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REPORT OF THE COMMISSION OF INVESTIGATION INTO THE CONDITIONS AND CIRCUMSTANCES RESULTING IN THE TRAGIC DEATH OF MR. DAG HAMMARSKJOLD AND OF MEMBERS OF THE PARTY ACCOMPANYING HIM*

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ANNEX I

GENERAL ASSEMBLY RESOLUTION 1628 (XVI) OF 26 OCTOBER 1961

An international investigation into the conditions and circumstances resulting in the tragic death of Mr. Dag Hammarskjöld and of members of the party accompanying him

The General Assembly,

Recalling that on 18 September 1961 the aircraft carrying Mr. Dag Hammarskjöld, the Secretary-General, and fifteen United Nations officials on a mission in the service of the United Nations crashed in the vicinity of the Ndola airport in Northern Rhodesia resulting in the tragic death of Mr. Hammarskjöld and his entire party,

Having regard to the world-wide public concern over the disastrous end of this flight undertaken on behalf, and in the service, of the United Nations,

Noting that much concern prevails in the world in regard to both this tragedy and the circumstances surrounding it, which warrant an international investigation, the absence of which can only lead to the continuance of the present undesirable speculation,

Noting further that inquiries have been or are being conducted by Governments or parties concerned,

Considering it desirable and necessary that, irrespective of such inquiries and investigation of such incidents, which concern the United Nations, should be carried out under the authority and auspices of the United Nations,

1. Expresses its profound shock and sorrow at the death of Mr. Hammarskjöld and the following persons who died with him in the service of the United Nations as a result of the air crash:

Mr. Heinrich A. Wieschhoff,

Mr. Vladimir Fabry,

Mr. William Ranallo,

Miss Alice Lalonde,

Mr. Harold M. Julien,

Mr. Serge L. Barrau,
Mr. Francis Eivers,
Mr. S.O. Hjelte,
Mr. P.E. Persson,
Mr. Per Hallonquist,
Mr. Nils-Eric Aahréus,
Mr. Lars Litton,
Mr. Nils Göran Wilhelmsson,
Mr. Harold Noork,
Mr. Karl Erik Rosén;

2. Offers its sincere condolences and deep sympathy to the families of Mr. Hammarskjöld and the other victims;

3. Decides that an investigation of an international character, under the auspices of the United Nations, should be held immediately into all the conditions and circumstances surrounding this tragedy, and more particularly as to:

- (a) Why the flight had to be undertaken at night without escort;
- (b) Why its arrival at Ndola was unduly delayed, as reported;
- (c) Whether the aircraft, after having established contact with the tower at Ndola lost that contact, and the fact of its having crashed did not become known until several hours afterwards, and if so, why;
- (d) Whether the aircraft, after the damage it was reported to have suffered earlier from firing by aircraft hostile to the United Nations, was in a proper condition for use;

4. Further decides to appoint a Commission of five eminent persons to carry out such an investigation, and requests the Commission to report its findings to the President of the General Assembly within three months of its appointment;

5. Requests all Governments and parties concerned and the appropriate specialized agencies of the United Nations to extend their full co-operation and assistance to the said Commission in making this investigation;

6. Decides to consider, in the appropriate Committee during the current session, the question of offering suitable remuneration to the families of the victims of this grave tragedy.



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ANNEX II

REPORT OF THE RHODESIAN BOARD OF INVESTIGATION

FEDERAL DEPARTMENT OF CIVIL AVIATION

C I V I L A I R C R A F T A C C I D E N T

Report by the Investigating Board on the accident to
Douglas DC6B aircraft SE-BDY which occurred near Ndola
Airport during the night of 17th September, 1961

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GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT

ADF	Automatic Direction Finding
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATS	Air Traffic Services Unit
C of A	Certificate of Airworthiness
C of G	Centre of Gravity
DME	Distance Measuring Equipment
ETA	Estimated Time of Arrival
F.A.A.	Federal Aeronautics Administration
FIG	Flight Information Centre
FIR	Flight Information Region
FL	Flight Level
GMT	Greenwich Mean Time
H/F R/T	High Frequency Radio Telephony
Hg	Inches of Mercury
ICAO	International Civil Aviation Organisation
IFALPA	International Federation of Airline Pilots Associations
ILS	Instrument Landing System
ins	Inches
kts	Knots
kc/s	Kilocycles
(M)	Magnetic
M.C	Mean Aerodynamic Chord
mbs	Millibars
mc/s	Megacycles
MER	Above Mean Sea Level
NDB	Non-directional Radio Beacon
QDM	"Q" Code symbol for the bearing to be steered in zero wind to reach the radio station concerned.
QFE	"Q" Code symbol for the pressure setting to be set on an altimeter for it to read zero on landing.
QNH	"Q" Code symbol for the pressure setting to be set on an altimeter for it to read the aerodrome height MER on landing.
R.A.F	Royal Air Force
RRAF	Royal Rhodesian Air Force
R/T	Radio Telephony
(T)	True
T.S	True Air Speed
U.N.	United Nations
VHF	Very High Frequency Radio Telephony
VOR	VHF Omnidirectional Radio Range
VSI	Vertical Speed Indicator

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I N D E X

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* All appendices are not reproduced. Those which appear as annexes to the United Nations Commission report are indicated. The others are on file with the Secretariat and may be consulted by interested delegations.

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REPORT BY THE INVESTIGATING BOARD ON THE ACCIDENT TO SE-BDY

PART 1 - INTRODUCTION

1. ACCIDENT DETAILS

- | | |
|---------------------------------------|--|
| 1.1 Location | From Ndola aerodrome control tower
8.05 nautical miles on a true
bearing 279°. Map reference
Ndola 1228D3 grid position 652657,
geographical position -

Latitude 12°58'20"S
Longitude 28°31'23"E |
| 1.2 Date and time (approx.) | 17th September, 1961. 2215 GMT
18th September, 1961. 0015 local |
| 1.3 Operator | Transair Sweden A.B., Malmo, Sweden. |
| 1.4 Aircraft type and
registration | Douglas DC6B SE-BDY |
| 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-BDY departed from Leopoldville at 1551 hours GMT on 17th September, 1961 with the Flight Plan destination stated to be Luluaburg. 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 Ndola 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 Ndola 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 Ndola airport on a bearing of 279° 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. M.C.E. Barber, D.F.C.	Director of Civil Aviation, Federation of Rhodesia and Nyasaland (Chairman)
G/Capt. J. Blanchard-Sims, A.F.R.Ae.S.,	Senior Operations Officer, Federal Department of Civil Aviation.
Mr. M. Madders, 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.

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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. B. Bratt	Minister for Sweden to the Republic of South Africa.
Mr. T. Nylen, LL.M.	Legal Adviser, Royal Swedish Board of Civil Aviation.
Mr. H.B.L. Lindman	Temporarily attached to the Royal Swedish Board of Civil Aviation, as Senior Inspector of Aircraft.
Mr. O. Danielsson	Superintendent, Swedish Criminal State Police.
Mr. N. Landin, M.Sc.	Assistant Director of the Swedish National Institute of Technical Police.
Mr. L.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., C.S. M.C.A.I.	International Civil Aviation Organisation/United Nations

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

Capt. S. Persson	Director of Flight Operations, Transair Sweden, A.B.
Mr. E. Virving	Chief Engineer, Transair Sweden, A.B.
Mr. C.G. Hellberg	Chief Flight Engineer, Transair Sweden, A.B.
Secretary to the Board :	
Mr. I.J. Berry	Senior Aerodromes Officer, Federal Department of Civil Aviation.

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PART 2 - FACTS ASCERTAINED 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 Pratt & Whitney R2800-CB-17
Posn. No. 1 serial P.35865
" " 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 Transair Sweden, A.B. Malmo,
Sweden.
- 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 90594
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 | Aft limit |
| 11.0% MAC | 33% MAC |
- Gross weight up to and
including 103800 lbs:
- | | |
|---------------|-----------|
| Forward limit | Aft limit |
| 14.2% MAC | 33% MAC |
- /...

Gross weight up to and
including 107000 lbs:

Forward limit	Aft limit
16.0% MLC	33% MLC

Landing gear extended.

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 26.9% MLC.

C of G position at time of
accident between 17.1 and
25.3% MLC

3.11 Airframe history -

3.11.1 Flying time
since manu-
facture

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 F.M. Airworthi-
ness Directives have been
complied with

3.12 Engine history

3.12.1 Flying time
since manu-
facture

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 F.M. Airworthi-
ness Directives have been
complied with

4. CREW INFORMATION

4.1 Name

Hallonquist, Per-Erik Bo.

Duty

Pilot in Command

Age	35 years
Type of licence	Swedish Airline Transport Pilot's licence number D-193.
Aircraft class	Single- and multi-engined land aircraft.
Type Ratings	Douglas DC-3, Curtiss C-46/ CW-20-T, Douglas DC-6.
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	Bucker Bestmann, Harvard, Focke Wulf, "Stieglitz", Fieseler Storch, Saab B17, Saab J21, Douglas DC-3, Curtiss C-46, Douglas LC-6, Douglas DC-6B.
Time on accident type:	LC-6 1266 hours DC-6B 179 hours
Time on type in past 90 days	DC6/6B 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.

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4.2 Name	Litton, Lars Olof.
Duty	Co-pilot
Age	29 years
Type of licence	Swedish Airline Transport Pilot's licence number D-360
Aircraft class	Single- and multi-engined land aircraft
Type Ratings	As a captain, Douglas DC-3, Douglas DC-6. As a co-pilot, Curtiss C-46.
Instrument Rating and date of last check	Included in the licence. 6th April, 1961.
Date of last medical examination	17th July, 1961
Expiry date of licence	31st January, 1962
Types flown	Cessna 140, Luscombe Silvaire, Piper Cub, Ercoupe, Luster V, D.H. 89, Airspeed Consul, Klemm 35, Douglas DC-3, Curtiss C-46, Douglas DC-6, Douglas DC-6B.
Time on accident type	DC-6 506 hours DC-6B 216 hours
Time on type in past 90 days	DC6/6B 261 hours
Time on type in past 24 hours	17 hours
Grand total	2707 hours

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.

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4.3 Name	Wilhelmsson, Nils-Goran
Duty	Flight Engineer
Age	27 years
Type of licence	Swedish Flight Engineer's licence number MF-129
Type Ratings	Curtiss C-46, Douglas DC-6
Date of last medical examination	17th July, 1961
Expiry date of licence	31st July, 1962.
Time on accident type	DC-6 1173 hours DC-6B 195 hours
Time on type in past 90 days	DC6/6B 311 hours
Time on type in past 24 hours	17 hours
Grand total	2630 hours

Mr. Wilhelmsson was also the holder of a valid Swedish Aircraft Maintenance Engineer's licence number MM-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.

4.4 Name	Ahreus, Nils-Erik
Duty	Reserve Captain
Age	32 years
Type of licence	Swedish Airline Transport Pilot's licence number D-199
Aircraft class	Single- and multi-engined land aircraft
Type Ratings	Douglas DC-3, Curtiss C-46, Douglas DC-6.
Instrument Rating and date of last check	Included in the licence 3rd May, 1961.

Date of last medical examination	28th April, 1961
Expiry date of licence	31st October, 1961
Types flown	Tiger Moth, Focke Wulf, "Steiglitz", Fieseler Storch, Klemm 35, Harvard, Buckner Bestmann, Saab Safir, Saab B.17, Vampire, Saab J29, Piper Cub, Luscombe Silhouette, Airspeed Consul, Douglas DC-3, Curtiss C-46, Douglas DC-6, Douglas DC-6B.
Time on accident type	DC-6 738 hours LC-6B 122 hours
Time on type in past 90 days	DC6/6B 241 hours
Time on type in past 24 hours	10 hours 40 minutes
Grand total	7107 hours

Captain Ahrens started his flight training in the Swedish R.L.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 Malmö at 1900 GMT on 17th September (3½ hours before the accident). This observation was recorded on a Form M.O. 48 (serial

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number 17) and passed to the Air Traffic Control Officer. It contained the following information:-

Neola - 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 Neola Air Traffic Control to the aircraft SE-BDY at 2137 (38 minutes approx. before the accident).

Surface wind 120°(M) 7 knots
Visibility 5 to 10 miles with slight smoke haze
Control 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
Neola - 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 331A-2 Course Line Indicator
2 ea Pioneer Bendix 36105-1J-15-C1 Magnetic Indicator
2 ea 51Y-1 ADF Receiver
1 ea 16002-1-C Flight Path Computer
2 ea 51 R-FLN Receiver (VOR/ILS)

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- 2 ea 51 V-2 GS Receiver (ILS)
- 1 ea MKI-7A Marker 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 Maps, 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, Messrs. 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 "II" 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 Ndolo aerodrome, situated on the outskirts of Leopoldville, is included. Certain notes appear in green on the Ndolo 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/F R/T communication with Salisbury FIC was maintained successfully until 2132 GMT when the aircraft was told to contact Ndola approach. At 2135 GMT the aircraft contacted Ndola on 119.1 mc/s and maintained VHF communication until the last contact at 2210 GMT when it was overhead the airport. Recordings of H/F R/T conversations between the aircraft and Salisbury FIC on 5521.5 kc/s and also between the Salisbury FIC ATOC and Ndola tower ATOC on 6915/3682 kc/s are at appendices 1.4 and 1.5. Extracts from the ATC log at Ndola are at appendix 1.6. There were no tape recording facilities at Ndola for recording radio communications.

8. GROUND INSTALLATIONS

8.1 Condition of aerodrome and installations.

8.1.1 Ndola 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 ATC, 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, 1961 and communication staff were on duty throughout the night. ATC 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° (M) 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

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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, Ndola, 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

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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.

10.3.4.2 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 Engine and Propellers. An 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 QNH for Ndola 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 hangar at Ndola airport where the major components and

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those parts which could be recognised were placed in their relative positions on the hangar 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 $\frac{1}{4}$ " sieves. This operation produced further pieces of the aircraft, cartridges, cartridge cases, bullets, coins and small items of personal property. With the exception of the aircraft parts all items were handed to Northern Rhodesia Government C.I.D. representatives. The raked residue which did not pass through the sieves was collected and moved to the Ndola airport hangar 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 " 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 hangar 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 1.13.

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 Ndola airport, containing the wreckage, was locked and sealed in the presence of two members of the Investigating Board.

PART 3 COMMENTS 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	at 2106 GMT
Abeam Ndola (NDB)	at 2147 GMT
Over Ndola airport	at 2210 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 1.3. This will be particularly true for the portion of the flight between Leopoldville and the point where the position report was made at

2035 GMT. The flight plan indicates that the initial cruising altitude should have been 13,500 ft (FL 135) but at 2035 GMT 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 airspeed of 184 knots. This climb should then have taken about 35 minutes and should have covered about 108 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 Ndola airport. During the period of the flight this wind is believed to have been $070^{\circ} - 100^{\circ}(T)$ at 10 to 15 knots. For computing purposes a wind of $085^{\circ}(T)$ at 15 knots has been used for the portion of the flight from 432B to Ndola airport and it has been assumed that for the portion of the flight Leopoldville until reporting time 2035 GMT 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 SE-HDY between Leopoldville and reporting point 432B was direct to an approximate position $04^{\circ}35'$ South, $29^{\circ}25'$ 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 Ndola airport at 2210 GMT. At 2147 GMT the aircraft reported abeam Ndola. This was 23 minutes before arriving over Ndola. A VDF bearing (QDM 279) taken at the time of this report indicates that the aircraft was then due East of Ndola airport. Assuming the aircraft travelled at an average ground speed of 255 knots (240 T.S plus 15 knot tail wind component) from where it was at 2147 GMT until it reached Ndola, it would be logical to conclude.

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that the aircraft was then 98 nautical miles from Ndola over position 13°00'S, 30°19'E. The distance from abeam Kasama to the assumed position when the aircraft reported at 2147 GMT is 170 nautical miles. The elapsed time for this portion of the flight was 41 minutes. This indicates a ground speed of 248 knots which would appear reasonably consistent with known and assumed circumstances. The distance from abeam Kasama to reporting point 432B (on a direct line from 432B to position assumed at 2147 GMT) 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 GMT and 2106 GMT, and was probably 22 nautical miles to the South or South East of 432B 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 CO-RIC or SE-EDY to carry Mr. Hammarskjöld to Ndola was proposed on Sunday morning to start at 1600 GMT on Sunday 17th September, 1961. In fact SE-EDY 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 LTCO Leopoldville suggested at 1500 GMT that he should file a departure plan for destination Luluabourg. 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 Ndola. 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 OO-RIC, the aircraft carrying Lord Lansdowne, which was to arrive and depart Ndola before the arrival of SE-BDY, the aircraft carrying Mr. Hammar-skjold. The route followed by SE-BDY was apparently Leopoldville Lake Tanganyika and then South to abeam Ndola.

12.4 SE-BDY did not contact Nairobi FIC but was in H/F radio contact with Salisbury FIC from 2002 GMT, when it was still outside the Salisbury FIR. During subsequent conversations until it was handed over by FIC to Ndola approach at 2132 GMT, the aircraft passed information comprising an abbreviated flight plan giving flight level, routing and ETAs 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 6,000 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 ETA of 2220 GMT. SE-BDY 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

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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-BDY was carrying out its approach would be similar to those seen by the pilot of the DC4.

12.8 No. 2 engine of SE-BDY 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-BDY 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

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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 DC6 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,

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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

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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-BDY 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-BDY was the only aircraft in the air in the vicinity of Ndola.

12.15 There is no evidence of any in-flight fire or explosion in SE-BDY. 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 blade, 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 orientation 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 superficially sited on them. The pathologists considered that this resulted from the incineration of bodies in the presence of aircraft wreckage and in no way suggests fragmentation from an explosion. None of the foreign objects was found in an individual in any way responsible for flying the aircraft. No other bodies were found to have any foreign metal fragments in them. The summary

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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 18th 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 uremic 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 OO-RIC 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. OO-RIC 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-BDY 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-BDY.

12.20 The remains of the aircraft control mechanisms, power plants and systems have been meticulously examined and no evidence was been found of failure or malfunction. This fact, together with the evidence at the crash site and of the mass of 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

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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. Hammarskjold'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. Hammarskjold 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 turn 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:-

13.1.1 "PROCEDURES FOR SEARCH AND RESCUE WITHIN THE SALISBURY SEARCH AND RESCUE AREA" - Reference 334/3 dated 6th October, 1959.

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

13.1.3 "STATION STANDING INSTRUCTIONS - NDOLA AIRPORT" dated June, 1961

13.2 The above documents state inter alia in this case that initiating action should have been taken by Ndola ATS Unit thirty minutes after the latest ETA of SE-BDY, i.e. at 2245 GMT. In spite of the fact that the "INCERFA" signal was not originated until 2342 GMT and was not despatched until 0016 GMT, other correct action was taken by Ndola airport staff.

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13.3 The ATCC Ndola continued to try and contact SE-BDY on both VHF channels from 2215 GMT onwards and queried Ndola police for reports of an aircraft crash. He also communicated with Salisbury FIC and initiated a "communication search" and checked other aerodromes for news.

13.4 The Ndola and Mufulira police originated 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 Ndola. These patrols which started at 0145 GMT found nothing significant. The Ndola control tower was closed at 0115 GMT and there was a communicator left on duty who knew how to contact the Airport Manager.

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

13.6 If the Africans 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-BDY whilst over or in the vicinity of Ndola airport, an experiment was carried out using a LO6 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 Ndola airport and out over the crash site on the night of 9th 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-BDY on the night of the accident. As the lowest flight during the tests was 6,000 feet (1840 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-BDY was low over the airport and very low during the turn to approach the airport. In fact this points to SE-BDY 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 Ndola 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-BDY 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 Ndola aerodrome, to investigate whether the town and aerodrome lights may have been confusing to a pilot strange to the area. It was agreed that the lights did not cause confusion. The second flight was made immediately

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before dusk to simulate as nearly as possible a DC6 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-BLY 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 Ndola 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 Ndola 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 GMT.
- 15.8 SE-BDY had been cleared by the ATCC Ndola down to 6,000 feet MSL 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 Ndola airport and overhead (or nearly so) the Ndola NDB. 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 MTR. Ndola airport is 4,160 feet MTR.

15.9 SE-BLY 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 FIC Salisbury and Ndola Tower had sufficient information regarding SE-BLY'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 INCERFA 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 led 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.

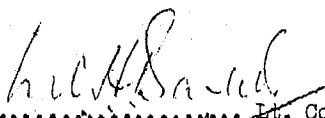
16.4 Some undetermined defect in the engines, the airframe, control mechanisms or systems, beyond the power of the crew to remedy in the air that might have induced the forced descent of the aircraft.

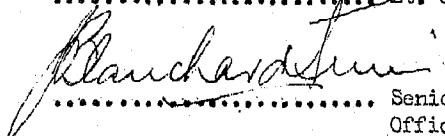
16.4.1 Comment. Despite intensive examination of the wreckage no such defect has been discovered.

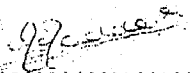
The weight of evidence suggests that the aircraft was airworthy and fully controllable immediately prior to collision with the trees.


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 (d).

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


..... Lt. Col. Chairman


..... Senior Operations Officer


..... Chief Inspector of Aircraft


..... W/Odr. R.A.F.

ANNEX III

REPORT OF THE RHODESIAN COMMISSION OF INQUIRY

To HIS EXCELLENCY SIMON, EARL OF DALHOUSIE, Knight Grand Cross of the Most Excellent Order of the British Empire, upon whom has been conferred the Decoration of the Military Cross, Governor-General and Commander-in-Chief in and over the Federation of Rhodesia and Nyasaland.

May it please Your Excellency,

We, the Commissioners appointed by Your Excellency in terms of the Federal Commissions of Inquiry Act, 1955, have the honour to submit our report. Our report is unanimous.

We were directed to inquire into:

"The cause or causes of and circumstances surrounding the accident involving aircraft SE-BDY near Ndola during the night of the 17th September, 1961, including any matter or circumstances relating to the preparation for and flight of the aircraft, the accident, the deaths of the occupants, and the conduct of any person or authority concerned before, during and after the accident."

PROCEDURE

Before entering on our inquiry we caused to be given in newspapers of the Federation and to be broadcast by the Federal Broadcasting Corporation notification that the inquiry would be held, coupled with a request that persons who might have any information to give to the Commission would do so. The Board of Inquiry appointed under the Federal Aviation Act had before given very extensive advertisement of its presence and its desire that anyone who had any information to give should come forward. We also sent a request to the Chairman of a Commission of Inquiry appointed by the United Nations Organization asking him to notify us of any facts which he thought might assist us. We, for our part, and the Federal Government before and during our inquiry have made available to that Commission all known information. At the end of our public sessions a reply was received to our request which indicated that that Commission had no further information.

Evidence was led on behalf of the Commission by Mr. F. G. Cooke of the Government Solicitor's Department. Counsel who appeared were:

Mr. Roland Adams, Q.C., on behalf of the Swedish Government to have a general care for the interests of the Swedish persons, whether individuals or companies, who might be concerned in the matter and who were not separately represented.

Mr. Geoffrey Lawrence, Q.C., with him Mr. P. J. Stuart Bevan on behalf of Her Majesty's Government in the United Kingdom.

Mr. C. S. Margo, Q.C., with him Mr. R. H. Streeten on behalf of the Federal Government and the Federal Department of Civil Aviation.

Dr. R. H. Mankiewicz appeared before the Commission to represent the United Nations.

Evidence was given before the Commission in public at hearings at Ndola from 16th - 20th January and Salisbury from 22nd - 29th January. The evidence was given on oath or under affirmation, but there were two witnesses who could not be brought before us and earlier statements by those witnesses were admitted. One technical report was also received without evidence.

The procedure adopted in regard to the hearing of the evidence was that the evidence was led on behalf of the Commission by Mr. Cooke. Then all Counsel, in an order determined in each case by themselves, asked whatever questions they wished. Then the Commissioners asked questions. Counsel were not limited in any way in their questioning, and were allowed to question the witness again if further matters occurred to them as a result of other questioning. Witnesses were recalled when that was suggested. At the start of the Commission, Counsel were informed that if they thought that any person who had not been called should be called they had only to tell the Commission and the person would be called if possible. No such request was made.

At the conclusion of the evidence we had the advantage of addresses by Counsel on the issues and evidence.

We must express our very great appreciation of the assistance we got from the earlier inquiry which had been held by the Board of Inquiry. That Board had

obtained statements from more than 130 persons, and the statements were available to us. We called as witnesses all those whose evidence we thought was relevant. In addition some persons came forward on their own initiative to give evidence to assist us. We heard evidence from 120 witnesses. The record of the evidence contains over 750 typed pages. In addition several lengthy technical reports were before us.

We inspected the scene of the crash from the air and on the ground. We inspected the Control Tower at Ndola Airport. And we inspected the wreckage of the aircraft SE-BDY which had all been collected into a hangar at Ndola.

FORM OF THE REPORT

The report is divided into the following parts:

- Part 1. Introduction.
Crew and Passengers.
- Part 2. Geography and Navigating Aids.
- Part 3. The Weather.
- Part 4. Planning and Preparation for the Flight.
- Part 5. Conduct of the Flight.
- Part 6. The Accident.
- Part 7. Examination of the Scene and Wreckage.
- Part 8. Causes of Death of the Occupants of the Aircraft.
- Part 9. Alerting, Search and Rescue Action.
- Part 10. Causes of the Accident.
- Part 11. Conduct of Persons and Authorities after Accident.

- Appendices*
- 1. Examination of Eye-witnesses' Statements.
 - 2. List of Witnesses.
 - 3. Map of Countries and Routes. (See ANNEX XII)
 - 4. Map of Ndola and Country to Crash Area.
 - 5. Photographs of Crash Site.
 - 6. Wreckage Plan. (See ANNEX XIV A)
 - 7. Enlarged Portion of Wreckage Plan. (See ANNEX XIV B)

Times

Throughout the report times are given as Greenwich Mean Time. The local time at Leopoldville is one hour in advance of G.M.T. The local time in the Federation is two hours ahead of G.M.T. Where there is need to refer to the date in September it is set out.

Abbreviations

The following abbreviations are used:

- A.T.C. Air Traffic Controller.
- C.A.S.O. Civil Air Search Officer.
- E.T.A. Estimated Time of Arrival.
- F.I.C. Flight Information Centre.
- F.I.R. Flight Information Region.
- F.L. Flight Level.
- M. Magnetic.
- N.D.B. Non-directional Radio Beacon.
- N.R.P. Northern Rhodesia Police.
- Q.D.M. "Q" Code symbol for the bearing to be steered in zero wind to reach the radio station concerned.
- Q.F.E. "Q" Code symbol for the pressure setting to be set on an altimeter for it to read zero on landing.
- Q.N.H. "Q" Code symbol for the pressure setting to be set on an altimeter for it to read the aerodrome height on landing, above mean sea level.
- R.C.C. Rescue Co-ordination Centre.
- R.R.A.F. Royal Rhodesian Air Force.
- T. True.
- V.H.F. Very High Frequency.

* All appendices are not reproduced. Those which appear as annexes to the United Nations Commission report are indicated. The others are on file with the Secretariat and may be consulted by interested delegations.

PART 1

Introduction. Crew and Passengers

A Swedish aircraft company, Transair Sweden A.B., in September 1961 was operating in the Congo Republic from Leopoldville under charter to the United Nations. It owned a Douglas D.C.6B, an aircraft powered by four Pratt & Whitney engines. This aircraft had been bought second-hand by Transair, and delivery of it was taken in the United States of America. It was flown from there to Leopoldville. Its registration letters were SE-BDY.

On the 17th September, 1961, this aircraft flew from Leopoldville to Ndola in the Federation of Rhodesia and Nyasaland. It carried the Secretary-General of the United Nations Organization, Mr. Dag Hammarskjöld. After reaching Ndola it crashed in the bush to the west of Ndola Airport.

The crew of the aircraft consisted of three pilots, a radio operator and a flight engineer. The pilot in command was Captain P. B. Hallonquist. He had flown for a little under 8,000 hours, including some 1,350 hours on the D.C.6 and D.C.6B types. He was a skilled navigator. His age was 35. The co-pilot was First Officer L. O. Litton. His flying hours were about 2,700, including 720 hours in these types. His age was 29. The reserve captain was Captain N. Ahreus with total flying hours of over 7,100, including 860 hours on these types. His age was 32. The flight engineer was Mr. N. Wilhelmsson, aged 27, with some 1,370 hours in the air on these types. Mr. C. E. B. Rosen was flying as the radio operator as it was anticipated that Mr. Hammarskjöld might need long-range communication.

In addition to Mr. Hammarskjöld there were ten other passengers: Mr. S. Barrau, Mr. F. Eivers, Mr. V. Fabry, Sergeant S. O. Hjelte, Sergeant H. Julian, Miss A. Lalande, Mr. H. Noork, Private P. E. Persson, Mr. W. Ranallo and Mr. H. Weischhoff.

All the crew and passengers died as a result of the accident.

PART 2

Geography and Navigating Aids

A. Geography

The town with which this report is mainly concerned is Ndola. Its general situation is shown in the map, Appendix 3. The direct distances by air from Ndola are to Leopoldville 970 nautical miles, to Elisabethville 115 nautical miles, to Kolwezi 230 nautical miles, to Lusaka 147 nautical miles and to Salisbury 333 nautical miles.

Ndola is a town of some size with substantial buildings and street lighting. Mufulira is a town connected with a copper mine which lies to the north-west of Ndola, 38 miles away by tarred road. Most of the country around Ndola, and between Ndola and Mufulira, is thick forest country, known locally as bush, and many parts of this forest are forest reserves. It was in one of these forest reserves that the aircraft crashed. The trees are hardwood trees, growing up to some 35 feet in height, mostly of a diameter of eight to ten inches but some of them of a diameter of up to two feet. They grow from five to ten feet away from each other. In this bush grass grows under the trees; in the month of September it is some eight inches high. In the bush there are areas in which very few trees grow. These are the areas which in the rainy season are swampy. The nature of the bush appears in the photographs, Appendix 5, and the amount of bush is indicated on the map, Appendix 4. September is in the dry season of the year and the trees and the grass under them easily catch fire. In that month it is usual to have many bush fires.

Ndola Airport has been a recognized airport for many years. It has a runway which can be used by all aircraft except large modern jet aircraft. Its runway is 4,160 feet above sea level. The surrounding country on the whole is flat, but there are some small hills in the vicinity. Between the runway and the place of the crash, 9½ miles away on a true bearing of 280°, there is no significant change in the country. The land at the place of the crash is 4,300 feet above sea level. It

then falls to 4,200 feet, rises again to a height which, from a very low altitude, would obscure the airport lights, and then falls gently to the runway.

Ndola, which is also mentioned, is an airfield some six miles from the Ndjili Airport at Leopoldville. It was closed for use by large aircraft in 1959. Its height above sea level is 951 feet. The runway at Leopoldville is at 1,027 feet, and that at Elisabethville at 4,187 feet above sea level.

The situation of Kolwezi, Abercorn and Kasama is shown on the map, Appendix 3.

B. Navigating Aids

Non-directional radio beacons existed at Ndola, Abercorn and Kasama. That at Ndola was in operation at all relevant times. Those at Abercorn and Kasama were switched off at 1600 (6 p.m.) as there had been no request to keep them open and it was then dark. It was not known in Salisbury that the aircraft would be on a route anywhere near Abercorn and Kasama until 2040.

All ordinary means of communication existed for communication between the aircraft and Salisbury and Ndola and these were effective until the aircraft reached Ndola and ceased to communicate. There was telex connexion between Ndola and Salisbury which was working throughout the night. Normal communication with Leopoldville was from Ndola through Salisbury and from Salisbury through Johannesburg. Ndola succeeded in making direct radio contact with Leopoldville on the 18th in a search for news.

PART 3

The Weather

The last routine weather observation taken prior to the accident was made by the Meteorological Officer on duty at Ndola at 1900 on 17th September, which indicated that the weather was fine with slight haze and no cloud. Visibility was five miles and surface wind 110°M., speed 10 knots.

At 2137, thirty-six minutes before the accident, the Ndola Air Traffic Control transmitted to aircraft SE-BDY the following weather information obtained from instruments in the Tower. Surface wind 12°M., speed 7 knots Q.N.H. 1021 mbs., Q.F.E. 877 mbs. From visual reference the Air Traffic Control also transmitted the visibility as 5 - 10 miles with slight smoke haze.

The Q.N.H. was again checked by the aircraft with Air Traffic Control at 2210 and a confirmation of 1021 mbs. given.

The Q.N.H. and Q.F.E. were later confirmed by the autographic record for 2200 on 17th September. Moonset on 17th September was 2224, first light on 18th September 0340 hours, and sunrise at 0400 hours.

PART 4

Planning and Preparation for the Flight

The United Nations Organization at Leopoldville, Congo, had from time to time chartered aircraft belonging to Transair and on Sunday, 17th September, 1961, were requested to provide a D.C.6B aircraft to fly the Secretary-General, the late Mr. Dag Hammarskjöld, and party to Ndola on that day. The purpose of the journey to Ndola was a meeting between Mr. Dag Hammarskjöld and President Moïse Tshombe. As part of the arrangements of the meeting, a D.C.4 aircraft, the property of a Belgian company and registered OO-RIC, was to take off ahead of SE-BDY, carrying Lord Lansdowne and party to Ndola. Lord Lansdowne was to take off from Ndola for Salisbury before the arrival of Mr. Hammarskjöld.

