1. ACCIDENT DETAILS

1.1 Location
From Ndola aerodrome control tower 6.05 nautical miles on a true bearing 279°. Map reference Ndola 1228D3 grid position 652657, geographical position -
Latitude 12°58'12"S
Longitude 28°31'22"E

1.2 Date and time (approx.)
17th September, 1961. 2215 GMT
18th September, 1961. GG15 local

1.3 Operator
Transair Sweden A.B., Malmo, Sweden.

1.4 Aircraft type and registration
Douglas DC6B SE-EDY

1.5 Extent of damage
Destroyed

1.6 Number of crew
Four, all killed. See appendix 3.1

1.7 Number of passengers
Twelve, all killed. See appendix 3.2

1.8 Type of operation
Public transport - non-scheduled (charter) flight.

1.9 Phase of operation
Approach preparatory to landing.

1.10 Type of accident
Insufficient altitude in approach: collision with trees.

2. SUMMARY

2.1 Brief summary of events leading up to the accident.

2.1.1 The aircraft SE-EDY departed from Leopoldville at 1551 hours GMT on 17th September, 1961 with the Flight Plan destination stated to be Luluabourg. After clearing Leopoldville tower frequency, radio silence was apparently maintained until the aircraft called Salisbury FIC at 2002 GMT filing a revised Flight Plan which indicated the aircraft destination to be Ndola, estimated time of arrival 2235 GMT. At 2035 GMT the aircraft reported over Lake Tanganyika, indicating that it was not flying on the direct route from Leopoldville to Ndola. See appendix 1.3

2.1.2 Radio contact was made with Ndola tower at 2135 GMT. During subsequent conversations weather and landing information, and descent clearance from 16,000
to 6,000 feet, were given. The aircraft reported when it was overhead Mola descending, with airport lights in sight. The altimeter setting was confirmed by the aircraft and at 2210 GMT the aircraft was requested to report reaching 6,000 feet. No such report and no further radio communication was received from the aircraft.

2.1.3 Eye witnesses saw the lights of the aircraft pass over Mola airport on a westerly heading and disappear from view. The aircraft failed to report for final landing instructions, and although it was then believed that it had changed its intention and was proceeding elsewhere, overdue action was nevertheless initiated.

2.1.4 The wreckage of the aircraft was located about eight nautical miles from Mola airport on a bearing of 270° True. Police arrived on the scene of the accident at 1345 GMT. Only one of the occupants was found to be alive and he subsequently died.

2.2 Authority convening inquiry, appointment of accredited representatives, etc.

2.2.1 In view of the importance of the personality involved and the widespread interest in this serious and tragic accident, the Federal Government required the Director of Civil Aviation personally to lead the technical investigation, assisted by Wing Commander Evans, R.A.F., of the British High Commission to the Federation. The investigating board consisted of:

Lt. Col. H.C.H. Barber, D.F.C. Director of Civil Aviation, Federation of Rhodesia and Nyasaland (Chairman)


Mr. M. Ladders, A.F.R.Ae.S., Chief Inspector of Aircraft, Federal Department of Civil Aviation.

W/Cdr. E. Evans, R.A.F. Air Adviser, British High Commissioner to the Federation.
2.2.2 Representatives from Sweden - the State of Registry,
the International Civil Aviation Organisation on behalf of
United Nations, the International Federation of Airline
Pilots Associations, and Transair the operators of the
aircraft, were invited to participate in the investigation.
These persons were:

Accredited Representatives:

Mr. E.A. Landin
Inspector of Civil Aviation,
Royal Swedish Board of Civil Aviation.

Mr. J.P. Fournier
International Civil Aviation
Organisation/United Nations

Capt. A.G. McAfee
International Federation of Airline
Pilots Associations

Technical Advisers:

To Mr. Landin:

Dr. E. Bratt
Minister for Sweden to the
Republic of South Africa.

Mr. T. Nylen, LL.M.
Legal Adviser, Royal Swedish Board
of Civil Aviation.

Mr. K. Lindman
Temporarily attached to the Royal
Swedish Board of Civil Aviation,
as Senior Inspector of Aircraft.

Mr. O. Denicolsson
Superintendent, Swedish Criminal
State Police.

Mr. N. Landin, M.Sc.
Assistant Director of the Swedish
National Institute of Technical
Police.

Mr. A.W. Jansson
Temporarily attached to the Royal
Swedish Board of Civil Aviation,
as Inspector of Aircraft.

To Mr. Fournier:

Mr. T.R. Nelson
A.F.R.L.O., S.M.C.,...L. International Civil Aviation
Organisation/United Nations

On behalf of Transair Sweden, ...E., the owners and operators
of the aircraft:

Capt. S. Persson
Director of Flight Operations,
Transair Sweden, ...E.

Mr. E. Wirving
Chief Engineer, Transair Sweden,...E.

Mr. C.G. Hellberg
Chief Flight Engineer,
Transair Sweden, ...E.

Secretary to the Board:

Mr. I.J. Berry
Senior Aerodrome Officer,
Federal Department of Civil Aviation.
PART 2 - FACTS SUBMITTED BY INQUIRY

3. AIRCRAFT INFORMATION

3.1 Registration marking
SE-BDY

3.2 Aircraft type and makers serial number
Douglas DC6B serial number 43559

3.3 Engine type, airframe positions and makers serial numbers
Prett & Whitney R2800-CB-17
Posn. No. 1 serial P.38665
" " 2 " P.31738
" " 3 " P.32147
" " 4 " P.35867

3.4 Certificate of Registration number and validity
No. 1508 - validity unlimited.

3.5 Certificate of Airworthiness; number and date of expiry, and Flight Manual number.
The temporary C of A has no number, and is valid until 31st October, 1961. The Flight Manual has no number, it is attached to the temporary C of A.

3.6 Certificate of Maintenance date and time (GMT) of issue and period of validity
Issued 17th September, 1961, at 1100 GMT and valid for 24 hours.

3.7 Date of construction of airframe
1952

3.8 Name and address of owners

3.9 Gross weight: maximum permitted by the C of A for this flight, and at time of accident
Maximum authorised take-off weight 107000 lbs.
Actual take-off weight 90994 lbs.
Maximum authorised landing weight 88200 lbs.
Actual weight at time of accident 76762 lbs.

3.10 Loading -

3.10.1 Centre of Gravity limits from Flight Manual
Gross weight up to and including 87500 lbs:
Forward limit - lift limit
11.0% MAC 33% MAC

Gross weight up to and including 103000 lbs:
Forward limit - lift limit
14.0% MAC 33% MAC
3.10.2 Actual C of G position at commencement of flight and at time of accident

C of G position at take-off between 20.0 and 26.0% MAC. C of G position at time of accident between 17.1 and 25.3% MAC.

