CAV/ACC/18/72

ACCIDENT INVESTIGATION BRANCH

CIVIL AIRCRAFT ACCIDENT

Report on the accident to Piper PA 32-300
Aircraft Registration Number 5Y-AHX
which occurred on the 23rd August
1972 near Mkamba Village ,
Tanzania.

E A S T  A F R I C A N  C O M M U N I T Y

ACCIDENT REPORT

ACCIDENT INVESTIGATION BRANCH

CIVIL AIRCRAFT ACCIDENT REPORT NO. CAV/ACC/18/72

| | |
|---|---|
| Aircraft: | Piper PA 32 - 300 Registration 5Y-AHX |
| Engine: | Lycoming IO-540-KIA5 |
| Registered Owner and Operator | Ker Downey & Selby Aviation Ltd., P.O. Box 41822, Nairobi. |
| Pilot: | Charles Fredrick Ehrhorn |
| Passengers: | Six |
| Place of Accident: | Near Mkamba Village, Tanzania. |
| Date & Time | 23rd August, 1972, approximately 1610 hours. |
| | ALL TIMES IN THIS REPORT ARE G.M.T. |

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## S U M M A R Y

The aircraft was returning to Dar es Salaam Airport from a flight to Behobeho Airstrip, 94 nautical miles south-west of Dar es Salaam, having been chartered by a group of six tourists for a day return trip to Behobeho Safari Camp in the Selous Game Reserve, Tanzania.

The return flight, according to the Flight Plan was to have taken 50 minutes under Visual Flight Rules (VFR). The aircraft, however, departed Behobeho Airstrip later than planned at approximately 1520 hours. In consequence, the pilot was unable to continue the flight visually owing to darkness. After sunset, at approximately 1522 hours, Eastair Centre (ATC) suggested that the pilot should file an Instrument Flight Rules (IFR) Plan for flight at night, but the pilot elected to continue in accordance with Visual Flight Rules (VFR).

Communications between the aircraft and Eastair Centre were maintained up until the time the pilot reported Dar es Salaam Control Zone Boundary at 1550 hours. Nothing further was heard from the aircraft by any ATC Unit. At 1557 hours, however, the pilot of an EAAC DC9 scheduled aircraft enroute from Blantyre to Dar es Salaam, intercepted a call from the subject aircraft, the pilot giving, "Dar es Salaam Control Zone Boundary - field in sight". Almost immediately afterwards, the pilot of the DC 9 heard the pilot of the subject aircraft calling Dar es Salaam Radar for a vector. Nothing further was heard from the subject aircraft, and it was subsequently learned the following day, 24th August, 1972 that it had crashed near Mkamba Village, 35 nautical miles south-west of Dar es Salaam, destroying the aircraft and killing all seven occupants.

## 1. INVESTIGATION

### 1.1 History of the Flight

On the morning of 23rd August, 1972 the pilot filed a Visual Flight Rules Through Flight Plan (VFR TRU PLN) in respect of a charter flight Dar es Salaam - Behobeho Airstrip - Dar es Salaam.

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The flight plan indicated an aircraft endurance of 5 hours, and flight times for both outward and return journeys as 50 minutes. The flight plan also indicated a total number of persons on board as 5, although in fact there was a total of 7 adult persons on board at both the take off from Dar es Salaam and on the return flight.

The aircraft subsequently took off from Dar es Salaam Airport, with full fuel tanks, at 0517 hours for Behobeho Airstrip in the Selous Game Reserve, a distance of 94 nautical miles, bearing 242°(T) from Dar es Salaam.

At 0557 hours the pilot reported 'field in sight' to Eastair Centre (ATC) on 118,9 mhz. Eastair Centre acknowledged and requested the pilot to "call again when airborne". According to witness reports, the passengers and pilot arrived at the Safari Camp, which is a drive of about 20 minutes by Landrover from the airstrip, at about 0600 hours. Whilst the passengers spent the day touring the game reserve it is reported that the pilot remained at the camp. Witness reports state that the pilot had lunch at the camp with another group of tourists, and drank only water. The pilot did not complain of feeling ill nor did he over expose himself to the sun while at the camp. The pilot did, however, become very agitated and according to witness reports, lost his temper when the driver arrived back late at the camp (at approximately 1445 hours) with the passengers after touring the game reserve. The latest departure time authorised by the operator for aircraft returning to Dar es Salaam from Behobeho Airstrip is 1430 hours.