Security measures were taken at Leopoldville before departure to make it appear that OO-RIC was actually carrying the Secretary-General and, apart from

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the crew, few knew of the plans to use SE-BDY, and no one except the crew of SE-BDY appeared to have any knowledge of the proposed route or flight levels that were to be used.

Witnesses testified that, in discussions with Captain Hallonquist, he made known his decision not to file a flight plan and to maintain radio silence throughout the flight for security reasons. On a suggestion by the Air Traffic Control Officer, Leopoldville, Captain Hallonquist filed a departure plan for destination Luluabourg.

No evidence could be found that any briefing was carried out at Leopoldville by the crew of this flight before departure.

There is no evidence that special security arrangements for SE-BDY were arranged and it was therefore left unguarded for two or three hours before departure. The main doors had been locked and the ladders removed.

Lord Lansdowne in OO-RIC did not take off until 1504 and the departure of the Secretary-General was thereby delayed until 1551. After taking off and clearing Leopoldville Tower frequency, radio silence was apparently maintained until SE-BDY called Salisbury F.I.C. at 2002, while still outside that F.I.R., requesting information on E.T.A. of aircraft OO-RIC.

Meanwhile OO-RIC had flown to Ndola via Villa Henrique de Carvalho (*see* Appendix 3) in full radio contact and with navigation lights on throughout the flight. A normal flight plan was filed and departure signal made. It arrived at Ndola at 2035 without incident.

The aircraft SE-BDY had been damaged by bullets fired at it from the ground at Elisabethville on the morning of 17th September. After a most careful search the only damage found was to an exhaust stub on one of the engines. This damage was repaired and routine pre-flight checks were carried out and the fuel and oil tanks filled. The fuel on board was sufficient to give the aircraft an endurance of approximately 13 hours. From the evidence submitted the Commission is satisfied that all the required inspections had been carried out and all the modifications prescribed by the manufacturers and the Swedish Aviation Authorities had been put into effect, and that the aircraft was serviceable when it left Leopoldville.

PART 5

Conduct of the Flight

The information available to permit a reasonable reconstruction of the flight of SE-BDY is vague and incomplete. From the time of departure from Leopoldville at 1551 no further communication was recorded with the aircraft until it called Salisbury F.I.C. at 2002. On request from Salisbury F.I.C., aircraft SE-BDY gave its destination as Ndola, aircraft Type D.C.6, E.T.A. Ndola at 2235 and place of departure Leopoldville. At 2040 the aircraft reported to Salisbury F.I.C. that it was over Lake Tanganyika at 2035 and was flying on advisory route 432 at 17,500 feet to avoid Congolese territory. At 2049 the arrival time of OO-RIC at Ndola was passed to the aircraft and at 2108 the aircraft reported abeam Kasama at 2106, estimate abeam Ndola at 2147 and requested permission to descend to 16,000 feet. Permission was given. At 2115 SE-BDY was asked its intentions on arrival Ndola but apart from saying it was intended to take off almost immediately no other information was given. At 2132 Salisbury F.I.C. instructed the aircraft to contact Ndola on V.H.F. 119.1. Radio contact was made with Ndola Tower at 2135 when the aircraft gave its E.T.A. Ndola as 2220 hours. Its actual arrival over Ndola Airport was 2210.

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 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. The flight plan to Luluabourg indicated that the initial cruising altitude should have been 13,500 feet (FL 135), but at 2035 the aircraft reported cruising at 17,500 feet (FL 175). Since there is no indication of the timing of the climb 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 air speed of 184 knots. This climb should then have taken about 35 minutes and should have covered about 108 nautical miles over the ground. The only upper wind information available for FL 175 covers

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that portion of the probable route from reporting position 432B to Ndola Airport. During this 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 Ndola Airport. For the portion of the flight Leopoldville to reporting point 432B 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.

The most likely route followed by SE-BDY 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.

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 Ndola Airport at 2210. At 2147 the aircraft reported abeam Ndola. This was 23 minutes before arriving over Ndola. A bearing (Q.D.M. 279) taken at the time of this report indicates that the aircraft was then due east of Ndola Airport. Assuming the aircraft travelled at an average ground speed of 255 knots (240 true air speed plus 15 knot tail wind component) from where it was at 2147 until it reached Ndola, it would be logical to conclude that the aircraft was then 98 nautical miles from Ndola over position 13°00' south, 30°19' east. The distance from abeam Kasama to the assumed position when the aircraft reported at 2147 is 170 nautical miles. The elapsed time for this portion of the flight was 41 minutes. This indicates a ground speed of 248 knots which would appear reasonably consistent with known and assumed circumstances. The distance from abeam Kasama to reporting point 432B (on a direct line from 432B to position assumed at 2147) 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 and 2106, and was probably 22 nautical miles to the south or south-east of 432B when it reported as being over this reporting point.

The total distance covered was approximately 1504 nautical miles. OO-RIC, on the route it took, covered 973 nautical miles.

It is clear that the captain was prepared to accept lower safety standards in certain respects for the sake of security. He flew over a large distance in Africa without any person, other than the crew, knowing what his route or intentions were; he did not take the precaution of filing a proper flight plan or even a proper passenger manifest; he undertook the flight in conditions of radio silence and with no apparent information on the weather conditions en route; he did not avail himself of navigation aids en route which would have been available on request; he did not report his presence on the Nairobi F.I.R.

We express no opinion on whether security measures justified these actions.

PART 6

The Accident

Following the radio contact by SE-BDY with the Ndola Tower at 2135, Ndola gave the aircraft at 2137 the weather, Q.N.H. and Q.F.E. settings and asked what time it wished to commence its descent. At 2138 SE-BDY requested descent clearance at 2157 and was given permission by the Tower to descend to 6,000 feet on Q.N.H., and to report top of descent. At 2147 the aircraft reported abeam Ndola and at 2210 reported "lights in sight, overhead Ndola descending, confirm Q.N.H." This was done and the aircraft was also asked to report reaching 6,000 feet.

It would seem that the aircraft started its descent at 2157 and was 6,000 feet when overhead Ndola and the aircraft's reference to "descending" at that time may well have related to the descent below 6,000 feet. Although requested to inform the Control Tower on reaching 6,000 feet no such report was received and no further radio communication was received from the aircraft.

At approximately 2210 an aircraft was heard and observed over the airport by a number of witnesses, none of whom noticed anything unusual in its flight. Estimates of height varied among witnesses, one indicating he thought it was flying

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higher than usual, while two thought it lower than usual for an aircraft approaching to the airport. Several considered it was flying at the average height.

The Commission considers that the evidence shows the aircraft to have approached at approximately the correct height above the airport in order to commence its landing approach (6,000 feet above mean sea level—1,840 feet above aerodrome level). It flew towards the Ndola non-directional radio beacon situated 2.5 miles west of the airport. It was reported by witnesses to appear to be lower than normal over the beacon area and beyond. Runway lights and high intensity approach lighting (set at maximum) were on at all times.

The evidence led enables us to time the crash at 2213. It is, we think, established by the watches recovered from the wreckage which we feel justified in assuming stopped at the time of impact. The evidence which established the appearance of a flash or glow in the sky at a point in the general direction the aircraft appeared to the witnesses to be flying when last seen is also consistent with this time.

The wreckage of the aircraft was located early in the afternoon of the 18th September, 9½ miles from Ndola Airport on a bearing of 280° T. The aircraft hit trees at an altitude of 4,357 feet above sea level at a shallow angle when slightly turning to the left at normal approach speed. The swath cut in the trees gave a clear indication of the heading of the aircraft.

PART 7

Examination of the Scene and Wreckage

From the time that the Northern Rhodesia Police arrived at the scene of the crash no unauthorized person was allowed to enter the area. It was cordoned off as soon as could be, and when night came lights were installed to exercise control. On the first afternoon and evening bodies, and papers which were lying about, in case there were secret documents, were removed. Sergeant Julian was taken to hospital.

The Investigating Board of Inquiry was made up of the Director of Civil Aviation, Lieutenant-Colonel M. C. H. Barber, D.F.C., Group-Captain J. Blanchard-Sims, A.F.R.Ae.S., who is Senior Operations Officer, Department of Civil Aviation, Mr M. Madders, A.F.R.Ae.S., who is Chief Inspector of Aircraft, and Wing-Commander E. Evans, who is Air Adviser to the British High Commissioner in the Federation. Representatives from Sweden—the State of Registry, the International Civil Aviation Organization 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 Organization/United Nations.
Captain 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. N. E. L. Lindman	Temporarily attached to the Royal Swedish Board of Civil Aviation, as Senior Inspector of Aircraft.
Mr. O. Danielsson	Superintendent, Swedish Criminal State Police.

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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.Ae.S., International Civil Aviation Organization/
M.C.A.I. United Nations.

On behalf of Transair Sweden, A.B.,
the owners and operators of the air-
craft:

Captain S. Persson Director of Flight Operations, Transair
Sweden, A.B.

Mr. B. Virving Chief Engineer, Transair Sweden, A.B.

Mr. C. G. Hellberg Chief Flight Engineer, Transair Sweden, A.B.

The examination of the scene and of the wreckage on the scene, the removal of the wreckage to a hangar at Ndola, the examination of the wreckage in the hangar, and specialist examination of parts of the wreckage were all carried out. There were detailed reports of every stage of the examination by those concerned. A wreckage plan, Appendix 6, and an enlarged wreckage plan of the area of the main part of the wreckage, Appendix 7, both showing the position of bodies, were prepared. These we have found of the greatest assistance in our inquiry.

An accurate survey of the scene of the wreckage, with measurement of the heights of the trees where they were damaged, shows clearly that the aircraft hit the trees at a normal angle of descent. There were no holes in the ground or scars in the ground to indicate steep descent. The measurement from the first tree damage to an anthill which the aircraft struck, and from which it cartwheeled to rest, shows an overall angle of 5° of descent. It is clear that with damage to the aircraft and loss of speed this angle must have been slighter initially. So that it can confidently be said that the trees were hit when the aircraft was descending at an angle of descent of less than 5°.

The total length of the wreckage trail from where the trees were first hit was 800 feet. There was no sign of fire at all except in the last 400 feet. The main area of incineration was in the last 80 feet. The fire backwards on the trail from that area was probably caused by flash-back of fuel on explosion and by burning grass.

We do not propose to discuss in detail the position of the wreckage or bodies. There was nothing significant in the position of bodies or wreckage, except that the nose wheel doors were found in the expected position if torn off on impact, and that four bodies were found with safety belts fastened. The presence of landing manuals at the scene is discussed later.

From the examination of wreckage in the hangar the following important matters emerge. The engines were under power at the time of the crash. The landing gear was all fully lowered and in the locked position. There was strong indication from the way in which the flap control quadrant was bent around its lever that there was 30° of flap at the time of impact.

Nothing was found to indicate that any of the controls were not operating before the accident. From the nature of the fire it was obvious that there was plenty of fuel.

Examination of the wireless equipment showed no apparent pre-accident failure.

The altimeters, three of which were on panels and two of which were spares, were sent to the United States of America for examination by the Civil Aeronautics Board and the manufacturers. Nothing was found to indicate that they were not operating properly before the crash. The barometric settings on the three instruments which were in use corresponded approximately to the setting given to the aircraft by the Controller at Ndola.

At the scene of the crash, in the wreckage, and from the bodies, a total of 201 live rounds, 342 bullets, and 362 cartridge cases were recovered. All were of calibre corresponding to weapons which were in the aircraft. No bullet showed any sign of

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having passed through a rifled barrel. Very careful examination of the wreckage was made to try to discover any sign of having been hit by a bullet or other projectile. Eventually only one suspect hole was put before us. It was of a size too small to have permitted passage of a 7.62 mm. bullet. Microscopic examination showed no presence of any metal foreign to the adjoining metal. The Board of Inquiry decided not to have a spectrographic examination made as the article still had to come before this Commission and the United Nations Commission. We consider that that decision was proper. We thought that it was important that spectrographic examination should be made. It disclosed no sign whatever that a bullet had come into contact with the metal. There were traces of cadmium, chromium and zinc and lead. Cadmium and chromium are metals associated with the plating of bolts, which gives some indication that the hole might have been caused by the tearing out of a small bolt. Bullets are not zinc or lead covered.

The plastic radar nose cone when first found did not show signs of penetration by any projectile.

The one possible examination which was not made was to remelt all the fused metal recovered from the place of fire, some 5 tons in weight, in order to see whether any projectile could be found. It had all been broken by hammer and steam hammer into pieces about 8 inches square and a few inches thick. In it there were many objects such as bolts. It tended to break where these objects lay. We were informed that at an early stage of the Board's inquiry a suggestion was made by Swedish representatives that further examination should be made. The Board decided not to do that, but broke up all the fused metal in the manner described. In the course of the hearing it was suggested to us that this examination should now be made, but the request was not persisted in in the final address. We considered carefully whether the melting of all this wreckage was justified, and decided that it was not.

Apart from examination of the actual scene of the crash a search was made of a large area back from the scene of the crash in the bush over which the aircraft must have come before the crash. The extent of this search is shown in Appendix 4, and it covered an area of some 2 miles by 1½ miles. Some 180 men were engaged in the search. Nothing which might have come from the aircraft was discovered. There was no sign of fire in the area.

PART 8

Causes of Death of the Occupants of the Aircraft

Very careful post-mortem examinations were carried out on all the bodies. When the aircraft was found all the crew and all the passengers except Sergeant Julian were dead. Of the other fifteen occupants of the aircraft, nine sustained such injuries, apart from burning, as to indicate that they were killed in the crash. Included in these was Mr. Hammarskjöld. He had been thrown clear of the aircraft and out of the area of the fire. The medical evidence is that he must have died instantaneously. Three of the bodies were too badly burnt to assess their injuries. In three bodies no lethal injuries apart from burns were discovered. The position of these other bodies in the wreckage, and the fact that they were not able, as was Sergeant Julian, to escape from the wreckage gives strong indication that if they were not killed by impact they were at least rendered unconscious, and so unable to escape.

Sergeant Julian had a compound fracture of one ankle. He said that he ran from the wreckage. That is improbable; he probably had to crawl. He died as a result of burns, caused by the fire, and aggravated by exposure to the sun in some ten hours of daylight during which he lay exposed. The total area involved in the burns was over 55 per cent. of the body surface. There was a possibility that but for this exposure, and exposure for six hours in the night, in a shocked condition, his life might have been saved. All was done for him that could be done after he reached the hospital. He developed renal failure and died in uremia.

Carboxyhaemoglobin estimations were made for twelve of the bodies including all three pilots. In three bodies the estimation was 7 per cent., in one 5 per cent., in one 2 per cent., and in seven bodies nil. Both in the flight deck, and in the cabin, there were persons with and without carboxyhaemoglobin percentages.

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There were no signs of alcohol in the organs of the pilots which were examined.

Evidence of fastened seat belts was to be seen on six bodies. This was confirmed in regard to four bodies by what was seen at the place of the crash.

Bullets were found in the bodies of the two soldiers who were in the fire. They had been seen at the time of departure to be carrying ammunition pouches. All bullets were recovered and examined microscopically. None of these bullets had passed through a rifled barrel. In the bodies they were relatively superficially situated and they were not associated with any discernible evidence of bleeding. All the bullets were of 9 mm. calibre, a type carried by these soldiers. In the same bodies there was also found 9 mm. cartridge cases, and brass fragments which appeared to have come from cartridge cases, and a percussion cap. Percussion caps and fragments of cartridge cases were found in one other body. All cartridge cases, fragments of cartridge cases and percussion caps were superficially situated either in the skin or in tissues exposed by incineration. Other metallic fragments, such as a small cog wheel and fused alloy, were found lying superficially in or on tissues exposed by incineration.

PART 9

Alerting, Search and Rescue Action

The procedures to be followed for search and rescue action by personnel of the Air Traffic Services is laid down in Procedures for Search and Rescue Action issued by the Federal Department of Civil Aviation and covers the Salisbury search and rescue area, i.e. the whole of Northern and Southern Rhodesia and Nyasaland together with a portion of Bechuanaland, the limits of which are not here relevant. The scheme therein set out involves co-operation between civil units and the Royal Rhodesian Air Force, but it is made clear that action in respect of overdue R.R.A.F. aircraft is the responsibility of that service, whilst action in respect of overdue civil aircraft rests with the Air Traffic Services and is specifically made the responsibility of a Rescue Co-ordination Centre (R.C.C.) established at Salisbury and covers initiating, co-ordinating and terminating the search and rescue action.

Any emergency calling for alerting procedure is notionally divided into three parts: (a) The Uncertainty Phase; (b) The Alert Phase; and (c) The Distress Phase, which phases bear the respective code names Incerfa, Alerfa and Detresfa. Circumstances which can create such phases are identified by the scheme as follows:—

Uncertainty Phase. An uncertainty phase is considered to exist when—

- (a) no communication has been received from an aircraft within a period of thirty (30) minutes after the time a scheduled position report or "All's Well" report should have been received; or when
- (b) an aircraft fails to arrive within thirty (30) minutes of the estimated time of arrival last notified or estimated by air traffic control service units, whichever is the later;

except when no doubt exists as to the safety of the aircraft and its occupants.

Alert Phase. An alert phase is considered to exist when—

- (a) following the uncertainty phase, subsequent communication checks have failed to reveal any news of the aircraft; or when
- (b) an aircraft has been cleared to land and fails to land within five minutes of the estimated time of landing and communication has not been re-established with the aircraft; or when
- (c) information is received which indicates that the operating efficiency of the aircraft has been impaired but not to the extent that a forced landing is likely; or when
- (d) information is received or it is reasonably certain that the aircraft is about to make or has made a forced landing;

except when there is reasonable certainty that the aircraft and its occupants are not threatened by grave and imminent danger and do not require immediate assistance.

Distress Phase. A distress phase is considered to exist when—

- (a) following the alert phase the absence of news from widespread communication checks in the circumstances points to the probability that the aircraft is in distress; or when

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- (b) the fuel on board is considered to be exhausted, or to be insufficient to enable the aircraft to reach safety; or when
- (c) information is received which indicates that the operating efficiency of the aircraft has been impaired to the extent that a forced landing is likely; or when
- (d) information is received or it is reasonably certain that the aircraft is about to make or has made a forced landing;

except when there is reasonable certainty that the aircraft and its occupants are not threatened by grave and imminent danger and do not require immediate assistance.

Both air and ground searches are contemplated. Should air search be necessary the scheme provides for the appointment by the Director of Civil Aviation of a civil air search officer (C.A.S.O.) with duties which are therein precisely indicated, which duties include an obligation to keep the Rescue Co-ordination Centre fully informed. For ground search, the R.C.C. may request assistance from the Police and local authorities.

The whole scheme, so far as it has relation to civil aircraft, presupposes knowledge on the part of the Air Traffic Services of the intended movement of such aircraft into or through the area. This is secured through the medium of a Flight Plan prepared by the captain of the aircraft and submitted to Air Traffic Control at the point of departure. Air Traffic Control carry the responsibility of transmitting this information to all Air Traffic Services en route up to the destination. The Flight Plan shows, *inter alia*, the registration letters of the aircraft, its type, the name of the captain, the number of crew and passengers, the destination, alternate airfields which are intended for use if prevented from landing at destination, endurance in hours, the aircraft's radio frequencies, details of life saving equipment on board, etc. The plan also shows the route, check points, the estimated time to the different check points and the altitudes the captain proposed to use. In practice, it is sometimes found necessary to amend such Flight Plan during the period of the flight and this is done by radio communication between the aircraft and the Air Traffic Services.

The information made available to the Air Traffic Controller (A.T.C.) at Ndola in respect to this aircraft came from four sources. He was told by responsible persons on the ground that the Secretary-General of the United Nations was expected to arrive at Ndola in a second aircraft leaving from Leopoldville and he was aware that the first aircraft, bringing Lord Lansdowne, had previously arrived. He was told by F.I.C. Salisbury that aircraft SE-BDY was en route for Ndola with an E.T.A. of 2235. From 2135 onwards he was in touch with the aircraft from which he learned that the E.T.A. was amended to 2220, and that the aircraft was descending to 6,000 feet and desired a Q.N.H. Fourthly, he was told that the aircraft had passed over the aerodrome heading west-north-west.

It would appear clear in consequence that a landing of the aircraft at or about 2220 should have been contemplated. Thirty minutes thereafter, para. (b) of the Uncertainty Phase provisions would apply, unless the exception justified no action. A.T.C. Ndola communicated to F.I.C. Salisbury at about 2242 the absence of any contact with the aircraft after 2210. Later, at 2342 A.T.C. Ndola originated the first Incerfa signal.

We have considered the evidence which bears upon the applicability of the exception. So far as concerns A.T.C. Ndola, Mr. Martin, he was at all material times in contact with and under the instructions of the Airport Manager, Mr. J. H. Williams. Mr. Martin's personal impression at the time that the aircraft had refrained from reporting termination of its authorized descent because it was purposely holding off to enable the Secretary-General to complete radio communication with a base outside Rhodesia was genuinely held, and sufficiently explains why he found no reason to question the prevailing belief expressed to him by Mr. Williams that the aircraft was holding off or had proceeded to some other destination. It is, we think, further corroborated by the fact that when a period of approximately an hour and a half had elapsed, a time to which the explanation of possible radio communications is not patently appropriate, Mr. Martin, after consultation with Mr. Williams, originated the Incerfa signal.

We turn to consider the attitude of mind disclosed by the evidence of Mr. Williams. He had returned to Ndola on the 16th September from leave with a view to commencing his duties as Airport Manager on Monday, 18th September, at 0700 (9 a.m. local time) but on Sunday 17th he was called to the airport to attend a meeting at which security and accommodation arrangements were discussed

for a projected meeting that day between President Tshombe of Katanga and Mr. Hammarskjöld. From 1230 (2.30 p.m. local time) onwards strict security provisions were in operation at the airport and the house of the Senior Provincial Commissioner, with a strong detachment of police at both places. R.R.A.F. operations from the aerodrome had required the crew briefing room to be given up to service personnel and the Airport Manager's own office had been reserved for the projected meeting. From 1400 (4 p.m. local time) onwards President Tshombe and the British High Commissioner, His Excellency Lord Alport, had made use of this office. From their conversation, Mr. Williams had gained the impression that some doubt existed both as to the certainty of the arrival of the Secretary-General and also of the time at which he was to be expected. Later, these two were joined by Lord Lansdowne on his arrival by OO-RIC from Leopoldville. The further information brought by Lord Lansdowne confirmed the expected arrival of the Secretary-General and indicated a possible time of arrival after Lord Lansdowne's departure from Ndola. It was against such a background that the passage of SE-BDY over Ndola aerodrome on a heading in the direction of Leopoldville was notified to Mr. Williams. He then went out and saw Lord Lansdowne's aircraft leave and when he returned he learned that SE-BDY was not responding to signals. He instructed the Duty Controller to report to Salisbury and Lusaka and continue to call SE-BDY. Later he caused Salisbury to be asked to check with Johannesburg to secure contact with Leopoldville. No news had been received by 0115 (3.15 a.m. local time) when he decided to leave the airport for his hotel, leaving instructions for an immediate message to be passed to him there should any information become available. He assured us that at this stage he entertained no thought that the safety of the aircraft was imperilled, taking the view that the departures from normal conventional working of civil aircraft in his area which had characterized this particular flight were explanatory of its continued silence, despite repeated requests by signal. A similar state of mind, although held by someone not experienced in airport practice nor charged with any responsibility for airport operation, was held by Lord Alport, who told us that, knowing that a cease-fire in Katanga was an essential requirement for any meeting between the Secretary-General and President Tshombe, he feared that whilst in flight the Secretary-General had been made aware of some breach of this armistice, and had in consequence abandoned his original intention of landing. This and other speculations Lord Alport told us he communicated to Mr. Williams, and we can well understand that the possibility of accident did not up to his departure from the aerodrome present itself to the mind of Mr. Williams, and that the overdue action already initiated was adequate in all the circumstances.

Reference has already been made to the presence of a strong contingent of police at the house of the Provincial Commissioner, Ndola. One of these officers detected what he referred to as a flash or a glow in the sky some minutes after SE-BDY had passed beyond hearing distance somewhat distant from what he had supposed was the track of that aircraft. In this area, bush fires and lightning flashes are of common occurrence, and no one seems at first to have associated the flash or glow with the aircraft, but when report was made to Ndola police station Assistant Inspector Begg thought the occurrence justified report to the aerodrome. When the communicator on duty was informed at about 0130 (3.30 a.m. local time) he directed the police to Mr. Williams and Assistant Inspectors Begg and Pennock called on Mr. Williams at his hotel and informed him of this reported flash. Mr. Williams expressed the opinion that nothing could be done until first light (which would be 0340 and 5.40 a.m. local time) and sent them away. These police officers on their own authority then sought and obtained leave by telephone for a police ground patrol to be sent out, but the search proved negative.

It was not until 0700 (9 a.m. local time, i.e. over three hours after first light) that Mr. Williams resumed duty as Airport Manager at Ndola, to find that F.I.C. Salisbury had originated the Distress Phase signal at 0445 and requested the assistance of two R.R.A.F. aircraft for local searches north and south of Ndola airfield at 0700, that search beginning at about 0800.

It is we think, a matter for comment that Mr. Williams' implied intention to initiate action at first light was not carried into practice. Though Mr. Williams did not suggest that it affected his action we have taken into account the fact that his official return from leave did not require his attendance at the airport until his normal duty time on that morning, but his part in the arrangements on the previous day and his acceptance of the police report as properly made to him, imposed upon him, as we see the matter now, an obligation to accept as from the time of his actual return the responsibility normally borne by the Airport Manager during his duty times.

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By paragraph 33 of the "Procedures for Search and Rescue within the Salisbury Search and Rescue Area" these duties are defined as those laid down in "Air Traffic Control Instructions" issued by the Department of Civil Aviation dated September, 1960, read together with "Station Standing Instructions" dated June, 1961.

The former provides that whenever the urgency of the situation so requires, the A.T.C. Unit responsible shall first alert and take other necessary steps to set in motion all appropriate local rescue and emergency organizations which can give the immediate assistance required. It is to be noted in this connexion that unlike the exception applicable to the Uncertainty Phase the exception to alerting action is expressed differently for it reads "except where evidence exists that would allay apprehension as to the safety of the aircraft and its occupants". The absence of any satisfactory response to the signals put out by his F.I.C. could have served only to excite rather than allay apprehension. It is true that responsibility for liaison with the R.R.A.F. is in these instructions laid upon the Salisbury Rescue Co-ordination Centre, but as this for its initiation would require a report from Ndola, it is reasonable to assume that a report by Mr. Williams to R.C.C. Salisbury at first light that he was apprehensive of the safety of the aircraft by reason, *inter alia*, of a report of a flash or glow in the sky in the Mufulira direction and timed only a few minutes after its departure from earshot would have produced the authority required to enlist the aid of the R.R.A.F. for an immediate air search of the vicinity.

The other document "Station Standing Instructions" is primarily concerned with crash landings, and although it places initial responsibility for action upon the Air Traffic Control Officer on duty, the recital of his duties, including informing the Airport Manager, is a clear indication that when available it is the Airport Manager from whom supervision of procedures is to be expected.

An independent search resulted from an observation by Assistant Inspector Vaughan of the Northern Rhodesia Police. He on the night of September 17th was engaged on road patrol duties by Land-Rover from Mufulira to Mokambo, a distance of some ten miles. When driving towards Mufulira he saw at about 2340 a sudden light in the sky in the direction of Ndola and an impression of a falling object. As this was an hour after the crash a possible explanation may reside in the bursting of a gas container during the fire. When on return to Mufulira he heard that an aircraft was overdue at Ndola he recalled his experience and reported it. At about 0140 he and another officer made a slow patrol and another officer made a fast patrol about half-way along the Mufulira-Ndola road to see if any sign was observable from the ground. Both searches proved fruitless. There was a further extensive search along this portion of the road next morning.

To assist the air search operations bearings were taken by R.R.A.F. personnel at the ground positions from which flashes and the like were reported as having been seen and map plots prepared in the hope of securing a fix.

The air search subsequently undertaken by Flying Officer Craxford on instructions given at 1245 (2.45 p.m.) succeeded in locating the crash site at 1310 (3.10 p.m.), and although the information upon which these instructions were given included statements not available until after midday, the information given by Assistant Inspector van Wyk to Assistant Inspector Begg and passed on by him to Mr. Williams should as it seems to us have been adequate guidance for a creeping search to have achieved success.

We realize that a recommendation for an air search involves acceptance of a heavy responsibility, in that it may secure dispersal of available aircraft on fruitless errands and deny the assistance they can provide if and when credible reports assist in identifying areas of high probability. The report of Assistant Inspector van Wyk came from a responsible police officer and had been thought by his superiors sufficiently cogent to justify a search by road which because of the extensive bush areas could not reliably exclude the possibility that the phenomenon he witnessed was associated with the apparent disappearance of SE-BDY. That it could not unreasonably in ordinary circumstances be attributed to a bush fire or an electric discharge we would accept, but its coincidence in time with the loss of all contact with SE-BDY seems to us enough to make it a clear warning that an urgent situation had arisen despite non-receipt of signals from Leopoldville until 0550 (7.50 a.m.), and certainly after that time. When to this is added the feature that a defined segmental area with a radius of only a few minutes of flight was required to be searched for investigation of the report we think that initiative on the part of so responsible an officer as an Airport Manager would have caused

him to invite R.C.C. Salisbury to authorize one of the available R.R.A.F. aircraft to undertake the task. Discovery of the crash site might then have been made some hours before it was and the living survivor been given succour before further exposure to the tropical sun had aggravated the burns sustained in the crash.

PART 10

Causes of the Accident

A. GENERAL

1. General Considerations

Before we come to consider particular suggested causes of the accident we shall set out some general considerations which govern throughout. What we have to try to discover on the evidence is why SE-BDY hit the ground some $9\frac{1}{2}$ miles short of the runway at Ndola Airport. It is certain that the examinations after the crash show clearly that the aircraft was intending to land at Ndola, and in conversation with the Control Tower that intention had been indicated. The engines were under power at the time of impact. All landing gear was fully lowered and locked. There is strong indication that there was 30° of flap, a normal amount at that stage in a landing. Those safety belts which could give indication of their condition, four in number, were found fastened, and six bodies, those on which examination in this regard was possible, showed signs of fastened belts. The fastening of safety belts takes place on take-off and before landing. The landing lights were not extended, but the aircraft was still too far from the runway for that normally to have been done.

When everything in an aircraft indicates that it was on its way to land and it hits ground before the runway is reached there can only be one of two general causes. One is that something caused the aircraft, against the will of the pilots, to come too close to the ground and to hit it. The other is that the pilots, misled by something or by mistake, brought the aircraft too close to the ground so that it hit the ground. There may, of course, be a combination of the two causes: the pilots may have brought the aircraft lower than they should have, so that it was in a position in which some other causes could operate more easily to interfere with flight. When some cause against the will of the pilot is being considered, the proper initial approach is, we think, to assume that such cause began to operate when the aircraft was at a height at which it should have been at that stage in the approach. For an assumption that the aircraft was below that height carries the implication of mistake on the part of the pilots.

At night an aircraft will land either by the pilot relying on what he can see, a visual descending procedure, or by the pilot adopting an instrument approach procedure. The latter procedure, when based on the existence of a non-directional radio beacon, consists of flight on a designated track in a direction opposite to that in which the aircraft will land, at a prescribed height until the non-directional radio beacon is passed. Shortly thereafter the procedure turn is made. This is a turn away from the track then being traversed, followed by a turn in the opposite direction, both turns being executed so as to bring the aircraft along the reciprocal of the track on which it was travelling before the procedure turn, so that the aircraft is then flying in the proper direction to land. The procedure is laid down for each airport. In some cases the aircraft is required to maintain its height until the procedure turn is completed; in other cases the aircraft is required to lose height during the procedure turn.

The instrument approach procedure for Ndola consists of initial approach at 6,000 feet altitude on a track of 280° until 30 seconds after the N.D.B. has been passed. The procedure turn is then made to the right at the same height. On completion of that turn and when on the inbound track of 100° to the N.D.B. the aircraft descends to 5,000 feet over the N.D.B., thereafter descending to the critical height of the aerodrome.

In the high intensity lighting system at Ndola there are two short parallel lines of lights at right-angles to the runway at the approach end of the runway. If these tend to merge into a single line the pilot knows that he is too low, and if they appear to be far apart he knows that he is too high.

The evidence of eye-witnesses establishes that SE-BDY crossed Ndola Airport at about 6,000 feet altitude on a bearing close to 280° . It also establishes that the

aircraft then turned to the right. As no sufficient time elapsed according to the evidence between this turn and the crash for the aircraft to have gone away for any substantial distance and then come back, we are satisfied that the pilot continued his approach by a subsequent turn to the left to reach the place of crash.

It has already been set out that when the aircraft hit the trees it was descending at an angle of descent of less than 5°, a normal angle of descent. The fact that the nose wheel doors were not detached in the air by speed, and they would be so detached if there was great speed, indicates clearly that there had not been any considerable dive towards the ground, followed by a flattening out to the angle of descent which was shown.

2. The Effect of Statements by Sergeant Julian in the Consideration of the Cause of the Crash

Statements by the sole survivor, Sergeant Julian, which have any relevance to the cause of the crash are as follows.