3.11 Airframe history -

3.11.1 Flying time since manufacture

16340 hours

3.11.2 Flying time since last overhaul

7210 hours

3.11.3 Flying time since last periodic check

105 hours

3.11.4 Modifications

All applicable FAA airworthiness Directives have been complied with

3.12 Engine history

3.12.1 Flying time since manufacture

No. 1 (P.35865) 5521 hours

" 2 (P.31738) 5886 "

" 3 (P.32147) 7927 "

" 4 (P.35867) 4848 "

3.12.2 Flying time since last overhaul

No. 1 (P.35865) 518 hours

" 2 (P.31738) 390 "

" 3 (P.32147) 278 "

" 4 (P.35867) 1091 "

3.12.3 Flying time since last periodic check

No. 1 (P.35865) 105 hours

" 2 (P.31738) 105 "

" 3 (P.32147) 105 "

" 4 (P.35867) 105 "

3.12.4 Modifications

All applicable FAA airworthiness Directives have been complied with

4. Crew Information

4.1 Name

Hallonquist, Per-Erik Bo.

Duty

Pilot in Command
Age
Type of licence
Swedish Airline Transport Pilot's licence number D-193.
Aircraft class
Type Ratings
Instrument Rating and date of last check
Included in the licence, 28th June, 1961
Date of last medical examination
24th April, 1961.
Expiry date of licence
31st October, 1961.
Types flown

Time on accident type: LC-6 1266 hours DC-6B 179 hours
Time on type in past 90 days DC-6B 205 hours
Time on type in past 24 hours 7 hours
Grand total 7841 hours

Captain Hallonquist started his flight training in the Swedish R.A.F. in 1946 where he remained until 1953. In 1947 he was issued with a Private Pilot's licence. A Commercial Pilot's licence was issued to him in 1953. At about this time he had further flight training for 4 months with Air Service Training Limited, England. He obtained his Airline Transport Pilot's licence in 1955. He was also the holder of a valid Flight Radio Telephony Operator's licence number 4447. He was employed by Transair as a co-pilot on DC-3 in 1954, and was promoted to captain on DC-3 in 1955 and on Curtiss C-46 in 1957. During October-November, 1959, he was given theoretical and practical training on DC-6 aircraft under the supervision of Scandinavian Airlines System. In December, 1959, he commenced flying as a captain on DC-6 for Transair. His total instrument flight time and night flight time was 2669 hours. He had not been involved in any previous flying accidents.
<table>
<thead>
<tr>
<th>Name</th>
<th>Litton, Lars Olaf.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duty</td>
<td>Co-pilot</td>
</tr>
<tr>
<td>Age</td>
<td>29 years</td>
</tr>
<tr>
<td>Type of licence</td>
<td>Swedish Airline Transport Pilot's licence number D-360</td>
</tr>
<tr>
<td>Aircraft class</td>
<td>Single- and multi-engined land aircraft</td>
</tr>
<tr>
<td>Type Ratings</td>
<td>is a captain, Douglas DC-3, Douglas DC-6. is a co-pilot, Curtiss C-46.</td>
</tr>
<tr>
<td>Instrument Rating and date of last check</td>
<td>Included in the licence. 6th April, 1961.</td>
</tr>
<tr>
<td>Date of last medical examination</td>
<td>17th July, 1961</td>
</tr>
<tr>
<td>Expiry date of licence</td>
<td>31st January, 1962</td>
</tr>
<tr>
<td>Types flown</td>
<td>Cessna 140, Luscombe Silvaire, Piper Cub, Beechcraft,uster V, D.H. 89, Airspeed Cansul, Klemm 35, Douglas DC-3, Curtiss C-46, Douglas DC-6, Douglas DC-5B.</td>
</tr>
<tr>
<td>Time on accident type</td>
<td>DC-6 506 hours DC-6B 216 hours</td>
</tr>
<tr>
<td>Time on type in past 90 days</td>
<td>DC-6 261 hours</td>
</tr>
<tr>
<td>Time on type in past 24 hours</td>
<td>17 hours</td>
</tr>
<tr>
<td>Grand total</td>
<td>2707 hours</td>
</tr>
</tbody>
</table>

First Officer Litton had his first flight training at a private Swedish flying school, and obtained his Private Pilot's licence in 1953. A Commercial Pilot's licence was issued to him in 1955. He obtained his Airline Transport Pilot's licence in 1961. He was also the holder of a valid Flight Radio Telephony Operator's licence number 4443. He was employed by Transair as a co-pilot on DC-3 and Curtiss C-46 in 1958. During November, 1960, he was given theoretical and practical training on DC-6 aircraft under the supervision of Scandinavian Airlines System. In December, 1960, he commenced flying as a co-pilot on DC-6 for Transair. His total instrument flight time and night flight time was 835 hours. He had not been involved in any previous flying accident.
<table>
<thead>
<tr>
<th>1.3</th>
<th>Name</th>
<th>Wilhelmsso, Nils-Goran</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Duty</td>
<td>Flight Engineer</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>27 years</td>
</tr>
<tr>
<td></td>
<td>Type of licence</td>
<td>Swedish Flight Engineer's licence number MP-129</td>
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<tr>
<td></td>
<td>Type Ratings</td>
<td>Curtiss C-46, Douglas DC-6</td>
</tr>
<tr>
<td></td>
<td>Date of last medical examination</td>
<td>17th July, 1961</td>
</tr>
<tr>
<td></td>
<td>Expiry date of licence</td>
<td>31st July, 1962</td>
</tr>
<tr>
<td></td>
<td>Time on accident type</td>
<td>DC-6 1173 hours DC-6B 195 hours</td>
</tr>
<tr>
<td></td>
<td>Time on type in past 24 hours</td>
<td>DO6/6B 34 hours</td>
</tr>
<tr>
<td></td>
<td>Time on type in past 24 hours</td>
<td>17 hours</td>
</tr>
<tr>
<td></td>
<td>Grand total</td>
<td>2650 hours</td>
</tr>
</tbody>
</table>

Mr. Wilhelmsso was also the holder of a valid Swedish Aircraft Maintenance Engineer's licence number M6-411. He completed a course at a Swedish Municipal Technical School for ground engineers during the years 1949-1951. During the years 1952-1957 he was employed as a ground engineer with a Swedish civil air carrier, and also with the Swedish R.A.F.

He was employed as a ground engineer by Transair in 1957 and started to work as a flight engineer on Curtiss C-46 with Transair in 1958. During March, 1960, he completed theoretical and practical training on DC-6 aircraft under the supervision of Scandinavian Airlines System.