At 1525 hours on the same day, the pilot of the aircraft, having departed from Behobeho Airstrip at approximately 1520 hours, called Eastair Centre on 118.9 mhz, but was unable to establish two way communication until 1538 hours. At this time, the pilot reported estimated time of arrival (ETA) Dar es Salaam 1610 hours.

At 1545 hours, as it was almost dark, Eastair Centre asked the pilot to confirm that the aircraft was now operating under Instrument Flight Rules (IFR). The pilot replied "we're still VFR". Eastair Centre replied to the effect that by definition it was now officially night and that VFR flight is not permitted at night. The pilot replied "I know we're a little late". Eastair Centre again asked the pilot to confirm that he would be filing an IFR plan. The pilot replied "Negative". Eastair Centre acknowledged and ascertained that the aircraft was flying at an altitude of 2000 feet.

At 1550 hours the pilot called Dar es Salaam Approach (ATC) on the Eastair Centre frequency of 118.9 mhz. and reported Control Zone Boundary. Eastair Centre acknowledged, and instructed the pilot to contact Dar es Salaam Approach on 119.1 mhz. This was not acknowledged by the pilot, and nothing further was heard from the aircraft by any ATC unit.

At 1557 hours, however, the pilot of EC 998, a DC 9 scheduled aircraft enroute from Blantyre to Dar es Salaam heard the pilot of the subject aircraft call Dar es Salaam Approach on the correct frequency of 119.1 mhz and report "Zone Boundary inbound, field in sight, request landing instructions". Almost immediately afterwards, the pilot of the DC9 heard the pilot of the subject aircraft call on the Dar es Salaam Radar frequency,

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120.9 mhz, saying, "Radar give us a vector". None of these calls were heard by the Dar es Salaam ATC Units, nor did the Radar Controller at Dar es Salaam, who was searching on radar for the subject aircraft, observe any unidentified object on the radar screen.

Nothing further was heard from the aircraft and Dar es Salaam ATC subsequently initiated Distress Procedure (DETRESFA).

It was not until the following morning 24th August, 1972 that it was learnt from Police sources that the aircraft had crashed near Mkamba Village, 35 nautical miles south-west of Dar es Salaam, destroying the aircraft and killing all seven occupants. It is relevant to mention at this stage that witnesses near the scene of the accident reported that at about the time the accident occurred they saw an aircraft "flying low with full landing lights on from the north-west direction and flying around as if looking for a place to land. After the first round it disappeared below some tree tops". The witnesses also stated that "no strange noises were coming from the aircraft", and that they "did not hear the noise of the crash".

1.2 Injuries to Persons

| Injuries | Crew | Passengers | Others |
|---|---|---|---|
| Fatal | 1 | 6 | - |
| Non-fatal | - | - | - |
| None | - | - | - |

1.3 Damage to Aircraft

The aircraft was substantially damaged on impact with the ground.

Fuselage. Forward section to the rear door jamb of the main entrance door completely smashed. Rear section severely damaged, broken at production joint adjacent to LH side rear door jamb but not completely separated.

Mainplanes. Structurally separated from fuselage on initial impact, both mainplanes extensively damaged, ailerons and flaps distorted. Note: Stbd. aileron seen in the top of a tree. Port and stdb. tip tank completely smashed, port and stbd. main tanks burst open. Port and stbd. landing gear including wheels undamaged.

Tail Unit. Stabilator, Fin and Rudder generally distorted but not seriously damaged.

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Power Unit. Engine separated from fuselage, engine shaft flange distorted, propeller retaining bolts sheared, engine sump holed, induction system smashed, Propeller separated from the engine, one blade bent back 50-60° at 75% blade radius, other blade has an impact inertia bend.

Cabin Area. Row 1 and 3 seats torn from their attachment fittings and seat belts and fittings torn and separated from their attachments. Row 2 seats damaged, seat belts were intact.

1.4 Other Damage.

No other damage, aircraft struck flat ground in a forest clearing.

1.5 Crew Information

Mr. Charles F. Ehrhorn, aged 38 years, was a citizen of the United States of America, and was issued with an East African Commercial Pilot's Licence No. 1293 (K.1175 and Radio Telephony Licence No. 2419 (K.1814 on the basis of his United States, Federal Aviation Administration (F.A.A) Commercial Pilot's Licence No. 1207373 dated 16th October, 1970, and F.A.A. Radio Telephony Licence dated 25th October, 1968, having passed an East African Commercial Pilots Conversion Examination in Air Law on 21st January, 1972. His East African Commercial Pilots' Licence and Radio Telephony Licence were validated to 20th July, 1972. This licence was rated in Group One, for Cessna 172, 182, 205, 206, 210 and Piper PA 23 type aircraft. He held an East African Instrument Rating dated 9th March, 1972 having passed the East African Initial Instrument Rating Flight Test on that date. According to East African Directorate of Civil Aviation records, his last aircrew medical examination was on 21st January 1972 when he was assessed as fit for initial issue of the East African Commercial Pilot's Licence.