Senior Inspector Allen of the Northern Rhodesia Police, on the evening of the 18th September, had the following conversation:

Allen: "The last we heard from you you were over Ndola runway. What happened?"

Julian: "It blew up."

Allen: "Was this over the runway?"

Julian: "Yes."

Allen: "What happened then?"

Julian: "There was great speed. Great speed."

Allen: "What happened then?"

Julian: "Then there was the crash."

Allen: "What happened then?"

Julian: "There were lots of little explosions all around."

Allen: "How did you get out?"

Julian: "I pulled the emergency tab and I ran out."

Allen: "What about the others?"

Julian: "They were just trapped."

Senior Inspector Allen said that he seemed to be understanding. The conversation was not simply as set out, as Sergeant Julian was very incoherent, and questions such as "What happened then?" were often repeated. Mr. McNab, the surgeon in charge, said that in his opinion the remarks could only be taken as a guide and were not necessarily true, having regard to the condition of Sergeant Julian. There was also the possibility of retrograde amnesia.

On the same evening, Sister McGrath heard him say: "We were on the runway and there was an explosion", and "We were on the runway when Mr. Hammarskjöld said 'Go back', then there was an explosion", and "I was the only one that got out all the others were trapped."

On the same evening Dr. Lowenthal said that he asked why they had not landed when they were expected to, and Sergeant Julian replied first in words which indicated that Mr. Hammarskjöld had changed his mind or said "Turn back", and then by saying that he did not know. He said that Sergeant Julian said that there was an explosion and then a crash, and a little later said that there was a crash and then an explosion; and also said that he had jumped from the aircraft. Dr. Lowenthal said that Sergeant Julian was highly sedated at the time but appeared to be speaking coherently.

No attention need be paid to remarks, later in the week, about sparks in the sky. They either relate to the fire after the crash, or to a symptom of his then condition.

In so far as weight can be given to these remarks at all they relate to the following:

On the runway

Sergeant Julian seems to have thought that what happened happened as they were just about to land.

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Great speed

Until the aircraft had passed over Ndola there is a body of evidence to indicate that it was flying at a normal speed. So the great speed, if it referred to the aircraft in the air, could only relate to some time during the approach procedure. The evidence indicates that the nose wheel doors would be blown off by unusual speed. They were not, but were found in the wreckage trail. If then this was an accurately remembered impression it could, we think, have been gained only when, by passage through the tree tops, an impression of speed could have been given.

An explosion in the aircraft before it hit the trees

There undoubtedly was an explosion after the aircraft hit the ground. In one remark Sergeant Julian put the events in that order. In so far as the remarks can be said to support a theory there was an explosion causing the aircraft to come to the ground the matter is dealt with later.

Instruction to go back

The only indication that there was a change of plan is in the evidence of Dr. Lowenthal that Sergeant Julian said that Mr. Hammarskjold "changed his mind or said 'Turn back'". It seems likely that the phrase "changed his mind" was the witness's interpretation from the words "Turn back" or "Go back". These words could not have been said after the crash, for the evidence shows that Mr. Hammarskjold died instantaneously. So the words must have been said in the aircraft. On both versions given the words were said before the explosion. There is nothing to indicate that Mr. Hammarskjold, apart from anything connected with the crash, would be likely to have changed his plan to land. What seems likely is that the first impact with the tree tops gave the impression to Mr. Hammarskjold that there was some designed obstruction to his landing, and that he then shouted words such as "Go back".

3. Accounts of eye-witnesses

To avoid undue complication in this part of the report we deal in detail with all the eye-witnesses in Appendix 1. We have divided them into four classes. In Classes A and B the general picture given by those witnesses who saw or heard SE-BDY is of it passing across the airport more or less in the direction in which it should have been heading, of it being at about 6,000 feet above sea level, perhaps a little lower, and of it going faster than aircraft usually went, which is probably explained by its being a larger type than was usual in this area. There were two witnesses, living to the west, who heard the aircraft passing over in what must have been a turn to the right, Mr. Bermant and Mrs. Wright. Both, from the sound, had an impression of low height. In so far as witnesses in Class B speak of some phenomenon in the sky they do not help in the discovery of the cause of the crash. Their evidence merely shows that there was a crash. But none of these witnesses, and they are many; saw or heard any other aircraft at about the time that SE-BDY passed over Ndola.

Class C, persons who speak of two aircraft at the same time, is dealt with later. Class D comprises witnesses who saw or heard something long after the crash. Their evidence does not bear on causation. The same is of course true of any evidence which relates only to the later discovery of the crashed aircraft.

B. POSSIBLE CAUSES

1. Damage Suffered at Elisabethville

When the aircraft left Elisabethville to go to Leopoldville on the morning of the 17th September it was fired on. On arrival at Leopoldville a bullet hole was found in an engine cowling and there was damage to an exhaust pipe. The pipe was replaced. There was careful examination but no other damage was found. It does not seem to have been hit by explosive bullets, so that even if a bullet had not been found it could not have caused later damage.

What happened at Elisabethville did not, we consider, contribute in any way to the crash.

2. Sabotage

Before the aircraft left the ground at Leopoldville it was in the charge of employees of Transair except for a period when they went for lunch. During that period the aircraft was locked and ladders were removed. This would leave avail-

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able for the deposit of an explosive machine the undercarriage wells. There was nothing in the wreckage to indicate explosive damage to the undercarriage. The interior of the aircraft was examined prior to take-off. It is inconceivable that any occupant wilfully carried some bomb into the aircraft. If any bomb had been placed in the personal luggage of any occupant the explosion would not be in the least likely to be in the flight deck so as to incapacitate the pilots. And if any explosion took place such as to disable the aircraft some part would almost certainly have been blown off and found short of the place of the crash. Examination of the wreckage and bodies showed nothing to indicate that any bomb had exploded.

Further to this we cannot imagine that there was any likelihood of any such thing being done at Leopoldville. If it had been done it must be assumed that it was directed at Mr. Hammarskjold and meant to be effective. No one could have timed an explosion for arrival at Ndola when that destination was known to very few people, and no one except the pilots could possibly have known that the flight would last as long as it did, having regard to the route selected.

We find no grounds for attributing the crash to sabotage.

3. Circumstances of the Flight to Ndola

There is nothing to suggest that the security precautions which were taken in regard to the flight, which led to a lack of information about it, were in any way the cause of the crash. There was no separate navigator on the aircraft, and the flight was for the greater part made by dead reckoning. Captain Hallonquist was, however, an experienced navigator, and the route taken, due east with a feature as enormous as Lake Tanganyika to govern change of course to the south, was not difficult to fly. There was radar in the aircraft which could have been used to determine when that lake was reached had visual conditions been difficult.

Two of the three pilots had flown the aircraft to Elisabethville on the previous day, and had flown it to Leopoldville in the morning of the 17th September. Captain Litton when he boarded the aircraft in the afternoon indicated that he was tired. Captain Hallonquist seemed to be fit and relaxed before the aircraft took off. The flight to Ndola was a long flight but it should not unduly have tired a pilot. Some strain may well have been associated with the flight in that a most important person was aboard and precautions had to be taken to conceal the route. We do not think that undue fatigue contributed to the crash.

4. Erroneous Communication from the Ground at Ndola

There was no tape recorder to record the conversation between Mr. Martin, the traffic controller on duty at Ndola, and SE-BDY. The account of the conversation is dependent on his memory; the flight strip confirms his evidence in part, and is in no way inconsistent with it. Information which could have misled the pilot was an incorrect Q.N.H., but examination of the altimeters showed that they were set approximately to the figure which he said he gave, and this was the correct figure. After the aircraft had disappeared, and long before it was known that it had crashed, the information he gave to Salisbury of his conversation accords with his account of the conversation. The height above sea level of Ndola Airport was not given, but that information is not given unless it is asked for. It is not usual for a pilot to ask for this information, and SE-BDY did not do so.

There is nothing to suggest that any but proper information was given to the aircraft, either from Salisbury or Ndola.

5. Failure to use Ndola approach chart, or use of Ndolo approach chart

Pilots in Transair were supposed to use the approach charts in the Jeppesen Manual. This is a large loose-leaf manual published in the United States of America. It contains a chart for Ndola which shows the instrument approach procedure. An individual issue of the Manual is made to each pilot. There is no record of the issue of the Manual to any of the pilots in SE-BDY. An inventory of Jeppesen Manuals, taken at our instigation, shows that three are missing. When they disappeared is not known. Each pilot is supposed to carry this Manual on a flight.

In the wreckage only one Jeppesen Manual was discovered. Others may have been entirely burnt. That is not known. In the one Manual which was found the Ndola chart was missing. It is usual practice to remove the chart needed in landing. This may have been done. The spring clip in which it is usually put on

the captain's side of SE-BDY had one part missing, so it could not be seen if anything had been in it. The state of the clip may have been caused in the fire.

In Leopoldville there seems to have been freely available to pilots a small bound manual of approach charts, The United States Air Force Approach Chart Manual, which is reprinted regularly. Although Ndola has been an airport for many years the issues in 1961 contained no approach chart for it. They did contain a chart for Ndolo, an airfield some six miles from the present Ndjili Airport at Leopoldville. Ndolo was abandoned as an airfield for large aircraft in 1959. In the wreckage three of these Manuals were found; two at the scene of the crash on the ground, and one later amongst the wreckage in the hangar. One of the Manuals on the ground lay open, folded back, and showing the Ndolo chart.

A pilot's papers and books are normally kept in a bag. The fact that three copies of this Manual, when there were three pilots, were found loose in the wreckage seems to us to give strong indication that reference had been made to it. And reference might well have been made to it if the Ndola chart was found not to be in the Jeppesen Manual, perhaps because it had been taken out by a previous user of the Manual and not replaced. It seems too much of a coincidence that there were three Manuals, not in bags, with the added coincidence that one was open at a page where a chart for Ndola would have been sought.

In one of the United States Manuals found there was written in green ink on the Ndolo page the height of the Ndola Airport. And there were two barometric pressures, one the standard and one more or less the figure for Ndola at that time of year. The latter figure did not exactly correspond to the conversion into inches of the figure in millibars given to the aircraft on the night in question. There were also odd dots along the chart of the turn and an underlining of an altitude of 2,500 feet. On the outside of the Manual the words "Approach Charts" were written. We arranged for this book to be sent to Sweden for quick comparison with the writing of the three pilots, and the report is that the writing does not correspond to that of any one of the pilots. So far as we were able, we confirmed this by comparing writings of the three pilots which were sent to us with a photo-static copy of the writing in the Manual. We accept that this writing was not that of any pilot in SE-BDY. If it had been it would, from the presence of the correct altitude of Ndola, have shown that there was realization that the height in the chart for Ndolo, 951 feet, had no relation to the Ndola Airport.

Nor do we consider that Captain Hallonquist would have thought that the Ndolo chart applied to Ndola. A week before in Elisabethville, and shortly before he took off in Leopoldville, Captain Hallonquist had discussed the altitude of Ndola, and showed that he knew that it was about the same altitude as Elisabethville, 4,187 feet. Quite apart from that, the Ndolo approach is shown as being from the opposite direction, with the beacon to the east and not to the west of the runway. And the clearance to 6,000 feet by the Controller, and the sight of lights some 2,000 feet and not over 5,000 feet below him as he passed over the airport would have indicated to a pilot of his experience that he was not about to land at an altitude of 951 feet. In addition the instrument approach procedure for Ndolo is a descending procedure with passage over the beacon at 4,000 feet, losing height to 2,500 feet on completion of the turn. Such an approach would be obviously impossible to an airport known to the pilot to have an altitude of over 4,000 feet.

If there was uncertainty in regard to the altitude of Ndola runway it might have been expected that inquiry would have been made from the Control Tower. But it appears that Captain Hallonquist had his own ideas in regard to information from a controller. About a week before in a conversation with Major Ljungkvist at Elisabethville he had stated that he thought it quite unnecessary that the tower should remind a pilot of the airport elevation, or give certain other information. It was a clear night, and the airport lights were plainly to be seen.

We do not consider that the pilots were misled by an Ndolo chart, but it may well be that there was no Ndola chart in the aircraft. We discuss the manner of approach later.

6. Mechanical Failure

The evidence shows that SE-BDY was in very good condition and fully serviceable at the time of the flight. Examination of the engines shows that they were under power at the time of the crash. Some five minutes before the crash the aircraft was seen to be flying normally. The aircraft was a four-engined aircraft and able to maintain altitude with some degree of engine failure. There was plenty

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of fuel. Examination of the controls mechanism disclosed no defect. Mechanical failure would undoubtedly have brought about some reaction in the pilots. There would either have been a message to the Control Tower or some sort of preparation for a crash landing, as by retracting the landing gear. There was no such action.

There is nothing to indicate that mechanical failure caused, or contributed to, the accident.

7. Defective Altimeters

All three altimeters which were in use were set approximately to the barometric setting given by the Controller. They were all damaged in the crash. Very extensive examination disclosed no abnormal condition not attributed to impact damage and fire.

There is nothing to indicate that defect in the altimeters caused or contributed to the accident.

8. Internal Fire During the Flight

There were two hand fire extinguishers discovered in the wreckage in a discharged state. Though they could have been discharged in the fire on the ground it cannot be said with certainty that that was how they came to be discharged. Two possibilities in regard to internal fire have to be considered: mere fire, or fire suddenly causing explosion. If fire occurred it must have occurred in the last few miles of the flight. The post-mortem examinations indicate that both among those who were in the flight deck and among those who were in the cabin there were persons with no carboxyhaemoglobin percentage. The percentage found in the bodies of the pilots was such that they could not have been so affected by it as to be incapable of action. In these circumstances it is really inconceivable that, if there were a fire, experienced pilots should have refrained from taking obvious steps. No message was sent; the aircraft did not make suddenly for the airport for an emergency landing; and none of the action was taken which would have been taken if the fire necessitated a crash landing in the bush, such as retraction of the undercarriage or extension of the landing lights to choose as favourable a spot as possible.

If there had been a fire causing sudden explosion, so that either or both pilots were incapacitated or the aircraft was put out of control, it must we think have been of such a nature that some evidence of it would have been found on the ground, either at the wreckage site or in the other searched area.

There is no reason whatsoever to suspect internal fire as the cause of the crash.

9. Incapacitation of the Pilots

This is suggested as a possibility in the report of the Board of Inquiry. We can find nothing to support it. Post-mortem examination indicated no disease in any one of the pilots. They had all passed medical examinations as pilots. The possibility of incapacitation by natural causes of any of these pilots is most unlikely. The chances of simultaneous incapacitation are in our view so remote that that possibility can be dismissed.

10. Action by Other Aircraft

(a) At the outset we would say that no reason was suggested, and we cannot think of one, why anyone who might have been able to attack this aircraft from the air should ever have wanted to attack it as it carried Mr. Hammarskjöld on the mission he was then undertaking. We have investigated the position of aircraft capable of offensive action not because of suggestions that there was such action but to eliminate any known aircraft within range. There was evidence that no aircraft of the Royal Rhodesian Air Force was flying on the night of 17th/18th September. That evidence was not queried at all. In the Congo, other than in Katanga, there was no aircraft capable of offensive action which was not under United Nations control. One aircraft capable of offensive action was in Katanga at the time and was not under United Nations control. It was a Fouga jet fighter trainer, armed with two 7.62 mm. machine-guns. On the night of the 17th/18th September it was at Kolwezi, where it was normally based, but there was another landing strip which it used which was further away from Ndola than Kolwezi. Its effective range, to allow five minutes for attack, is 135 nautical miles. Kolwezi is 230 nautical miles from Ndola. Quite apart from the impossibility of the Fouga having reached Ndola and returned, there is evidence from several witnesses that Kolwezi runway was not then equipped for night take-off or landing, and in fact obstacles had been placed on the runway on the night of the 17th/18th September. In addition, Major Delin gave sworn evidence before us that it was only he who then

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flew this aircraft and that he did not fly it on that night. Major Delin came voluntarily to give this evidence; we had no way to compel him to do so. In addition, when information was given to the Commission which might have indicated that his evidence was not true, he returned to give further evidence. We found no reason to doubt his evidence.

One De Havilland Dove belonging to the Katanga Government was after the 18th September armed by removing a door and placing a machine gun on the floor to fire through the opening. On 17th September this and possibly another were in the hands of the United Nations at Elisabethville. Three Doves were then in the Republic of South Africa undergoing examination.

There was one military aircraft of the United States of America on the ground at Ndola.

(b) Very careful examination was made of all the wreckage recovered. There was only about one-fifth of the total aircraft which could be examined. This examination disclosed only one hole which could possibly have been caused by a bullet or other projectile. The parts of the aircraft which had been fused by the fire were, as has been said, broken up into small pieces. The fused metal tended to break where there was any object, such as a bolt, in the fused alloy. Nothing suspicious was found. The one suspect hole, in a pilot's window frame, was too small for a 7.62 mm. bullet to pass through it. Both microscopic and spectrographic examination of the metal around the hole disclosed no traces of metal of which a bullet might have been made. No bullet was found anywhere which had passed through any rifled barrel, and the many bullets which were found were of a type to be used in the weapons carried in the aircraft. There were bullets and parts of bullets disclosed on X-ray in some of the bodies, not the bodies of the pilots. None of these disclosed any sign of having passed through a rifled barrel. They came from ammunition carried by persons on the aircraft which exploded in the fire. In the bodies they lay either on the burnt surface or slightly under the skin or in the muscle. There was no injury to bony structure in any of the bodies which indicated damage by any projectile.

If any projectile of a rocket type had hit the aircraft, so as to disable both pilots, or so to damage the aircraft as to render it uncontrollable, there must have been an explosion. No witness speaks of the sound of an explosion before the aircraft hit the trees. If the aircraft was hit by an explosive missile it is almost certain that some part of the aircraft, blown off, or some part of the missile, or some sign of fire, would have been discovered on the ground in the searched area over which the aircraft passed before the crash. Nothing was found at all. Except in the area where the aircraft came to rest and caught fire, and an area back from that in which fire could be expected, there was no sign at all of burning of any part of the aircraft which became detached, or of the vegetation. The area in which there was no fire is shown on the wreckage plan, Appendix 6, and covers the first half of the wreckage trail. Nor was there any sign of burning in the large area back from the scene of the crash which was examined.

(c) There were seven witnesses who spoke of a second aircraft. One is not worthy of consideration. Three were very definite in regard to the times of which they spoke, which times could have no reference at all to the time of arrival and crash of SE-BDY. In addition to speaking of a different time one spoke of hearing two aircraft at a place some 30 miles away from any place over which SE-BDY can have passed, and another was obviously referring to the arrival of the aircraft OO-RIC.

We turn now to the three charcoal burners. We give in Appendix 1 our appreciation of these Africans as witnesses. All three were unsatisfactory. Apart from that finding, their evidence discloses so improbable an attack that it could carry no weight. Both Mr. Simango and Mr. Mazibisa speak of the second aircraft being with the large aircraft immediately before the crash and then apparently disappearing in the crash. No sound of an aircraft was heard by them thereafter. Both Mr. Mazibisa and Mr. Buleni speak of a second aircraft which had a light on it, which seems highly improbable for an attacking aircraft. None of these witnesses heard any sound of firing in the air, a most distinctive sound, or any sound of explosion before the crash. If there had been any attack it could have been expected that it would have been when SE-BDY was at a normal height in an approach to land, but they speak of that aircraft just before the crash when it must have been very low indeed, and speak of the second aircraft as still being very close to it, and, in the case of Mr. Buleni, in a position from which no attack could have been made. Only the one witness, Mr. Buleni, speaks

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of the second aircraft after the crash, and in a statement he gave one version of what it did as it flew off, with its lights still showing, and in evidence, given a few days later, he gave a quite different version.

(d) There was no communication from SE-BDY after it was over the airport. If the aircraft was at its proper approach height and was then attacked, unless both pilots were instantaneously killed, or the wireless was put out of action, it is hard to imagine that there should have been no message. If the aircraft came low in evasive action it could still have communicated.

(e) Another factor against aircraft attack is the extreme difficulty of interception at night. The first indication of a time of arrival was given to Salisbury at 2006. The time given was 2235. At 2135, to Ndola, an estimated time of arrival of 2220 was given. In fact it arrived over the airport at 2210 and had crashed by 2215. It has to be assumed that any attacking aircraft arrived either 25 minutes, or at least 10 minutes, before it thought SE-BDY would arrive. It has to be assumed, too, that it managed to arrive at a place where it could attack without being heard in the air by anyone as it was on its way. There were many people on duty in Ndola on that night who heard SE-BDY. But no one heard another aircraft at that time. And, having so arrived, it had only some two or three minutes in which to attack. If SE-BDY was at proper approach height interception would have been difficult enough. If SE-BDY was coming in low it would have been in an unexpected position, and interception would have been all the more difficult. When it did attack the attack has to be assumed to have been such that either both pilots were disabled, or the aircraft was so put out of control that no communication could be made or emergency action taken. And this had to be done in such a way that no part of the aircraft was blown off, and the aircraft came down apparently in normal descent and under power.

(f) Having regard to all these factors we consider that it is clear that the aircraft was not shot down in any way from the air.

11. Action From the Ground

This again is a cause which has to be considered although there is nothing to indicate that the crash was caused in this way. Normally the aircraft could have been expected to be some 2,000 feet above ground and not in the area in which it was before it crashed. If attack from the ground had been designed it is almost certain that weapons would not have been sited to make it effective against the aircraft on the course which it did take. The absence of any sign of bullet damage to the aircraft or its occupants and the factors relating to the improbability of the putting out of action of both pilots or of the aircraft again operate. So, too, does the absence of indication of attack in the discovery of anything short of the scene of the crash. Not one of the charcoal burners who say that they saw the aircraft speaks of any sound of firing. It is impossible to imagine that a stray shot from a rifle should have brought down this large four-engined aircraft with two pilots without there being any opportunity to communicate with the ground or prepare for a crash landing.

We do not consider that action from the ground was the cause of the crash.

12. Pilot Error

We have already set out how it may have come about that a decision to carry out a visual descending procedure was made. To support the view that the Ndola instrument approach procedure was not carried out are the facts that the aircraft did not pass over the airport exactly on the course it should have been on as it went to the non-directional radio beacon and for 30 seconds beyond that beacon. It flew over the house of Mr. Bermant which is some three-quarters of a mile to the north, and slightly to the west of the beacon. At that stage, to make the noise which Mr. Bermant heard, it must have been below the proper altitude in an instrument approach, 6,000 feet. Then it came near the house of Mrs. Wright, seven miles to the north-west of the airport. The procedure turn would not have taken it so far out, nor would the aircraft have seemed to be so low.

We consider that the evidence establishes that, whether or not the decision was influenced by chart manuals, it was decided to bring the aircraft in by a visual descending procedure approach. It was a clear night, all the lights of the airport were at maximum intensity, the aircraft had reported that it had seen them, and the aircraft had been told that there was no other traffic. There was no reason why a visual approach should not have been made. The absence of signals, usual in the instrument approach procedure, is another indication that there was visual

approach, for there was nothing, except silence, to suggest that the wireless equipment was not working before the crash.

The altitude of the aircraft as it crossed over the airport has been taken by us, on the evidence of eye-witnesses, to be about 6,000 feet above sea level. The absence of a report on reaching 6,000 feet, which was asked for, may well have been because the aircraft had reached that altitude when the request was made. It is as certain as can be that the aircraft started to descend soon after it had passed over the airport.

In the country to the west of Ndola there is bush, and after the lights of Ndola were passed and as the descending turn was made to the right there would be blackness ahead. This is what is known in the language of the air as a "black hole". And if in the course of the turn the aircraft came far too low the slight rise in the ground between the place of the crash and the airport would obscure the lights of the runway, and of Ndola, as the aircraft came back to a course on which those lights might otherwise have been seen to port.

Failure to recognize the dangerous altitude of the aircraft in relation to the airport elevation, and the slightly higher elevation of some of the country to the west, is unexplained in view of the apparent correct settings of the three altimeters and the fact that, as far as can be determined, they would have been functioning properly.

C. CONCLUSION

It has been strongly urged on us that we should not reach the conclusion that the accident was due to pilot error by considering first other possible causes, dismissing them, and so being left with a cause which can seldom be dismissed in an aircraft accident. Obviously suggested causes have to be dealt with in some order. We have given our reasons for saying that other suggested causes were not really possible. And we have given our reasons for concluding that the approach to the airport was made by a visual descending procedure in which the aircraft was brought too low. We cannot say whether that came about as a result of inattention to altimeters or misreading of altimeters. But the conclusion to which we are forced is that the aircraft was allowed by the pilots to descend too low so that it struck the trees and was brought to the ground.

PART 11

Conduct of Persons and Authorities after Accident

Civil Air Authorities

We have considered the action taken by each of the four sections falling within this category, viz. Air Traffic Control, Ndola (A.T.C.), Flight Information Centre, Salisbury (F.I.C.), Rescue Co-ordination Centre, Salisbury (R.C.C.) and the Department of Civil Aviation.

So far as concerns A.T.C. the action taken by the Air Traffic Controller on duty at the material times was proved in evidence. In our view, all that was done by the Control Tower was in proper accordance with recommended practice, and the initiative shown by Mr. Martin in originating an Incerfa signal at 2342 when the passage of time made his original supposition for the non-arrival of SE-BDY improbable was, we think, proper. The reference of the police report on a flash or glow to the Airport Manager by the Communicator on duty properly laid responsibility for further action upon Mr. Williams and, as we have already indicated, there was an absence of a proper sense of urgency in Mr. Williams' failure to initiate further action so soon after first light as was possible.

The only specific matter which attracted comment at the hearing was the decision taken at 0105 to close the airport and tower (erroneously said to be "closing down" since a 24 hour communicator service was kept in operation). It was explained to us that difficulties in procuring efficient staff for the onerous duties of Air Traffic Control and the absence of air traffic scheduled for arrival during the early morning justified a shut down of airport and tower so as to provide adequate rest periods for the staff. We can find no room for legitimate criticism of the decision so taken, which was communicated to F.I.C. Salisbury.

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The action taken by F.I.C. was also proved in evidence and here again the proper observance of recommended practice was established.

There was some confusion in the evidence with regard to the decision to close the airport and tower at Ndola. The message from Ndola to Salisbury was in the form of a request for permission, and on the evidence this request did not reach the Controller at Salisbury whose duty would include dealing with the approval sought. The Communicator at Salisbury agrees that he responded with the letters O.K. but is unable to recall the circumstances in which this was done. In the result, nothing turns upon this point and we have made no attempt to resolve the doubt.

We should here take note that Mr. Thorogood, Air Traffic Control Officer, Salisbury, anticipated the issue of the Incerfa signal from Ndola by arranging for contact with Nairobi, Johannesburg and Leopoldville in an endeavour to secure information regarding SE-BDY, but the failure of Leopoldville and Elisabethville to reply rendered his effort nugatory.

In addition, Mr. Knight, the Senior Air Traffic Control Officer, who took over from Mr. Thorogood, initiated the Detresfa signal at 0445 for transmission to Ndola, Elisabethville and Leopoldville in order to secure news from the two Congo stations.

Unhappily, these efforts were of no avail until H.F. Air Ground frequency signals, commencing at 0450 and continued until contact was secured, procured a reply from Leopoldville at 0542 that no news of the aircraft had been received.

It appears that messages to Leopoldville were initially received by a Congolese national and transmitted by hand thereafter to the Flight Information Centre. This gentleman, at the material time, did not understand the English language and required the services of a colleague or a United Nations co-ordinating officer before he could deal with such messages. This involved serious delays.

Despite the repeated request for information sent from Salisbury during the night of 17th/18th September to Elisabethville, the first communication received from that station was at 0816 when an H.F./R.T. message requesting news of SE-BDY was received by Salisbury F.I.C.

Additionally to the execution of normal duties, Mr. Murphy, the Airport Manager at Salisbury, maintained close contact by telephone with Colonel Barber, the Director of Civil Aviation, who, because of the importance of the visit of the Secretary-General, had instructed that both he and the R.R.A.F. should be kept fully advised.

The R.C.C. forms part of the F.I.C. at Salisbury, and put into operation the requisite procedures for alerting the various centres from which information and possible assistance could be expected and in the Distress Phase procured the appointment of the Civil Air Search Officer and secured effective liaison with the officer commanding the R.R.A.F. station at Ndola. Here, again, the maintenance of close contact with the Director of Civil Aviation ensured the effective co-ordination of the various interests involved.

The fourth section, the Department of Civil Aviation, calls for a review of the activities of the Director, for he it was who personally represented his Department in connexion with this important flight. He, like the responsible people at Ndola, and no doubt because of the expression of their belief communicated to him by telephone to Salisbury, accepted initially that the aircraft had diverted. He gave instructions that confirmation should be sought from Leopoldville and Elisabethville, and when informed that neither station would respond to signals, he proceeded to Salisbury Airport to study all available information at first hand and be in immediate touch with affairs and later flew to Ndola to take personal charge. It will be appreciated that the potential area which might have required air search extended fanwise from Ndola into Congolese territory, and that close liaison with aircraft based on Leopoldville—for R.R.A.F. aircraft could not be directed beyond the frontier—was requisite before any effective general air search could be put into operation. The preparations for this general search, which involved the procurement of long range aircraft from as far afield as Nigeria in one direction and Tripoli in another, were in our view wise precautionary measures and justified Colonel Barber in leaving the conduct of a local search to Mr. Williams (whom he had nominated as Civil Air Search Officer, C.A.S.O.) in association with the R.R.A.F. unit at Ndola. It is, as we think, from the wider aspect of overall responsibility that the Director's actions are to be judged and, so far from finding

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blame, we find that at all stages he maintained proper control of the situation and initiated and supervised appropriate action.

Police

As we have already recorded, there were officers among the police on duty who noted a flash or glow in the sky shortly after SE-BDY had flown over and reported it. In addition, the police despatched road patrols during the hours of darkness to investigate these phenomena. The distance of the crash site from the roadway and the thickness of the intervening bush effectively prevented such patrols from sighting the remains of the aircraft and we cannot question the efficiency with which these patrols were conducted. There was a further daylight patrol sent from Mufulira which, despite careful search, found nothing.

As soon as information was received by the police from the Africans who discovered the wreckage, they took prompt action to reach the site and render assistance to any survivors. The arrangements for the presence of ambulances, first aid assistance, etc., were promptly made and efficiently carried out. The site of the crash was well guarded.

R.R.A.F.

The complete log of R.R.A.F. activity at Ndola at the material time was put before us and this was supplemented by the evidence of Squadron Leader Mussell, the Commanding Officer at this station. The unit was flying regular reconnaissance sorties as part of its normal duties and so soon as reports were received by the Duty Operations Officer of flashes seen during the night, instructions were sent to reconnaissance pilots to look for any signs of a crashed aircraft. In addition, Canberra, Vampire and Provost aircraft were detailed for search duties in areas recommended by the civil authorities, and at 1310 Flying Officer Craxford, flying a Provost, located wreckage and reported its map reference by radio. Altogether some 16 hours 40 minutes of flying time was applied to the specific search operations.

We can find no ground for criticism of the contribution made by the R.R.A.F. to search and rescue activities.

The Board of Inquiry

In accordance with Annexure 13 to the Convention of Civil Aviation, Chapter 5, a Board of Inquiry was set up on the 18th September, commenced its investigation on the 19th September and concluded its investigation by the 2nd November, 1961. Its Final Report, we are given to understand, was signed on the 11th January, 1962. It was assisted by accredited representatives and technical advisers, the names of each of which have already been set out. The team was divided into two groups, one the operations and one the technical, although all inspected the site and wreckage both from the air and on the ground. As a result of appeals issued over the normal broadcasting service, in newspaper advertisements, by posters and handbills, contact was made with all persons thought to have relevant evidence to convey and statements were taken from 133 witnesses. Technical reports on instruments, radio equipment, electrical equipment, flight system and auto-pilot and altimeters were procured, and medical and ballistic examinations undertaken by experts. Flight tests simulating the actual passage of SE-BDY as spoken to by ground observers were carried out in the vicinity of the airfield. We have derived great assistance from a consideration of the documents collated by the Board which were made available to us, particularly as a preparation for the understanding of the oral evidence led at the hearing before us. In the course of that hearing, certain findings by the Board in relation to causation of the accident were brought to our attention and these we have thought it proper to consider. In so far as our conclusions are more precise than those of the Board, we would make it plain that no implied criticism of the Board is intended. Indeed, we wish to place on record our conviction that the investigation made by the Board is noteworthy for its thoroughness and the Report detailing it remarkable for its clarity. We cannot conclude this section of our report without acknowledging our indebtedness to and admiration for the patient, tedious, informed and precise study which the Board conducted, the results of which materially lightened the burden of our own inquiry.

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APPRECIATIONS

In the first place we wish to express our great appreciation of the work done on our behalf by Mr. F. G. Cooke. He arranged for the attendance of a great number of witnesses in such manner that our work could go on without any hitch, and led all relevant evidence for the witnesses who were called.

Your Commissioners have already acknowledged their great indebtedness to the Board of Inquiry. We would express our special appreciation to Mr. I. J. Berry of the Department of Civil Aviation, who was the Secretary of that Board, for the work which he did for us in the care and production of exhibits before us.

We would also thank the staff of the British High Commissioner for making arrangements in regard to the production of witnesses from outside the Federation. The Northern Rhodesia Police gave us every assistance in securing the attendance of witnesses from Ndola. It was a great advantage to have been allowed the use of the High Court at Ndola.

