No. 40

Central African Airways Corporation (Salisbury, Rhodesia), Viscount, VP-YNE (Mpika), crashed on the hills 5-1/2 miles to the southeast of Benina Aerodrome, Cyrenaica, on 9 August 1958. Report released by the Ministry of Communications, United Kingdom of Libya.

## Circumstances

The flight is a scheduled service from Salisbury, Rhodesia, to London and is known as the Zambezi service. This service is operated by three crews, one crew operating from Salisbury to Entebbe, the second from Entebbe to Benina and the third from Benina to London. On 8 August this service departed from Salisbury at 0713 hours and a stop was made at Ndola for traffic purposes. At Entebbe, a relief crew took over the aircraft for the sector to Benina. Stops were made at Khartoum and Wadi Halfa for refuelling and the aircraft left Wadi Halfa at 2120 hours for Benina; the flight was completely uneventful and slightly ahead of schedule up to the time of the accident. At 0112 hours the aircraft was cleared into Benina control zone. At the request of the pilot, at 0114 hours, permission was given by Benina Approach Control to make a direct approach on to runway 330° Right, using the locator and the responder beacons. Between 20 and 30 seconds after this clearance had been acknowledged by the pilot the aircraft struck high ground 5-1/2 miles to the southeast of the aerodrome. Fire broke out on impact. Of the 7 crew and 47 passengers aboard the aircraft, 4 crew and 32 passengers were killed in the crash.

## Investigation and Evidence

### Weather

The following is a summary of the actual weather conditions prevailing in the Benina area at the time of the accident, taken from evidence given by the captain of an Argonaut aircraft inward bound to Benina from Khartoum. The aircraft was flying approximately 45 miles behind VP-YNE when the accident occurred, and the captain saw the flash as the aircraft struck the ground.

There was no upper cloud. The lights of Benghazi were visible 45 miles out from 14 500 ft, but the aerodrome lights were not visible at that range. It was estimated that there was 4/8 low cloud with tops at 2 000 to 2 500 ft in the Benina area and to the southeast of the aerodrome there was 7/8 stratus which started at the edge of the aerodrome and extended for about 30 miles to the east and southeast. To the west and north of the aerodrome there was only 2/8 cloud with mist patches below. Whilst the Argonaut was carrying out a visual circuit it was confirmed that the cloud base was 500 ft. On base leg of the circuit, patches of mist or low stratus were encountered which temporarily obscured the runway lights. Visibility on short final approach was good and estimated at 5 to 6 miles.

The Argonaut captain was also under the impression that the cloud base was lower than 500 ft to the southeast on the approach to runway 330° Right but had no means of confirming this.

The assessment of the weather reported by this pilot is regarded as an accurate picture of the weather conditions prevailing at the time of the accident, since he made two circuits of the crash at 6 000 ft and two circuits of the aerodrome before landing very shortly after the accident occurred. There was also a quarter moon which had risen at 2256 hours.

The weather minima given in the Central African Airways Operations Manual for compliance by pilots when landing at Benina by night, using VDF or the non-directional beacon, is that the cloud base will not be below 400 ft and the runway visual range less than 3 000 yards. Since the last weather report passed to the pilot advised 6/8 stratus, cloud base 500 ft, visibility 6 miles, wind 360° at 2 knots, conditions were above these minima.

Crew

The captain's Airline Transport Pilot's licence was last renewed on 21 July 1958. His total flying experience at that time on multi-engined aircraft as pilot-in-command was: by day: 8 603 hours; by night: 555 hours; as second pilot:- by day: 1 456 hours; by night: 100 hours. These totals included 768 hours as pilot-in-command, and 152 hours as second pilot on Viscount aircraft.

When his Airline Transport Pilot's licence was last renewed the first officer's total flying experience as pilot-in-command was:- by day 2 916 hours; by night: 288 hours; as second pilot:- by day: 1 136 hours; by night 163 hours. Included in these totals was 961 hours as second pilot on Viscount aircraft. He passed his annual instrument rating test on 28 July 1958.