Further investigation revealed, however, that he was re-examined on 17th July, 1972 and assessed fit for East African Commercial Pilot's Licence Renewal. There were no endorsements on this certificate. The certificate, however, was not presented to the East African Directorate of Civil Aviation and the licence therefore was not renewed.

In addition to the above licences, Mr. Ehrhorn was also issued with an East African Flight Navigator's Licence No. 132 (K.132) on 4th January, 1972, against United States F.A.A. Flight Navigator's Licence No. 1802754 dated 21st November, 1967, having passed an East African Flight Navigator's Conversion Examination in Air Law on 6th August, 1971. His East African Flight Navigator's Licence was validated to 2nd August, 1972.

At the time of the accident Mr. Ehrhorn had accumulated 5300 hours as Flight Navigator, 1800 hours of which were with United Airlines, U.S.A., during period 1968-1971 and 204 hours were with East African Airways during period July, 1971 to January, 1972. He had also accumulated 1315 hours as pilot in command, of which 57 hours were on Piper PA 32 type aircraft. According to his flying log book he had flown 7 hours in Piper 32, 5Y-AHX, on the two days previous to the accident, and a total of 72 hours in Piper 23 and

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Piper 32 type aircraft during the month prior to the accident. He had made six flights Dar es Salaam - Behobeho and return since 9th July, 1972 all in Piper 32 type aircraft. It may be seen from the above that, notwithstanding the fact that Mr. Ehrhorn was medically re-examined on 20th July, 1972 showing intent to renew the licence, his East African Commercial Pilot's Licence expired on 20th July, 1972 and therefore was not valid at the time the accident occurred, and further, he was not rated for Piper PA 32, type aircraft.

1.6 Aircraft Information

5Y-AHX a Piper PA 32-300 serial no. 32-40391 powered by one Lycoming IO-540-K1A5 engine serial no. L-5231-48 and constructed by Piper Aircraft Corporation, Vero Beach, Florida, U.S.A. in 1968.

The aircraft arrived in East Africa with an F.A.A. Export Certificate of Airworthiness No. E-84769 issued on 9th May, 1968. An East African Certificate of Airworthiness No.524 was issued on 3rd August 1968 for twelve months, expiring 2nd August 1969. This Certificate of Airworthiness had been renewed within the prescribed periods and was valid until 9th February, 1973. The Certificate of Airworthiness was re-categorised in Transport (Passenger) category on 17th August 1972.

Maintenance History

The aircraft formerly belonged to the African Medical and Research Foundation and operated in the PRIVATE category, and as such was maintained to their schedule reference AMRF/1 issue 1 which was approved for operation of aircraft in the Private category. A Check I inspection was completed to an AMRF work order and the aircraft was certified in accordance with their maintenance schedule on the 15th August 1972.

Ker, Downey & Selby Aviation Ltd. purchased this aircraft for operation in the Transport (passenger) category on the 15th August 1972 and commenced to operate at about 21st August 1972, on the Certificate of Maintenance issued against maintenance completed to a PRIVATE maintenance schedule. Although the scene of the crash was searched, no evidence of a Technical log could be found, subsequent discussions with the operator revealed that in fact a technical log had not been issued for that aircraft. In consequence, flight times, defects and refuelling uplifts have not been recorded for this aircraft during the operation with the new operator.

At the time of the accident the following hours had been recorded.

| | | |
|---|---|---|
| Airframe total hours since manufacture | | 1243.40 hrs. |
| " " " " last check 3 | | 89.05 " |
| " " " " " " 2 | | 89.05 " |
| " " " " " " 1 | | Not known. |
| Engine " " " manufacture. | | 1243.30 hrs. |
| Propeller " " " manufacture. | | 1243.40 hrs. |
| " " " " overhaul. | | 89.05 " |

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The times mentioned have been extracted from log books up to 15th June 1972, the aircraft was out of operation until the 15th August 1972. The exact number of hours flown with Ker, Downey & Selby Aviation Limited are not known.