Your Commissioners also wish to express their appreciation of the excellent work done in preparing daily the verbatim record of evidence, and the work done in the typing of this report.

Finally, we wish to thank especially our Secretary, Mr. H. S. Perry, and our Assistant Secretary, Mr. R. B. Ulyett. They have given us every assistance at all stages of our inquiry.

This we submit for Your Excellency's consideration.

(Sgd.) J. CLAYDEN,
Chairman.

(Sgd.) G. H. LLOYD-JACOB,
Member.

(Sgd.) J. NEWTON,
Member.

(Sgd.) H. S. PERRY,
Secretary,
Salisbury.
February, 1962.

APPENDIX I

EXAMINATION OF EYE-WITNESSES' STATEMENTS

To enable us to make easier reference to the evidence of eye-witnesses in the body of the report we have divided the eye-witnesses into the following classes:

- Class A. Those in or close to Ndola who heard or saw an aircraft pass over the airport.
- Class B. Similar witnesses, who in addition saw anything which might be associated with the crash.
- Class C. Those who heard or saw two aircraft at about the same time.
- Class D. Those who, without seeing an aircraft, saw anything which might be associated with the crash.

In each case the evidence is summarized, and our comments in regard to the evidence follow the summary.

CLASS A

MR. D. L. BERMANT:

He lived in a house some five miles west of Ndola, about three-quarters of a mile to the north of the N.D.B. and a little further to the west. After he had gone to bed, and at a time which he estimated as 2130 he was awakened by the thundering roar of an aircraft flying very low over his house, so that it shook the house. It seemed much lower than was usual with aircraft. It seemed to be going towards the north.

Comment. The time might have been later, and the aircraft probably was SE-BDY passing near the beacon shortly after 2210. The evidence of very low altitude is not consistent with other evidence, and is probably explained by a type of aircraft which was unusual to the area, but his evidence does indicate that the aircraft was lower than is usual. The direction of travel was admittedly uncertain.

MR. A. C. MARTIN:

He was the controller at the airport, and after SE-BDY reported at 2210 that it was overhead he heard it.

Comment. Nil.

MRS. A. D. WRIGHT:

She lived on a farm some seven miles to the north-west of Ndola. At about 2215-2230 she was woken by the very loud noise of an aircraft. It came from the east. She heard only one aircraft.

Comment. This evidence fits in with what must have been the course of SE-BDY. The time is a little late but as the witness was woken up the time she gave was only an approximation.

MR. LEMON MWANSA:

As he was on his way to assume duty as a plantation firewatcher, which duty began at 2300, he heard an aircraft, and saw one red and one white light of an aircraft. It went out of sight.

Comment. The time is most uncertain. It was probably SE-BDY.

MR. F. J. ANDREWS:

He was on duty as a Reserve Inspector of the N.R.P. at the airport. Shortly after 2200 he heard an aircraft, glanced up and saw two flashing red lights. The aircraft was going to the west and there was nothing abnormal about its height. He heard no other aircraft in the air.

Comment. This fits in with the passage of SE-BDY over the airport.

CHIEF INSPECTOR J. A. EADE, N.R.P.:

Shortly after 2200 he heard and saw two red lights of an aircraft going to the west over the airport. It seemed to be a little low and to be going fast. He heard no other aircraft.

Comment. This fits in with the passage of SE-BDY over the airport.

SENIOR SUPERINTENDENT R. J. READ, N.R.P.:

He was on duty at the airport. At about 2200 he heard and saw the lights of an aircraft going across the airport to the west. It seemed to be at normal height. He heard no other aircraft.

Comment. This fits in with the passage of SE-BDY.

ASSISTANT INSPECTOR A. E. BEGG, N.R.P.:

He was on duty at the airport. At about 2200 he heard an aircraft and saw a light of one going across the airport to the north-west. There was nothing unusual about the height.

Comment. This fits in with the passage of SE-BDY.

PRIVATE M. G. VOSLOO:

He was on guard duty on the side of Mufulira away from Ndola (some 45 miles away), from 2000-2200. At some time towards the middle of his duty he heard a twin-engined aircraft pass overhead.

Comment. This witness does not strictly fall within this class. This aircraft was almost surely the D.C.4 OO-RIC which came from that direction to Ndola and landed at 2035.

LIEUTENANT-COLONEL F. D. SLATER:

He was in barracks about ten miles to the south-east of Ndola. He was awakened in the night by a large aircraft flying very low over his house. He could not fix the time.

Comment. This aircraft was almost surely the D.C.4 OO-RIC which took off from Ndola at 2235 to go to Salisbury, and kept low to be out of the way of SE-BDY which it was thought might come into land. Its route to Salisbury would take it in that direction.

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SENIOR TECHNICIAN K. H. HAMMOND, R.R.A.F.:

He was on duty at the airport. At about 2200, he heard and saw the red lights of an aircraft, which crossed the airport from east to west. He estimated its height as from 8,000 to 12,000 feet above the airport.

Comment. The height given is much higher than that given by any other witness. Otherwise the evidence fits in with the passage of SE-BDY.

SENIOR TECHNICIAN J. A. TOWNSEND, R.R.A.F.:

He was on duty at the airport. At about 2230 he heard and saw the lights of an aircraft which crossed the airport from east to west. Its height was about 2,000 feet above the airport.

Comment. Except that the time, an estimate, is a little late this fits in with the passage of SE-BDY.

CORPORAL T. N. LLOYD, R.A.F.:

He was on duty at the airport. At about 2200 he heard and saw the lights of an aircraft going overhead from east to west. He thought that the height was 2,000 feet above the airport.

Comment. This fits in with the passage of SE-BDY.

CLASS B

MRS. O. ANDERSON:

She lived in Ndola. At a time which she fixed by having looked at a clock as 2225 she heard an aircraft. She glanced out of a window and saw the red lights of an aircraft coming from the north-west towards Ndola and about eight to ten miles away. It seemed a bit low. At a time which she said was about seven minutes later, but which by her actions was the time taken in getting water from a refrigerator and walking to a bedroom some eight yards away, she heard an explosion, followed by two other explosions in rapid succession. She heard no other aircraft.

Comment. Except that the time is some ten minutes later than was probable this seems to accord with other evidence.

MR. D. A. C. CLARKE:

He was on security duty at a place some five miles east of Ndola. Shortly after 2200 he heard an aircraft and saw the steady red light of an aircraft go from east to west towards Ndola. The noise ceased and the light could not be seen. Shortly thereafter he saw a glow in the far distance to the west. He reported what he had seen after hearing the news at 1100 on the 18th September.

Comment. This evidence seems to fit in with other evidence and to be accurate.

MR. D. E. PEOVER:

He is an architect. He lives about one and a half miles from the airport. At about 2030 he saw an aircraft over Twapia Township area. It switched on its landing lights, twin beams, and approached in a steep descent. At that time he saw or heard no other aircraft. Just after 2200 he heard a large aircraft and from the balcony of his flat saw the red flashing light of an aircraft going from the airport to the north-west. It seemed to be slightly higher and to be going somewhat faster than the normal aircraft. It went out of sight behind some trees. About half a minute later he saw a red glow in the sky which went up and down twice. After the news at 1100 on the 18th September he reported what he had heard and seen to the airport. He heard no other aircraft.

Comment. This witness was by far the most impressive of the eye-witnesses. His account was, we consider, an accurate account of the landing of OO-RIC, which landed at 2035, and the passage of SE-BDY.

MR. D. MOYO, MR. L. DAKA, MR. P. BANDA:

These three witnesses can conveniently be dealt with together. They are three charcoal burners who were sleeping in the bush near where they worked, about two and a half miles from the scene of the crash. At dawn on the 18th they all went to the scene. They were all three convicted of the theft of a typewriter from the wreckage. Moyo said that at about 2400 he heard a sound as of a gun and later saw something burning. He said that Daka woke him up. Daka said that at about 0100 he was woken by a noise as of something exploding. He then saw a lot of fire. He said that he also saw something coming down and breaking the trees. He awakened Moyo. Banda was also awakened by Daka who said: "Wake up, listen, and hear what has exploded." He then heard sounds as of a gun going off many times. He saw a fire through the trees. None of them speaks of hearing any aircraft in the sky.

Comment. The times given are quite unreliable as is to be expected with these witnesses, awakened in the night. Moyo was awakened after the crash and the noise of a gun which he speaks of is obviously an explosion after the crash or the noise of exploding ammunition, as spoken of by Banda. Daka's evidence as to seeing something breaking the trees is obviously a reconstruction from what he saw at dawn, for he could not have seen that at night and that distance away. The failure to report the discovery of the crash was most regrettable but is no doubt explained by the theft of a supposed typewriter from the wreckage.

There is one matter which must be mentioned in regard to Banda, though it is not relevant to the Inquiry. In a statement made to members of the Board of Inquiry he said that when he went to the scene of the crash he saw dead bodies. Before us he said that he saw none. Asked to explain the difference in statements he said that he was beaten. Although it was inconceivable that the members of the Board who interviewed him should have been in any way concerned to make him say that he saw bodies, we thought it proper, in regard to the conduct of the Board, to inquire shortly into this allegation of the witness. We are satisfied that there was no truth in the allegation whatsoever.

ASSISTANT INSPECTOR M. U. VAN WYK, N.R.P.:

He was on duty at the house of the Provincial Commissioner in Ndola. At approximately 2220 he heard a large aircraft and then saw the steady red lights go across to the west, and disappear behind the trees. There was nothing unusual in height or speed. Three

or four minutes later he saw a red flash in the sky coming upwards from the ground. The glow lasted for about two seconds. He heard no other aircraft. When he came off duty at 2400 he told Assistant Inspector Begg what he had seen. Begg said that he would report it to the airport, and did so. Next morning the witness at the house gave the bearing of the glow to Squadron Leader J. Mussell.

Comment. This was accurate evidence.

Mr. L. H. COCK:

He was on duty at the airport. At 2205, checked by a watch, he heard an aircraft pass overhead going in a north-westerly direction. He glanced up but did not see it. It seemed to be at normal height. When the noise could no longer be heard he saw a flash to the north-west which lit up the horizon. He thought that it was lightning. He heard no explosion. He heard no other aircraft.

Comment. This was accurate evidence.

DETECTIVE INSPECTOR D. J. F. BUCHANAN, N.R.P.:

He was on duty at the house of the Provincial Commissioner. At about 2205 he saw the lights of an aircraft which went to the north-west. It seemed to be climbing slightly. At about 2210 he saw a flash of light to the north-west which lasted for about one second and lit up the sky. He thought that it was lightning. He heard no explosion.

Comment. This seems to be accurate, except that the impression that the aircraft was climbing must be wrong having regard to other evidence.

Mr. D. D. LOWE:

He was on duty at the house of the Provincial Commissioner as a Reserve Police Officer. He is district sales manager of the British Overseas Airways Corporation in Northern Rhodesia and has worked at airports. He knew the D.C.6 type of aircraft. At 2207 he heard what he thought was a D.C.6 pass overhead. He saw lights intermittently through the trees. It was heading west. He thought that it was rather low, and it seemed to be going fast. About ten minutes later he saw a pinkish glow in the sky to the west which lasted a few seconds. He thought that it was the reflection of a bush fire. He heard no explosion. He heard no other aircraft. He admitted that in an earlier statement he had put the times earlier, and thought that earlier times were correct.

Comment. This seems to be accurate except possibly as to times.

GENERAL COMMENT ON CLASSES A AND B

Apart from witnesses who must have been referring to the aircraft OO-RIC, there is general agreement in the evidence of all these witnesses as to what happened to an aircraft which must have been SE-BDY. It flew across the airport to the west, apparently at a height of somewhere about 6,000 feet above sea level, or maybe a little lower. Hammond seems to be inaccurate as to height. Many witnesses saw a flash some minutes later. None of these witnesses heard any explosion. None of the witnesses in Class A and B heard or saw any other aircraft.

CLASS C

Mr. W. J. CHAPPELL:

Comment. This witness was completely unreliable. He contradicted himself again and again, and gave evidence in a most unconvincing manner. We do not propose to examine his evidence.

Mrs. Y. JOUBERT:

She lived at Mufulira, some 40 miles to the north-west of the airport. In regard to times she was definite. She said that at 2300 she heard a jet aircraft far away, and ten minutes later she heard another aircraft fly low over the house. At 2330 she heard an explosion and saw a fire in the sky. At 0100 the fire was still burning.

Comment. The evidence as to the fire may be accurate, though whether it was a fire caused by the crash is uncertain. There may have been a later explosion from the crashed aircraft one and a quarter hours after the crash, but it seems unlikely that it would have been heard some 30 miles away. If it had been so loud as to be heard at that distance it is strange that no one else heard it. If she did hear an aircraft at about 2300 in Mufulira it certainly was not SE-BDY, which never went anywhere near Mufulira and had crashed by 2215. There is no question of mistake as to times on her evidence. It seems probable that there has been imaginative reconstruction.

Mr. T. J. KANKASA:

He is the secretary of the Twapia Town Management Board. Twapia is some four miles to the west of the airport. He was walking to his house at about 2035. He fixed this time by knowing that when he got home he listened to the Springbok Radio news service at 2100. He was certain the time he spoke of was before 2100. He did not think that it was possible that it was the Brazzaville news service at 2300 to which he listened. At 2035 he heard the peculiar noise of an aircraft and saw a big aircraft flying to the north-west. He actually saw the aircraft. It had lights. He saw a smaller aircraft, without lights, flying above the big aircraft in the same direction, at a slightly faster speed. Then he said, "I saw as if the small plane was beaming lights on this bigger plane and from that instant that bigger plane had then two headlights bright lights bearing straight." They disappeared in the horizon. He described the beaming of lights as being like the light of a torch put on and off two or three times.

Comment. One thing is clear, that the big aircraft seen at 2035 was not SE-BDY. It was almost certainly OO-RIC which landed at 2035. The witness Peover saw it over Twapia at 2030 and saw it switch on its landing lights, two beams. The small aircraft was probably the tail plane of the large aircraft; the light as of a torch may have been a flashing light on the big aircraft seen momentarily as the aircraft banked to come in to land.

Mr. J. M. LAURIE:

He is a reporter. He was at the airport from 2200 on the 17th September to 0330 on the 18th September. Shortly after 2200 he heard an aircraft pass overhead. At 2340 he heard an aircraft, sounding like a D.C.3, over the airport. It continued to drone very faintly around the vicinity of the airport for 20 minutes. The noise was very faint.

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Comment. The aircraft which he heard after 2200 was obviously SE-BDY. If there was another aircraft overhead at 2340 it is strange that no one else heard it. There were many police officers on duty.

MR. D. SIMANGO:

He is a charcoal burner who was sleeping near his kiln some two and a half miles from the scene of the crash. He saw the shape and lights of an aircraft going away from Ndola. Shortly afterwards it came back towards Ndola. He did not then see the lights. Then he saw a flash of light and the aircraft crashed down. Then he heard some explosives banging. After the flash and crash all sound of engines ceased. His cross-examination was deferred until after Mazibisa had given evidence. Under cross-examination he said that he saw two aircraft. A small one was showing between the wing and fuselage of the large one. In his earlier statement he had said that he saw what he believed to be two aircraft.

Comment. His description of the sequence of flash and crash was very vague. It is hard to discover how he could have seen a second aircraft on the return of the large aircraft when he did not even see the lights of the large aircraft. From the fact that all engine noise ceased with the crash it seems clear that there was not in fact a second aircraft, and that his original statement is more likely to be correct, that he saw what seemed to be two aircraft. This would fit in with his having mistaken the tail plane of the large aircraft for a second aircraft.

MR. F. MAZIBISA:

He is a charcoal burner and the president of the Charcoal Burners' Association. He was sleeping near his kiln about two and a half miles from the scene of the crash. It was he who through the Forestry Station reported the finding of the crashed aircraft at some time after 1230 on the 18th September.

He made two statements. In the first statement he made no mention at all of having seen an aircraft in the night, and said that he became "excited" when he discovered the crashed aircraft on his way from work. He made a second statement about a week later, after he had discussed the matter with a Mr. Mattson, a trade union organizer who had interested himself in the affairs of the Charcoal Burners' Association. In that he said that he was attending to his work when he heard aircraft and saw lights in the sky which he thought were two aircraft, about 100 yards apart, one behind the other coming from the north. A few minutes later at about 2215 he heard a horrible noise and saw a very bright light on the ground. Then he heard a lot of smaller noises.

In his evidence before us he said that at 2230, a time which he fixed by looking at his watch, he heard the noise of two aircraft and looked up and saw the lights of two aircraft. Then he went to sleep. After a few minutes he heard a very big bang and saw a very big light. Then there was a number of smaller explosions. He went away.

In later questioning he said that he saw the shapes of two aircraft. And then he said that it was the spacing of the lights which led him to think that there were two aircraft.

Comment. This witness was not impressive. He had no real explanation as to why in his first statement he made no mention at all of seeing aircraft in the night, or of hearing the crash. The smaller noises, or explosions he speaks of, if heard, would be cartridges exploding in the fire. His story does not confirm that a second aircraft was still in the air after the crash. There is no satisfactory explanation as to why this witness, if he heard the crash in the night, and did not, as he first said, find it on his way from work next day, should not have reported sooner.

MR. D. BULENI:

He first made a statement on 20th January, 1962. He had a discussion with Mr. Mattson and Mazibisa and decided to give evidence to this Commission. He is a charcoal burner who said that he was sitting outside his house in the compound on Sunday night. There was a beer drink in progress. Between 2000-2100 he saw an aircraft with lights flying from west to east. After a long while he saw another aircraft with very big red lights. Above this was a smaller aircraft with a red light on it. They flew from the north to the south. The small aircraft was above the large aircraft, about 150 yards above it. One aircraft burst and fell to the ground. He then saw a big flame. Then the small aircraft flew off towards Kitwe. In an earlier statement he said that it flew in a different direction towards Mufulira.

Comment. He was not a reliable witness. There are statements in his evidence such as: "It is easy for one to see aeroplanes flying at night because of the buzz of the engines." It is most unlikely that he would have confused the direction of Mufulira with the direction of Kitwe, and the difference in this regard shows that he had forgotten what he said a few days before.

CLASS D

ASSISTANT INSPECTOR N. J. VAUGHAN, N.R.P.:

He was on patrol in a vehicle on a road from Mufulira. At 2340 he saw in the direction of Ndola what appeared to be an exploding light in the sky and something falling. He likened it to a lamp bulb bursting. It lasted for some two seconds. He reported this on his return to his station in Mufulira at 0130. As a result of this report patrols were sent out.

Comment. Probably what was seen was a red-hot oxygen cylinder, or some other part of the wreckage, blown into the sky. Whatever was seen, was seen over an hour after the crash.

MR. J. NKIATA:

At a time determined by cock-crow as between 2400 and 0100 he heard an explosion. He was lying awake in his house in a road camp on the Mufulira-Ndola road.

Comment. Nil.

MR. M. A. BRACHE:

At about 0130 he was motoring from Mufulira to Ndola. At a point on that road which is about opposite the scene of the crash he saw a fire which appeared to be a localized bush fire, and smelt an unpleasant smell such as would not come from a bush fire.

Comment. This may have been the burning aircraft, though the scene of the crash was some four miles from the road.

ANNEX IV

LIST OF WITNESSES HEARD BY THE UNITED NATIONS COMMISSION

AHMED, Mr. W.S., Chief Administrative Officer, ONUC
ALLEN, Mr. A.V., Senior Inspector, Northern Rhodesian Police, Ndola
ALPORT, His Excellency the Right Honourable Lord, T.D., British
High Commissioner
ANDERSON, Mrs. O., housewife

BANDA, Mr. P., charcoal burner
BARBER, Colonel M., Director of Civil Aviation, Federation of Rhodesia
and Nyasaland
BEGG, Assistant Inspector A.E., Northern Rhodesian Police, Ndola
BERMANT, Mr. D.L., business director
BLANCHARD-SIMS, Wing Commander, Department of Civil Aviation,
Federation of Rhodesia and Nyasaland
BRICHANT, Mr. P., ICAO
BRINKMAN, Mr. G., Chief Communications Officer (ONUC)
BUDREWICZ, Mr. R., Air Traffic Control Officer, Ndola Airport
BULENI, Mr. D., charcoal burner

CABALLERO, Mr. Quijano, Chief of ITU Mission, ONUC
CAREY, Mr. M.T., Assistant Police Inspector, Assistant Superintendent,
Ndola Police Station
CHILVERS, Mr. C.P., Senior Air Traffic Controller, Salisbury Airport
CHISANGA, Mr. S., charcoal burner
COASE, Superintendent B.G., Officer Commanding Nufulira Police District
COISTINOS, Mr. D., Radio Technician, ICAO
CORDIER, Mr. Andrew W., Under-Secretary for General Assembly Affairs

DAKA, Mr. L., charcoal burner
DANIELSSON, Mr. O., Superintendent, Swedish Criminal State Police;
Adviser to Swedish Representative, Rhodesian Board of Investigation
DEPPE, Captain, Belgian International Air Services (pilot of OO-RIC)

EVANS, Wing Commander, Air Adviser to the British High Commissioner,
Federation of Rhodesia and Nyasaland

FOURNIER, Mr. J.P., Chief of ICAO Mission to the Republic of the Congo
(Leopoldville); United Nations Observer, Rhodesian Board of
Investigation

GOODBRAND, Mr. M.J.A., Communicator, Ndola Airport
GREGORY, Mr. Alan, Inspector of Aircraft, Department of Civil Aviation,
Federation of Rhodesia and Nyasaland

HAMMARSKJÖLD, Mr. Knut

HAWKER, Mr. T.H., Sales Secretary, Leyland Albion (CA) Ltd.

HAWKINS, Air Commodore, Deputy Chief of Air Staff, Royal Rhodesian
Air Force

HICKS, Mr. L.A., Assistant Police Commissioner, Ndola

KANKASA, Mr. T., Secretary, Twapia Township Board

KANYAKULA, Mr., court interpreter

KAVANAGH, Mrs. D.M., nurse

KAZEMBE, Mr. M.K., watchman

KHIARY, Mr. M., Chief of Civilian Operations, ONUC

KNIGHT, Mr. A.W., Senior Air Traffic Control Officer, Salisbury Airport

KROON, Mr. H., Deputy Chief Security Officer (ONUC)

LAMPPELL, Colonel S., Chief of Fighter Operations, ONUC

LANDIN, Mr. E.A., Inspector of the Royal Swedish Board of Civil
Aviation, Representative to Rhodesian Board of Investigation

LANSDOWNE, Lord, Joint Parliamentary Under-Secretary of State for
Foreign Affairs

LEMAIRE, Mr. G., Adviser to Airport Manager, Ndjili, Leopoldville

LINDMAN, Mr. N.E.L., Temporarily attached to the Royal Swedish Board
of Civil Aviation, as Senior Inspector of Aircraft; Adviser
to Swedish Representative, Rhodesian Board of Investigation

LINNER, Dr. S., Officer-in-Charge, ONUC

LJUNGKVIST, Major K.O., UN Air Operations, ONUC

LOWENTHAL, Dr. M.N., Medical Doctor, Ndola

MacEOIN, Lt. Gen. Sean, Commander UN Forces in the Congo

McGRATH, Miss A., nurse

McNAB, Dr. D., Surgeon, Ndola

MADDERS, Mr. M., Chief Engineer, Department of Civil Aviation,
Federation of Rhodesia and Nyasaland

MARTIN, Mr. A.C., Air Traffic Control Officer, Ndola Airport

MATLICK, Col., Air Attaché, United States Embassy, Leopoldville

MATTSON, Mr. S., International Federation of Free Trade Unions

MAZIBISA, Mr. F., President, United African Charcoal Burners' Association

MOYO, Mr. D., charcoal burner

MPINGANJIRA, Mr. A.J. Lemonson, charcoal burner

MUBANGA, Mr. J., charcoal burner

MURPHY, Mr. L.J., Airport Manager, Salisbury

MUSSELL, Squadron Leader, Royal Rhodesian Air Force

NELSON, Mr. T.R., Chief, Accident Investigation Unit, ICAO; United
Nations Observer, Rhodesian Board of Investigation

NKOLOSSO, Mr. M., Public Relations Officer for the United National
Independence Party

NKONFELA, Mr. L., charcoal burner

NKONJERA, Mr. D., storesman

OWEN, Mr. G., Air Traffic Control Officer, Salisbury Airport

PARKES, Mr. T.K., Senior Air Traffic Controller, Ndola Airport
PENNOCK, Assistant Inspector J.K., Ndola Traffic Station
PEOVER, Mr. D.E., architect, Ndola
PERSSON, Capt. S., Director of Operations, Transair
PHILLIPS, Mr. R.A., Refuelling Superintendent, Ndola Airport
POUJOULAT, Mr., Personal Assistant to Officer-in-Charge (ONUC)
POWELL-JONES, Mr., First Secretary, United Kingdom Embassy, Leopoldville

RICHES, H. E. Ambassador D.M.H., British Ambassador, Leopoldville
ROEDER, Assistant Inspector V.G., Commanding Officer, Ndola Station
ROSS, Dr. H.D., Pathologist and Forensic Specialist, Federation of
Rhodesia and Nyasaland

SCOTT, Mr. D.A., Deputy British High Commissioner
SIMANGO, Mr. A., charcoal burner
SLATER, Lieutenant Colonel, Commanding Officer, Northern Rhodesia
Regiment
SPINELLI, Mr. P.P., Director of the European Office of the United Nations

THOMAS, Mr. Donald E., Personal Aide to the Secretary-General
THOROGOOD, Mr. L.E., Air Traffic Control Officer, Salisbury Airport
TJERNELL, Mr. O.E., Transair Technical Service
TURNBULL, Mr. J., Communicator, Salisbury Airport
TURP, Mr. S., Transair Engineer

van WYK, Assistant Inspector M.U., Police Mobile Unit, Bwana Mkubwa
VAUGHAN, Assistant Inspector N.J., Mufulira Central Police Station
VERVING, Mr. B., Technical Director, Transair

WACHTMEISTER, Mr. Wilhelm, Chief of General Assembly Section and
Personal Assistant to the Secretary-General
WILLIAMS, Mr. J.H., Manager, Ndola Airport
WRIGHT, Mrs. A.R., housewife

YEADON, Mr. Alan (ICAO) Air Traffic Control Officer

ANNEX V

MATERIAL DEALING WITH THE AIRWORTHINESS OF THE AIRCRAFT
AND PARTICULARS OF RADIO AND ELECTRONIC NAVIGATIONAL
EQUIPMENT ABOARD SE-BDY

Aircraft information relating to SE-BDY certificates of airworthiness and of maintenance are summarized in part 2, section 3 (paragraphs 3.1 to 3.12), of the report of the Rhodesian Board of Investigation (annex II).

The following radio communications equipment and electronic aids to navigation were carried by SE-BDY.

Radio communications and equipment

2 HF transmitter/receivers, type 6185-1

1 HF receiver, type EC-348-P

2 VHF transmitters, type 17 L-6

4 VHF receivers, type 51 R-3

1 VHF portable transmitter/receiver

1 Dinghy transmitter, type T-74/CRT 3

Electronic navigational equipment

2 ADF (radio compass), type 51 V-1

Weather radar, type AV 610

Radio altimeter, type AV 610

Glide slope indicator and ILS marker receiver

Loran receiver, type R 65/AFW 9

Of the radio equipment salvaged after the crash, none of the receivers or the transmitter/receivers was found set at any of the frequencies internationally agreed for the ICAO African region. Experts believe that this was due to changes in the settings owing to the force of impact. The radio compass (ADF) when salvaged was tuned to a frequency not employed by radio beacons in the area (see in this respect the opinion expressed in section 3.5 of the report of Dr. Frei-Sulzer (annex XII)).

ANNEX VI

RADIO COMMUNICATIONS RELATING TO THE FLIGHT OF
SE-BDY AND SEARCH AND RESCUE OPERATIONS

A

Summary of communications exchanged between Salisbury Flight Information Centre (FIC), Ndola Tower, the aircraft SE-BDY and OO-RIC, Leopoldville, etc.*

17-18 September 1961

NOTE

{ All times are Greenwich Mean Time
{ For local time Congo add 1 hour to GMT
{ For local time Rhodesia add 2 hrs. to GMT }

- 17.9.61 1525 Signal No. ZI 13 addressed to Ndola by Salisbury for attention (Airport Manager) AFM.
"There is a message received from Leopoldville at 1409 - one UNO aircraft ex Leopoldville ETA Ndola 1900 presumed GMT passenger Lord Lansdowne will probably request clearance to Salisbury from yours STOP Also one other UNO aircraft ex Leopoldville to arrive during night STOP Your station to remain open until both aircraft landed - authority (Director of Civil Aviation) DCA STOP Acknowledge."
- 1530 Ndola advised by Salisbury on 6915 kc/s to pass details of signal ZI 13 on "tie-line" to Lusaka and that Lusaka to remain open as alternate.
- 1535 ZI 14 addressed to Lusaka by Salisbury for attention APM - Reference signal ZI 13 your station to remain open as alternate - authority DCA STOP Acknowledge.
- 1551 SE-BDY with Secretary-General departed Leopoldville.
- 1553 Signal received by Salisbury from Lusaka acknowledging receipt of ZI 13.
- 1559 Signal received by Salisbury from Ndola acknowledging receipt of ZI 13.

* Initially prepared for the Commission by the Aeronautical Adviser from all sources available including transcriptions of tape recorded radio telephone communications, flight progress strips, copies of telegraphic and teleprinter messages and witnesses statements.

- 1928 Flight Plan OORIC received at Ndola. "ETA Control Area Boundary 1955, ETA Ndola 2017".
- ?1940- OORIC given QDM Ndola.^{a/}
1950?
- 2002 SE-BDY made first contact with Salisbury FIC and requested
(2006) ETA OORIC. Salisbury requested destination and aircraft type and was informed that SE-BDY was DC 6, destination Ndola. Salisbury requested ETA Ndola and SE-BDY replied ETA 2235 approximately. SE-BDY, in reply to request, stated place of departure Leopoldville. Informed by Salisbury that ETA OORIC 2017 Ndola (conversation apparently intercepted by Ndola which later received substance from Salisbury).
- 2007 OORIC given QNH^{b/} and approach instructions on VHF (Very High Frequency Radio Telephone) by Ndola. OORIC cleared to approach on NDB (Non-Directional Radio beacon) and to descend from FL 75 (7,500 ft.) to 6000 ft. (a/c to report at 6000 ft.)
- 20..? OORIC reported at 6000 ft.
OORIC instructed to maintain 6000 Ft. and report ND (Non-Directional Radio Beacon) or "lights in sight".
- 20..? OORIC reported lights in sight and was given wind direction and strength, cleared to RWY 10 and instructed to report "on base leg".
- 20..? Above signal acknowledged by OORIC.
- 20..? OORIC reported "on base leg" (its lights were sighted by the Air Traffic Controller) and was given wind direction and strength and final clearance to land.
- 2035 OORIC landed (17 minutes later than its ETA).
- 2041 SE-BDY reports position to Salisbury 432B (0740S 3033E) at 2035 and now flying on route 432 at Flight Level 175 (17,500 ft.) to avoid Congolese territory.

a/ "Q" code symbol for the bearing to be steered in zero wind to reach the radio station concerned.

b/ "Q" code symbol for the pressure setting to be set on an altimeter for it to read the aerodrome height above sea level on landing.

- 2049 SE-BDY informed by Salisbury FIC that OORIC arrived Ndola 2035.
- 2108 On HF SE-BDY reported abeam Kasama at 2106 estimating abeam Ndola at 2147 and requested permission to descend from FL 175 to FL 160. FIC Salisbury advised SE-BDY that there was no traffic and approved descent to Flight Level 160 (16,000 ft.) (2111).
- 2111- SE-BDY reported on HF to Salisbury that he had reached
2115 Flight Level 160, keeping outside Congolese territory proceeding around the border to Ndola to land at Ndola. In reply to questions stated not remaining overnight at Ndola, taking off almost immediately, not returning Leopoldville and unable to state destination after Ndola.
- 2131 SE-BDY confirmed estimating abeam Ndola at 2147. Salisbury advised SE-BDY to contact Ndola on VHF.
- 2135 SE-BDY contacted Ndola Tower on VHF 119.1 Mc/s "abeam Ndola 2147 ETA 2220".
- 2137 Ndola advised weather. Wind 120/7 knots. Visibility 5 to 10 miles with slight smoke haze. Control QNH c/ 1021 mb (30.15"/Hg) QFE d/ 877 mb. Duty Runway 10.
- 2138 SE-BDY acknowledged weather. Requested descent clearance beginning at 2157. Clearance given to 6000 ft. Requested "Report top of descent".
- 2140 Teleprinter message received by Salisbury from Ndola stating
(approx) SE-BDY will not divulge his destination after landing Ndola. (This was in reply to a query made by the FIC on 6915 kc/s)
- 2142- SE-BDY in reply to inquiries said not proceeding to Salisbury
2144 after landing Ndola, not remaining over night Ndola. Would give intentions on ground.
- 2147 SE-BDY reported abeam Ndola.
- 2153- SE-BDY in reply to question said might require a little
2154 refuelling at Ndola.

c/ "Q" code symbol for the pressure setting to be set on an altimeter for it to read the aerodrome height above sea level on landing.

d/ "Q" code symbol for the pressure setting to be set on an altimeter for it to read zero on landing.