Reconstruction of the flight

The take-off from Wadi Halfa was made at 2120 hours with an estimated time of arrival at Benina of 0126 hours.

After passing longitude 25° east, the boundary of the Malta Flight Information Region, two-way radio communication was established with Malta Area Control Centre and at 0047 hours the following message from the aircraft was transmitted to Malta "abeam El Adem 0036 flight level 16.5. Estimating Benina 0116, estimating Benghazi southeast 0111. Request descent clearance at 0101." This message indicated that a slightly better ground speed had been achieved than was anticipated when leaving Wadi Halfa. Over the greater length of this desert route the radio navigational aids would give little real assistance and for this reason astro-navigation would have been used. However, when the aircraft came abeam of El Adem it was possible for the navigator to obtain an accurate bearing and distance from this aerodrome and, therefore, he was able from this information to plot the aircraft's position with accuracy. At 0038 hours a bearing of 131° class "A" was given to the aircraft by Benina Homer, and at 0048 hours a distance of 93 miles from Benina was read off on the distance measuring equipment. Therefore, it can be accepted that, at 0101 hours when the aircraft commenced its descent from flight level 16 500 ft, it was at the correct distance of 46 miles out from Benina and on track. At 0052 hours Malta cleared the aircraft to Benina Approach Control and to a flight level of 4 000 ft.

Subsequently, the aircraft communicated with Benina and confirmed its estimated time of arrival Benghazi South East (the boundary of Benina Control Zone) as 0111 hours and on this first contact with Benina, Approach Control passed the 0100 hours weather observation "Surface wind 360° at 2 knots, visibility 6 miles. Weather cloudy with 6/8 stratus estimated base 500 ft QNH 1012. Benina Approach Control then asked the aircraft to report reaching flight level 4 000 ft and when at Benghazi South East, which was acknowledged. At 0112 hours, VP-YNE advised "At Benghazi South East this time and just coming up to flight level 4 000 ft." The aircraft was then under the direct control of Benina Approach Control. The controller then cleared the aircraft to continue its descent to a height of 2 500 ft which was acknowledged by "Roger, clear down to 2 500 ft request QFE and surface temperature." This was passed to the aircraft as 997 millibars, surface temperature 22°C, the aircraft acknowledging with "Roger 997 22°". Approximately one minute later the pilot asked if he was clear for a direct approach on responder and locator beacons. This was acknowledged by Benina Approach

Control "Affirmative, I have no other traffic. You are cleared to position for a direct approach on locator beacon and responder. Advise finals". This was acknowledged, "Roger leaving two-five now". This was the last call received from the aircraft.

Rescue Services

Due to misunderstanding mainly created by language difficulties in the control tower, the effort to locate the site of the accident did not get into full swing until 0300 hours.

At the time of the accident Benina tower was manned by the controller and an Air Traffic Control clerk, the normal staff complement. The controller instructed the clerk to alert the telephone exchanges and then to inform the airport fire section of the accident and to order the dispatch of fire and rescue vehicles, but to retain one fire tender to cover the expected departure of a Britannia aircraft. This conditional instruction, which had to be translated into Arabic by the clerk and passed to the fire section, manned at that time entirely by Arabic speaking staff, resulted in one ambulance only being dispatched immediately. The controller then asked the clerk to inform the British Military Hospital (BMH), the army fire brigade and the civil hospital that an aircraft with 54 people on board had crashed and to send ambulances and medical aid to Benina immediately. The controller contacted the U.S.A.F. at Berca 2 aerodrome, and the R.A.F. at El Adem and Malta, informing these units of the accident and requesting assistance.

The evidence relative to subsequent events is conflicting. However, the following facts have heen substantiated:

The fire and rescue vehicles ordered by the controller through the Air Traffic Control clerk were not dispatched at once. However, the ambulance was dispatched to a point just outside the aerodrome where it waited some considerable time and eventually followed other vehicles to the accident.

The fire-rescue Landrover fitted with VHF R/T, which should have been the first vehicle away, did not leave the aerodrome until approximately 0230 hours when it was taken by the Fire Services Officer, who had driven by car from his residence in Benghazi after being notified of the accident.