All Federal Aviation Administration Airworthiness Directives applicable to the aircraft, its engine, propeller and equipment had been complied with. The requirements of the Maintenance Schedule ref. AMRF to which the aircraft was previously maintained had been complied with as had DCA Notices applicable to this type.

1.7 Meteorological Information

There is no record of the pilot having requested information about the weather over the proposed route, Dar es Salaam - Behobeho and return. It is not known therefore, what weather information he had in his possession.

The weather at Dar es Salaam Airport at 1600 hours was:

Wind: SE/05 knots

Visibility: Greater than 10 kilometres

Weather: Fine

Cloud: 1/8 cumulus 2000 feet.

According to an appreciation of the weather subsequently prepared by the East African Meteorological Department, an elongated anticyclone was oriontated along the Mozambique coast, and a diffluent ridge associated with this anticyclone was indicated along the East African coast giving fine weather throughout Tanzania on the day the accident occurred.

1.8 Aids to Navigation

The route between Behobeho Airstrip and Dar es Salaam Airport is normally conducted with visual reference to the ground and is not defined by radio aids. Dar es Salaam Airport, which is 94 nautical miles from Behobeho Airstrip is equipped with the following radio navigational aids: Non-directional beacon (NDB) - range 250 nautical miles. Very High Frequency Omnidirectional Radio Range (VOR). Surveillance Radar (SRE). The aircraft was equipped with ADF and VOR.

A torn part of chart, International Map of the World 1:1,000,000, Dar es Salaam, was found close to the wrdckage.

1.9 Communications

1.9.1 On the return flight from Behobeho to Dar es Salaam ~~the~~ aircraft maintained two way communication with Eastair Centre (ATC) on ~~frequency~~ 118.9 mhz until 1550 hours (see tape transcript). At 1550 hours the pilot ~~called~~ Dar es Salaam Approach on the Eastair Centre frequency, reporting Control Zone Boundary. Eastair Cenre acknowledged this call and instructed the pilot to contact Dar es Salaam Approach on 119.1 mhz. This instruction was not acknowledged by the pilot, and nothing further from the aircraft was heard by any ATC unit. At 1557 hours, however, the pilot of a DC9 scheduled aircraft enroute from Blantyre to Dar es Salaam Approach heard the pilot of the subject aircraft call Dar es Salaam on 119.1 mhz saying "Zone boundary in-bound, field in sight, request landing instructions". Almost immediately afterwards the pilot of the subject aircraft changed frequency to 120.9 mhz and was heard, by the DC9 pilot, to call Dar es Salaam Radar saying, "Radar give us a

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a vector". None of these calls were heard by Dar es Salaam ATC, probably because the aircraft was flying lower than the last reported altitude of 2000 feet. It was not until after landing that the pilot of the DC9, on learning that anxiety was felt for the safety of 5Y-AHX, informed TC at 1640 hours of the attempts by the pilot of the subject aircraft to establish communication with Dar es Salaam.

1.9.2 The tape transcript of radio communications between Eastair Centre and 5Y-AHX on 118.9 mhz is as follows:-

1525 hours

Aircraft: East Air Centre 5Y-AHX
E.A.C.: 5Y-AHX East Air Centre

1526 Hours

E.A.C.; 5-HX East Air Centre
Aircraft: East Air Centre 5Y-AHX
E.A.C.: 5Y-AHX East Air Centre. Go ahead.
(NO REPLY)

1527 hours

Aircraft: East Air Centre 5H-YAEX. Do you read.
E.A.C.: 5-HX East Air.

1538 - 1540 hours

E.A.C.: 5Y-AHX This is East Air Centre.
Aircraft: Centre HX
E.A.C.: HX Centre. Can I have your E.T.A. Dar es Salaam.
Aircraft: Say again. You're unreadable.
E.A.C.: HX Request E.T.A. Dar es Salaam.
Aircraft: Roger HX. Estimating Dar es Salaam 10.
E.A.C.: 1610 Dar es Salaam Roger.
Call again. In contact.
Aircraft: HX

1545 - 1548 hours

E.A.C.: 5-HX East Air
Aircraft: East Air Centre HX
E.A.C.: HX East Air Centre. Confirm now operating IFR
Aircraft: We are V.F.R.
E.A.C.: It's now official night HX.
V.F.R. is not permitted at night.
Aircraft: I know. We're a little late.
E.A.C.: HX Again.
Aircraft: We are late tonight.
E.A.C.: Yes... Affirmative. You will be filing I.F.R.
I take it.
Aircraft: No. Negative.