- 2210 Ndola Air Traffic Control Officer reported following from SE-BDY: "Your lights in sight overhead Ndola, descending, confirm QNH".
- Ndola - "Roger QNH 1021 mb, report reaching 6000 ft."
- SE-BDY - "Roger 1021."
- 2215 Estimated time of crash by Rhodesian Investigating Board. (Mean and average of 4 watches stopped within one minute of each other was equivalent of 2211).
- 2225 OORIC given taxi clearance by Ndola Tower. Wind 110/5 knts. Clear to the holding position Runway/10. Control QNH 1021 mb. QFE 877 mb. (Acknowledged by OORIC)
- 2230 Take-off clearance requested by OORIC. OORIC instructed by Ndola Tower to hold position, as DC6 SE-BDY was descending to 6000 ft. and the Tower had been unable to contact it during the previous 20 minutes. (OORIC endeavoured to contact SE-BDY to assist tower.)
- 2230- OORIC, at holding position on Runway 10, requested take-off
2235 at own discretion (no visual sign of DC6 SE-BDY).
OORIC given permission by tower to take-off at own discretion, right turn out and report on track Salisbury.
- 2235 OORIC took off and again endeavoured to contact SE-BDY on HF (High Frequency) as well as VHF (Very High Frequency), with negative results.
- 2238 OORIC reported on track, estimating control area boundary at 2255. Abeam LS 2318 and ETA Salisbury 0026. Above signal acknowledged by Ndola Tower and OORIC cleared to FL 75 to report on reaching Control Area Boundary. OORIC reported at FL 75. Instructed to maintain FL 75 and report Control Area Boundary.
- 2253 OORIC reported Control Area Boundary FL 75. Signal acknowledged by Ndola tower, and OORIC instructed to contact Salisbury on 5506 kc/s. Instructions acknowledged by OORIC.
- 2310 Call from Ndola to Salisbury on 6915 kc/s stating no contact with SE-BDY since he reported overhead at 2210.
- 2315 APM (Air Port Manager) Ndola advised by tower Ndola.

- 2330 Phone call to FIC Salisbury from Ndola (Air Port Manager) confirming above details and stating Ndola were taking overdue action.
- 2350 DD priority signal received by Salisbury from Ndola ZC 40 (also addressed to Leopoldville ATC and FIC and Lusaka) requesting news of SE-BDY and stating aircraft was overhead Ndola at 2210 and nil further contact.
- 18/9/61 0005 Lusaka reports to FIC Salisbury - "no news or contact with SE-BDY".
- 0016 INCERFA signal received by FIC Salisbury from Ndola (also addressed to Leopoldville and Lusaka) stating SE-BDY intended landing Ndola at 2220, having reported abeam Ndola at 2147 and overhead at 2210 - no further communication received from aircraft and its endurance was not known.
- 0030 Defence headquarters operations advised by FIC Salisbury of above details.
- 0040 DD signal sent to Ndola stating Salisbury FIC had no news of SE-BDY.
- 0338 First light.
- 0443 DHQ were 'phoned (by Mr. Knight SATCO who came on duty at 0400) re further news from RRAF. DHQ advised that the RRAF at Sarum were in the picture that there were no DC3s at Ndola but that there were Vampires and Canberras. RRAF suggested that SE-BDY may have returned to Leopoldville after having spoken to OORIC by radio. (Mr. Knight then records that he spoke to Mr. Thorogood (the ATCO on duty at FIC until 0400) who said that the pilot of OORIC stated he did not have any contact with SE-BDY although he called him on VHF just after getting airborne at Ndola at 2235 for Salisbury).
- 0445 DETRESFA signal sent by the Rescue Coordination Centre (RCC 1) Salisbury to Leopoldville and Elizabethville (with a copy to Ndola for info) "Request reply immediate to Ndola signal No. ZC 40 reference SE-BDY overhead Ndola at 2210 nil arrival Ndola ex Leopoldville STOP send flight plan details - nil departure signal received".
- 0446 Salisbury RCC advised DHQ by 'phone that pilot of OORIC did not have any R/T contact with SE-BDY.

- 0450 Signal received by Salisbury ex Ndola (ZC 2) stating "Person reported to the police here seen great flash in the sky at approx 2300Z in direction of Mufulira" (DHQ were advised of this).
- 0509 Salisbury inquires whether police are working on SE-BDY. Ndola replies that can't say. Air Port Manager has been informed but not here.
- 0520 Jan Smuts Airport, Johannesburg, advised Salisbury RCC they will have no contact with Leopoldville until 0600/0630 approx.
- 0535 RCC 2 DETRESFA signal sent to Ndola by RCC requesting information on action taken to date on SE-BDY.
- 0542 Message sent to Leopoldville by RCC on HF A/G frequency requesting news of SE-BDY (This message was originated at 0415 but no contact was made with Leopoldville until 0542).
- 0544 Leopoldville replied (relaying through Luluabourg) that they had no news of SE-BDY (DHQ were advised of this).
- 0550 RCC 3 sent by Salisbury to Ndola advising that Leopoldville had no news of SE-BDY.
- 0553 Salisbury inquires from Senior Air Traffic Control Officer Ndola if local copperbelt police have been put in picture. Ndola replied had not advised other police stations but presumably since report came from police they had alerted other copperbelt police stations. General opinion that SE-BDY turned back and doesn't think there's probably anything in report.
- 0554 Salisbury stated just raised Leopoldville through Luluabourg. No news. Ndola replied Roger. We have of course aircraft available here for search if necessary.
- 0600 RCC Salisbury sent to Nairobi (copy to Ndola) "request news DC6 SE-BDY from Leopoldville to Ndola overhead Ndola 172210 did not land Ndola".
- 0602 Ndola were requested by RCC on 6915 kc/s to ensure that Police on the Copperbelt were alerted.
- 0627 Message received by Salisbury RCC from Nairobi on HF A/G stating no news of SE-BDY.

- 0630 RCC 5 sent by Salisbury to Ndola and Lusaka "Alert NRP stations north of Lusaka on DC6 SE-BDY STOP Nil further details available on endurance and number on board".
- 0630 Ndola signal ZC 5 received by Salisbury RCC - "Police advise all Copperbelt police stations informed ref SE-BDY".
- 0647 Signal received by Salisbury RCC ex Nairobi FIC stating no news SE-BDY this FIC.
- 0700 D/CATCO Salisbury (Mr. Chilvers) arranged by telephone with SATCO Ndola to request 2 Provosts to search 50 miles radius of Ndola.
- 0717 Message received by Salisbury RCC on Hf from Leopoldville requesting news of SE-BDY (reply was sent "No news").
- 0717 Message sent to Lepoldville on HF "request endurance of SE-BDY on departure Leopoldville for Ndola and number on board". (This message was originated at 0708)
- 0721 ZC 11 ex Lusaka "All police stations notified stop awaiting news".
- 0730 RCC 6 sent by Salisbury to Ndola (copy to RRAF Salisbury and DHQ) "Ref phone conversation request Air Search 2 Provosts 50 M radius Ndola".
- 0731 Message sent by RCC to CAA Viscount flight CE 804 - "Request you keep lookout for DC6 or parts thereof on ground en route to Ndola" (This aircraft was bound from Salisbury to Ndola).
- 0732 H/F RT message received by Salisbury RCC from Leopoldville stating SE-BDY departed Leopoldville at 1552 for Ndola with an endurance of 1325 hours "VIP on board and 5 crew".
- 0742 Signal confirming request for search by 2 Provosts received by RRAF.
- 0744 HF/RT message received by Salisbury RCC ex Leopoldville stating SE-BDY had 5 crew and 9 passengers on board.
- 0745 RCC 7 sent by Salisbury RCC to Ndola and Lusaka (copy to RRAF Salisbury and DHQ) - "SE-BDY departed Leopoldville 171552 endurance 1325 hr 5 crew 9 passengers".

- 0805 Message received by Salisbury RCC from Ndola on 6915 kc/s stating that air search had been organised - 1 Provost will search up to 50 mls south of Ndola and 1 Canberra 50 miles North except where that radius crosses the Congo border.
- 0816 HF/RT message received by Salisbury RCC from Elizabethville requesting news of SE-BDY.
- 0816 Message sent by Salisbury RCC to VP-YSP (DC3) - "Request you keep lookout for DC6 or parts thereof on ground".
- 0823 HF/RT message sent by Salisbury RCC to Elizabethville stating no news of SE-BDY.
- 0823 Ndola signal ZC 12 received by RCC stating 1 Provost and 1 Canberra departed on search.
- 0832 HF/RT message sent to Kamina by RCC requesting news of SE-BDY (This message originated at 0613 but there had been no previous contact with Kamina).
- 0833 Kamina replied - no information SE-BDY.
- 0848 HF/RT message ex Elizabethville to RCC - "did SE-BDY land at Livingstone?" - replied "Negative".
- 0919 HF/RT message received by RCC ex Leopoldville "Request news SE-BDY?"
- 0922 Reply sent to Leopoldville - "Nil news, will advise".
- 0954 ZC 24 received by RCC from Ndola (also addressed to Leopoldville and DHQ) stating Elizabethville, Kamina and Luluabourg have nil news of SE-BDY no reports yet received from search aircraft.
- 1029 HF/RT message from Leopoldville to RCC - "Any news yet SE-BDY?"
- 1035 Reply sent to Leopoldville - "Nil news SE-BDY".
- 1040 Lusaka advised by RCC on 6915 kc/s that they had received a message that the crashed aircraft found 10 miles south of Mafulira.
- 1220 DCA on 'phone to APM Ndola appointing him as Civil Air Search Officer.

- 1230 Entry in Ndola log as follows:
- "Co-ordination - Col. Matlick (USAF ex Leopoldville)
Mr. Williams (CASO) S/Ldr. Mussell (RRAF) 4 UNO DC4s
ex Leopoldville, 2 USAF C54s AIR SEARCH RESCUE 3 US DC3s
at Ndola. Provosts report nil information RRAF search
in FIR only (2 Provosts and 1 Vampire)."
- 1335 RRAF advise wreckage sighted 7 miles from Ndola bearing
290°(M). A DC3 and a Provost overhead now.
- 1350 RRAF advise position of crash 12573 283220E Heading 114°(M).
Aircraft hit tops of trees and skidded over distance of
150 yds - wreckage scattered - elevator and two engines only
identifiable - area burnt out - aircraft still smouldering.
- 1407 Ndola reports 4 bodies - 1 alive not Hammarskjold - ambulance
on the spot.
- 1417 RRAF report 6 bodies found Hammarskjold definitely dead -
1 alive very seriously injured.
- 1440 Signal received ex DCA Stockholm - "Please request all
available information regarding United Nations chartered
Swedish aircraft SE-BDY type DC6B reported missing on a
flight from Leopoldville departed 1552 September 17th".
- 1457 RCC 8 sent to Ndola, Leopoldville, Elizabethville, Nairobi,
Lusaka, Livingstone, Kamina, Luluabourg, RRAF Salisbury and
DHQ - "Cancel DETRESFA SE-BDY found burnt out in position
1257S 28 32 30E seven miles from Ndola on bearing 294°(M)".

B

Transcription of tape recorded radio-telephone (R/T)
communications between SE-BDY and Salisbury Flight
Information Centre

Date: 17 September 1961
Recorded at: Salisbury
Circuit: No. R/T. 1. Frequency 5521.5 Kc/s
Time: Between 2002 GMT and 2132 GMT

Time	Call Signs To	From	Remarks
2002	SBY	SDY	Call
	?	SBY	Aircraft calling Salisbury say again your call sign
		SEBDY	Good evening. How do you read
		SPY	Say again your call sign
		SEBDY	How do you read
		SDY	Roger three to four slight static
2002½		SDY	Request LTN. GCRIC
		SBY	Standby one (ask PIC on intercom)
	SDY	SDY	Calls
		SDY	Go ahead
		SDY	What is your destination and aircraft type
2004½		SDY	Standby one
	SPY	SDY	Call
		SBY	Go ahead
		SDY	Destination Ndola aircraft DC6(c)?
		SBY	Understand destination Ndola DC6C is that affirmative
		SDY	DC??
		SPY	Understand destination Ndola and aircraft type DC6 is that affirmative
		SDY	That is affirmative
2006½		SBY	Roger what is your LTN. Ndola
		SDY	Roger standby one
	SDY	SDY	Calls
		SBY	Go ahead

Time	Call To	Signs From	Remarks
		SDY	ETA 2235 approximately standby for ??? ETA.
	SDY	SBY	Roger approximate ETA 2235 what was your place of departure
		SDY	Place of departure Leopoldville
		SBY	Roger Leopoldville place of departure, the ETA CORIC 2017 Ndola.
		SBY	2017 is that affirmative
		SBY	That is affirmative
2009 $\frac{1}{4}$		SDY	Roger, check, listening out
2031 $\frac{1}{2}$	SBY	SDY	Call
		SBY	Call
		SDY	Request arrival time of CORIC over
		SBY	Standby one
2033	SDY	SBY	Go ahead
		SDY	Go ahead
		SBY	Go ahead go ahead
		SDY	Go ahead
		SBY	Nothing for you were you calling
		SDY	Request arrival time of CORIC
2033 $\frac{1}{2}$		SBY	Roger standby one
2040	SBY	SDY	Call
		SBY	Go ahead
		SDY	Checks 432B at 2035 Flight level 175 Flying on advising route 432 to avoid Congolese territory
42		SBY	Confirm position 432B at 2035 flight level 175 and your flying on route 432 is that affirmative
		SDY	That is affirmative
		SBY	Roger standby for arrival time CORIC

Time	Call To	Signs From	Remarks
	SBY	SDY	Standing by
2049	SDY	SBY	Arrival time Ndola CORIC 2035
		SDY	Roger 2025
		SBY	Negative 2035
		SDY	Roger thank you 2035
		SBY	That is affirmative
2111/ 08	SBY	SDY	Call
		SBY	Go ahead
		SDY	Check abeam KS/(Kasama) 06
			Estimate abeam ND(Ndola) 47
			Flight level 175 request flight level 160
		SBY	Say again your position estimate at 47
		SDY	Roger estimate abeam ND at 47
		SBY	Roger abeam KS 06 Flight level 175 estimate abeam ND 47 request Flight Level 160, is that affirmative
		SDY	Roger that is affirmative
		SBY	Standby one
2114/ 11	SDY	SBY	Nil traffic to flight level 160
		SDY	???
		SBY	Nil traffic to flight level 160 please acknowledge
		SDY	Roger check will give you a call reaching 160
		SBY	Roger thanks
2118/ 15	SDY	SBY	What are your intentions on arrival Ndola
		SDY	Say again
		SBY	What are your intentions on arrival Ndola
		SBY	Standby

Time	Call To	Signs From	Remarks
	SBY	SDY	We are keeping outside Congolese territory proceeding around the border to Ndola to land at Ndola.
		SBY	On <u>arrival</u> Ndola are you night-stopping or proceeding elsewhere
		SDY	I'm taking off almost immediately (etc??? unreadable)
		SBY	Are you returning to Leopoldville tonight
		SDY	Negative
		SBY	What is your destination on departure Ndola.
		SDY	Unable to say at present
2122/ 15	SBY	SDY	We have reached FL160
		SBY	Roger understand reached 160
2139/ 32	SDY	SBY	Confirm you estimating abeam ND at 47
		SDY	Affirmative
		SBY	Roger contact Ndola VHF 119.1 now
		SDY	Roger will do.

PLEASE NOTE latter times shown after oblique stroke are actual times as opposed to recorder times.

LEGEND
SBY - SALISBURY
SDY - AIRCRAFT SBDY

Transcription of tape recorded radio-telephone (R/T)
communications between Salisbury FIC and Ndola Tower

Date: 17/18 September 1961
Recorded at: Salisbury
Frequency: 6915/3682 Kc/s
Time: Between 2002 GMT 17 September and 1356 GMT
18 September

TIME	CALL SIGNS		REMARKS
	To	From	
2002 ¹	SAY	NDO	Call
2018	SAY	NDO	Call
2018 ¹	SAY	NDO	Call - Do you read?
2019	SAY	LUS	Call - 6915
2020	LUS	NDO	Our Teleprinter is out with SAY will you ask them to see us 5455
	NDO	LUS	Roger will do.
2036	NDO	SAY	Call
	NDO	SAY	Go ahead
	NDO	SAY	You are strength 2 distorted there is a DC6 SRBDY at FL 175 from LEO EST NDO 2235 and we haven't received any ARR SIG on OORIG
	SAY	NDO	Roger he arrived at 2035 over
	NDO	SAY	Roger thanks is the ARR SIG on its way?
	SAY	NDO	Affirmative our teleprinter is unserviceable will you see us on 5455
	NDO	SAY	Roger will do
2036 ¹	SAY	NDO	Thank you
2039	NDO	SAY	Call
2043	NDO	SAY	Call
	SAY	NDO	Reply
	NDO	SAY	Still no news of VZM? over
	NDO	SAY	Negative will advise you soonest

TIME	CALL SIGNS		REMARKS
	To	From	
(2043)	NDO	SAY	Roger thanks I keep on dodging up to the TWR and will be going up shortly I have 830 arriving from Johannesburg I'll probably be up there for the next 20 minutes over
2043½	SAY	NDO	Roger thanks
2112	NDO	SAY	Call
	NDO	SAY	69
2113	NDO	SAY	6915 do you read over
2114	NDO	SAY	6915 do you read over
2114½	NDO	SAY	69 do you read over
2115	LUS	SAY	Over
2119½	SAY	NDO	Will you try again now over
	NDO	SAY	Roger you are now strength 3
	SAY	NDO	Roger you're about 2 to 3 now go ahead
	NDO	SAY	Roger SDY now at fl 160 he gave a position report abeam Kilo Sierra (Kasama) at 2106 and estimated November Delta (Ndola) at 47 over
2120	SAY	NDO	Roger thanks
2122	NDO	SAY	Call
n	SAY	NDO	Reply
	NDO	SAY	SDY to you
2122½	SAY	NDO	Roger thank you
2129	SAY	NDO	Ndola has SDY over
	NDO	SAY	Thank you Alan if you can get any information

TIME	CALL SIGNS		P	REMARKS
	To	From		
(2129)	NDO	SAY	5	from him as to his future movements I'd be most grateful
	SAY	NDO		sorry would you mind trying again you're fading badly
	NDO	SAY		Roger I say again if you can get any information from SDY as to his future movements after landing Ndole I'd be most grateful
2130	SAY	NDO		Stand by one
2131	SAY	NDO		Call
	NDO	SAY		Go ahead
	SAY	NDO		Reply on the tie line please, I will reply on the tie line --- correction, I will reply on the teleprinter over
	NDO	SAY		Roger thank you. Still no news of ZM?
	SAY	NDO		I think they're standing by for this lot to finish over
2134	NDO	SAY		Roger thank you
2135	SAY	NDO		Call
2224	NDO	SAY		Call
2225	NDO	SAY		Call - 6915 over
2229	NDO	SAY		Call - over
2300	NDO	SAY		on 6915 do you read over

TIME	CALL SIGNS		REMARKS
	To	From	
2320.	NDO	SAY	How do you read?
2321	NDO	SAY	Do you read?
			- Nothing heard during this period -
			18/9/1961
0436	SAY	NDO	Call
	NDO	SAY	Reply
	SAY	NDO	Good morning to you I've <u>nothing (?)</u> on 36 I had a message from radio police they are (?) informing at 3 o'clock and they reported that <u>a man (?)</u> at 2300 zulu about <u>seen (?)</u> great flash in the sky in direction of Mifulire or locking a bit (?) out from Ndola will you require a signal?
	NDO	SAY	Affirmative <u>Budge (?)</u> confirm by signal and advise any future developments please
0436.5	SAY	NDO	Roger

TIME	CALL SIGN		REMARKS
	To	From	
0508	ndo	sbj	calls (no reply)
0509	nde	sbj	calls
	sbj	ndo	go ahead
	ndo	sbj	It may sound a little pedantic but would you check with police and various other organizations are working on this aircraft.
	sbj	ndo	Sorry Salisbury say again
	nde	sbj	I say again would you just confirm that the police organization etc. is working on this aircraft this missing aircraft ever
	sbj	ndo	I cant say that they are working or not. The A.P.M. has been informed. He's not here and as far as I know they didn't- (?) but of course I havent been (?)
0512	nde	sbj	I thought security was bad but not as bad as that It's a complete blanket is it ?
			(no reply by ndols to this query)
0552	SAY	NDO	Call
	NDO	SAY	Reply
	SAY	NDO	Can I speak to the SATCO if he's there please?
	NDO	SAY	Roger stand by
			- pause -
	NDO	SAY	Go ahead Ndols
	SAY	NDO	Ref your RCC2 what action would you suggest we take over
0553	NDO	SAY	Keith I was just wanting to check that the local Copperbelt police had all been put in the picture over

TIME	CALL SIGNS		REMARKS
	To	From	
(0553)	SAY	NDO	We haven't heard advised any other police stations but presumably since this report came from the police in the first place they have alerted their other Copperbelt police stations general opinion seems to be that he's turned back - I don't think there's probably anything in this report over
0554	NDO	SAY	Roger Keith I'll keep it short I just sent a signal to you now-now-now replying from Leo with nil contact with them on any point-to-point frequency we just raised them through relay of Lulusbourg nil news
	SAY	NDO	Roger thank you we have of course aircraft available here for search if necessary
0554	NDO	SAY	Roger Keith thank you
0606	NDO	SAY	Were you calling?
			- no reply -
	NDO	SAY	Call
	SAY	NDO	Reply
	NDO	SAY	Were you calling Bud?
	SAY	NDO	Negative
	NDO	SAY	Roger a message from RCG would you please check and confirm with us that all the police stations along the Copperbelt have been alerted for this Aircraft over
0606	SAY	NDO	Roger will do

TIME	CALL SIGN			REMARKS
	To	From		
0724½	SAY	NDO		Call
	NDO	SAY	M	Reply
	SAY	NDO		Would you ask GATCO please to confirm his request for RRAF search aircraft by signal over
0725	NDO	SAY		Roger Keith I'll do that I believe it is being done at the moment over
	SAY	NDO		Sorry come again
	NDO	SAY		Roger Wilco
	SAY	NDO		They're making the arrangements to carry out the search as requested but they'd like it confirmed in a signal for the record please over
0725½	NDO	SAY		Roger a signal will be arranged
0749	NDO	SAY		Call 69
	SAY	NDO		Reply
	NDO	SAY		Reference the aircraft 5 crew 9 pax (repeats) 5 crew 9 pax signal follows
0749½	SAY	NDO		Roger
0805½	SAY	NDO		Call 69
	NDO	SAY		Reply
	SAY	NDO		Controller pax
	NDO	SAY		Go ahead Bob
	SAY	NDO		Ref the search aircraft there'll be one Provost and one Canberra the canberra to the North --- (unreadable) --- 50 miles radius of --- (unreadable) --- Congo border
	NDO	SAY		Sorry Bob you're fading badly say again pax
0806	SAY	NDO		Stand by one

TIME	CALL SIGNS		REMARKS
	To	From	
(0806)	SAY	NDO	I say again for SATCO Reference the search the aircraft aircraft will be one Provost to the South and one Canberra to the North --- (unreadable) --- 50 miles radius --- (unreadable)
0807	NDO	SAY	Keith understand one Provost to the South and one Canberra to the North all after that I'm afraid was unreadable
	SAY	NDO	I'll try again --- (unreadable) --- 50 mile radius but not over (?) the Congo border
	NDO	SAY	I can understand within a 50 mile radius - and - up to the Congo Pedicle is this correct?
	SAY	LUS	CALL
	LUS	SAY	Go ahead
	SAY	LUS	No he said 50 miles to North and 50 miles to South the other way it takes them over the Congo border
0807+	LUS	SAY	Roger thank you
0931	Sby	Ndo	Call
	Ndo	Sby	Go ahead
	Sby	Ndo	Can you confirm Jacko +69 departed Thornhill 0630 elapsed time 57 minutes still nil contact.
	Ndo	Sby	Roger. He'll probably be quite close in before he contacts you Bud He's descending to I think to about 3000 feet agl to have a look for this queer job
0933	Ndo	Lus	+69 passed abm mine at eight minutes ago he is down to 3 thousand searching.

1.

D

**Extracts from the Air Traffic Control Log
of Ndola Airport**

SUNDAY 17TH SEPTEMBER, 1961

0320 Budrewicz on.
0325 Runway inspection.
0335 Fire bell and stop watch O.K.
0810 Ndola CTL 5 x 5.
1045 Budrewicz off. House on.
1053 Fire bell O.K. Stop watch seen and O.K.
1735 House off. Martin on. Stop watch and Fire Bell O.K.
2135 First contact with SEEDY EST. ABM. ND. 2147
Ndola 2220.
2147 Reported ABM. Ndola (AD200 - 278 degrees) would
not divulge future movements
2210 Overhead Ndola. (Visual sighting by RRMP personnel)
A/C checked GPH, given 1021 report reaching 6000 feet.
No further contact after repeated calls from 2214.
Police contacted re any reported crash and overdue
action taken.
2345 Overdue action. (QUL) taken on SEEDY LC-6 and INCERFA.

MONDAY 18TH SEPTEMBER, 1961

0001 Martin on.
0115 Martin off.

**Statement of communications between SE-BDY and Ndola Tower,
prepared by Air Traffic Controller Martin partly from memory
and partly from flight progress strips**

On the night of the 17th September, 1961, I was Duty Air Traffic Control Officer at Ndola Airport. First radio contact with SEBDY was at 2135 Z and subsequent communications were as follows:-

- 2135^{a/} NDOLA/SEBDY Estimate abeam ND at 47, ND at 20.
SEBDY/NDOLA Roger, confirm ETA ND in 20 minutes, or at 2220.
NDOLA/SEBDY 2200.
- 2137 SEBDY/NDOLA Roger. Ndola weather wind 120/7 Knots. Visibility 5 to 10 miles with slight smoke haze. Control QNH 1021, QFE 877 mb. Duty R/W 10. At what time do you wish to make your descent?
- 2138 NDOLA/SEBDY Roger on your weather, request descent clearance at 57.
SEBDY/NDOLA Roger, no traffic in area, at 57 clear to descend to 6000 feet on QNH report top of descent.
NDOLA/SEBDY Roger.
- 2142 SEBDY/NDOLA Are you proceeding Salisbury after landing Ndola?
NDOLA/SEBDY Negative.
- 2143 SEBDY/NDOLA Roger are you night stopping Ndola?
NDOLA/SEBDY Negative.
- 2144 SEBDY/NDOLA Due parking difficulties would like your intentions.
NDOLA/SEBDY Will give them on the ground.
SEBDY/NDOLA Roger.
- 2147^{a/} NDOLA/SEBDY Now abeam ND (AD200 QDM 279 degrees).
SEBDY/NDOLA Roger report top of descent.
NDOLA/SEBDY Roger.
- 2153 SEBDY/NDOLA Will you require refuelling at Ndola?
NDOLA/SEBDY Standby.
- 2154 NDOLA/SEBDY May require a little.
SEBDY/NDOLA Roger.
- 2210 NDOLA/SEBDY Your lights in sight overhead Ndola, descending, confirm QNH (AD200 317 degrees).
SEBDY/NDOLA Roger, QNH 1021 mb, report reaching 6000 feet.
NDOLA/SEBDY Roger 1021.

The aircraft was visually seen overhead the field proceeding WNW at an estimated height of plus 10,000 feet by RRAF personnel, who were attending to a DC-4 registration OORIC. This aircraft was given taxi instructions

- 2225 WIND 110/5 K.
Clear to the holding position RW 10.
Control QNH 1021 mb QFE 877 mb.

a/ The 2135, 2147 and 2210 times are stated by Mr. Martin to be accurate, the remainder approximate.

2230

OORIC completed his power check and asked for Take off Clearance. Instructed to hold position, as SEBDY was descending to 6000 feet and I had been unable to contact him for the last 20 minutes.

OORIC requested take-off at his own discretion.

2235

No visual sign of DC-6 SEBDY so I allowed OORIC to take-off, right turn out, report on track Salisbury. I had the anti-collision lights of this aircraft in sight for approximately 3/4 minutes.

Numerous calls made to SEBDY on 119.1 Mc, and 118.1 Mc, with no results. OORIC offered to try to contact SEBDY, with my approval, but was unable to do so.

Contacted police to ascertain any crashes reported in the area and commenced overdue action.

Signed. A.C. MARTIN.

AIR TRAFFIC CONTROL OFFICER.

19th September, 1961.

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ANNEX VII

Medical Information

A

Summary conclusions of the Rhodesian Medical report relating to "accident cause" and "apparent accident sequence".

The following are summary conclusions relating to "accident cause" and "apparent accident sequence" from the report of the medical investigation carried out by three pathologists for the Rhodesian Board of Investigation. The examining pathologists were Dr. H. Douglas Ross, Forensic Pathologist and Consultant Histologist to the Federal Government of Rhodesia and Nyasaland; Dr. P.J. Stevens, Squadron Leader, R.A.F. Officer in Charge Department of Aviation Pathology, R.A.F. Institute of Pathology and Tropical Medicine, Halton, Bucks, England; and Dr. J. Hillsdon Smith, Government Pathologist, Public Health Laboratory, Lusaka, Northern Rhodesia:

"Medical Evidence in Relation to Accident Cause"

a) State of health of flight crew

No evidence of impaired bodily function which could have a bearing upon the cause of the accident was discovered on the initial post mortem examinations, or the histological examinations of any of the crew. Toxicological examinations of organs taken from the three pilots were negative and an examination of the pilots' medical records revealed no cause for incapacity.

b) The significance of the blood carboxyhaemoglobin Estimations

i) As an accident causative factor: It is not considered that the positive results recorded, the highest of which was 7%, can be implicated in the cause of the accident. Impaired function in a normal adult does not occur at levels less than 20 - 25% and only the mildest symptoms, such as headache, under 30%. Further, the apparent significance of three of the five positive results being in crew members, is considerably reduced by the fact that the other two probable occupants of the flight deck were not affected.

ii) As an indication of in-flight fire: Similar reasoning precludes the possibility that an in-flight fire caused this carbon monoxide absorption, since the five people with positive results were almost certainly distributed among unaffected individuals throughout the length of the plane.

iii) As an indication of individual survival in the post crash fire: Victims of conflagrations frequently show carboxyhaemoglobin levels of over 15%. The levels in the present instance would be consistent with very short periods of survival in the fire but, could equally well be explained by the smoking habit which is well recognized to produce low levels of carboxyhaemoglobin.

c) The Possibility of Sabotage

No evidence of in-flight explosion or firearm injuries was discovered despite exhaustive examination with this possibility in mind. X-rays revealed a number of bullets, cartridge cases and metallic fragments in six of the bodies, the significance of which is assessed as follows:-

i) None of the foreign bodies was found in an individual in any way responsible for flying the aircraft.

ii) Bullets were found in Bodies Nos. 1 and 2. Their orientation within the tissues did not support a contention that they had been fired from any consistent direction. They were relatively superficially situated, and were not associated with any discernible evidence of bleeding. They did not appear to have any rifling marks but were handed to the police for expert examination.

iii) Cartridge cases, whole or in part and percussion caps were found in bodies Nos. 1, 2 and 6. The distorted cartridge cases with separate percussion caps precluded their having been exploded in a breech mechanism. All these fragments were superficially situated either in the skin or in tissues exposed by incineration.

iv) Other metallic fragments consisted of irregular fused or partially fused, aircraft alloy, or of identifiable manufactured objects such as a small toothed wheel and fragments of a zip fastener. These were all lying superficially in or on tissues exposed by incineration.

It is impossible to escape the conclusion that these foreign bodies resulted from the exploding of ammunition in the post crash fire and from the fortuitous contamination of the surface of incinerated bodies by debris from the burning wreckage.

"Correlation of Medical Evidence with that of Apparent Accident Sequence"

1. The distribution of bodies throughout the wreckage, with an assessment of the type and severity of injuries inflicted on them, is in general agreement with the reconstructed accident sequence and the assumed probable seating positions occupied by the victims during flight.

2. Evidence of fastened seat belts, in respect of Bodies Nos. 1, 3, 5, 6, 7 and 11 lends support to the contention that preparations for landing were being made.

3. The probable occupants of the flight deck (Nos. 3, 4, 11, 15 and 10) were five of the first seven bodies along the flight trail and showed the severest multiple injuries. The presence of Nos. 6 and 13 among those of the crew in the first group of seven bodies is regarded as fortuitous and probably consistent with these individuals being in a forward part of the main compartment.

4. No real inconsistencies arise in the positions of the next eight bodies; from that of No. 5 it may be assumed that the purser, having warned the other occupants to fasten their safety belts, did so himself towards the rear of the fuselage. Nos. 7, 8 and 9 were in positions entirely consistent with these individuals having occupied the rear private compartments. The initial survivor had obviously crawled from a burning area and therefore the plotted position of No. 16 is immaterial to this discussion."

The report also affirms that "confident identification of all bodies was made". It concludes that "no medical cause for this accident has been found and there exists no evidence of sabotage".

B

Summary of the report prepared for
the Royal Medical Board of Sweden
and submitted to the United Nations
Commission by the Government of
Sweden.