<table>
<thead>
<tr>
<th>4.4</th>
<th>Name</th>
<th>Ahreus, Nils-Erik</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Duty</td>
<td>Reserve Captain</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>32 years</td>
</tr>
<tr>
<td></td>
<td>Type of licence</td>
<td>Swedish Airline Transport Pilot's licence number D-199</td>
</tr>
<tr>
<td></td>
<td>Aircraft class</td>
<td>Single- and multi-engined land aircraft</td>
</tr>
<tr>
<td></td>
<td>Type Ratings</td>
<td>Douglas DC-3, Curtiss C-46, Douglas DC-6.</td>
</tr>
<tr>
<td></td>
<td>Instrument Rating and date of last check</td>
<td>Included in the licence 3rd May, 1961.</td>
</tr>
<tr>
<td>Date of last medical examination</td>
<td>28th April, 1961</td>
<td></td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>Expiry date of licence</td>
<td>31st October, 1961</td>
<td></td>
</tr>
<tr>
<td>Time on accident type</td>
<td>DC-6 738 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LC-6B 122 hours</td>
<td></td>
</tr>
<tr>
<td>Time on type in past 90 days</td>
<td>DC6/6B 244 hours</td>
<td></td>
</tr>
<tr>
<td>Time on type in past 24 hours</td>
<td>10 hours 40 minutes</td>
<td></td>
</tr>
<tr>
<td>Grand total</td>
<td>7107 hours</td>
<td></td>
</tr>
</tbody>
</table>

Captain Ahrons started his flight training in the Swedish R.A.F. in 1947, where he remained until May, 1954. In 1947 he obtained his Private Pilot's licence. A Commercial Pilot's licence was issued to him in 1948. Around June, 1954, he was employed as a pilot with a Swedish air carrier engaged in agricultural flying. In 1955 he obtained a Senior Commercial Pilot's licence. He was given an Airline Transport Pilot's licence in 1956. He was also the holder of a valid Flight Radio Telephony Operator's licence number 4402. He was employed by Transair as a co-pilot on DC-3 in 1955 and was promoted to captain on DC-3 in 1956, and on Curtiss C-46 in 1958. During October and November, 1960, he completed a course of theoretical and practical training on DC-6 aircraft under the supervision of Scandinavian Airlines System. In November, 1960, he commenced flying as a captain on DC-6 aircraft for Transair. His total instrument flight time and total night flight time was 1500 hours. He had not been involved in any previous flying accident.

5. **WEATHER INFORMATION**

5.1 The last routine weather observation taken prior to the accident was made by the Meteorological Office staff at Molga at 1900 GMT on 17th September (3½ hours before the accident). This observation was recorded on a Form No. 48 (serial...
number 17) and passed to the Air Traffic Control Officer. It contained the following information:-

**Wabra - 17/9/61 1900 GMT**
- Surface wind - direction 110°(M) speed 10 knots
- Visibility - 5 miles
- Present weather - fine, slight haze
- Cloud - nil
- QNH - 1019.9 mbs (30.12 ins)
- QFE - 875.6 mbs (25.86 ins)

5.2 The following is an extract from the autographic record for 2200Z on 17th September, 1961.
- Surface pressure 876.7 mbs i.e. 25.89 ins giving a
  - QNH of 30.15 ins (1021 mbs)
- Screen temperature - 70°F.
- Surface wind - 120/9 kts (True)

5.3 The following is the weather report transmitted by Hiala Air Traffic Control in the aircraft NE-61Y at 2137 (38 minutes approx. before the accident).
- Surface wind - 120°(M) 7 knots
- Visibility - 5 to 10 miles with slight smoke haze
- QNH - 1021 mbs
- QFE - 877 mbs

5.4 Moonset - 0024 GMT - 1st Quarter

6. **NAVIGATION AIDS**

6.1 **AIDS AVAILABLE ON THIS FLIGHT**
- Leopoldville - NDB and VOR
- Hiala - NDB, VLF and DME

6.2 **AIDS FITTED TO THE AIRCRAFT**
- 1 ea US Army Type BE-16 Magnetic Compass
- 2 ea Pioneer Bendix D120 Master Direction Indicator
- 2 ea Collins Type 3314-2 Course Line Indicator
- 2 ea Pioneer Bendix 36105-1J-15-C1 Magnetic Indicator
- 2 ea 61Y-1 ADF Receiver
- 1 ea 16002-1-C Flight Path Computer
- 2 ea 51 R-FLY Receiver (VOR/ILS)

/...
2 ea 51 U-2 GS Receiver (ILS)
1 ea MX-74 Korkor Receiver (ILS)
1 ea AN-10 Receiver Transmitter (Radar)

6.3 AIDS used and their effectiveness.

6.3.1 Navigation was not a significant factor in this accident as the aircraft arrived safely over the destination airport of Ndola. All the aids at 6.1 above were fully serviceable throughout the duration of the flight.

6.4 Aids, radio facility charts, etc.

6.4.1 It was not possible to ascertain what maps were actually used during the flight. However, as the aircraft completed a flight from Leopoldville to Ndola via the
Southern end of Lake Tanganyika, the maps used were obviously sufficient for the purpose.

6.4.2 The operators of the aircraft, lessers, Transair, have stated that all let-down and destination information is obtained from the Jeppesen Route Manual. A copy of this manual was recovered from the wreckage and, although badly burned, it was possible to ascertain that it had been amended by "IL" on 11/9 to include amendment number
34. The approach chart sheet for Ndola was missing, and it is possible that it was removed by the captain and placed in front of him whilst carrying out his approach to the airport. It was ascertained from a complete copy of the manual that the information regarding Ndola was correct. In addition, a copy of the U.S. Air Force publication "Flight Information Publication - Terminal (Low Altitude)" dated July, 1961, was found in the wreckage. There is no mention of Ndola in this publication but Ndola aerodrome, situated on the outskirts of Leopoldville, is included. Certain notes appear in green on the Ndola sheet and on the top cover of the publication. These notes may be significant in that there is reason to believe that Ndolo was not used by large aircraft at any time after the issue of this particular publication (July, 1961) and in that at least one of the notes on the Ndolo sheet appears to relate to Ndola. The relative approach altitudes, shown on the Ndolo sheet are substantially lower than those applicable to Ndola.
7. COMMUNICATIONS

7.1 Data on communications and their functioning.

7.1.1 The aircraft obtained take-off clearance from Leopoldville tower on VHF and was airborne at 1551 GMT. The Investigating Board has found no evidence to show that this aircraft had any radio communication after leaving Leopoldville until 2002 GMT when contact was made with Salisbury FIC on 5521.5 kc/s. H/T R/T communication with Salisbury FIC was maintained successfully until 2132 GMT when the aircraft was told to contact Mola approach. At 2135 GMT the aircraft contacted Mola on 119.4 mc/s and maintained VHF communication until the last contact at 2210 GMT when it was overhead the airport. Recordings of H/T R/T conversations between the aircraft and Salisbury FIC on 5521.5 kc/s and also between the Salisbury FIC and Mola tower were made at 1820-1822 kc/s. Extracts from the LTC log at Mola are at appendix 1.4 and 1.5. There were no tape recording facilities at Mola for recording radio communications.

8. GROUND INSTALLATIONS

8.1 Condition of aerodrome and installations.

8.1.1 Mola aerodrome has one bitumen runway 10/28 which is 6650 feet long by 100 feet wide, and is an all-weather aerodrome. The aerodrome is normally manned with LTC, communications, meteorological, and fire fighting staff during the hours 0400-1600 GMT and to cover scheduled movements outside these hours. The aerodrome and all facilities were fully serviceable during the night of 17th/18th September, 1964 and communication staff were on duty throughout the night. LTC and fire fighting personnel remained on duty from 1600 GMT on the 17th until 0115 GMT on the 18th.