PAUSE

Aircraft: Eh listen. We're coming in late from BEHOBEHO and we're late and we're very sorry.
E.A.C.: HX Roger. What is your cruising level? Over.
Aircraft: Er. We're at 2000 ft.

1550 hours

Aircraft: Dar es Salaam 5Y-AHX. Control Zone Boundary.
E.A.C.: 5-HX East Air Centre. Contact Dar es Salaam approach on 119.1
(NO REPLY)

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1.9.3 No tape transcript of the Dar es Salaam ATC frequencies is available for the relevant period owing to a major power failure between 1242 and 1300 hours on 23rd August, 1972 and the subsequent ommission to reset the tape recorders.

1.9.4 It is relevant to mention at this juncture that the tape playback on 118.9 mhz (Eastair Centre) indicated that during the outward flight and the first part of the return flight the pilot's voice was crisp and messages clear. From about 1545 hours however the voice of the pilot became hesitant, and messages passed to Eastair Cetre about the requirement to fly under IFR at night were uncertain.

1.10 Aerodrome and Ground Facilities

Dar es Salaam Airport, elevation 181 feet, has two tarmac surfaced runways. One is 1372 metres in length and provides take off and landing directions of $138^{\circ}/318^{\circ}$ under visual flight conditions. The other runway is 2378 metres in length and provides take off and landing directions of $048^{\circ}/228^{\circ}$ under both visual and instrument flight conditions. This runway is the only one available for use at night and is equipped with low intensity simple approach lighting, Visual Approach Slope Indicator System (VASIS), green threshold lights, and low intensity omni-directional runway edge lights. Other aerodrome lighting consists of obstruction lights, apron lighting, lighted landing tee and emergency goose-neck flares. The aerodrome and Air Traffic Control hours of operation are on a continuous basis throughout 24 hours.

1.11 Flight Recorder

No recorder was fitted to the aircraft nor was one required to be fitted.

1.12 The Wreckage

Examination of the wreckage at the crash site revealed that the aircraft struck the ground at a steep nose down attitude, about $30^{\circ}$ from vertical with the starboard wing slightly down. The area of the initial impact showed a small crater 15 feet. long by 4 feet wide and 2 feet deep, which contained a large amount of windscreen perspex and part of the windscreen structure. The propeller separated from the engine and was also found in the crater. The point of impact was 10 yards from the edge of a small clearing in a forest about 400 yards long by 200 yards wide, the main wreckage was found at a point some 60 feet from the initial impact.

The aircraft structure was inspected for evidence of pre-crash failure, all major components were accounted for with the exception of the starboard aileron which could not be found in the immediate area of the crash site. It was decided to carry out a search in the area of the forest which was directly in the line of flight, but since the forest was rather dense an air search by helicopter revealed the aileron, crumpled, lying in the top of a tree approx. 200 yds. from the point of impact. The trees in this area were estimated to be between 60-80 ft. high.

Aircraft Structure

There was no evidence of pre-crash failure, both mainplanes had separated from the fuselage on impact and were carried along with the main wreckage approx. 60 feet by the flying control cables. The

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The starboard wing became inverted after impact and all fuel tanks were burst open. The tail unit remained intact. The fuselage was seriously damaged, the section forward of the RH door rear post and the cabin roof had disintegrated and various rivetted skin joints had burst open.

The two entrance doors to the cabin were checked to ascertain whether they were open or closed at the time of impact and inspection of the latch assemblies revealed that the latches were engaged at impact.

Propeller

It was considered that the engine was operating at a high power setting before the time of impact. One blade was bent aft approx. 50-60° and was in a fine pitch setting. The other blade showed signs of an inertia bend and was in a feathered position. The propeller was dismantled and the operating piston was approx. ¼" off its fine pitch stop. The actuator pin of the feathered blade was sheared allowing the pitch link assy: to cut the oil tube.

Engine

All propeller attachment bolts sheared and propeller mounting flange severely damaged, engine suffered general damage to components, casings, pipelines and ducts etc. Oil and fuel filters were inspected for foreign matter, magneto and fuel pump drives examined for damage. No defects apparent.

Exhaust Heater

Examined for gas leaks, its general conditon was good although it was badly damaged. Assembly was pressure tested and no leaks were revealed on the heat exchange surface. The cabin floor aft of the main spar was removed to check the flap torque shaft position which confirmed that the flaps were in the full down position. The auto pilot aileron servo motor was inspected for defects and was found to be disengaged.