The following is a summary of the opinion of Dr. A. Frykholm and Dr. N. Ringertz relating to the cause of the accident and the death of Mr. Hammarskjöld based on their examination of the Rhodesian medical report, summary conclusions of which are contained in annex VII A above.

As a general assessment of the post mortem reports, it can be said that they are, though brief, adequate and give an impression of careful examination and reliability. Extensive X-ray investigation has been carried out in conjunction with the post mortems, and supplementary histological and chemical investigations have been carried out in England. The identity of the bodies has been established in various ways and the identification should be sufficiently reliable in all cases. In the following, comments are made on some of the points in the discussion which is given in the medical report's "Summary and conclusions".

State of health of the crew of the aircraft: with regard to the three pilots Hallonquist, Litton and Ahreus, as well as of the mechanic Wilhelmsson, nothing remarkable can be found in the information with regard to health received from Transair. In all cases, at the post mortem, the condition of the heart and of the main artery could be assessed and they showed no changes due to disease, and no signs of illness were found either in any of the other internal organs which could be examined. An alcohol analysis was carried out with negative results on blood samples taken at the post mortem from Hallonquist and Litton and no other poisonous substance has been discovered on toxicological analysis of the organs. On the other hand, carbon monoxide has been found in blood samples from five out of the twelve victims on whom it was possible to carry out tests for this. Among these is included Hallonquist with 5 per cent and Litton with 7 per cent. Even Rosen (additional member of crew and radio operator) had 7 per cent, while Wilhelmsson had nought per cent. The pathologists state in their conclusions that a carbon monoxide content of 7 per cent at the most in the blood is far too low to produce any deleterious effect on mental and physical capabilities.

We agree with this conclusion. It is also concluded that the carbon monoxide content does not support the assumption that fire broke out in the aircraft before the crash, since the five victims in whom carbon monoxide was found almost certainly were situated in different parts of the aircraft among other victims in whom no carbon monoxide content could be found. In this connexion, it must be stated that both the pilots, who were probably on duty in the cockpit (Hallonquist and Litton), were found to have a carbon monoxide

content, in the same way as Rosén who most probably was on the deck of the aircraft. On the other hand, Wilhelmsson, who also was most probably on the deck of the aircraft, was found to have no carbon monoxide in his blood. In addition, Barrau was found to have a carbon monoxide content and the fifth person with such a content was Hammarskjöld, who had only a very small one (2 per cent). It cannot be considered that the carbon monoxide content in the blood of the pilots and of Barrau supports the assumption that fire broke out in the aircraft before the crash. The pathologists consider that the carbon monoxide content which was found is either the result of a short survival period during the fire after the crash or of the smoking of tobacco during the flight. It must be noted that against the first alternative is the fact that both Hallonquist and Litton had such severe crush wounds in the head that death must have taken place very quickly. The discovery of a slight and not entirely definite fatty embolism in the pilots' lungs does not contradict this, since such an embolism can develop extremely quickly in the presence of such severe and numerous skeletal fractures as were found in both cases. It seems to us more probable that the carbon monoxide content is a result of smoking during the flight. It has been stated that Hallonquist was a heavy smoker and Litton a moderate smoker. With regard to Rosén and Barrau, no information in this connexion has been obtained but Wilhelmsson, who did not have any carbon monoxide in his blood, was a non-smoker.

With regard to the possibility of sabotage, the pathologists state that no proof of any explosion in the aircraft before the crash has been found during their investigation. We should agree with this.

The pathologists discuss further the nature of the foreign bodies which the X-ray investigation revealed in a number of the bodies. These consisted of bullets, and either whole or exploded cartridges in the bodies of Persson and Hjelte. In Hjelte's body other small objects such as rivets and a small toothed wheel were found to have been forced in. In the body of Barrau, exploded cartridges and percussion caps were found. The objects were located relatively near the surface, the bullets lying in an irregular manner. Most of the bullets and cartridges were found in the region of the hip or the thigh. In spite of the fact that all of the dead bodies found on the scene of the disaster were completely X-rayed, bullets were found only in the three named who could all, with great probability, be assumed to have been carrying ammunition of their bodies. The simultaneous presence of cartridges and percussion caps forced into the bodies in those cases where bullets were found is highly convincing evidence that the bullets penetrated as a result of the explosion of ammunition during the fire. The foreign bodies which were found in some of the bodies of persons who could not reasonably be supposed to have been carrying ammunition were made up of superficially located particles of the metal of the aircraft. We agree with the conclusions of the pathologists that the post mortem investigation does not give any support to the assumption that the bullets in question entered the bodies as a result of firing. In the medical report, the correlation between the results of the post mortem and those based on the technical investigation of the reconstruction of the way in which the accident took place

are analysed. The pathologists do not find any contradictory evidence here. We can agree with this in all essentials. It must be noted, however, that the assumption with regard to tightened seat belts in the case of a number of the victims is not based on the results of the post mortem but on an examination of the scene of the disaster.

Secretary-General Hammarskjöld's body was the only one of those found dead on the scene of the accident which had completely escaped burning; the position of the body indicates that he was thrown out of the rear part of the aircraft. His traumatic wounds were appreciable and included inter alia a severe fracture of the spine between the second and third thoracic vertebrae, several broken ribs and broken breast bone, severe internal haemorrhage in the pleurae (500-700 ml), and a broken thigh bone. Haemorrhages were also found under the skin in the region of the temples and in the meninges but no brain damage. Severe congestion was found in head and neck. The results of the post mortem indicate that he lived for a certain period of time after the crash. The congestion gives some support to the assumption that suffocation as a result of breathing difficulties (severely crushed chest, high spinal fracture and crushing of the lungs as a result of haemorrhage) are significant as the ultimate cause of death. It is not possible to estimate with certainty how long he may have lived after the crash. The haemorrhages which took place as a result of the wounds could have developed in a shorter time than a few hours. We agree with the pathologists in their opinion that Hammarskjöld's wounds would have been fatal in any case. If he had been rescued immediately after the accident and immediately received medical care equipped with the latest devices, it may perhaps be supposed that the survival period could have been somewhat lengthened. The passenger Julian who was found alive had as traumatic wounds mainly a broken fibula but extensive burns. Both observations during his stay in hospital and the results of the post mortem indicate that his death was caused by the burns.

We finally agree with the over-all conclusion reached by the pathologists that the medical examination cannot reveal the cause of the accident and this examination does not give any support to the suspicion of sabotage.

Stockholm

15 February 1962

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ANNEX VIII

STATEMENTS OF WITNESSES RELATING TO A SECOND AIRCRAFT

In paragraphs 137-139 of the report, the Commission has considered testimony of certain witnesses to the effect that they saw or heard a second aircraft flying near SE-BDY and has expressed its views with respect to this testimony. In this annex the statements of these witnesses are presented in greater detail.

I. Testimony of Mr. T.J. Kankasa, Secretary, Twapia Town Management Board

1. Mr. Kankasa made a statement to the Rhodesian Board of Investigation and testified at the Rhodesian Commission of Inquiry and the United Nations Commission.
2. On Sunday night (17 September 1961) some time before 11:00 p.m. local time (2100 GMT) he was returning from a friend's house along a road in Twapia approximately four miles west of the airport. He heard an unusual noise which sounded like two airplanes. The sound was loud and also rising and falling. He looked up and saw two planes - a smaller plane with no lights flying above and a little behind a bigger plane. The smaller plane appeared to be going slightly faster as though it was catching up to the bigger plane. Both were flying in a north-westerly direction. The smaller plane appeared to flash a light two or three times on the bigger plane like a torch going on and off. At almost the same time he saw two bright white lights like automobile headlights on the big plane. The big aircraft continued to fly off towards the north-west and the smaller one appeared to go towards the north-east although they were still close together when they disappeared from sight. He had told the District Officer about this the next morning and asked if there had been air manoeuvres in the area.
3. Mr. Kankasa appeared to be very certain that his observations were made before 11:00 o'clock. He fixed the time by a news broadcast from a South African station which he heard on reaching home. The announcer had said it was 11:00 o'clock. He told the Rhodesian Commission of Inquiry that he believed he had seen the planes at between 10:35 and 10:40. If this is correct, it seems reasonable to believe that he saw OO-RIC, the DC-4 in which Lord Lansdowne arrived, at 10:35. There is testimony that OO-RIC turned on its landing lights

when over Twapia. Since it appears certain that there was no second plane flying near OO-RIC, it is probable that Mr. Kankasa mistook the tail assembly of the DC-4 for a smaller plane flying above and behind a larger plane. The flashing light could have been OO-RIC's rotating anti-collision beacon. The apparent differences in speed and direction of the two planes might be accounted for by the angle of vision, particularly if the plane banked or turned. OO-RIC, however, was flying south-east toward the airport rather than in the north-westerly direction reported by Mr. Kankasa. It should also be noted that Mr. Kankasa rejected the suggestion that he might have mistaken the tail assembly of one aircraft for a second airplane.

II. Testimony of the charcoal burners

4. The crash of SE-BDY occurred in the Ndola West Forest Reserve. The nearest settlement was the Ndola West charcoal burners' compound and on the night of 17/18 September many of the charcoal burners were at separate places in the bush attending their kilns within a mile or two of the crash site. Several of these have testified to seeing the crash or the fire which followed and it is probable that others who did not testify must have also seen or heard the crash.
5. Three, Messrs. Banda, Daka, and Moyo, were awakened during the night and heard loud bangs and saw a fire burning. At dawn they went to the crash site but did not report it. Mr. Daka carried away a code machine from the wreckage which he tried to sell thinking it was a typewriter. They were arrested and are serving prison sentences for theft or as accessory to theft.
6. Five of the charcoal burners have testified that they saw two planes flying close together just before the crash. Two of these, Mr. Mazibisa and Mr. Simaungo, made statements before the Rhodesian Board of Investigation and testified at the Rhodesian Commission of Inquiry and the United Nations Commission. One, Mr. Buleni, appeared for the first time before the Rhodesian Commission in January and also testified before the United Nations Commission. Two, Mr. Mpanganjira and Mr. Chisanga appeared for the first time before the United Nations Commission in February 1962. The testimony of these five charcoal burners is summarized in the following sections.

A. Mr. Farie Mazibisa, President of the United African Charcoal Burners' Association

7. Mr. Mazibisa said that he slept in the bush tending his charcoal kiln the night of 17 September. He showed the Commission the spot at which he had been. He said that he was awakened around midnight by a terrific noise which appeared to come from the north. He saw two airplanes, one a bit ahead and one a bit behind. He told the Rhodesian Board of Investigation that he saw some lights which he thought were two airplanes about 100 yards apart, one behind the other. He lay back down to sleep but after a few minutes he heard a very big noise. He got up and saw the whole bush lit up and heard many smaller noises like shooting. He did not hear another plane at that time. He told the Rhodesian Board of Investigation that this was 12:15 and the Rhodesian Commission of Inquiry that it was 12:30. He was about a mile from the crash site. He was frightened and ran to his house in the charcoal burners' compound. He still couldn't sleep and bicycled to his house in town. In the morning he returned to the compound and asked what happened. He was told by those he asked that they didn't know. They had just heard loud noises. Mr. Mazibisa said that after finishing his work he, his organizing secretary Mr. London Nkonfela, and another member, Mr. Mubanga, were discussing what had happened when they heard on the radio that the Secretary-General's plane was missing. They were afraid to go and see because they thought there might be soldiers. Eventually, however, they went along the "new road" until they saw flames and then wreckage. They went to the Forest Station and reported to the authorities. They took the police to the scene and generally gave assistance.

8. Mr. Mazibisa in his first statement to the Rhodesian Board of Investigation told only about discovering the wreckage and said nothing concerning the night of 17 September. It was only about a week later, after he had talked to Mr. Mattson, a trade union organizer, who had urged him to tell everything he knew, that he made a second statement to the Board concerning the events during the night. Both Mr. Nkonfela and Mr. Mubanga maintain that Mr. Mazibisa had never told them about having seen planes or the crash the night before and that it was Mr. Nkonfela who first saw the wreckage as they were cycling home together.

Mr. Mazibisa said he had not told what he saw to the authorities at first because he had been afraid and some people had said he might be accused of having caused the crash.

B. Mr. Davidson Simango, charcoal burner

9. Mr. Simango was lying down near his work at a point which he estimated to be two miles from the crash site. In the middle of the night, he guessed it might be about midnight, he heard the loud noise of airplane engines. He looked up and saw lights. He saw two airplanes flying closer together than they usually fly. There was a red (or red and white) flashing light on the larger and lower airplane. The planes were going in a direction away from Ndola. The noise faded and then a few minutes later grew louder again. He saw one airplane coming back. The first time the planes had gone directly over him. The second time the single plane was some distance away. Then he saw a flash and the plane went down and after that there was a very loud explosion. Later he heard several small explosions. He did not hear or see a second plane after the two planes had first disappeared from sight. He thought it was an airplane with bombs and was afraid the second one might come back. He lay down and covered his head and stayed there all night. He did not report what he saw immediately because he had been busy preparing his charcoal for delivery.

C. Mr. Dickson Buleni, charcoal burner

10. Mr. Buleni had not made a statement to the Rhodesian Board of Investigation. He had discussed the crash with Mr. Mattson and Mr. Mazibisa in October 1961. On 20 January 1962 he made a statement to the Northern Rhodesian Police and testified before the Rhodesian Commission of Inquiry shortly thereafter. He also testified before the United Nations Commission. He said he had not told what he saw earlier because he was afraid the Federal Government would accuse him of having burnt the plane.

11. Mr. Buleni was sitting outside his home in the charcoal burners' compound with his wife on the night of 17 September. He saw an airplane fly over between 10:00 and 11:00 p.m. local time (2000-2100 GMT). A long time later he saw a second plane similar to the one he had seen earlier. It was flying a bit low

and had a number of steady red lights. A small plane was flying above the big plane. It had one flashing red light. He heard two different engine sounds, one higher than the other. He saw a fire coming from the small plane and light on the roof of the big plane and he heard the sound of a fire. Then the big plane fell down and began burning and there was much light. The small plane circled once and then flew off in the direction of Kitwe (westerly). He was reported in the statement taken by the police to have said it was the direction of Mufulira (north-westerly), but he said this had been a mistake in writing it down. There was also some confusion in his testimony as to the direction in which the larger plane was flying. Mr. Buleni said he and his wife had been by themselves and were not drinking. There were a number of groups in the compound who had been outside their houses drinking. Nearly everyone was shouting that a plane fell down. He could see that most of them were frightened, some were running into the bush, and someone said that maybe the Katanga war was coming to their compound.

D. Mr. A.J. Lemonson Mpinganjira, charcoal burner and ex-Provincial President of Malawi African Congress

12. Mr. Mpinganjira testified for the first time before the United Nations Commission in February 1962. He said that on the night of 17 September he was in Ndola West Forest Reserve with a companion, Mr. Steven Chisanga. They had been erecting a charcoal kiln. At a time which Mr. Mpinganjira guessed to be between 9:00 and 10:00 p.m. local time (1900-2000 GMT) he saw a big plane flying at normal speed from the north toward Ndola airport. A little while later, which he variously estimated at from 10 to 15 minutes and 30 minutes, a big plane which he took to be the same one flew from Ndola towards the north and turned west. Just as it was turning he saw two small aircraft, one flying very high and the other low. The big aircraft had normal lights. He saw one red blinking light on each of the small aircraft. The lower of the small aircraft overtook the big plane when it was turning back to Ndola. It flew just above the bigger plane and a red flash came on the big plane. The big plane dipped down, followed by an explosion. Afterwards there were a series of explosions. The little plane circled and flew off in the direction of Ndola (easterly).

Mr. Mpinganjira and Mr. Chisanga took cover behind an ant hill. Mr. Mpinganjira said that about thirty minutes later he saw two land rovers with two European occupants each, driving at breakneck speed towards the site of the crash. Ten or fifteen minutes later the flames increased and the land rovers returned with the same speed. The next morning (18 September) Mr. Mpinganjira went to town and purchased a newspaper, the Northern News, and read that the Secretary-General's plane was missing. (The story could not be found in a copy of the Northern News for 18 September which was presented to him while he was testifying.) He wrote in his diary for 17 September "Dag Hammarskjöld mystery flight". In trying to return to his work at about 10:00 a.m. he was stopped by the police at the Ndola West turn off from the Mufulira road and prevented from entering the charcoal burning area. (The Northern Rhodesia police testified that a guard had not been posted at that spot until the morning of 19 September, the day after the wreckage was discovered.)

13. Mr. Mpinganjira said he had not given evidence before because he did not trust the Federal Commission. He would have nothing to do with anything Federal. He also said that there had been intimidation since he had been stopped from going to the charcoal field where he was working.

E. Mr. Steven Chisanga, charcoal burner

14. Mr. Chisanga gave an account similar to that of Mr. Mpinganjira, except that he said he saw only one small plane which was on top of the big plane. He also placed the time that he saw the land rovers as much nearer the dawn and said that he had seen only a driver in each vehicle by a light inside the land rovers. The next day he had continued his work and at 2:00 p.m. saw another plane circling the crash site and supposed that it had sighted the wreckage. Mr. Chisanga and Mr. Mpinganjira at separate times pointed out to the Commission or its staff the place from which they had made their observations. Mr. Mpinganjira had some difficulty in finding the place but eventually he identified the same spot as that pointed out by Mr. Chisanga.

III. Testimony of Mr. Nkonjera and Mr. Kazembe

A. Mr. Davison Nkonjera, storeman living at Kabushi West - a couple of miles West of Ndola

15. Mr. Nkonjera at a time which he guessed to be between 10:00 and 11:00 p.m. local time (2000-2100 GMT) saw, from the African Ex-Servicemen's Club about a mile from Ndola airport, an airplane which came from the north, circled the airfield three times and flew off towards the west. While the plane was circling, the lights at Ndola airport went off both in the tower and on the ground. After the lights were off, he heard two jets which he believed took off from Ndola airport and he saw them following the big plane. Their lights were turned on after they were above the big plane. He had got on his motor scooter and started home which was also to the west in the direction the planes were going. He saw a fire or flash coming from the jet on the right and landing on the big plane.

16. He said that he had told this the next morning to the manager under whom he worked. (The manager when located and questioned in Salisbury testified that Mr. Nkonjera had never said anything to him on the subject.) Mr. Nkonjera said he had thought that what he had seen concerned the war in Katanga. He had not testified at the previous inquiries because he was not interested in anything Federal. He had come to the United Nations Commission because he was sure that his evidence would receive wide publicity outside the Federation.

17. It may be noted that the time and the direction from which the aircraft is reported to have come corresponded more closely to OO-RIC which landed at 10:35 after arriving from the north-west. Lights in the Ndola tower are dimmed during landings to enable the controller to see the aircraft.

B. Mr. M.K. Kazembe, watchman at the African Ex-Servicemen's Club, Ndola

18. Mr. Kazembe gave much the same evidence as Mr. Nkonjera. He believed that the incident had taken place before 11:00 p.m. when the Club normally closes. He had seen the two jets take off from Ndola airport and return there and land both in darkness as the lights of the airfield were off. He said he had been afraid to testify earlier because he thought he would be killed in the same way as the Secretary-General because he had revealed this.

IV. General considerations

19. Two other witnesses testified before the Rhodesian Commission that they had heard a jet aircraft at approximately the time that they believed they had heard SE-BDY. This testimony was considered in no way convincing. (See annex III, appendix I.)

20. Counsel for the Governments which were represented before the Commission suggested various factors which they believed should be taken into consideration in evaluating the testimony of the foregoing witnesses. Counsel for the Swedish Government stated that while he believed that certain of the witnesses gave an impression of honesty they may have been confused as to exactly what they saw or have indulged in "imaginative reconstruction". SE-BDY was a larger and a noisier aircraft than the type normally seen at Ndola and just before the crash it presumably was flying at a very low altitude. Its several lights, including a rotating anti-collision beacon on the tail similar to the one on OO-RIC which may have been seen by Mr. Kankasa, could well be confusing to persons who were not skilled in the observation of aircraft. This might be particularly so if, as in some cases, they had just awakened.

21. With respect to other witnesses who displayed strong anti-federal feelings, it was suggested that they might have testified in a way deliberately intended to embarrass the Rhodesian Government. It was also pointed out that some witnesses, particularly under cross-examination, claimed to distinguish details such as the wings, engines and retracted landing gear of aircraft, which it was believed would be impossible to see at night. One witness had said that it was easy to see aeroplanes flying at night because of the buzz of the engines. (It seemed reasonable, however, that the sound of a plane should help in locating it.) Some statements, it was said, seemed improbable on their face, for example, that two land rovers drove at break-neck speed at night along a jungle track with a light turned on inside the vehicles and that two jets took off and landed at Ndola airport in the darkness. With respect to the last statement it was noted that there were a great many people at and around Ndola airport that night and that there was convincing testimony that the lights were not turned off at the time SE-BDY was overhead, that SE-BDY had not circled the airfield, and that no

jets took off or landed. Moreover there was expert testimony that it would be madness for jets to take off and land in darkness.

22. It should also be noted that fourteen other witnesses testified to seeing SE-BDY as it approached and passed over the airport and six of these saw a glow in the sky (which they variously mistook for lightning or associated with the factories, smelters and mines in the area) shortly after it passed from sight. None of these fourteen witnesses saw or heard a second plane. (See annex III, appendix I.)

23. As noted at the beginning of the present annex, the views of the Commission with respect to the testimony presented herein are set out in paragraphs 137 to 139 of the report.

ANNEX IX

REPORT ON ALTIMETERS BY THE UNITED STATES
CIVIL AERONAUTICS BOARD

The Representative of the
United States of America
to the United Nations

December 13, 1961

Dear Mr. Chairman:

I am forwarding herewith the report by the Civil Aeronautics Board of the United States of America on the examination of the altimeters from Douglas aircraft Model DC6B, Swedish registration No. SE-BDY.

This examination was undertaken by the Civil Aeronautics Board of the United States of America under the circumstances outlined in United Nations Document A/4945 of October 30, 1961. As indicated in that document, the three altimeters of the aircraft in question were presented to the American Consulate General at Salisbury, the Federation of Rhodesia and Nyasaland, on October 24, 1961. The altimeters were shipped to the United States by diplomatic pouch and were delivered by the Department of State to the Civil Aeronautics Board on October 31, 1961.

A copy of this report was delivered to the Director of Civil Aviation of the Federation of Rhodesia and Nyasaland on November 25, 1961.

Sincerely yours,

Adlai E. Stevenson

Enclosure:

As stated.

Chairman of the Commission Appointed to
Conduct an Investigation into the Circumstances
Resulting in the Tragic Death of Mr. Dag Hammarskjöld
and of the Members of the Party Accompanying Him

UN-3306/F

/...

CIVIL AERONAUTICS BOARD
Bureau of Safety

Washington, D. C.
November 17, 1961

REPORT ON THE EXAMINATION OF THE ALTIMETERS FROM
DOUGLAS AIRCRAFT MODEL DC-6 B, SWEDISH REGISTRY
NUMBER SE-BDY

I. INTRODUCTION

Three altimeters manufactured by the Kollsman Instrument Corporation; bearing serial numbers 671CPX-6-051-20329, 671CPX-6-051-17753 and 64990 were received by the undersigned on October 31, 1961. A letter accompanying these instruments requested the Board to make checks it normally performs to such instruments recovered from aircraft involved in an accident. To comply with this request arrangements were immediately made with the manufacturer to use his facilities in the examination of these altimeters. On November 1, 1961, a meeting was held at the Kollsman plant in New York City to outline the examinations desired. At this time an examining group was formed and consisted of the following personnel:

Wesley D. Cowan, Civil Aeronautics Board
Walter Angst, Kollsman Instrument Corporation
Robert Cooperman, Kollsman Instrument Corporation

The three altimeters were in the personal custody of the undersigned from the time of receipt until all examinations were completed.

II. INVESTIGATION

To attempt to determine whether a possible malfunction existed in any of the altimeters prior to the accident the examinations were made in three phases; external observations, operational testing and detailed inspection of the internal mechanisms.

The external observations covered the damage due to ground fire or impact forces, the presence of proper mounting attachments, the static hose fitting, the presence of an inspection seal and all pointer positions.

The operational testing phase applied a pressure change to the static port fitting and pointer movement, if any, observed.

/...

The third phase examinations were made to determine if all parts of the assembly were present; if any foreign matter or objects were present; if any corrosion, dents or foreign deposits existed on the bellows surface; and the condition of the various gears, springs, levers and bearings.

Photographs were taken at appropriate times during the examinations.

The following is a resume of the highlights of the examinations:

Kollsman Altimeter, S/N 671CPX-6-051-20329 Unit A

There was light impact damage to the case of this unit but no evidence of exposure to excessive heat. The hose fitting was still intact and the rubber pressurization seal was still in place. The knob shaft was broken off at the bezel and the inspector's lead seal was not present. The instrument did not respond to a pressure change. The bellows still retained a vacuum but were dislodged from the mounting bracket. The rocking arm was loose from its mounts. The damage to the gears, levers and springs was attributed to impact forces. The 100 foot pointer was loose on its shaft but the 1000 foot and 10,000 foot pointers were still attached to their shaft mechanisms. There were no foreign objects found within this instrument. No evidence was found to indicate that this altimeter was malfunctioning prior to ground impact. The following readings were obtained:

100 foot pointer - loose

1000 foot pointer - 9000 feet

10,000 foot pointer - 19,000 feet

barometer setting - 30.14 inches

outer setting marker - minus 205 feet

inner setting marker - minus 200 feet

Kollsman Altimeter, S/N 64990, Unit B

The glass face cover of this instrument was cracked and the knob shaft was broken off. The mounting screws appear to have been broken after exposure to fire. The hose fitting was intact but there was no lead inspector's seal present. The dial and pointers were fire damaged although two pointers remained firmly attached to the shafts. The pressurization seal was in position. Two bellows sections still retained vacuum but heat exposure apparently softened the solder on various fittings. The diaphragm mounting stud and various levers and springs were bent or broken by impact forces. A dark liquid or greasy film covered the inside surface of the case and most of the mechanism. Portions of this instrument that were covered by this substance were subsequently taken to the Federal Bureau of Investigation to get their assistance in identifying the unknown substance. Attachment A is a copy of their report which indicates that this substance was a combustion by-product. This is to be expected in an accident of this type. The examination of this altimeter disclosed no evidence to indicate malfunction prior to ground impact. The following readings were obtained:

100 foot pointer - 560 feet

1000 foot pointer - loose

10,000 foot pointer - 4000 feet

barometer setting - 30.16 inches

outer setting marker - minus 220 feet

inner setting marker - minus 200 feet

Kollsman Altimeter, S/N 671 CPX-6-051-17753, Unit C

The case of this instrument had a slight indentation near its center. Part of the bezel and knob shaft was broken. The glass cover and hose fitting were missing. The dial, pointers and setting markers were fire damaged. There was no inspector's seal. The pressurization seal was in position. Heat from the ground fire apparently desoldered the bellows construction causing the loss of vacuum. The rear bellows section showed an indentation that matched the ~~xxxx~~ deformation in the case due apparently to impact forces. The bending and breaking of gears, pivots and levers was believed to be caused by impact forces. There was no evidence to indicate that this altimeter was malfunctioning prior to ground impact.

100 foot pointer - loose

1000 foot pointer - loose

10,000 foot pointer - 6000 feet

barometer setting - 30.18 inches

outer setting marker - minus 230 feet

inner setting marker - minus 200 feet

The dials of all three altimeters were taken to the Federal Bureau of Investigation and were examined under four different frequencies of ultraviolet light. There were no indications that the pointers had impacted against the dials. See attachment B.

Photographs and examination data are included in a report submitted by the Kollsman Instrument Corporation. See attachment C.

Wesley D. Cowan
Systems Specialist

Attachments.

/...

Attachment A

Report of the FBI Laboratory

FEDERAL BUREAU OF INVESTIGATION
Washington, D.C.

November 15, 1961

To: Mr. Melvin Gough
Director
Bureau of Safety
Civil Aeronautics Board
Washington, D.C.

Attention: Mr. Wesley D. Cowan

Re: CRASH OF THE DAG HAMMARSKJOLD
AIRCRAFT; CIVIL AERONAUTICS
BOARD MATTER

signed: J. Edgar Hoover,
Director

Examination requested by: Addressee

Lab. No. PC-67845 DE

Reference: Evidence delivered by special messenger
on 11/14/61

Examination requested: Chemical Analyses

Q4 Altimeter, Unit - B

Results of examination:

This report confirms and supplements the telephonic report furnished to Mr. Cowan on November 14, 1961.

The foreign material in the altimeter has the typical appearance and odor of a condensate from some kind of burned plastic material. The fact that the altimeter was very close to a fire is shown by the small blisters in the paint near the open end of the unit. It was not possible to identify the pyrolyzed material in the unit. Plastics, adhesives, rubbers, and the like could be the source of the material found in the unit.

Specimen Q4 is being retained in the Laboratory until called for by a representative of your office.

8. No fire damage is visible.
9. The pointers do not respond to pressure changes.
- B. Examination of the mechanism after removal from the case disclosed the following:
 1. The 100 ft. pointer is loose on the pointer shaft.
 2. The 1,000 ft. and 10'000 ft. pointers are still attached to their respective shafts.
 3. Both diaphragm temperature compensating links were loose in the case.
 4. Both sector rockingshaft pivots are broken.
 5. The diaphragms are free of visible damage.
 6. No pointer impact marks could be detected on the dial under ultra violet light.

Altimeter Serial No. 64990, Unit B:

- A. Examination before removal of the mechanism from the case disclosed the following:
 1. The lead seal is missing.
 2. The barometric pressure setting knob shaft is broken off flush with the bezel.
 3. The three instrument mounting screws are broken; portions of each screw left in the instrument flange.
 4. The cover glass is cracked.
 5. Dial and pointers are fire damaged.
 6. The 100 ft. pointer indicates 560 ft.
 7. The 1000 ft. pointer is loose.
 8. The 10'000 ft. pointer indicates 4000 ft.
 9. The barometric pressure setting reads 30.16 inches.
 10. The field pressure outer setting marker indicates -220 ft.; the inner setting marker -200 ft.
 11. Shaking discloses loose pieces inside the case.
 12. The pointers do not respond to pressure changes.

B. Examination of the mechanism after removal from the case disclosed the following:

1. The 100 ft. pointer is tight on its shaft.
2. The diaphragm mounting stud is bent in the direction of the impact shock.
3. The solder holding the diaphragm to its stud melted and permitted the diaphragm to move on the stud. The diaphragm centerpiece, to which the link connects, also shifted due to the solder melting.
4. The link broke where it is pinned to the diaphragm centerpiece.
5. Both rockingshaft pivots are broken.
6. The balance weight spring broke at the mounting stud.
7. The balance weight lever arm on the rockingshaft broke.
8. One intermediate gear shaft pivot broke.
9. Both diaphragm temperature compensating links were loose in the case.
10. One of the diaphragm capsules lost the vacuum due to the solder melting.
11. The diaphragm and most of the mechanism is covered by a black sticky fluid. Kollsman was not able to identify it by its odor.
12. No pointer impact marks could be detected on the dial by ultra violet light.

C. Alimeter 671CPX-6-051-17753, Unit C

Examination before removal of the mechanism from the case disclosed the following:

1. The knob shaft was sheared off flush with the bezel.
2. The cover glass is missing.
3. Part of the bezel itself is broken off.
4. The three instrument to panel mounting screws are broken; portion of each screw left in the flange.
5. The dial and pointers and the setting markers are fire damaged, the 100 ft. pointer is badly bent.

6. The 100 ft. and the 1000 ft. pointers are loose.
7. The 10'000 ft. pointer indicates 6000 ft.
8. There is no hose fitting screwed to this case.
9. The barometric pressure setting reads 30.18 inches.
10. The field pressure outer setting marker indicates -230 ft.;
the inner setting marker indicates -200 ft.

Examination of the mechanism after removal from the case disclosed the following:

1. The handstaff of the 100 ft. pointer broke off with the pointer.
2. Part of the top mechanism casting is bent up (towards the dial) near the inner setting marker drive gear.
3. The solder on the three cells of the diaphragm assembly melted destroying the vacuum, and causing the diaphragm to come off its mounting stud.
4. The two temperature compensating links were loose in the case.
5. The calibrating arm was forced out of its hold in the rockingshaft either by the impact shock or by the force of the expansion of the diaphragm due to the loss of vacuum noted in "3" above. This caused the link to bend.
6. The balance weight spring broke at the mounting stud.
7. Both rockingshaft pivots are broken.
8. One pivot of the intermediate gear shaft is broken.
9. The rear part of diaphragms is dented.
10. The case shown impact damage on bottom half of cylindrical, portion of case.
11. No pointer impact marks could be detected on the dial by ultra violet light.

Conclusions:

Careful examination of all three altimeters and the inspection of the mechanism of each after removal from the case disclosed no abnormal condition not attributed to impact shock and fire resulting from the crash of the aircraft.

/...

Due to the damage caused by the impact of the crash the pointer indications have no significance and do change with the physical movement of the instrument without any relation to pressure changes.

The correlation between the barometric setting dial and the two setting markers was found to be correct. Due to the damage sustained by the mechanism as a result of the impact shock no correlation check between barometric pressure setting and the pointer could be made on any of the three altimeters.

Photographs No. 3, 4 and 5* show the altimeters in their disassembled state.

November 2, 1961

Walter Angst
Kollsman Instrument Corporation
Air data Engineering

* Photographs are not reproduced.