9. FIRE FIGHTING EQUIPMENT

Due to the ignition of large quantities of fuel, estimated to be in excess of 1,000 imperial gallons, released by the rupture of the tanks during the crash, the wreckage was largely consumed by fire. The crashed aircraft was not found for some considerable time and therefore no fire fighting activities took place.
10. EXAMINATION OF WRECKAGE AND TECHNICAL INVESTIGATION

10.1 General Observations

10.1.1 Examination of the site of the accident indicated that the aircraft had first struck the tops of trees when on a heading of about 120° (N) at a shallow angle and a moderate rate of descent. The first point of impact with the tree tops is 66 feet higher than the point of impact of the nose of the aircraft with the ground. The linear distance between the two points is 760 feet, giving an average angle of descent after the first impact of 5°.

10.1.2 The propellers of the aircraft cut through the uppermost branches of the trees, and the severed branches, together with pieces of rubber from the propeller de-icing boots, were the first items to be found along the wreckage trail. The left wing tip was severed from the aircraft at an early stage indicating that the aircraft was probably in a slightly left wing-low attitude and the swath cut by the aircraft through the trees indicated an increasing angle of left bank. As the left outer mainplane of the aircraft collided with the trunks of the trees it was progressively demolished. At the same time the propellers and the fuselage suffered increasing damage by impact with trees and detached pieces were scattered along the wreckage trail.

10.1.3 The nose of the aircraft, with the fuselage, centre section empennage and right wing largely intact, struck a 12 foot-high anthill and the fuselage cartwheeled about the anthill swinging through approximately 180° and suffering complete demolition from further impact with trees and ground. Fire, fed by fuel from the burst tanks, covered the main wreckage and spread 350 feet back along the wreckage trail.

10.1.4 The intensity of the fire melted and fused most of the aluminium alloy of the wing centre section and fuselage. The four engines were broken from their mountings and severely damaged by impact and the subsequent fire. See Wreckage Plan appendix 1.1.
10.1.5 A ground search was organised using more than 160 policemen covering the area indicated on the map at appendix 1.7. The search failed to reveal any parts of the aircraft which had been detached prior to impact with the trees.

10.2 Condition of the wreckage.

10.2.1 The main wreckage was contained in an area approximately 60 feet by 90 feet and its disposition is shown on the wreckage plan at appendices 1.1 and 1.2. With the exception of the empennage, the fuselage aft of the rear pressure dome, and the left hand outer (No. 1) engine, the whole of the concentrated main wreckage was badly damaged by fire. The photographs at appendix 1.9 show the extent of destruction. The wing assembly, comprising left and right inner sections and right hand outer, came to rest correct side uppermost and had been attached to fuselage and power plants prior to impact. The right hand wing and flying control surfaces were badly damaged by impact and this occurred as the wing fell on to the trees in a vertical movement. The empennage was inverted with upper halves of the vertical stabiliser and rudder broken off, the complete right hand stabiliser and elevator were also detached. The left hand inner (No. 2) and the right hand inner (No. 3) engines, together with their respective propellers and nacelles were extensively incinerated. The fuselage nose section including the cockpit was broken up and scattered in an area centred approximately 100 feet before the nearest part of the main wreckage. The fuselage forward of the rear pressure dome was completely destroyed by impact and subsequent fire, the seats, interior fittings and galley equipment being scattered over a wide area. The landing gear assemblies were located in the main wreckage. The left hand wing tip was recovered some 600 feet from the main wreckage, parts of the left hand outer wing being
located in the flight path between these two positions.

Fire had not occurred prior to impact. The detailed technical report on the condition of the wreckage will be found at appendix 1.8.

10.3 Technical Examination of the Wreckage

10.3.1 The accident site was surveyed by two land surveyors of the office of the Northern Rhodesia Government Divisional Surveyor, Nkola, who prepared a grid reference of the site showing contour lines at one foot intervals, position of large anthills and heights of some trees in the wreckage path which had been cut and damaged. The grid reference was marked out on the site by the surveyors using stakes and string, location of damaged trees referred to on the grid drawing being indicated by indexed pegs. The area covered by the grid was 168,000 square feet (840' x 200').

10.3.2 All items of the wreckage were examined at the site for unusual features, relevant settings were recorded where applicable and the parts marked or labelled with the grid reference in which they had been found. The position of all significant parts of the wreckage are plotted on the Wreckage Plan at appendices 1.1 and 1.2.

10.3.3 Various samples of ash, metal and fabric were taken from selected locations in the wreckage by the Chief Research Officer of the Rhodesian Selection Trust, Kalalushi, and subjected to laboratory examination and analysis to check for evidence of explosive agents. A copy of the report prepared following this analysis is contained at appendix 1.10.

10.3.4 A detailed technical report is at appendix 1.8. However, examination of significant wreckage produced the following facts -

10.3.4.1 Landing Gear. The left hand gear assembly was in the "down" position, shown by both pairs of down latch locking lugs in contact and fully engaged with the actuating strut piston at bottom of stroke (fully extended). The right hand gear assembly...
Actuating strut piston was also fully extended, but the down latch locking lugs were broken; this type of breakage would occur only if the lugs were in the fully locked "down" position. In the case of the nose gear assembly the actuating strut piston rod had fractured at the cylinder with the piston at the top of the stroke, indicating that this assembly was also in the fully down position. The landing gear control lever was recovered spring loaded in the landing gear "down" position. The door operating mechanism was also found in the "open" position. There is no doubt that the landing gear was selected "down" and fully locked "down" at the time of impact.

10.3.14.2 Wing Flap System. The flap operating handle was recovered damaged and burnt, the plunger housing was loose on its quadrant which was bent and indicated that the operating handle plunger was in the 5th slot at the time of impact; this represents the 30° flap down position. The quadrant has eight positions: 10°, 15°, 20°, 25°, 30°, 35°, 40° and 50°. The plunger assembly was detached from the operating handle, therefore no positive indication is given by this control, although it is probable that the selector was in fact at the 30° position at the time of impact. The flap position indicator had markings on the dial at the 30° position consistent with the pointer having probably been in this position. All four flap actuating struts were recovered - left hand units loose, right hand units in position. Piston rod extensions were checked but were considered unreliable since the left hand units were wrenched from the wing in the crash and the right hand units were in the full flap "up" position. The right hand wing flaps would be
forced into the "up" position in the crash and since
the hydraulic pipes to the actuating struts were
broken the pistons would move with the flaps.

10.3.4.3 Flying Controls. It is considered that
nothing significant can be deduced from the position
of any of the flying controls and surfaces. The
only components that might have given some indication
were the trim tab actuators. However, these are
cable operated and were forced to the extreme in
one direction, the direction being dependent on
the order of breaking of the operating cables.