Flying Controls

All attachment assemblies, turn buckles and locking devices were examined and found satisfactory, one aileron balance cable was found broken, examination of the break revealed a tension break consistent with increased tension on separation of the wings. Stabilator trim was found to be set for normal cruising flight slightly forward (nose down) from neutral.

A pair of pliers were found lodged on the control column, there were no marks on the pliers to indicate whether or not they had jammed the controls, and it is not known where they came from.

1.13 Fire

Fire did not occur.

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1.14 Survival Aspects

The pilot and the passenger sitting in row 1 and the passengers sitting in Row 3 were strapped in but due to the high loads on impact the seat belts failed either at the attachment fittings or as in one case the belt material failed. The seat fittings also failed. It is thought that 3 passengers sat in row 2, although only 2 seats are fitted in this row the seat belts were not fastened. These 3 passengers had severe head injuries consistent with the damage to the cabin roof section.

Due to the high loads sustained by the occupants on impact this accident was not survivable.

1.15 Tests and Research

Investigations at the accident site revealed no evidence of either aircraft structure of system failure.

Fuel System

The fuel system of the Piper PA 32-300 consists of 4 tanks, 2 main tanks each of 25 U.S. gallons capacity situated in the leading edge of each mainplane and 2 auxiliary tanks each of 17 U.S. gallons situated at the wing tip of each mainplane. The aircraft had been refuelled at Dar es Salaam on the morning of the day of the accident, the fuel uplift was 210 litres (55 U.S. gals.) and the tanks were reported to be full. The pilot filed a flight plan in which he stated that his endurance was 5 hours, from this it is evident that he calculated his endurance at the rate of 16 U.S. gallons an hour. By reference to the 2 previous flights, on the 21st, time flown 3.2 hours fuel uplift on 22nd 229 litres (60 U.S. gallons), fuel consumed at a rate of 18.7 U.S. gals. per hour. On the 22nd time flown 3.6 hours, fuel uplift on the 23rd 210 litres (55 U.S. gals) fuel consumed at a rate of 15.3 U.S. gals. per hour.

The duration of the flight to Behobeho is estimated to be 50 mins, fuel consumed on this sector would be approx. 13.4 U.S gallons. It is also estimated that he departed from Behobeho at 15.20, the aircraft clock found in the wreckage had stopped at 16.07 hours which makes the return flight duration 47 mins, fuel consumed on this sector would be approx. 12.5 U.S. gals, making the total fuel consumed 25.9 U.S. gals. If the previous day's fuel consumption is considered at 15.3 U.S. gals. per hour then the total fuel consumed on the round flight would be approx. 24.7 U.S. gals. which would be practically the usable capacity of one of the main tanks.

The fuel system as a whole was badly damaged as a result of the accident and it was difficult to establish with any certainty which tank was selected at the time of the accident. Eye witness reports and the condition of the propeller have indicated that the engine was running at a high power setting on impact.

Cabin Heater

The heat exchanger was inspected for the possibility of gas leakage into the cabin ventilation system, although this unit was severely damaged the heat exchange surface remained intact.

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A visual inspection of the heat exchange surface was carried out and the metal was found to be in good condition free from cracks, burning and surface distortion. Orifices were blanked off and the unit pressure tested - no leaks were revealed.

Power Plant

The engine and propeller were transported to Tim Air Charters maintenance base at Dar es Salaam where they were partially dismantled for further investigation. No seizure of the engine and ancilliary drives had taken place, oil and fuel filters were clean and free from foreign matter. The propeller was partially dismantled to ascertain its blade setting on impact and the piston was found to be about $\frac{1}{4}$ in. off its fine pitch stop.

1.16 Medical Aspects

A post mortem was carried out on the pilot to ascertain the cause of death so far as physical injury was concerned. However, before a complete autopsy was carried out the body of the pilot was cremated at the request of the United States Embassy in Dar es Salaam and authority was granted by the police authorites without reference to the Chief Inspector of Accidents.

2.1 Analysis

2.1.1 Factors leading to the Accident

The evidence indicated that the aircraft struck the ground after first striking a tree while the pilot was circling low in an attempt to find a place to land. Approximately 13 minutes before the accident occurred the pilot was heard to report "field in sight" followed by 'Radar give us a Vector'. As the accident site is 35 nm south west of Dar es Salaam Airport and approximately 12 nautical miles south of track Behobeho/Dar es Salaam, and since examination of the wreckage failed to reveal any malfunction of the aircraft, it can be inferred that the pilot probably became lost and possibly disorientated during the final phase of the flight.