ANNEX X

REGULATIONS OF THE RHODESIAN FEDERAL DEPARTMENT OF CIVIL
AVIATION GOVERNING SEARCH AND RESCUE ACTION

PROCEDURES FOR SEARCH AND RESCUE ACTION WITHIN
THE SALISBURY SEARCH AND RESCUE AREA

INDEX:

- Para. 1 - INTRODUCTION
- " 3 - AUTHORITY AND EFFECTIVE DATE
- " 5 - BOUNDARIES OF SALISBURY SEARCH AND RESCUE AREA
- " 6 - ESTABLISHMENT OF SALISBURY RESCUE CO-ORDINATION CENTRE
- " 7 - EMERGENCY PHASES
- " 11 - GENERAL OUTLINE OF SEQUENCE OF EVENTS DURING SEARCH ACTION
- " 13 - ACTION TO BE TAKEN BY SALISBURY RCC
- " 22 - DUTIES OF THE CIVIL AIR SEARCH OFFICER
- " 26 - CO-ORDINATION OF AIR SEARCH
- " 27 - TERMINATION OF AIR SEARCH
- " 29 - GROUND SEARCH
- " 31 - GROUND RESCUE
- " 32 - INDICATION OF EMERGENCY PHASES IN MESSAGES
- " 33 - ACTION BY AERODROME OF DESTINATION
- " 34 - ACTION BY AERODROME OF DEPARTURE
- " 35 - SEARCH AND RESCUE ACTION IN EVENT OF OVERDUE RRAF AIRCRAFT

APPENDICES: (Not reproduced)

- "A" - SIGNALS FROM GROUND SEARCH PARTIES TO AIRCRAFT
- "B" - DETAILS OF ICAO SURVIVAL EQUIPMENT
- "C" - GROUND TO AIR SIGNALLING CODE FOR USE BY PERSONNEL OF
FORCED LANDED AIRCRAFT
- "D" - LIST OF AERODROMES TO BE CHECKED WHEN AN AIRCRAFT IS OVERDUE

INTRODUCTION

1. It has been agreed that the Royal Rhodesian Air Force will provide as many aircraft as possible for search purposes in the Salisbury Search and Rescue Area should this become necessary, and that these aircraft will be commanded by an R.R.A.F. officer but will come under the control of a Civil Air Search Officer (CASO) who will be responsible direct to the Salisbury R.C.C. for conduct of the air search. It should be noted that the R.R.A.F. cannot guarantee to have search aircraft airborne in less than two hours from their receipt of the "Alert" phase.
2. In view of the foregoing, the existing "PROCEDURES FOR SEARCH AND RESCUE ACTION WITHIN THE SALISBURY FLIGHT INFORMATION REGION" needs amendment. The above procedures are therefore cancelled and the following procedure adopted in their place.

AUTHORITY AND EFFECTIVE DATE

3. Authority. The following procedures for search and rescue within the Salisbury S.A.R. Area are issued in compliance with and amplification of:
 - (a) ICAO Annex 12 - Standards and Recommended Practices for Search and Rescue.
 - (b) ICAO Doc. 4446-SAR/501, 3rd Edition September, 1956. Procedures for Air Navigation Services - Search and Rescue.
 - (c) Minutes of a conference held at Mafeking on 15 September 1949, to decide details of search and rescue facilities and procedures within the Bechuanaland Protectorate.
4. Effective Date. The procedures will replace the "PROCEDURES FOR SEARCH AND RESCUE ACTION WITHIN THE SALISBURY FLIGHT INFORMATION REGION" dated 5 October 1953, with effect from 1 November 1959.

SEARCH AND RESCUE AREA

5. Salisbury Search and Rescue Region

"The Salisbury Search and Rescue Region comprises the territories of Northern Rhodesia, Southern Rhodesia and Nyasaland and a portion of Bechuanaland North of a line joining the following co-ordinates 22°00'S 29°03'E and 22°00'S 26°00'E and east of a line joining 22°00'S 26°00'E and the junction of the Bechuanaland, Rhodesia and Caprivi strip international borders."

RESCUE CO-ORDINATION CENTRE

6. A Rescue Co-ordination Centre (R.C.C.) has been established in the Flight Information Centre at Salisbury, Southern Rhodesia for the express purpose of initiating, co-ordinating and terminating search and rescue action within the area defined in paragraph 5 above.

EMERGENCY PHASES

7. Any emergency that calls for an alerting procedure for search purposes will be divided into three phases:

- (a) Uncertainty phase
- (b) Alert phase
- (c) Distress phase

8. Uncertainty phase. An uncertainty phase is considered to exist when:

- (a) No communication has been received from an aircraft within a period of thirty (30) minutes after the time a scheduled position report or "All's Well" report should have been received; or when
- (b) an aircraft fails to arrive within thirty (30) minutes of the estimated time of arrival last notified or estimated by air traffic control service units, whichever is the later;

except when no doubt exists as to the safety of the aircraft and its occupants.

9. Alert phase. An alert phase is considered to exist when:

- (a) following the uncertainty phase, subsequent communication checks have failed to reveal any news of the aircraft; or when
- (b) an aircraft has been cleared to land and fails to land within five minutes of the estimated time of landing and communication has not been re-established with the aircraft; or when
- (c) information is received which indicates that the operating efficiency of the aircraft has been impaired but not to the extent that a forced landing is likely; or when
- (d) information is received or it is reasonably certain that the aircraft is about to make or has made a forced landing;

except when there is reasonable certainty that the aircraft and its occupants are not threatened by grave and imminent danger and do not require immediate assistance.

10. Distress phase. A distress phase is considered to exist when:

- (a) following the alert phase the absence of news from wide-spread communication checks in the circumstances points to the probability that the aircraft is in distress; or when
- (b) the fuel on board is considered to be exhausted, or to be insufficient to enable the aircraft to reach safety; or when
- (c) information is received which indicates that the operating efficiency of the aircraft has been impaired to the extent that a forced landing is likely; or when
- (d) information is received or it is reasonably certain that the aircraft is about to make or has made a forced landing;

except when there is reasonable certainty that the aircraft and its occupants are not threatened by grave and imminent danger and do not require immediate assistance.

GENERAL OUTLINE OF SEQUENCE OF EVENTS DURING SEARCH ACTION

11. The Royal Rhodesian Air Force has agreed to provide, so far as possible, such aircraft as are required for search purposes whenever this becomes necessary, and they have further agreed that these search aircraft commanded by a R.R.A.F. officer will come under the control of the Civil Aviation Authority.

12. The following is a broad outline of the sequence of events if air search becomes necessary:

- (a) The Salisbury R.C.C. will initiate action and alert A.H.Q., R.R.A.F. as necessary in the circumstances of the case.
- (b) The Salisbury R.C.C. will decide on the area of probability and will inform R.R.A.F. and all others concerned.
- (c) A civil air search officer (C.A.S.O.) will be chosen from the senior members of the Department of Civil Aviation.

- (d) The Salisbury R.C.C., in consultation with the appointed R.R.A.F. Commander and C.A.S.O. will decide on a "base of operations" from which the R.R.A.F. aircraft will carry out their search operations.
- (e) The search aircraft will fly to the "base of operations", if possible carrying out a search en route. The C.A.S.O. will either accompany the R.R.A.F. or fly independently to the base of operations.
- (f) The C.A.S.O. will take charge of search and rescue operations and will make full use of any local knowledge available, and will keep the Salisbury R.C.C. fully informed of action being taken.
- (g) The R.R.A.F. Officer in charge of the air search aircraft will co-operate with the C.A.S.O. to carry out air search as expeditiously as possible.
- (h) The Salisbury R.C.C. will keep all those concerned fully informed of the action being taken at the base of operations, and will generally do all in its power to co-ordinate search action.
- (j) The air search will only be terminated by the Salisbury R.C.C. after C.A.S.O. has requested such action. C.A.S.O. will not request termination of air search until he has satisfied himself that further air search will serve no useful purpose.
- (k) All local details at the base of operations regarding fuel supplies, crew accommodation, and other administrative matters connected with the air search, are the responsibility of the nearest APM in the territory in which the search is being carried out.

ACTION TO BE TAKEN BY THE SALISBURY R.C.C.

13. General. The Salisbury R.C.C. will take all necessary steps to ensure the initiation, co-ordination and termination of search and rescue within the area defined in paragraph 5. The appropriate adjoining R.C.C. (Nairobi, Leopoldville, Lourenco Marques, Pretoria or Luanda) will be kept fully informed of all known details regarding an aircraft in distress that may continue its flight into the area of responsibility of the adjoining R.C.C. The owner/s will be informed when their aircraft is overdue and will be kept informed of developments.

14. The appropriate Air Traffic Service Units and the R.C.C. will co-operate with any other authorities that may be concerned in order that reports are speedily appreciated.
15. Uncertainty phase. As soon as considered appropriate after the conditions detailed at paragraph 8 above exist, the R.C.C. will inform a senior operations officer of the Department of Civil Aviation, Salisbury; one of these officers will be detailed as C.A.S.O. by the D.C.A. Salisbury. The duties of the C.A.S.O. (Civil Air Search Officer) are detailed at paragraph 22.
16. The R.C.C. shall notify Air Headquarters, R.R.A.F. that the "Uncertainty phase" exists indicating type of aircraft and possible area of search.
17. In the event of further news being received that the aircraft has been located, the R.C.C. is to notify all concerned.
18. Alert phase. Immediately the conditions as detailed in paragraph 9 exist, the R.C.C. will notify Air Headquarters R.R.A.F. and request that crews and aircraft be alerted for search. At the same time the base of operations and the area of probability will be decided in conjunction with the C.A.S.O. The R.C.C. will then originate or re-transmit as necessary the message indicating that the "Alert phase" exists.
19. Should news be received subsequently to the effect that the aircraft and its occupants have been located, the R.C.C. will advise all concerned.
20. Distress phase. When the conditions detailed at para. 10 exist, the R.C.C. will notify the R.R.A.F. and request that they commence search. The R.C.C. will then originate or re-transmit as necessary the message advising that the "Distress phase" exists. The base of operations will be advised details of search to be carried out, name of C.A.S.O. and E.T.D. of search aircraft.
21. Should the news be received subsequently that the aircraft and its occupants have been located the R.C.C. will notify:
 - (a) All R.R.A.F. search aircraft in flight
 - (b) The C.A.S.O.
 - (c) Air Headquarters, R.R.A.F.
 - (d) All others concerned.

DUTIES OF CIVIL AIR SEARCH OFFICER

22. The C.A.S.O. will proceed to the base of operations by air as soon as the conditions detailed at paragraph 10 exist and search aircraft have been requested to proceed. He will on arrival, in conjunction with the R.R.A.F. officer in command of the search aircraft, make a careful study of the facts and making use of what 'local knowledge' is available decide the exact areas and method/s of air search.

23. He will investigate all local reports of aircraft movements and decide in consultation with the R.R.A.F. officer in charge search aircraft what action will be taken.

24. He will keep the R.C.C. fully informed of all action taken, areas searched, aircraft involved, hours flown, etc., and when the aircraft and its occupants have been located, he will signal the following details to the Salisbury R.C.C. as soon as possible:

- (a) location of aircraft;
- (b) injuries to occupants and medical requirements;
- (c) action proposed or being taken to rescue occupants;
- (d) damage to aircraft;
- (e) reason for forced landing or crash. (Engine or airframe failure, lost, weather, shortage of fuel, etc.);
- (f) if guard has been placed on the aircraft (the guard should not be removed without prior permission from the Salisbury F.I.C.)

25. He will terminate the air search as and when it is decided in consultation with the R.R.A.F. officer in charge of search aircraft that this course is necessary and the R.C.C. has confirmed his request to do so.

CO-ORDINATION OF AIR SEARCH

26. The R.C.C. will keep H.Q., R.R.A.F. fully informed of all information available from the C.A.S.O. and other sources to keep them fully in the picture regarding use of their aircraft and the progress of the search.

TERMINATION OF AIR SEARCH

27. The air search will only be terminated on authority from the R.C.C. when the aircraft has been found or when termination is suggested by C.A.S.O. after due consultation with the officer in charge of the search aircraft. This latter course will only be undertaken after all likely areas have been searched and hope of survival of the occupants of the crashed aircraft abandoned. The personnel concerned with the air search (C.A.S.O., Officer i/c search aircraft and local authorities) should be satisfied beyond all reasonable doubt that this course is advisable.

28. The R.C.C. will then notify H.Q., R.R.A.F., to the effect that the air search is terminated.

GROUND SEARCH

29. The R.C.C. will request the Police or any other local authorities to co-operate by organizing ground search parties as circumstances require and if such action becomes necessary.

30. Details of signals to be used by ground search parties to aircraft are at Appendix "A".

GROUND RESCUE

31. In the event of the occupants of the aircraft being located, survival packs will be dropped by the locating aircraft, which will also inform C.A.S.O. by radio that the aircraft has been found. The officer in charge R.C.C. or C.A.S.O. as applicable, will immediately take all necessary steps to ensure rescue, including asking the police or other local authority for motor transport. Should it be necessary he will request the R.R.A.F. to drop further survival equipment, or despatch their airborne Landrover rescue vehicle and team to the aerodrome nearest the located aircraft. Details of survival equipment recommended by I.C.A.O. are at Appendix "B".

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INDICATION OF EMERGENCY PHASES IN MESSAGES

32. In all communications relating to emergency phases between Air Traffic Control Units and the R.C.C. or adjoining R.C.C.'s the first word of the text should be one of the following words appropriate to the phase of the emergency:

"INCERFA" - (Uncertainty phase)

"ALERFA" - (Alert phase)

"DETRESFA" - (Distress phase)

ACTION BY AERODROME OF DESTINATION

33. A.T.C. staff at aerodrome of destination will carry out procedure as laid down in A.T.C.I.'s/manual.

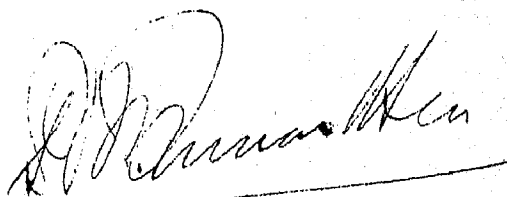
ACTION BY AERODROME OF DEPARTURE

34. A.T.C. staff at aerodrome of departure will carry out procedure as laid down in A.T.C.I.'s/manual.

SEARCH AND RESCUE ACTION IN EVENT OF OVERDUE R.R.A.F. AIRCRAFT

35. Should any R.R.A.F. aircraft be overdue in their local flying area the entire alerting, search and rescue action will be conducted by the R.R.A.F. with any possible assistance Civil Unit may be able to render.

36. In the case of R.R.A.F. aircraft outside the R.R.A.F. Flying Area, alerting action will be originated and carried out by Civil Units. The Search and Rescue action will be co-ordinated and terminated by the R.R.A.F. who may make use of the FIC facilities and may position an officer at the R.C.C. for this purpose. All civil stations will co-operate in passing relevant information immediately to the R.C.C.



for DIRECTOR OF CIVIL AVIATION

ANNEX XI

SECRETARIAT OF THE UNITED NATIONS COMMISSION

Principal Secretary	Blaine Sloane
Deputy Principal Secretary	Nicolas Teslenko
Aeronautical Adviser (seconded from ICAO)	Neil Richardson
Air Law Adviser (seconded from ICAO)	R.H. Mankiewicz
Consultant	Hugo Blandori
Administrative and Finance Officer	Edouard Beique
Chief of Verbatim Reporters	Ronald Hall
Interpreter	Jaime Valdes
Secretary and Documents Officer	Mrs. Colette Gilroy
Secretaries	Miss Judith Bishop Miss Janette Seldes

During its investigation in the field, the secretariat was assisted by temporarily recruited verbatim reporters and clerical staff.

ANNEX XII

REPORT OF THE EXPERT APPOINTED BY THE UNITED NATIONS FOR THE SCIENTIFIC EXAMINATION OF THE WRECKAGE OF SE-BDY

The following is the report submitted by Mr. Frei-Sulzer, Chief of the Scientific Department of the Zurich Police and Professor of Science Criminology at the University of Zurich. Mr. Frei-Sulzer was appointed by the Secretary-General of the United Nations at the request of the Commission to perform certain scientific tests on the wreckage.

1/ NATURE OF MISSION.

It was my task, as put down in the contract of February 21, 1962, to assist the members of the Investigation Commission 1628/XVI in their study of conditions and circumstances that led to the death of the Secretary-General and members of his party.

Before my departure to Ndola the Investigation Commission assembled on February 26, 1962 under Chairman Mr. Rishikesh Shaha. To this meeting I was invited by Mr. Blaine Sloan, Principal Secretary of the Commission, in order to learn directly from the members of the Commission which problems in their eyes merited further examination. The general opinion expressed was that I had to concentrate my efforts in the study of foreign bodies eventually contained in the fused parts of the wreckage, so that it would be possible to answer whether the aircraft had been attacked by gunfire, exploding shells or rockets, or whether there was evidence of sabotage, including the use of modern explosives such as plastic-bombs.

NOTE. The exhibits referred to in this report are not reproduced as a part of this annex. They are, however, on file with the Secretariat and may be consulted by interested delegations.

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The Commission agreed further to invite the expert to re-study the whole evidence laid down in previous reports in the light of his personal experience in similar cases and to proceed by elimination in the discussion of all the possible causes of the accident. At the same time, special wishes of the Commission dealing with the examination of the radio-compasses and eventually malicious interference with the cables of the aircraft were handed to the expert in a letter, signed by Mr. Neil Richardson, Aeronautical Adviser.

2/ COOPERATION WITH RHODESIAN AUTHORITIES.

On my arrival at Salisbury March 2, 1962, I shortly informed Colonel M. Barber, Director of Civil Aviation, and Mr. M. Madders, Chief Engineer, Dept. of Civil Aviation, on the subject of my mission. On March 3, 1962 we held our first working meeting in order to discuss the problem of melting down the fused parts of the wreckage. We determined that the melting should be done in crucibles at a temperature not higher than 820° C.

On March 5, 1962 we flew to Ndola and met Mr. E.R. Raine, Director of the Raine Engineering Company Ltd., Ndola, who had kindly offered his equipment and the technical assistance of his staff in the melting down of the fused parts of the wreckage. In a short preparatory meeting we agreed in the best methods for the foundry work and the necessity of strict temperature-control in order not to destroy any evidence.

On the same day, the melting process was started and from the very first "cooking" we got the definite impression that the method proved to be quite suitable for extracting all non aluminium alloys with melting points higher than 800° C. (For details see § 5). Together with Colonel Barber and Mr. Madders I assisted to the whole melting process and the extraction of embeded objects that merited further examination. As stipulated in my contract, I collected samples of suspect metals and other inclusions from the fused parts of the wreckage for further study in the laboratories of the Scientific Department of the City Police of Zurich (Switzerland). These last examinations have been done

after my return from Rhodesia from March 13 to 19, 1962.

The Rhodesian Authorities enabled me also to visit the crash-site on March 8, 1962 and to restudy the cables and other remains of the aircraft in the hangar, which had been protected from any interference by locking and sealing the doors.

Colonel Barber arranged for me also a meeting with Mr. Els, the ballistic expert, in order to discuss with him his findings on weapons, cartridges and bullets gathered from the crash-site and to show him the newly extracted evidence. He fully cooperated in the identification of the foreign bodies recovered from the melted aluminium.

On March 10, 1962 finally, Mr. Gregory, Inspector of Aircraft, Salisbury, assisted me in examining the radio compass. (See Chapt. 3.5).

This short review of my activities shows that during my whole stay in Rhodesia I enjoyed the full cooperation of the competent authorities to whom I wish to express my sincere gratitude as well as to Mr. E.R. Raine, Ndola, and his staff. Without their most efficient help it would not have been possible to perform so many investigations in so short a time.

3/ THE RE-EXAMINATION OF THE WRECKAGE IN THE HANGAR AT NDOLA.

On my first visit to the hangar at Ndola Col. Barber showed me the precautions he had taken to avoid any intrusion into the hangar: The locks of the big doors had been soldered and the small entrance-door was locked and secured by the application of seals, which showed to be intact at our arrival. Although it was not my task to restudy the whole evidence assembled in the hangar, I took the opportunity to have a short look on all the different heaps of pieces and debris. My special attention was directed to the following items:

3.1/ Foreign bodies,

i.e. fragments of shells, parts of infernal machines, timing devices for bombs, detonators for starting explosions etc.

No such bodies were found. All recognizable fragments proved to belong to the aircraft and its loading.

3.2/ Suspect holes.

The Rhodesian Authorities had already put apart a certain number of pieces of the wreckage with holes that merited further examination. Although they had already been controled several times by the different commissions involved in the study of this accident, I had a look at them once more and was convinced that every single hole was caused by the accident itself. (For example piercing of stiff bodies through other parts of the plane). In this connection I studied the report on the spectrographic analyses of the hole in exhibit 26. I fully agree with its conclusions that there is no evidence for the impact of a bullet.

To my opinion, none of the holes in the remaining identifiable parts of the aircraft has been caused by shooting.

3.3/ Suspect deformations or breakings.

It is well known that an explosion on board of an aircraft is not only detectable by fragments blown off and found far distant from the rest of the wreckage, but also by evidence in the wreckage itself. The expanding forces during the explosion produce characteristical deformations (partly inflations) which are well distinguishable from the breakings caused by the impact in the crash. In none of the examined fragments of the aircraft, we could find the typical breaking-lines or edges caused by explosions. (Exceptions concern fuel tanks, fire extinguishers, oxygen- or CO₂-cylinders).

It can therefor be stated that in any part of the aircraft which has not been destroyed by the fire there is no trace of an explosion previous to the crash.

3.4/ Cables operating the primary control surfaces.

Following the wish expressed by the Commission, I checked whether or not there was evidence of any malicious interference with the sections of cables that have been preserved. This

examination with the help of a strong magnifying glass showed sharp cuts made during the operations for transporting the wreckage to the hangar and a few very distinct breaks with typical signs of overstrain during the impact. I did not find any cuts or damages which would be the result of sabotage in this part of the aircraft. This result was to be expected because the aircraft had been travelling for several hours without any known difficulty and the pilot had reached Ndola and passed above the airfield in quite a normal or perhaps slightly too low a flight. Any defects in the cables operating the primary control surfaces would have shown their catastrophic effect much earlier. (Exceptions would be possible for cables operating the wing flaps or the undercarriage).

3.5/ Radio compasses.

According to the invitation of the Commission to restudy the salvaged radio compass, I took it from the hangar to Salisbury, where its mechanism was examined with the help of Mr. Gregory, Inspector of Aircraft.

First of all I checked the possibility of a secondary displacement of the reading from 394 Kc/s (frequency of Ndola non directional beacon) to 499 Kc/s (actual reading) during the operations of clearing the wreckage-place. For this purpose the frame was opened and the smoke blackening of the gear examined. It was obvious that the smoke deposits were more concentrated on the actually outer surface and teeth of the gear. This fact proves that the frequency indicator came to a standstill in the actual reading position previous to its exposition to the fire. Therefore any important change in the reading after the crash is excluded.

Next, I checked how easily the gear could have been moved. In fact, the change in the reading of the hundreds from 3 to 4 is absolutely in the reach of a possible effect of impact. The more significant difference in the units from 4 to 9 can not be explained by a simple effect of impact because the most delicate mechanism of the gears would be blocked suddenly. But another explanation of the change in the reading is most probable and

cannot be excluded: When the radio-compass in the first phase of the crash was flung away from its original place, it could possibly glide along an obstacle or such an obstacle could possibly hurt the instrument, thus causing the reading to change before the final impact blocked it in the actual state.

These considerations leave enough space for the possibility that the radio compass was originally set on the frequency of 394 Kc/s. This explanation seems the more probable as it is well known that the aircraft reported abeam Ndola at 2147 G.M.T. It is ascertained that this message corresponded to the actual position of the plane which afterwards coming from that direction, passed over the airfield. This correct message would not have been possible if the radio compass was not in use or was not tuned to the right frequency.

3.6/ The sampling for the melting process.

Together with the Rhodesian Authorities I selected for melting down all those pieces of the wreckage which had been completely fused on the crash-site. They were loaded on a lorry and transported to the foundry well guarded by Mr. Madders and a police-escort.

4/ VISIT ON THE SITE OF THE CRASH.

On March 8, 1962 I had the opportunity of visiting the scene of the crash. Although the development of the vegetation had sensibly altered the original state, it was quite easy to distinguish between the zone damaged by fire and the nonburnt area. Even more than five months after the crash it was obvious that the aircraft had cut its way through the forest in a very slow angle of descent and a perfectly normal flight-position. The cut tops of the trees were still visible and gave a good impression of the impacts of wings and propellers. Colonel Barber and Mr. Madders explained to me the details of the wreckage plan (app. 1.1 to the main report of the Federal Dept. of Civil Aviation). I was greatly impressed by the fact that the nacelle had not ploughed itself deeply into the ground, and that all the engines were developing power in the moment of the impact, as I

had already noticed in the hangar. Once more Colonel Barber and Mr. Madders confirmed the result of the ground research executed in order to find blown off fragments of the aircraft which would have been a most important proof for an explosion in the air previous to the final crash. As no such evidence had been found on the ground, I looked out for corresponding wounds in the bark of the trees, as similar accidents had taught me that smaller blown off pieces in a forest do not always reach the ground. They may as well be kept back by branches of the trees and can easily be found in freshly healed wounds of the bark. My efforts to find such complementary evidence had no positive result. I left the crash-site fully convinced that the aircraft hit the first trees in an absolutely normal flight position while it was under full control of its pilots. This my opinion is based on the comparison of the runway cut into the forest with similar accidents previously investigated.

5/ THE SEARCH FOR FURTHER EVIDENCE IN THE FUSED PARTS OF
THE WRECKAGE.

The remaining and identifiable parts of the wreckage had been examined by several most qualified experts belonging to or giving their assistance to the different Commissions of Investigation. No foreign bodies or suspect holes had been found which would confirm the suspicion of sabotage or hostile action either from the air or the ground. But the value of these negative results was sensibly reduced by the fact that a most important part of the wings and the fuselage had been burnt and the aluminium had been melted, so that nobody could state whether foreign bodies or other evidence was hidden in the fused metal. Propositions had been made to melt down the fused blocks in order to extract eventually enclosed foreign bodies. To avoid the reproach of destroying evidence by this procedure, the melting down had been postponed until the U.N. had nominated a neutral expert who could assist the local authorities in this delicate and responsible task.

5.1/ The choice of methods for melting down the fused blocks.

In order not to destroy any evidence, the melting down had to be done most carefully, avoiding any overheating. Colonel Barber had already made a few experiments before my arrival to Salisbury and found out that with the exception of lead all the other metals to be expected (iron, steel, brass, copper etc.) could be extracted from the melted aluminium without losing their shape so that they could perfectly be recognized. I myself had made the same experience before my first meeting with the Commission at Geneva, melting down in a crucible a few pounds of a DC 6 B aircraft-wreckage (kindly put at my disposal by Swissair). Adding steel-bodies from shells, screws, nails, bolts and nuts, different bullets, a toothed wheel etc. I had studied the effect of different temperatures on the tested alloys. With the exception of lead and its alloys, all mentioned objects were easily recognizable even after a prolonged stay in the melted aluminium (80 minutes) up to temperatures of 830° C. The coating effect of the aluminium did not at all destroy the shape and other distinctive marks of the embeded objects so that they could easily be recognized.

The metallurgists of the Raine Engineering Company at Ndola had prepared all the necessary equipment for the melting process, including 2 crucibles heated by coke-fire with regulated ventilation and temperature-control by a radiation-pyrometer ($650 - 820^{\circ}$ C., average temperature $700 - 720^{\circ}$ C.). This first pyrometer had to be substituted by a dipping-in measuring-device of higher precision. The melted aluminium was poured out to form ingots and the scoria and the non melted bodies were cooled in a basin filled with water. After extraction from the water, we sorted them by hand on a big sorting table, using a strong magnet for picking out iron metals.

5.2/ Directly recognizable recovered bodies.

During the sorting action, most of the bodies extracted from the fused blocks could be identified without any difficulty. We found hundreds of bolts and nuts, partly still connected by

locking wire, screws, angled unions for pipes, rivnuts, coiled springs, panel fasteners, cables, wires, washers etc. From the very beginning of the melting process Colonel Barber, Mr. Madders and the assisting engineers of the Raine Co. were most impressed by the fact that such a variety of iron and non iron objects could be extracted undamaged although they had been exposed to the heat of the melted aluminium twice (once on the site of the crash and finally during our operation in the foundry). Even pieces of fabrics from seat belts and fragments of twigs and bark could be recovered in more or less carbonized state. They had not been destroyed because the melted aluminium protected them from the contact with oxygen.

Every single object was checked in order to make sure whether it belonged to the normal outfit of the aircraft or whether it could be in connection with sabotage or malicious interference to the aircraft. In order to permit all the members of the Commission of the U.N. to have a personal impression of the multiplicity of extracted objects I prepared some exhibits (see photos 1-3). In the first of them I placed side by side one piece of evidence extracted from the fused blocks and the corresponding piece of comparison recovered directly from a non burnt part of the wreckage. The exhibit proves clearly that every single object is identifiable without any difficulty. Exhibit Number 2 contains 57 different objects, all belonging to the aircraft including 2 fragments of cartridge cases originating from the ammunition carried on board, and in exhibit Number 3 I assembled a few pieces of melted metal which for further identification had to be submitted to a chemical analysis.

In the described manner we melted down all the completely fused blocks which were susceptible to contain hidden evidence. I agreed with the Rhodesian Authorities that there was no reason for melting down flat pieces of the wreckage which could be examined from both sides and which showed no suspect holes or only partly embeded foreign bodies, so that their origin could be defined without extracting them. The total weight of the 142 ingots resulting from our melting action was 3189 pounds.

In all the treated blocks no suspect bodies could be found, in spite of our careful and repeated checking of the scoria.

All the metallurgists present gained the full conviction that by our procedure no metallic bodies with melting points higher than 800° C. could have been destroyed. Therefore shells, infernal machines, rocket heads, timing devices for bombs, fragments of detonators etc. could not have escaped our attention, as even screws of not more than a quarter of an inch in length had been recovered. The fact that no suspect objects of this kind have been detected, will greatly influence the discussion of the possible causes of the accident in chapter 6.

5.3/ Objects which needed further examination in the experts laboratory.

It is evident, that not all extracted objects could be identified at first view and by comparison with the non-burnt parts of the wreckage. A few bodies had to be examined closer. For example one of the four linkage pieces moving the door which closes after retracting the undercarriage (Exhibit 3, first row, Number 2) was identified only at Zurich airport by the help of engineer Knuchel from the maintenance base of Swissair to whom go my acknowledgments. He helped me too in recognizing different other small pieces which all belonged to the normal outfit of a DC 6 B, so that all shaped bodies could be cancelled from the list of suspect objects.

This result would not exclude the possibility that the fused blocks might contain residues of foreign bodies involved in the causes of the crash but composed of metals or alloys which would have been melted completely because of their low point of fusion, losing therefore completely their shape so that they would not be recognizable any longer. From a theoretical point of view, it would be possible to build up a whole infernal machine out of parts of aluminium and other low melting metals only. Such a device would not be found by sorting the scoria, but only by a chemical analysis of such pieces of alloy which by colour or gravity would differ from the rest of the fused metal. I therefore took care to sort out such suspect pieces before the melting

process in the foundry and to secure them for spectrographical analysis. In the laboratories of the Scientific Department of Zurich Police in the week from March 14 to 21, 1962 these investigations were accomplished by the help of a grating spectrograph designed by the F.B.I. Without going into details I want to summarize the following results: The normal metal from the fused wings, flaps or the fuselage was easily distinguishable from such parts where an alloy containing a high rate of magnesium was built in. (see exhibit 4, spectrographical records). Further we found three distinct zones of fused metal with a most significant proportion of lead, bismuth and antimony. (Exhibit 4). The result of this spectrographical analysis has convinced the expert that he is confronted with melted bullets undoubtedly deriving from the ammunition-cases carried on board the aircraft. The expert is of the opinion that such lumps of lead mixed with copper-alloys cannot originate from single bullets of gun fire (with impacts more or less distant from each other) but only from the melting of tightly packed ammunition.

To conclude this chapter it can be stated that none of the chemical investigations carried out in our laboratories has shown evidence of the presence of bodies or metals in the fused blocks extraneous to the aircraft itself or to its loading.

6/ DISCUSSION OF THE POSSIBLE CAUSES OF THE ACCIDENT.

At the meeting when the expert was introduced to the members of the Investigation Commission they formulated the wish that the expert should give his opinion on all the possible causes of the accident, proceeding by elimination.

As a basis for my studies I considered the reports already issued and the newly gained evidence resulting from my mission in Rhodesia as well as from the laboratory analysis. In the light of my professional experience I tried to connect all the known established facts and to estimate the different conjectures expressed in previous reports, comparing the total weight of evidence with the results of similar investigations.

6.1/ Hostile action from the ground or another aircraft to bring the SE - BDY down.

6.11/ General possibilities.

It is well known to military experts that it is fairly difficult to shoot down a 4-engined aircraft, especially by night. There is not only the question of hitting the moving target but also that of concentrating the necessary means of attack in a suitable place. No testimonies have observed any hostile actions from the ground, nor have they heard any detonations or shooting. Despite the low probability of such an attack, we have studied carefully the different possibilities.