10.3.4.4 Engines and Propellers. In examination of
the engines and propellers revealed no sign of
failure or malfunction prior to impact. Inspection
of the propeller stop ring assemblies confirmed
that the angular setting of all propellers was in
the constant speed range. Therefore, it is
considered that the engines and propellers were
operating in a normal manner and developing power
at the moment of first impact.

10.3.4.5 Altimeters. All three altimeters were
set at approximately the correct GND for Miola
airport at the time of the accident. The controller
had given 1021 mb (30.15" Hg) and the altimeter
pressure settings were:

- 1st Pilot's instrument: 30.14" Hg.
- 2nd Pilot's instrument: 30.16" Hg.
- Navigator's instrument: 30.17" Hg.

The pointers on all altimeters were loose and the
readings unreliable. See appendix 1.11 for a
report by the United States Civil Aeronautics Board.

10.3.5 During the period 24th to 30th September, the
wreckage was transported from the crash site to the
hanger at Miola airport where the major components and
those parts which could be recognised were placed in
their relative positions on the hanger floor on a planned
layout of the aircraft. See appendix 1.12.

10.3.6 Following removal of the wreckage from the accident
site, the area where the wreckage and bodies had lain
between grid line 64 and the track (shown on appendix 1.1)
was then raked and sifted using ½" sieves. This operation
produced further pieces of the aircraft, cartridges, cartride
cases, bullets, coins and small items of personal
property. With the exception of the aircraft parts all
items were handed to Northern Rhodesia Government O.I.D.
representatives. The raked residue which did not pass
through the sieves was collected and moved to the Mash
airport hanger for further investigation.

10.3.7 The large fused blocks of metal salvaged from the
fuselage and centre wing area were broken into small pieces
and any visible unmelted parts suspended in the blocks
removed for identification and examination. The thinner
sections of blocks were broken by sledge hammer and
chisel, but it was necessary to break up the heavy blocks
by steam hammer.

10.3.8 All fused items and burnt rubble still adhering
to the wreckage was removed and this, together with the
residue from the breaking operation and heaps of debris,
shovelled from the crash site, were sifted through ¼" sieves.
This second sifting operation produced further pieces
of the aircraft, cartridges, cartridge cases, bullets,
coins and small items of personal property.

10.3.9 To assist in the detailed technical examination
of the wreckage all items removed from the crash site
were segregated in the hanger in the following divisions:

All structural parts of the aircraft that could
be identified together with the power plants and
propellers were placed in approximate correct
positions in the aircraft layout mentioned at
10.3.5 above.
The respective hydraulic, pneumatic, electrical systems, etc.

Small unburnt pieces that could be identified as some part of the wing structure.

Small burnt pieces and pieces embedded in fused blocks that could be identified as parts of the wing structure.

Small unburnt pieces that could be identified as parts of the fuselage structure.

Small burnt pieces and pieces embedded in fused blocks that could be identified as parts of the fuselage structure.

Broken pieces from fused blocks from which all visible unmelted pieces had been removed.

Dust from sifting operations.

Small miscellaneous parts, bolts, nuts, small cabin articles, etc.

10.3.11 Special Technical Investigations and Tests

10.3.11.1 The three altimeters recovered from the first and second pilots and navigator's flight panels were forwarded for detailed specialist examination and report to be carried out under the auspices of the Civil Aeronautics Board, Washington. The relevant report is at appendix 1.11.

10.3.11.2 Samples of ash and burnt wreckage taken from selected positions at the accident site were analysed and checked for the presence of explosive agents, with negative results. The relevant report is at appendix 1.10.

10.3.11.3 All residue from the accident site was raked together and sifted to retrieve all ammunition reported to have been carried in the aircraft, and to search for any bullets or missiles inconsistent with the weapons carried in the aircraft. At the same time a search was made for any foreign objects
or parts of such objects which could have contained explosive agents. The result of these searches was negative.

10.3.11.4 All fire-arms and ammunition recovered from the wreckage were taken by the Northern Rhodesia Police who carried out appropriate investigation. This investigation proved that none of the bullets in the fire-arms had been fired. A report of the ballistics expert is attached at appendix I.13.

10.3.11.5 All parts of the aircraft were examined for bullet holes or signs of explosion or sabotage. Certain items were segregated and formed the subject of special investigations by the Northern Rhodesia Police and by Swedish Government experts. No bullet holes or evidence of sabotage were found.

10.3.12 At 1430 GMT on 2nd November, 1961, the hangar at Mola airport, containing the wreckage, was locked and sealed in the presence of two members of the Investigating Board.

### EXHIBIT 3 CONCLUSIONS AND FINDINGS

11. **RECONSTRUCTION OF FLIGHT UP TO THE ACCIDENT**

11.1 The information available to permit a reasonable reconstruction of the flight is vague and incomplete. The time of departure from Leopoldville was 1551 GMT and the following position reports were made during the flight:

- Over reporting point 432E (07°40'S - 30°33'E) at 2035 GMT
- Abeam Kasama
- Abeam Mola (NDB) at 2106 GMT
- Over Mola airport at 2147 GMT
- Over Mola airport at 2100 GMT

Consequently, there must be some conjecture in any attempt to reconstruct the flight or what should be considered as the most likely route followed by the aircraft. See appendix I.3. This will be particularly true for the portion of the flight between Leopoldville and the point where the position report was made at
2035 G.M.T. The flight plan indicates that the initial cruising altitude should have been 13,500 ft (FL 135) but at 2035 G.M.T. the aircraft reported cruising at 17,500 feet (FL 175). Since there is no indication as to when the aircraft climbed from FL 135 to FL 175, this part of the flight has been computed as if the climb to FL 175 was made immediately after take-off from Leopoldville. It has also been assumed the climb was made in still air at a true speed of 184 knots. This climb should then have taken about 35 minutes and should have covered about 168 nautical miles over the ground. The only upper wind information available to the Board for FL 175 covers that portion of the probable route from reporting point 432B to Nola airport. During the period of the flight this wind is believed to have been 070° - 100°(T) at 10 to 15 knots. For computing purposes a wind of 085°(T) at 15 knots has been used for the portion of the flight from 432B to Nola airport and it has been assumed that for the portion of the flight Leopoldville until reporting time 2035 G.M.T. the wind was weaker and from the East; a wind speed of 5 to 6 knots has been used as the average for this purpose.

11.2 The most likely route followed by SS-EDY between Leopoldville and reporting point 432B was direct to an approximate position 04°35’ South, 29°25’ East, then down Lake Tanganyika to reporting position 432B.