The reason why the pilot may have become lost is obscure. The flight time from Behobeho to Dar es Salaam Airport was of only 50 minutes duration and navigational facilities provide adequate guidance from a point at least 20 minutes flight time from the Airport. Further more, the new Tanzam Railway Line should have provided a good track check, even in twilight conditions, for the first half of the flight. This was substantiated during a flight carried out by an Inspector of Accidents during the investigation. On this particular flight which departed Behobeho for Dar es Salaam at approximately the same time as the accident aircraft, the Inspector of Accidents noted the following:

1. The non-directional beacon (NDB) 'DR' at Dar es Salaam gave a positive indication while on the ground at Behobeho.

2. The VHF omni-range at Dar es Salaam gave a positive indication about 10 minutes after take-off.

3. The new Tanzam Railway was plainly visible until darkness fell, even through haze in twilight conditions.

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4. At Flight Level 50 (5000 feet) Dar es Salaam Radar located the aircraft at 47 nautical miles. The aircraft was subsequently indentified by radar at 27 nautical miles.

5. The lights of Dar es Salaam were visible at a distance of approximately 12 nautical miles.

6. Hazy conditons were encountered due to numerous bush fires.

There is no evidence that failure of aircraft radio communications or navigation equipment occurred, and even if the pilot had become lost in an area relatively close to his destination a commercial pilot such as he with a background as flight navigator with several thousand hours flying experience would normally resort to basic airmanship and climb to a higher level in order to:-

(i) establish radio contact with Dar es Salaam

(ii) enable radar at Dar es Salaam to locate the aircraft

(iii) provide better guidance from the aircraft radio navigational equipment.

Instead of carrying out this procedure, the aircraft, according to witness reports was seen "flying low with landing lights on as if looking for a place to land". The area over which the aircraft was seen to be flying low and where it subsequently hit a tree and crashed, is sparsely populated, and, could not be mistaken for Dar es Salaam Airport. Unless an aircraft system failed or the pilot became ill, it is difficult to find reasons for his actions.

It also remains for conjecture as to the reason why the pilot was reluctant to file an airborne Instrument Flight Rules (IFR) Flight Plan. The pilot was instrument rated and although the aircraft, being single engine, was not approved under the Regulations for flight at night for the purposes of Public Transport, the pilot could have resorted to instrument flying without being unduly disturbed about spatial disorientation which is common to pilots who are not instrument rated and who inadvertently encounter IFR conditions.

The accident site although 35 nautical miles from Dar es Salaam is only about 12 nautical miles starboard of track and it is possible that numerous bush fires in the area were mistaken for the lights of Dar es Salaam.

Another aspect of this accident is that it happened when the estimated fuel used on the round trip was approaching the capacity of one main tank. Although this aircraft was not certificated to carry 6 passengers, the pilot had previously been flying a PA 32-300 which was certificated for 6 passengers, in such a configuration this model has a zero fuel weight limitation of 3112 lb. and all weight above this figure must be fuel, the tip tanks being filled first and the remaining fuel weight being added to the main tanks making a total gross weight of 3400 lb. The fuel selection is placarded and part of the placarding reads USE MAIN TANKS FIRST.

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2.1.2. Loading

The gross weight and centre of gravity at the time of the accident has been computed as follows:-

| | | | | |
|---|---|---|---|---|
| A/c empty weight | 1903 lb. | 80.4" | ARM | 153,100 lb. ins. |
| Fuel | 348 lb. | 95.0 | " | 33,060 " " |
| Oil | 16 " | 16.6 | " | 266 " " |
| Row 1. | 358 " | 85.5 | " | 30,609 " " |
| Row 2. | 436 " | 120.2 | " | 58,407 " " |
| Row 3. | 330 " | 155.7 | " | 51,381 " " |
| Baggage | 20 " | 178.0 | " | 3,560 " " |
| | 3411 lb. | | | 330,383 lb. ins. |

C.G. = 96.85" AFT OF DATUM.

C.G. at max. authorised weight of 3400 lb. is 95.5 ins. aft of datum.