A Landrover from the fire section, which had been asked for by the captain of the relief crew awaiting the arrival of VP-YNE, left the aerodrome approximately thirty minutes after the accident. Aboard this vehicle were the captain, his first officer, a flight hostess, the control tower clerk and the driver.

At approximately 0245 hours the controller realized that the ambulances from the BMH had not arrived, and, therefore, put a call through to the hospital himself, and was told that the hospital had not been notified before.

On this point the evidence is again conflicting since the clerk states that he spoke to the BMH when told to do so by the controller and thought that the controller had spoken to the BMH on one line while he, the clerk, was giving a message to the civil hospital on another. The operator in the Benghazi telephone exchange states that he put a call through to the BMH from Benina at about 0115 hours but the duty telephonist at the BMH states that no calls were received by him between 2230 hours on the 8th and 0300 hours on the 9th, when a call was received from Benina asking if the ambulances were on their way to the accident. This was confirmed by the Wardmaster who was in the hospital telephone exchange from 2100 hours to 0300 hours.

The ambulances from the BMH arrived at the scene of the accident at 0500 hours, led there by the Cyrenaican Defence Force vehicle that had located the accident a short time before.

No fire fighting vehicles arrived at the accident site.

In spite of the delay in the arrival of the rescue services there is evidence from the commanding officer of the BMH to show that an earlier arrival would not have affected the number of survivors. The delay must have caused additional suffering to those injured.

Accident Site

The first indications of contact with the ground were the track marks of the nose and mainwheel tires at a position surveyed as 6.058 statute miles from the Control Tower at Benina aerodrome and 539 ft above the height of the runway (964 ft a.m.s.l.). The magnetic heading of the aircraft at the time of impact was 328°, this being clearly shown by the ground markings. The path of approach had been over a rocky plateau with some undulations, but for the most part flat country.

Pre-crash failure

The possibility of any structural failure of the airframe or malfunctioning of the engines or propellers is dismissed in view of the complete lack of any evidence to support such a possibility. The examination of the wreckage, the survivors' statements, some of whom were expert witnesses, and the fact that the pilot was in R/T communication with Benina Approach Control 20, or at the most 30, seconds before the accident occurred all point to the conclusion that no emergency existed.

There is no reason to suspect malfunctioning of any of the navigational or radio aids. In this connection the DME responder on the aerodrome was functioning correctly at the time of the accident and the fact that the pilot had used this equipment when passing El Adem and on the approach to Benina indicates that the aircraft's equipment was also serviceable. The Benina non-directional beacon "BN" was serviceable since it was being used by the BOAC Argonaut at the time of the accident. The runway locator beacon "BN1" was operating and the fact that the pilot had asked to use this aid when within range would indicate that he was receiving the signal satisfactorily. The receiving equipment for the two radio compasses was recovered from the wreckage and found to be tuned to the correct frequencies.

Instrument approach procedures, Benina

At Benina aerodrome the pilot had the choice of three instrument approach-to-landing procedures. The first involves the use of the locator beacon "BN1", the second the locator beacon and DME, the third VDF.

In this instance the pilot elected to approach the runway using the DME and locator beacon without first establishing himself over the aerodrome by the appropriate radio aids. This decision had doubtless been influenced by the fact that the major part of the descent had been made in the clear and with the lights of Benghazi in sight and possibly those of the aerodrome, although the latter is considered to be unlikely. This method of approach, which in reality is the last part of the published DME locator procedure, can be regarded as acceptable if all the equipment is serviceable, and in this case the evidence indicates that it was so. However, with a cloud base of 500 ft the margin of safety must be reduced compared with the procedure whereby the pilot first establishes his position over the aerodrome at the minimum safe altitude. Nevertheless, the controller's evidence shows that the type of approach used in this instance by the captain of VP-YNE is often carried out by pilots when landing at Benina.