11.3 The computation for the portion of the route that is most likely to have been followed after 432B has been made in reverse, i.e., starting from the time over Nola airport at 2210 G.M.T. at 2147 G.M.T. the aircraft reported above Nola. This was 23 minutes before arriving over Nola. A VDF bearing (QDM 279) taken at the time of this report indicates that the aircraft was then due East of Nola airport. Assuming the aircraft travelled at an average ground speed of 255 knots (240 + 15 knots plus 15 knot tail wind component) from where it was at 2147 G.M.T. until it reached Nola, it would be logical to conclude.
that the aircraft was then 96 nautical miles from Ncola over position 13°00'S, 20°19'W. The distance from abeam Kasama to the assumed position when the aircraft reported at 2147 G.T is 170 nautical miles. The elapsed time for this portion of the flight was 41 minutes. This indicates a ground speed of 245 knots which would appear reasonably consistent with known and assumed circumstances. The distance from abeam Kasama to reporting point 4326 (on a direct line from 4326 to position assumed at 2147 G.T) is 150 nautical miles. This portion of the flight took 31 minutes and indicates that the ground speed would have been 290 knots. This ground speed is not consistent with the other section of the flight and in view of reported wind conditions appears to be unlikely. Since the ground speed South of the point abeam Kasama appears reasonable and consistent, the computed ground speed of 290 knots would appear to suggest that the aircraft covered a shorter distance than 150 nautical miles between 2035 G.T and 2106 G.T, and was probably 22 nautical miles to the South or South East of 4326 when it reported as being over this reporting point.

12. DISCUSSION OF THE EVIDENCE

12.1 There is evidence that an intended flight using either CC-RIC or SE-EDY to carry Dr. Hemmertsjold to Ncolan was proposed on Sunday morning to start at 1600 G.T on Sunday 17th September, 1961. In fact CC-RIC was used and took off 9 minutes early at 1551 GMT.

12.2 Captain Hallonquist apparently did not wish to file a flight plan for this last flight, and the UN Leopoldville suggested at 1500 G.T that he should file a departure plan for destination Lualubourg. Hallonquist did so and on it stated his endurance was 13 hours 25 minutes.

12.3 The U.N. Air Commander, Leopoldville, knew only 45 minutes prior to take-off that destination was Ncola. No one except the aircraft crew concerned appeared to have any knowledge of the proposed route and flight level. This route proved to be
entirely different from that followed by G-HEK, the aircraft carrying Lord Lansdowne, which was to arrive and depart Ndola before the arrival of 5E-HDY, the aircraft carrying Dr. Hammarskjöld. The route followed by 5E-HDY was apparently Leopoldville Lake Tanganyika and then South to embrace Ndola.

12.4 5E-HDY did not contact Nairobi FIG but was in VHF radio contact with Salisbury FIG from 0002 ZUZ, when it was still outside the Salisbury FIR. During subsequent conversations until it was handed over by FIG to Ndola approach at 2132 GMT, the aircraft passed information comprising an abbreviated flight plan giving flight level, routing and ETA Ndola.

12.5 From 2135 GMT the aircraft worked Ndola approach on VHF during which time it was cleared to commence its descent at 2157 GMT from 16,000 feet to 10,000 feet, and was asked to report "top of descent". It did not do so but presumably commenced its descent at that time and flew overhead Ndola airport from East to West at approximately 2210 GMT Sunday 17th September at normal circuit altitude or less. The aircraft was asked to report reaching 6,000 feet after stating he was overhead Ndola, but failed to do so.

12.6 When over the airport the aircraft was heard and observed by a number of witnesses none of whom noticed anything unusual in its flight. The flashing red anti-collision light on top of the aircraft fin was operating and the navigation lights were switched on "steady". It had already indicated its intention to land at Ndola as it had given an MI of 2220 GMT. 5E-HDY apparently flew overhead Ndola radio beacon 2.5 nautical miles West of the airport and apparently continued on a normal procedure turn and letdown. The aircraft was reported as low over the beacon and very low during the procedure turn. Although it had only been cleared down to 6,000 feet MSL (1840 feet above Ndola aerodrome) it did not report as having reached that altitude and, in fact, hit trees and the ground at a shallow angle of 5° or less, at what appears to have been normal approach speed, at an altitude of 4,357 feet MSL with its undercarriage locked down, flaps...
partially extended, and with all 4 engines developing power and all the propellers in the normal pitch range, heading towards the Ndola radio beacon on a landing approach. The 3 cockpit altimeters were set correctly, within fine limits, to the QNH setting given by Ndola. These altimeters are American instruments and cannot be set to QFE settings at Rhodesian altitudes; in addition, it is normal Transair practice to set all altimeters to QNH. However, had it been possible to set the captain's and first officer's altimeters to QFE, then by setting one at QNH and the other at QFE a simple subtraction of indicated heights would have given the height of the aerodrome as a check of the instruments.

12.7 Smoke from a factory chimney near the airport may have been drifting across the approach to runway 10, but it is considered that this had no bearing on the cause of the accident as the pilot of a DC4 which landed at 2035 GMT saw the smoke but had no difficulty whatever in carrying out a visual approach and landing. As the surface wind speed and direction did not alter appreciably between the time the DC4 landed and the time of the crash, the smoke conditions at the time that SE-EDY was carrying out its approach would be similar to those seen by the pilot of the DC4.

12.8 No. 2 engine of SE-EDY was slightly damaged by one small calibre bullet on the morning of Sunday, 17th September at Elisabethville. It was thoroughly inspected and repaired by the afternoon of the same day at Leopoldville. The Transair maintenance staff carried out a very thorough inspection of the aircraft and no further damage was found. The Investigating Board has no reason to doubt the serviceability of SE-EDY for this flight.

12.9 Although Ahreus and Litton had flown from Leopoldville to Elisabethville and return on the night of Saturday, 16th September, Captain Hallonquist had not flown for over 24 hours prior to the flight to Ndola and appeared rested and
in good spirits before take-off. In fact he was apparently most anxious to make the flight. There were crew bunks and sleeping bags on the aircraft.

12.10 Captain Hallonquist was almost certainly seated in the aircraft captain's seat at the time of the impact and co-pilot Litton was almost certainly in the starboard pilot's seat. The three pilots were well qualified and were experienced on the DO6 and had each flown over 100 hours in the Congo within the 6 weeks prior to the crash.

12.11 SE-BDY may have been carrying two parachute flares and while there is no doubt that the magnesium content of these flares would intensify the fire at the crash there is no evidence to show that they caught fire or were dropped prior to the crash.

12.12 There is no evidence that special security arrangements for this aircraft were made at Leopoldville, therefore the possibility for a saboteur to place an infernal device on board this aircraft prior to take off, or to otherwise interfere with it, cannot be precluded. However, no evidence was found which points to sabotage as the cause of the crash. There is no sign of explosion or fire in the air, and the aircraft appears to have been under full control until it hit the trees, and all remaining control system parts appear to have been in good order at the time of impact.