Known weights:- PILOT EHRHORN 200 lb.
PASSENGERS. Mr. Toussaint 158 lb.
" Mrs.Toussaint 128 lb.

| | | | | |
|---|---|---|---|---|
| Unknown weights: | " | Mrs. Molge. | Assessed average wt. | 143 lb |
| | " | Mr. Schmidt | " " " | 165 lb |
| | " | Mr. Moge | " " " | 165 lb |
| | " | Mr. Meyor | " " " | 165 lb |

Baggage. 1 cold box and contents assessed at ..... 20 lb

to determine the centre of gravity the position of the passengers had to be assessed by comparison of injuries to the known factors of seating.

Row 1. Mr. Toussaint

Row 2. Mrs. Toussaintm Mrs Molge & Mr. Meyor.

Row 3. Mr. Schmidt and Mr. Molge.

2. At the time of the take off from Behobeho the gross weight and centre of gravity was:-

Gross weight 3486 lb. C.G. 96.81 ins. aft of datum.

3. At the time of the take off from Dar es Salaam on the day of the accident the gross weight and C.G was:-

gross weight 3566 lb C.G. 9677 ins. aft of datum.

There was no seat or safety belt available for the 7th person on board at the time of the accident. The Zero fuel weight limit of 3112 lb. was not exceeded.

2.2 CONCLUSIONS

1. The aircraft, certificated as a six seater, was incorrectly loaded in that (a) seven persons were carried, (b) the certified gross weight of 3400 lb. was exceeded by 166 lb. at take off from Dar es Salaam, by 86 lb. at take off from Behobeho and by 11 at

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the time of the accident. (c) the certified aft limit of the centre of gravity at gross weight was exceeded by 1.27 inches at take off from Dar es Salaam, by 1.31 inches at take off from Behobeho and by 1.35 inches at the time of the accident. It should also be noted that the loaded C.G at take off from Dar es Salaam was aft of the fuel arm consequently as fuel was consumed ruring flight the C.G. would move aft as opposed to the C.G. normally moving forward as would be the case if the aircraft was loaded correctly.

2. All maintenance requirements had been completed to a schedule approved for operation in PRIVATE category, however, the new operator omitted to have a Check I carried out a schedule approved for operations in the TRANSPORT category and consequently a Certificate of Maintenance was not issued for operation in this category. A Technical log book had not been issued for this aircraft as required under the Regulations.

3. The pilot's licence was not valid at the time of the accident nor was he type rated for the aircraft.

4. The pilot continued flight under Instrument Flight conditions in contravention of the Regulations governing flight at night for the purpose of public transport.

5. The FAA approved flight manual for this aircraft was not carried in the aircraft on this flight.

6. The pilot's mental condition on the flight may have impaired his airmanship since just before the departure from Behobeho he lost his temper and quarreled with a driver from Ker Downey & Selby Safaris concerning the delay in transporting the passengers to the airstrip.

7. There was no evidence of pre-crash structural or system failure, the flap torque tube was found to be in the flap extended position.

8. Eye witness reports have stated that the aircraft was observed flying low in the area of the crash site, in darkness, with its lights on. Examination of the wreckage revealed the flap torque tube to be in the flap extended position. It could be assumed therefore that the pilot was looking for a suitable area in which to make a landing when the aircraft flew into the top of a tree. It is not clear whether the pilot was lost at this stage of the flight, having on the one hand, called 'airfield in sight' and on the other calling Dar. radar for a vector. No messages were received or relayed to East Air Centre or Dar es Salaam A.T.C. to indicate that the aircraft was malfunctioning or, in the case of loading was becoming difficult to control at the lower airspeeds associated with approach and landing. From the evidence available it would appear from the time of the departure from Dar es Salaam on the day of the accident the flight was not undertaken in accordance with the regulations governing the operation of aircraft certificated in the transport (passenger) category.

Cause

The aircraft struck the top of a tree with its starboard wings resulting in the separation of the aileron from its attachments while flying low in the area of a forest clearing during darkness in an attempt to make a landing in a clearing. The aircraft then became uncontrollable and struck the ground at an angle of about 30° from the vertical.

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**Recommendation**

It is recommended that operators should take all reasonable steps to ensure that the pilots they employ are suitably qualified and that their licences are both valid for the types of aircraft that they are going to fly and that the validity has not expired. In addition they must be sure that their pilots are familiar with the routes to be flown and conversant with the emergency operating procedures.

Operators should also ensure that their admistrative and sales staff are familiar with the type of aircraft being operated, so that over-booking does not occur and that a pilot is not faced with the embarrassing situation of having to turn passengers away at the last minute.

(SIGNED)
K.R. Grant)
INSPECTOR OF ACCIDENTS

11th January, 1973

KRG/ZH