The captain's decision to make an approach using DME and locator beacon indicates that it was he and not the first officer who was flying the aircraft, since he was sitting in the left-hand seat and the DME indicator is on the lower left-hand side of the captain's instrument panel making it difficult for the second pilot to read this instrument when sitting in his seat in a normal position.

At a distance of 5-1/2 miles from the locator beacon the aircraft's misalignment with the extended centreline of the runway would only be indicated by a small deflection of the radio compass needle. Therefore, if the pilot was satisfied that he was at his correct height of about 1 650 ft above aerodrome level and 5-1/2 miles from the aerodrome then he would also have been satisfied that he had sufficient height and distance to turn on to the extended centreline in good time before reaching the runway. At the time of the impact he was closing on the centreline, if only slowly, as shown by the aircraft's heading of 328° compared with the runway bearing of 330°.

The descent

The pilot commenced his descent from flight level 16 500 ft at 0101 hours. The descent was made in the clear until the aircraft entered the stratus cloud reported to the southeast of the aerodrome at probably 2 000 to 2 500 ft a.m.s.l. During the descent it is certain, from the evidence given by the Argonaut captain, that the lights of Benghazi would have been visible to the crew of VP-YNE, and it is possible, although unlikely, that some of the lights of Benina were also visible occasionally.

At 0112 hours the pilot reported that he was at flight level 4 000 ft and his position Benghazi South East (this is the entry point to the Benina Control Zone and is 14 miles from the aerodrome). The aircraft was then cleared to continue the descent to 2 500 ft, but before reaching this height the pilot asked for clearance to make a direct approach on to runway 330° Right, using the responder and locator beacons. After permission was given for this approach, the pilot announced that he was leaving 2 500 ft which, as near as can be judged, was two to three minutes after he had called when over Benghazi South East. Twenty to thirty seconds after the call at 2 500 ft the aircraft struck the ground 964 ft a.m.s.l., 8-1/2 miles from the zone boundary and 5-1/2 miles from the aerodrome.

It is difficult to calculate with accuracy the rates of descent and ground speeds during the latter part of the flight since R/T messages at Benina are not automatically recorded. The evidence concerning the time lapse between the last call from the aircraft and the crash, as estimated by the controller and subsequently checked by a timed demonstration, is sufficiently accurate to calculate that a rate of descent between 3 100 and 4 600 ft per minute would have been necessary for the aircraft to have struck the ground at a height of 964 ft a.m.s.l. assuming that it was actually at 2 500 ft when the call was made. Additionally, the evidence given by the Argonaut captain supports the controller's estimation of the short period of time between the last call and the crash.

Such an excessive rate of descent is unacceptable in view of the survivors' evidence on the normality of the descent, and it would have resulted in far greater initial structural damage than was evident from examination of the wreckage. Alternatively, since the distance of the crash from the aerodrome has been definitely established as 5-1/2 miles, and accepting that the last call was made 20 to 30 seconds before impact, the aircraft would have been between 6.25 and 6.6 miles from the aerodrome at the time of the call, assuming an approach speed of 135 knots. Therefore, if a rate of descent of as much as 1 500 ft per minute was being maintained the aircraft would have been located a little more than 4 miles from the aerodrome when it reached the height of 964 ft and at this distance would not have collided with the high ground. Although in this example a rate of descent of 1 500 ft per minute has been used, it should have been considerably less (nearer to 500 ft per minute) if the pilot was adhering to the procedure for approaching runway 330° Right when using DME and locator aids. Therefore, on this final descent it is evident that when the pilot made the call "leaving two-five now" he could not, in fact, have been at this altitude.