12.13 No evidence has been found to support the suggestion that SE-BDY was shot down by ground fire or by offensive aircraft. In fact the weight of evidence is all against such actions having taken place. The aircraft indicated that once it crossed into the Salisbury FIR it intended to remain outside Congolese territory. SE-BDY had its normal night flying lights on when in the vicinity of Ndola - these included the anti-collision light which would be visible for miles. It is unlikely that the captain would leave these lights on if he realised he was being shot at or chased,
or even if he was concerned about such action being taken against him. The one Katangese Fouga fighter bomber trainer was examined at its base at Kolwezi by some members of the Board and the calibre of its two machine guns noted. No such calibre bullets (or any bullet holes) were found in the wreckage. In fact no bullets inconsistent with weapons carried in the aircraft were found. Local witnesses at Kolwezi have stated that the Fouga had never been operated at night. After examining information from the aircraft manufacturers, the Board is satisfied that Ndola is beyond the Fouga's combat range from Kolwezi - the only known airfield from which it could operate. The aircraft commander stated that he had never violated the Federal border and that he had never shot down an aircraft. There was no radio transmission from SE-BDY indicating that it was being, or had been, shot at or attacked and there was no evidence of bullet or shell injury to the crew which might have prevented such transmission. Up to approximately 2210 GMT on 17th September the pilot was in contact with Ndola tower and was acting and talking normally and the aircraft was seen and heard to be flying in a normal manner. From that time on, for the remaining 5 minutes or so of the aircraft's flight, it was under observation by many police officers on duty and by three witnesses in particular, except for the last 20 or 30 seconds when SE-BDY apparently went below the line of vision of one of them who was standing on a fourth floor balcony. No strange bullets or anything resembling parts of a shell, grenade or rocket have been found and no bullet holes or damage consistent with offensive action have been found in the wreckage. Neither of the pilots made any transmission which indicated trouble or alarm from the time when it was overhead Ndola to the time of the crash (2215 GMT approx.). The aircraft crashed on track, and the wheels and flaps were down - which again points to a normal descent and approach. If the aircraft had been under attack or if the pilots had been worried about such a possibility, the logical thing would have been for them to retract the wheels
and flaps, increase power to take avoiding action, switch out the
lights and warn the aerodrome. The weight of evidence clearly
predominates in favour of a situation that was normal and
correct, except that SE-EDV was about 1,700 feet lower than it
should have been at this point. The Board does not hold the
view that the pilot was flying low intentionally.

12.14 The overwhelming weight of reliable evidence is that at
the time SE-EDV was the only aircraft in the air in the vicinity
of Nicosia.

12.15 There is no evidence of any in-flight fire or explosion in
SE-EDV. There is no singeing, discolouration or burning of the
tree tops prior to the beginning of the ground fire which extended
back from the final wreckage point some 120 yards, which is some
200 yards after the aircraft first touched the tree tops. The
first pieces of wreckage of the aircraft were found in the
direction of flight from the first point of impact with the tree
tops. These were pieces of propeller rubber de-icing boots, then
the port wing tip, pieces of port outer wing, propeller blades, etc.
There was no evidence of fire damage on those pieces which were
not in the area of ground fire.

12.16 Medical evidence shows that two bodies were found to have
bullets, fragments of exploded cartridge cases and percussion caps
in the skin, the subcutaneous tissues or the muscles. These bodies
had ammunition in their vicinity in the wreckage, and the orient-
ation of the bullets within the tissues did not support any
contention that they had been fired from any consistent direction.
The pathologists consider that these injuries resulted from
explosion of ammunition in the fire. The bullets found in the
bodies have been microscopically examined by ballistics experts
and it was ascertained that they had not passed through the barrel
of a fire-arm. Three or four other severely burned bodies were
found to have pieces of partially melted aircraft metal super-

...
and conclusions from the medical report are at appendix 3.3.

12.17 The temporary survivor of the crash made several statements during the 5/6 days he was in hospital. Medical evidence regarding this is that those statements made on the 16th September are unreliable because he was delirious at that time and that statements made during the last 24 hours of his life, with regard to sparks in the sky, may also have no significance as he was then unwell and part of the picture of this disease is spots and flashes of light before the eyes.

12.18 The route taken by the pilot of 00-RIO was virtually direct from Leopoldville to Ndola and passed within 60 miles of Kolwezi. The aircraft was in radio communication with both Kamina and Elisabethville and had its anti-collision beacon and navigation lights illuminated. Until a short time before departure it was generally believed that this aircraft would be carrying the U.N. Secretary General. 00-RIO arrived safely at Ndola without any interference en route.

12.19 The possibility that one of the three American DC3 aircraft parked (2 at Ndola and 1 at Elisabethville) might have been in radio contact with SE-BDU and may have instructed it to divert or had knowledge of the intention to do so was investigated. The evidence of the senior American officer and of the other two aircraft captains is that there was no communication by any of these three aircraft with SE-BDU.

12.20 The remains of the aircraft control mechanisms, power plants and systems have been meticulously examined and no evidence was found of failure or malfunction. This fact, together with the evidence at the crash site and of the mass or the observers' evidence as to the aircraft's behaviour, indicate that there was no technical defect or structural or material failure.

12.21 It was noted that the aircraft captain's altimeter, which was in comparatively good condition, was found disconnected from the static supply. However, had there been a break in the static line as a result of disconnection during flight, the effects would have been immediately apparent as the captain's VSI would have remained stationary, and the airspeed indicator and altimeter would have under-read, i.e. the indicated height would have been lower than the actual height. In other words it would have erred on the safe side. The Board cannot see how this can have any significance as a causal factor in the accident. Additionally, as the co-pilot's and navigator's static instruments were connected to a separate supply any
discrepancy in the readings should have been obvious. The simple misreading of an altimeter, however, cannot be ruled out as a possibility.

12.22 Amounts of up to 7% of carboxyhaemoglobin were found in the two pilots in control, the radio operator and Mr. Serge Barrau as well as 2% in Mr. Hammarskjöld's body, while all others which it was possible to test were negative. The pathologists have stated that these amounts are not significant.

12.23 Because the aircraft flew over the airport and away to the West, some of the witnesses thought that it was going elsewhere or was communicating with another station. Similarly, when the aircraft did not land some witnesses thought that Mr. Hammarskjöld had changed his mind and had diverted the aircraft back to its starting point or to Elisabethville. However, the investigation has satisfied the Board that the aircraft was almost certainly engaged in some form of procedure preparatory to a landing approach.

13. SEARCH AND RESCUE ACTION

13.1 The relevant documents defining Search and Rescue action to be taken in respect of a missing aircraft are:


13.1.2 "AIR TRAFFIC CONTROL INSTRUCTIONS" Department of Civil Aviation dated September, 1960.


13.2 The above documents state inter alia in this case that initiating action should have been taken by Ngola ATS Unit thirty minutes after the latest ETA of SE-EDY, i.e. at 22:45 GMT. In spite of the fact that the "INCELRA" signal was not originated until 23:42 GMT and was not despatched until 00:16 GMT, other correct action was taken by Ngola airport staff,
13.3 The Nociola police continued to try and contact SE-EDY on both VHF channels from 2215 GMT onwards and queried Nociola police for reports of an aircraft crash. He also communicated with Salisbury PIC and initiated a "communication search" and checked other aerodromes for news.

