engine sound which was heard shortly before impact.

The accident happened during a rainy season and there had been heavy rains at the Island. While the temperature was high on the day of the accident, the ground was still soft from previous rains.

It is considered therefore that the standard rough field factor of 5% used in performance calculations is conservative, and the actual figure may have been about 10% or so.

Performance calculations on the Cessna 402 show that on the assumptions set out in section 1.6, the aircraft would have required a minimum ground run of 730 metres, which represents over 90% of the usable length of the runway.

Any adverse factors such as the presence of a tail wind, a higher-than-standard rough field factor, the erosion of take-off margin at the start of the take-off run, etc. should necessarily lengthen the required ground run. Should this be the case, the aircraft would reach the end of the runway before attaining the rotation speed. The presence of small trees in the area straight ahead of the runway threshold makes an aborted take-off dangerous. It is, however, considered prudent to abort take-off and risk damage to the aircraft in overshoot rather than attempt a take-off in a partially stalled condition.

On the basic assessment that the aircraft required a minimum ground run of almost the entire runway length, the propeller-chopped elephant grass evidence (at the end of runway 06), is consistent with aircraft being rotated near the runway threshold. While the rotation may have been initiated following the attainment of the take-off speed, it is also quite possible that this may have been made as the only possible alternative when the entire usable length of the runway was already covered without attaining the take-off speed.

3. CONCLUSIONS :

a) Findings :

- (i) The aircraft was properly maintained and its documents were in order.
- (ii) The pilot was properly licenced to undertake the flight.

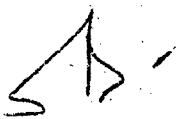
- (iii) The Pilot was given wrong information about the runway length.
- (iv) Take-off was initiated from a runway which was not long enough to allow a safe execution of an aborted take-off.

b) Cause

The accident was caused by the failure of the aircraft to accelerate shortly after lift off. The aircraft may have been rotated in a partially stalled condition when it came at the end of the runway.

4. SAFETY RECOMMENDATIONS :

- 4.1 DCA should regularly verify information given on unlicensed airfields.
- 4.2 The operator should fix minimum lengths of runways from which he can operate various models of his aircraft.
- 4.3 The areas ahead of the runway thresholds at Rubondo should be cleared of the small trees which had grown by the time of the accident.



CHIEF INSPECTOR OF ACCIDENTS :