The main point at issue in this accident is, therefore, the determination of why the

aircraft struck the ground 539 ft above aerodrome level and 5-1/2 miles out from the aerodrome on final approach, when it should have been at about 1 650 ft at this distance. If the pilot was aware of the distance from the aerodrome then he would have elected to be a great deal higher than he was, or, alternatively, if he was aware of his height then he must have estimated that he was considerably nearer to the aerodrome than he actually was. In regard to his awareness of distance, the earlier paragraphs give reasons for the assumption that the DME was serviceable, but the possibility of his misreading this equipment should not be overlooked. In this connection it will be remembered that the two scales 0 to 20 miles, and 0 to 200 miles on the indicator are presented on the same instrument dial; however, the very big difference in the position of the needle when reading 6 miles on the 0 to 20 mile scale and the same distance on the 0 to 200 mile scale makes the possibility of inadvertent range selection remote. This equipment would almost certainly have been used to establish VP-YNE's position when at Benghazi South East, 14 miles distant from the aerodrome, and the fact that it was necessary for this position to be established with accuracy supports the view that the correct lower range scale was selected then, as well as at the time of the accident.

Turning now to the error in height at the time of the crash when the aircraft was 539 ft above aerodrome level instead of at about 1 650 ft as given in the approach chart - three explanations are possible.

Firstly, the pilot deliberately descending to 500 ft above runway height in order to break cloud is considered to be extremely unlikely since there is no doubt that he was familiar with Benina aerodrome and the surrounding terrain. In support of this view, the captain had used this aerodrome on many occasions, and evidence given by a pilot who had recently flown as his first officer confirms that he was well aware of the presence of the high ground to the southeast of the aerodrome.

Secondly, the incorrect setting of the altimeter millibar scale by the pilots has been considered but rejected as unlikely. The QNH and QFE were repeated back to the controller by the pilot, and the dial of one altimeter was recovered from the wreckage; the dial of this instrument had the correct QFE set upon it and the 10 000 ft needle, the only one remaining, was found at the zero position. To minimize the possibility of incorrect settings of the millibar scale and to check the accuracy of two altimeters it is common practice for pilots to cross check their respective QNH and QFE altimeter readings after the settings are applied, the difference in altimeter readings indicating the published height of the aerodrome, or, that one of the altimeters is unserviceable. Central African Airways had issued an operational order to pilots requiring this to be done. In view of the foregoing it is unlikely that either of the altimeters was unserviceable or incorrectly set on the millibar scale.

Thirdly, the misinterpretation of the reading of the altimeter by the pilot is strongly supported by the evidence of the short lapse of time between the last call from the aircraft and the moment of impact. It must be taken into account that, since for the greater part of the descent the pilot had been flying in clear weather conditions with the lights of Benghazi in view, he had probably not made the same reference to his instruments as if the whole descent had been in cloud. It is possible that the initial incorrect interpretation of the instrument reading may have been made some time before entering cloud at about 2 000 ft. After entering the cloud at this height the pilot would have been commencing the direct approach and his attention would, in all probability, be more concerned with the 100 ft hand than with the 1 000 ft hand, so that an error made before entering the cloud would have been maintained subsequently. It is pertinent to consider here that if the pilot did in fact over-read his altimeter by 1 000 ft, then the rate of descent between the time of his last call

and the time of the crash would be acceptable. A contributory factor when considering the likelihood of the pilot misreading his altimeter is the instrument panel lighting. VP-YNE was equipped with two lighting systems, ultra-violet and red. When the red system only is being used, the positioning of the lights causes a shadow to be cast over the upper part of the altimeter, thus detracting from the ease of reading. This is particularly noticeable when the 1 000 ft hand is between the dial figures 9 and 3. However, if the ultra-violet lighting is directed on to the altimeter, this difficulty is eliminated, but in any case it has not been possible to establish whether either or both systems were being used at the time.

Possibility of crew fatigue

Finally, the question of whether or not the pilots were unduly fatigued at the time of the accident should be considered. A surviving crew member stated in evidence that the crew had returned at about 1900 hours on 7 August and the following morning had taken breakfast at 0630 hours. The same witness was not aware of any crew member sleeping between breakfast time and 1230 hours, the time they reported for duty at Entebbe aerodrome. Therefore, at the time of the accident the crew would have completed over 19 hours without sleep, of which 12 hours, 44 minutes had been spent on duty, including 9 hours, 30 minutes flight time, although from 3 August until the commencement of this flight the crew, with the exception of the cabin staff, had been relieved of all duties. During the sector between Wadi Halfa and Benina the captain had complained to a flight hostess of slight pains in his stomach, for which he was given some kaolin. The fact that the captain was slightly indisposed is not considered significant in itself. Nevertheless, this, coupled with the long period he had been without sleep, and the fact that the flight was finishing in the early hours of the morning, make it possible that his efficiency had been lowered to some extent.