13.4 The Nociola and Rufuriva police organised ground search action by sending out Land Rover patrols in the early hours of the morning from both places to investigate a report of a flash in the sky North West of Nociola. These patrols which started at 0145 GMT found nothing significant. The Nociola control tower was closed at 0145 GMT and there was a communicator left on duty who knew how to contact the Airport Manager.

13.5 The FAA search action which started on Monday morning was finally successful at about the same time as ground reports from Kafirs reached police and airport authorities.

13.6 If the Kafirs who witnessed the crash or heard the explosion had reported the fact to any authority they could have led police or rescue vehicles to the scene of the accident before daylight. No such report was made until about 1300 GMT on Monday 18th.

14. SPECIAL TESTS

14.1 In view of the diversity of opinion amongst witnesses as to height above ground and as to what lights were showing from SE-EDY whilst over or in the vicinity of Nociola airport, an experiment was carried out using a L06 aircraft belonging to Transair, and flown by a Transair crew with one of the Board's observers (who is also the Director of Flight Operations of Transair) acting as second pilot. Two members of the Board were in the aircraft observing the flights.

14.2 During this experiment the aircraft was flown over Nociola airport and out over the crash site on the night of 19th October, 1961, making five different runs at varying heights with different combinations of lights showing, at different power settings and speeds. Full details of these flights are at appendix 1.14.

14.3 During these tests the pilot followed the let-down pattern detailed in the Jeppesen route manual as used by Transair crews, and on each occasion it was noted that the aircraft flew over, or very close to, the crash site and on approximately the same heading as the swath through
the trees. (The crash site in the forest was identified by Police Land Rover vehicles stationed there with their headlights illuminated).

14.4 Whilst this flying was being carried out all but one of the relevant witnesses were placed in the positions they held on the night of the accident and were accompanied by members or observers of the Board. These witnesses were given forms to complete which requested information regarding height, direction, noise and lights of the aircraft being used in the tests as compared with what they saw and/or heard on the night of the accident.

14.5 An analysis of the results of these flights, together with discussion with the witnesses at the time, shows that the majority of witnesses were emphatic that the aircraft on test was never as low as SE-EDY on the night of the accident, as the lowest flight during the tests was 6,000 feet (1,840 feet above ground) over the airport and 5,300 feet (934 feet above the tree tops) over the crash site, it would seem to indicate that SE-EDY was low over the airport and very low during the turn to approach the airport. In fact this points to SE-EDY being below 6,000 feet MSL when overhead the airport and certainly much lower than the obstacle clearance limit of 4,660 feet (500 feet above the airport) specified on the Nola approach chart in the Jeppesen Route Manual, after passing over the airport and during the turn to approach.

The majority of the witnesses indicated that SE-EDY was showing its flashing red anti-collision light and navigation lights on "steady", with the power settings and speed consistent with a normal circuit and approach.

14.6 In addition, two special flights were made using DC3 aircraft with members of the Board flying in the aircraft as observers on each occasion. The first flight was made at night, carrying out an instrument procedure let-down to Nola aerodrome, to investigate whether the town and aerodrome lights may have been confusing to a pilot arriving to the area. It was agreed that the lights did not cause confusion. The second flight was made immediately
before dusk to simulate as nearly as possible a D6 carrying out a procedure approach. The speed was maintained at 140 knots. In each case the test aircraft flew approximately overhead the crash site on approximately the same heading as the crash swath through the trees, and the Board is satisfied that SE-MLY was carrying out a procedure approach when it crashed.

15. **CONCLUSIONS**

15.1 The aircraft was correctly certificated and had been maintained in accordance with the approved maintenance schedule.

15.2 The aircraft was correctly loaded with the C of G within prescribed limits.

15.3 No evidence could be found to suggest failure or malfunction of the aircraft control mechanisms, power plants or systems. The evidence at the crash site and the mass of observers' evidence as to the aircraft's behaviour indicate that there was no technical defect or structural or material failure.

15.4 The three altimeters installed in the aircraft were recovered and it was possible to determine that the correct QNH for Kola was set on each instrument.

15.5 The crew held valid licences appropriate to their duties and had not exceeded the prescribed flight time limitations.

15.6 All navigational aids and radio facilities at Kola were fully serviceable and operating at the time of the accident.

15.7 The weather at the time of the accident was fine with slight smoke haze and the night was dark and there was no cloud. The moon was in its first Quarter and set at 2224 G.M.T.

15.8 SE-MLY had been cleared by the A.T.C. Kola down to 6,000 feet M.A.S. after checking the QNH and was asked to report reaching 6,000 feet. The aircraft did not report reaching 6,000 feet but passed overhead Kola airport and overhead (or nearly so) the Kola I.D.S. It had almost completed the procedure turn when it struck the tree tops. Its wheels
were extended and the flaps partially extended at the time.
The aircraft first touched the tree tops at a height of 4,357
feet MSL. Ndola airport is 4,160 feet MSL.
15.9 SE-HEY was showing the correct external lights up to
the time of the accident.
15.10 The pathologists have stated that no medical cause
for this accident has been found and that there exists no
medical evidence of sabotage.
15.11 IIG Salisbury and Ndola Tower had sufficient infor-
mation regarding SE-HEY's position, destination and ETA for
their control purposes.
15.12 The Control Tower was closed down at Ndola airport on
the night in question after INCREASE action had been initiated
but not resolved. A communicator was on duty throughout the
night who could have recalled staff if required.
15.13 Certain African charcoal burners could have reached
the crash site by 2245 GMT and loc rescuers to the crash
before daylight had they so wished.

16. CAUSES.
16.1 The Investigating Board is of the opinion that the
evidence available does not enable them to determine a
specific or definite cause.
16.2 The following list gives the Board's opinion of the
possibilities. The order of listing is not intended to
indicate any degree of priority.
16.3 The wilful act of some person or persons unknown which
might have forced the aircraft to descend and collide
with the trees.

16.3.1 Comment. The Board is of the opinion taking
into consideration the extent of the destruction of
the aircraft and the lack of survivor's evidence,
that this possibility cannot be completely ruled out.
The Board is, however, satisfied, on the weight of
evidence available to it that it is an unlikely
possibility.
16.4 Some undetermined defect in the engines, the airframe, control mechanisms or systems, beyond the power of the crew to remedy in the air that might have induced the forced descent of the aircraft.

16.4.1 Comment. Despite intensive examination of the wreckage no such defect has been discovered.

The weight of evidence suggests that the aircraft was airworthy and fully controllable immediately prior to collision with the trees.

16.5 Descent of a fully controllable aircraft into the trees due to (a) some misunderstanding of the aerodrome altitude or (b) some sudden incapacitation of the three pilots on board or (c) some misreading of the aircraft's altimeters or (d) some incorrect altitude indication on at least one of the aircraft's three altimeters, or some combination of (a) to (a).

16.5.1 Comment. In the opinion of the Board the probable cause of the accident lies within this group.