A pilot's flight time limitation, as prescribed in the Federation of Rhodesia and Nyasaland Air Navigation Regulations 1954, is 12 hours in any 24 consecutive hours.

Probable Cause

The cause of the accident was that when making an approach to runway 330° Right and whilst flying in cloud, the pilot descended below the correct height thus permitting the aircraft to strike high ground.

The reason why the pilot descended so low, 5-1/2 miles from the aerodrome, cannot be established, but the most probable cause is that he misinterpreted the reading of his altimeter. The possibility that his efficiency had been reduced by fatigue and a slight indisposition cannot be excluded.

Observations

Electronic recording of the R/T between Benina tower and the aircraft would have facilitated the Board's investigation into the accident and it is thought that this equipment should be provided at Benina and other airports having a similar traffic density.

Statements made by certain of the survivors indicate that difficulty was experienced in locating the operating handles of the emergency exits after the crash. When considering these statements it must be appreciated that the crash occurred in darkness and caused the fuselage to become inverted although some of the survivors were not aware of the fuselage position until after they had evacuated the aircraft. Whilst instructions explaining the method of operation are printed on the flap covering the operating handle of each emergency exit, it is thought that passengers should, in addition, be informed either orally or by illustrated printed instruction, of the correct method of operating these exits so that in an emergency the exits can be released immediately.

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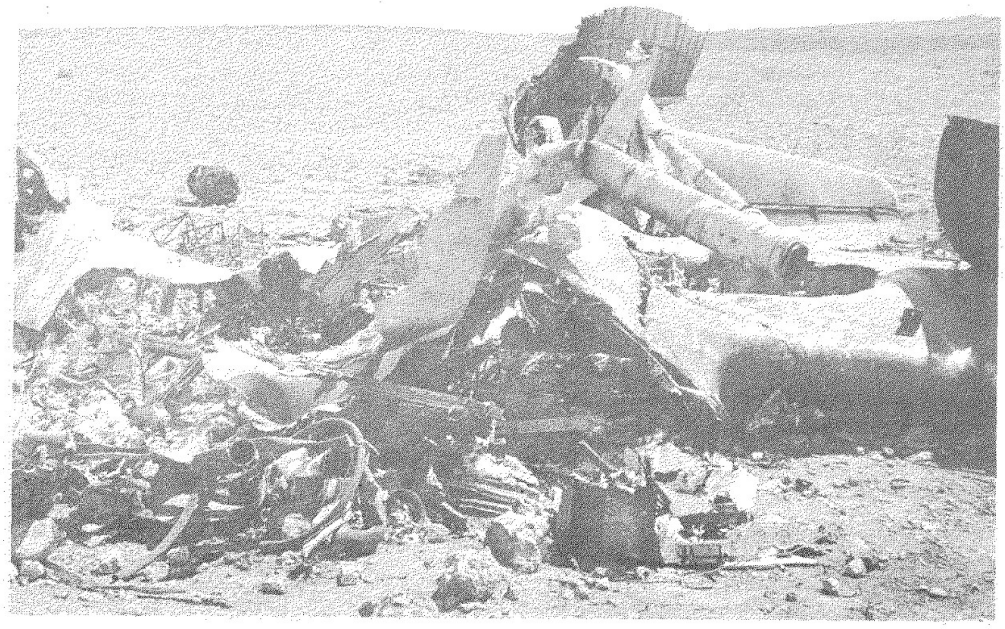

FIGURE 24

CENTRAL AFRICAN AIRWAYS, VISCOUNT, VP-YNE, ACCIDENT SOUTHEAST OF BENINA AERODROME, CYRENAICA, 9 AUGUST 1958.
- General view of the main wreckage - fuselage