6.12/ Gunfire shooting.

Such a shooting would only be effective if vital parts of the aircraft could be hit, in order to render it uncontrollable or to cause the loss of part of the engines. It is absolutely impossible that such an intensive damage could be done without leaving any traces still visible in the wreckage. Not even the melting down of the fused parts of the wreckage disclosed the presence of any bullets. It is most improbable that an aircraft would be shot at by lead bullets, and any other quality of projectiles would have been recovered. Lead-bullets or bullet-holes were missing in the non-burnt parts of the aircraft too. Therefore the idea of gunfire attack can be discarded.

6.13/ Shooting of shells.

The same arguments which speak against the possibility of gunfire exclude also the possibility of shell-explosions. No fragments of shells, no traces of explosions, no suspect holes could be found. No part of the aircraft has been torn or blown off previous to the first impact with the trees. Not even in the fused blocks it was possible to detect any fragment of shells, and as it was shown in chapter 5, the method used for extracting hidden metals was most effective. These negative results allow to exclude completely the possibility of any explosion of shells as a cause of the crash.

6.14/ Rocket-shooting.

Any projectile of a rocket type would cause a heavy explosion and blow off some parts of the aircraft or cause characteristic deformations. No sound or light of such an explosion was observed by witnesses and the examination of the wreckage disclosed no corresponding evidence, as has already been mentioned.

6.15/ Conclusions.

According to the experience of the expert hostile actions from the ground or from another aircraft without setting distinct traces in the wreckage are impossible and therefore it is proved beyond any reasonable doubt that they can be eliminated.

6.2/ Sabotage.

6.21/ General possibilities.

It has been stated that there was no special guard provided for the aircraft SE - BDY at the airport of Leopoldville, so that a saboteur would have had the opportunity to approach the aircraft without being detected if he intended to prepare an explosion in the undercarriage, the hydraulic compartment or the heating system. It would have been easy to smuggle a bomb on board in the luggage or to hide it somewhere in the toilet or under a seat. Especially the use of a plastic bomb would not have needed long preparations. On the other hand, it could not be foreseen that the Secretary-General was to take off with such a delay and in the aircraft SE - BDY and not on board the OO - RIC, as originally planned. Furthermore only very few persons could know that SE - BDY would have such a long flight because Captain Hallonquist did not follow the direct route to Ndola. Therefore the moment of the crash after this long flight is a very strong argument against sabotage, if one does not consider a direct connection between the lowering of the undercarriage or the setting of the wing flaps and an explosion or a damage caused to the mechanism of flaps or the undercarriage.

itself. The design and application of such means of sabotage is not easy and a skilful saboteur would not run the risk of premature detection of such a device if he had other, less complicated possibilities at hand.

6.22/ Malicious interference in order to cause damage to vital parts of the aircraft.

The technical examination of the cables operating the control surfaces, the wing flaps or the undercarriage mechanism revealed no pre-crash damage as far as these parts had not been destroyed by the impact or the fire. All four engines were delivering power in the moment of the impact so that a defect in the feeding system for fuel can be excluded. Furthermore the aircraft had been properly trimmed for its approach to the beacon and the crash path showed no abnormality in the control, as it would be expected in the case of this kind of sabotage.

6.23/ Infernal machines.

I have already mentionned the fact that a time bomb would probably have been set to explode in a far earlier stage of the flight (delayed departure, prolonged flight-route). Furthermore most timing devices require a set of metallic objects such as batteries, wires, clockworks, springs, receptacles with chemicals etc. which would not have disappeared completely in the wreckage. The same remark is to be made concerning infernal machines linked to the mechanism of the undercarriage or the wing flaps. Together with the fact that no explosion has been heard or seen and that the wreckage shows no sign of deformation due to explosions, an infernal machine as cause of the accident is most unlikely

6.24/ Plastic bombs.

This most modern instrument for sabotage and terrorism has the advantage that the explosive material itself does not need to be enclosed in a compact shell in order to produce its destroying power. Therefore after the explosion no splinters are found. But all plastic bombs need a primary detonator which would produce splinters. In other cases, residues of a timing device, a chemical corrosion unit or a wire-tearing device

would subsist. No such evidence and no traces of an explosion in the form of deposits of powder smoke in non-burnt areas were found, so that the use of a plastic bomb can be excluded

6.25/ Conclusions.

An act of sabotage which might have struck vital parts of the aircraft or incapacitated the pilots would have left significant traces (deformations, splinters of exploding bombs or at least the detonator, timing mechanism). No such evidence was found neither in the unburnt nor in the fused parts. The expert cannot imagine how an aircraft, after a normal flight of many hours and well arriving over the airport of destination could be made to lose some 1000 feet of height without any other irregularity in the descending phase and without giving the crew the time for a message to the tower and eventually for regaining height. The total weight of evidence that speaks against sabotage is so overwhelming that this possibility can be eliminated.

6.26/ (Annex to the problem of sabotage).

There is one kind of sabotage that would not leave any trace: The wilful act of the pilot(s) to destroy the aircraft with all the persons on board, thus committing suicide in a "heroic" manner, in obedience to some secret orders. But this idea is so absurd that it is mentioned here only to show the limits of all investigations and why an absolute certainty to have found out the truth by studying the traces alone cannot be reached.

6.3/ Other possible causes.

The previous reports have already thoroughly discussed a great number of possibilities. My mission did not contribute to bring forth any new evidence in the following items: Technical or structural defects, altimeter failure, internal fire or explosions on board during the flight, incapacitation of pilots etc.

I therefore consider it unnecessary to deal again with these arguments well known to the Commission.

C O N C L U S I O N .

The reexamination of the wreckage in the hangar and the melting down of the fused parts of the wreckage allow to exclude the possibility of hostile actions from the air or from the ground and leave no room for the suggestion of sabotage.

As no evidence of technical failure could be found and considering that the aircraft obviously made a perfectly normal approaching procedure turn and was normally trimmed in the moment of the first impact with the trees, the only abnormal fact was the dangerous low altitude of the aircraft in relation to the airport elevation, probably due to human failure.

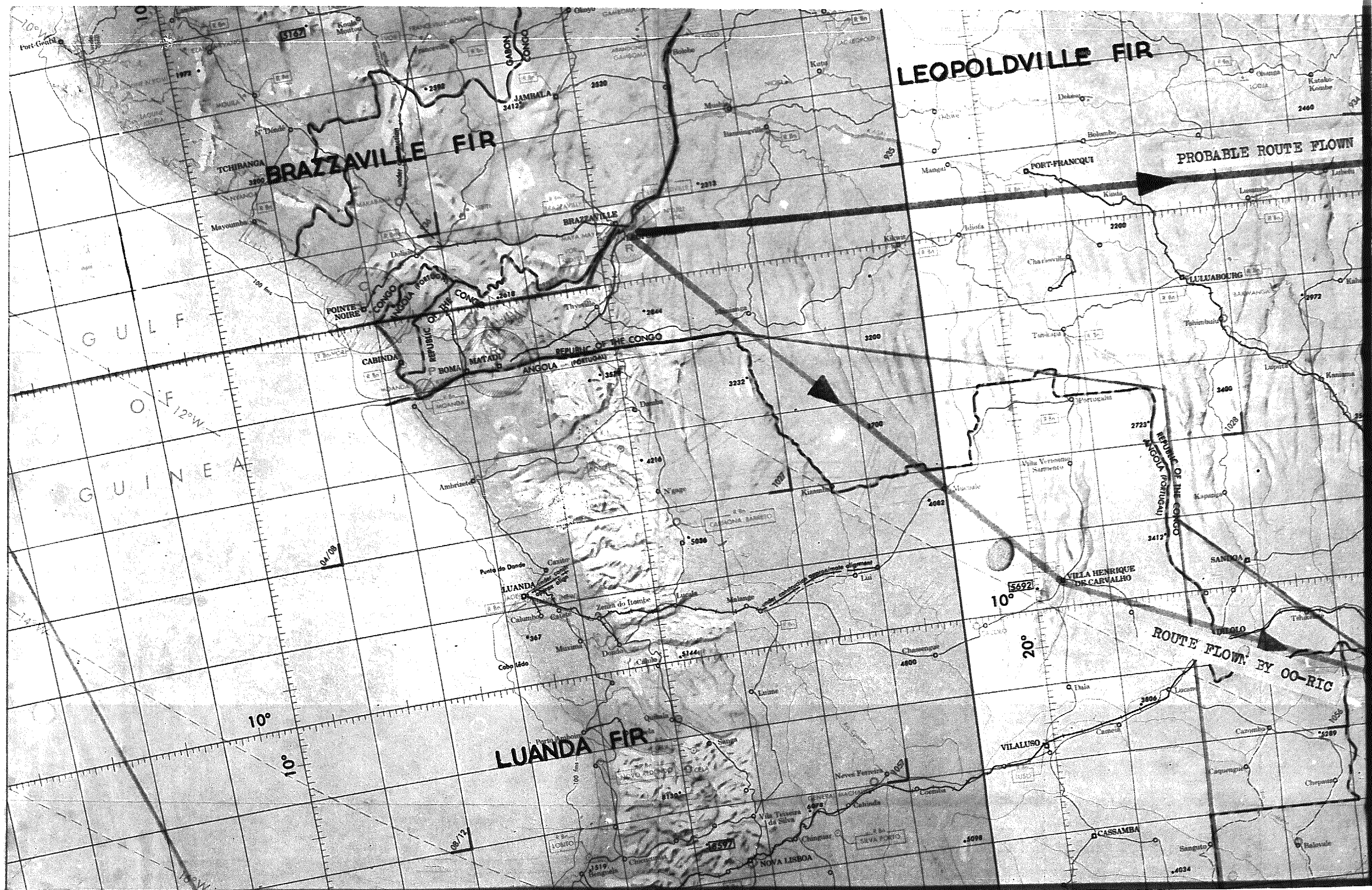
Zurich/Switzerland,
March 27, 1962.

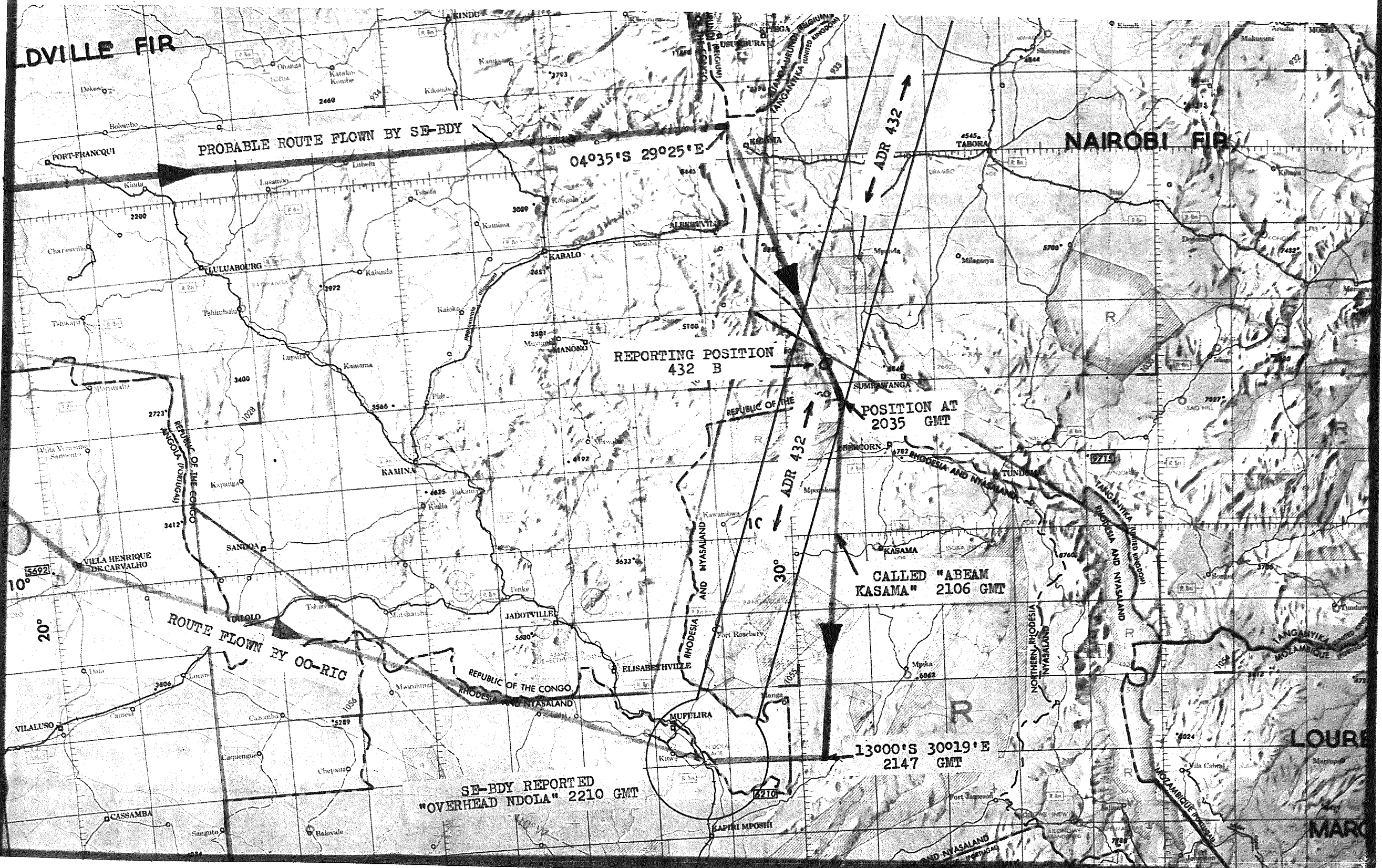
M. Frei
(Dr. M. Frei-Sulzer)

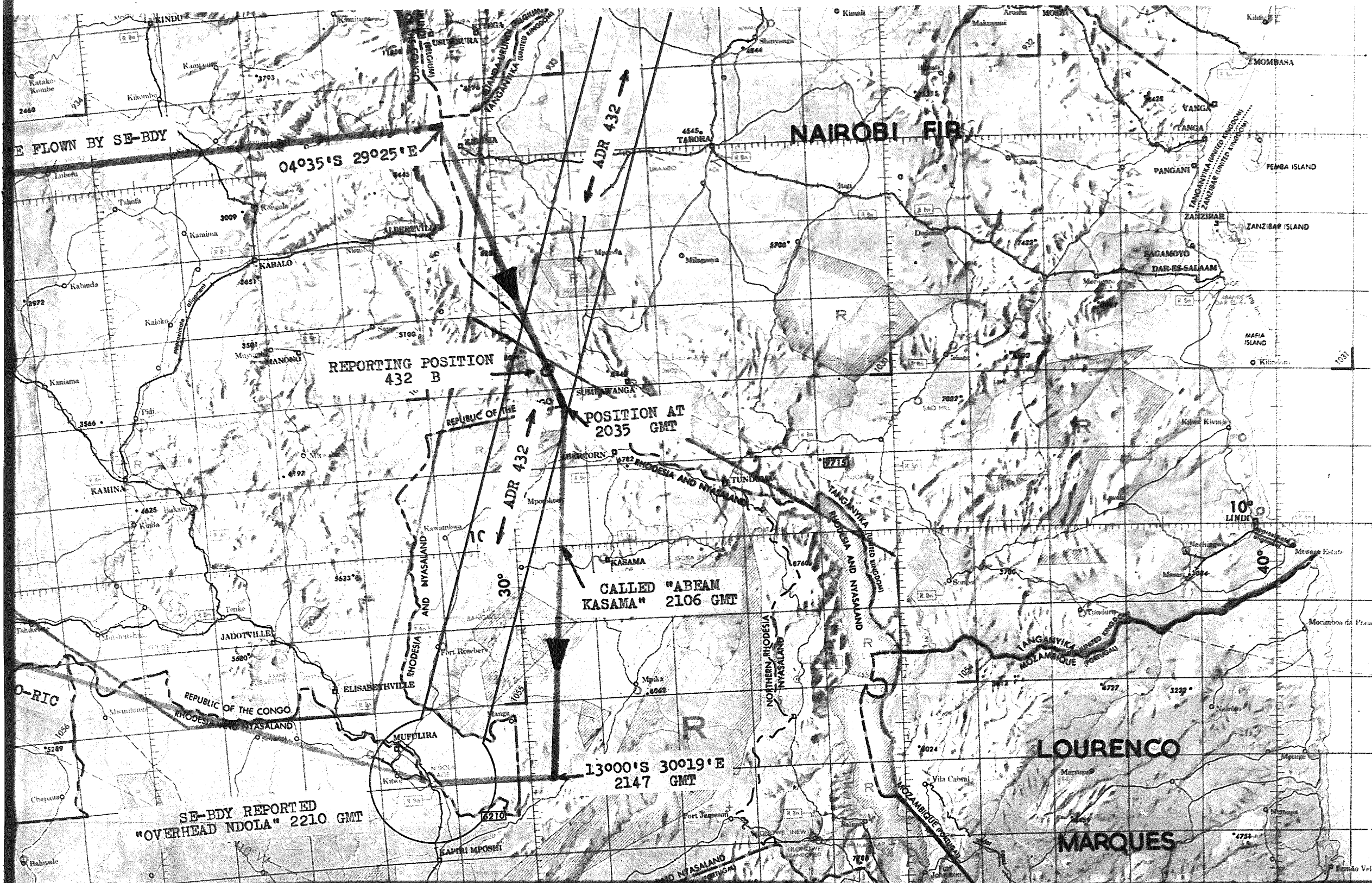
ANNEX XIII

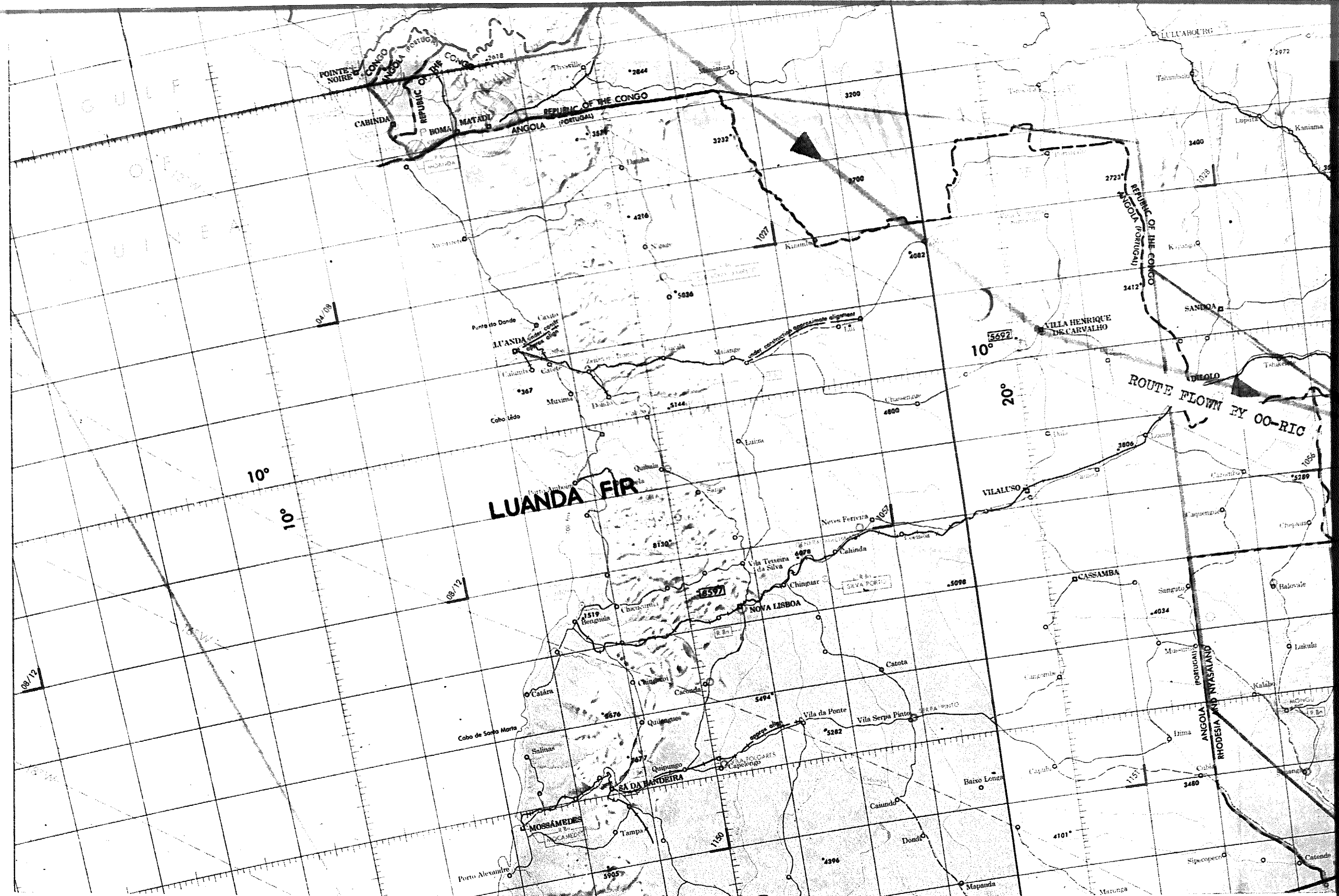
MAP SHOWING PROBABLE FLIGHT ROUTE OF SE-BDY,
AS RECONSTRUCTED BY THE RHODESIAN BOARD OF
INVESTIGATION*

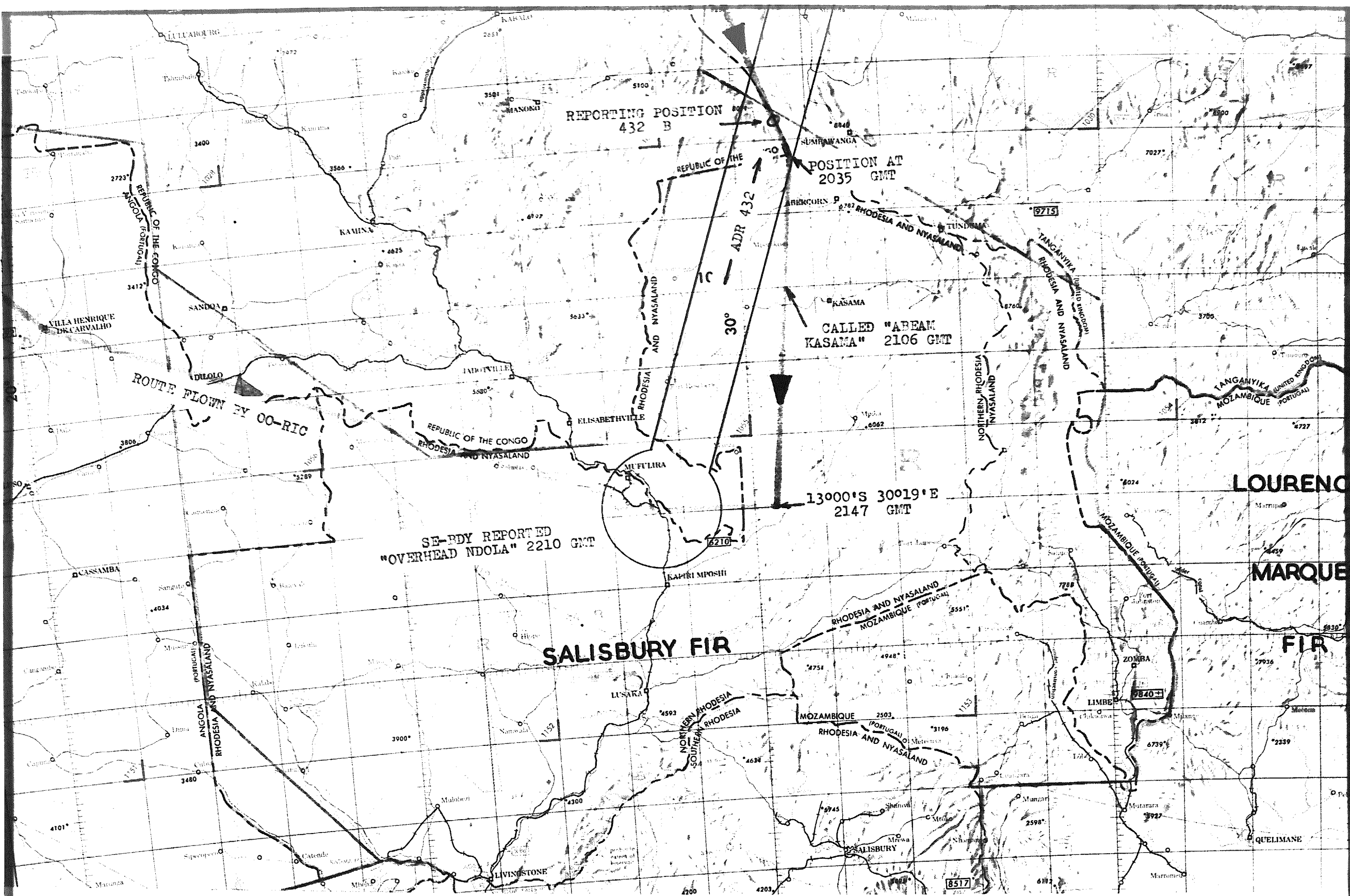
- * With respect to final leg it is possible that SE-BDY flew further south in order to skirt the Katanga pedicle and approached Ndola from the south east. See foot-note to paragraph 98 of the Report.

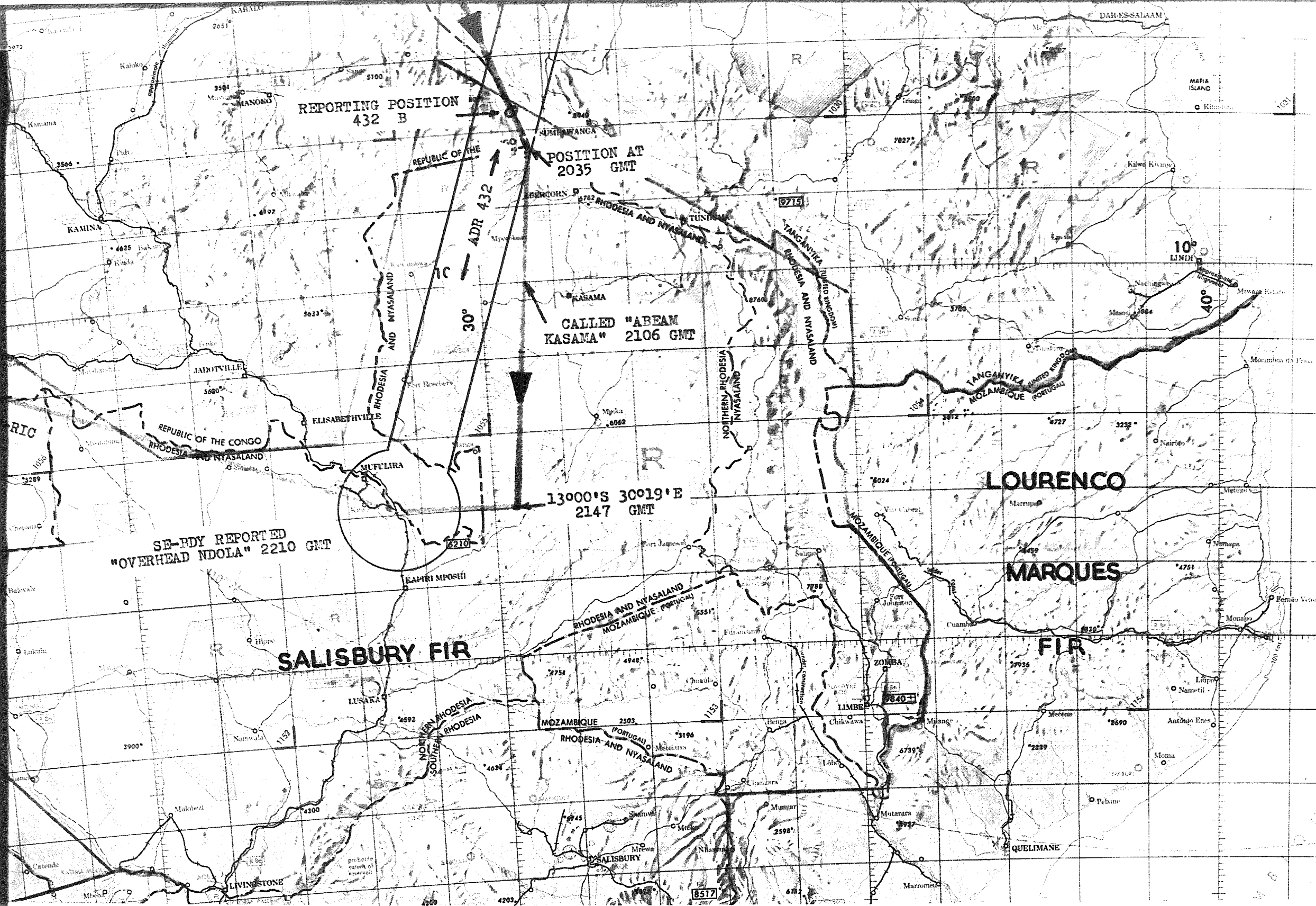












REPORTING POSITION
432 B

POSITION AT
2035 GMT

CALLER "ABEAM
KASAMA" 2106 GMT

13°00'S 30°19'E
2147 GMT

SE-BDY REPORTED
"OVERHEAD NDOLA" 2210 GMT

SALISBURY FIR

LOURENÇO

MARQUES

FIR

QUELIMANE

ANNEX XIV

INSTRUMENT APPROACH CHARTS

A

Ndola (Northern Rhodesia) Charts
from Jeppesen Airway Manual

Aviation Manual

16 24 JAN 61

N'DOLA, NORTH RHODESIA

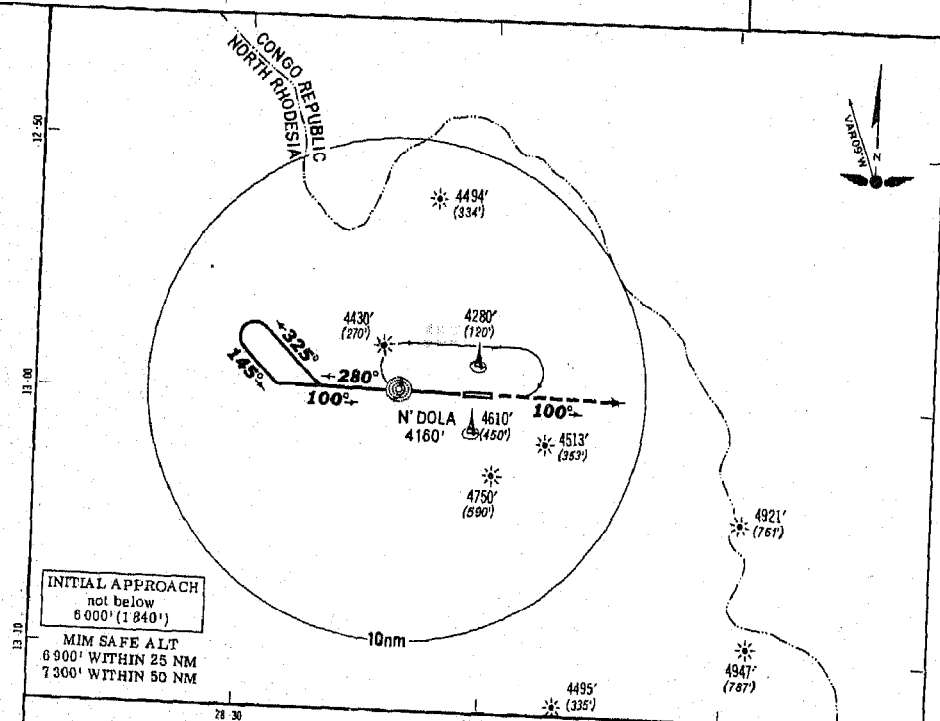
N'DOLA (CIV) 4160'
NDB

VDF-APPROACH 119.1

APPROACH
119.1

TOWER
118.1 5680

IDENT **ND :::**
XMTS **394**
CLASS **HW**



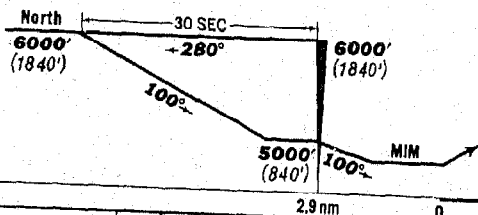
INITIAL APPROACH
not below
6000' (1840')

MIM SAFE ALT
6900' WITHIN 25 NM
7300' WITHIN 50 NM

BASED ON T.A.S. 150 KTS
(STILL AIR)

TRANSITION LEVEL: **70**
TRANSITION ALTITUDE: **6000' (1840')**

MISSED APPROACH
climb to **6000' (1840')**
on **100°**



DCL **4660' (500')**

GROUND SPEED KNOTS	90	100	110	120	130	140	160	180	200	LANDING MINIMUM CONVERSION			
Time NDB to FIELD	2.9 nm	1:56	1:45	1:35	1:27	1:20	1:15	1:05	0:58	0:52	OFE	800'	
											QNH	4980'	

HOURS OF OPERATION: 0400-1800
ND-NDB: H 24

CHANGES: Freq of ND-NDB revised.

HEIGHTS SHOWN IN PARENTHESES ARE QFE

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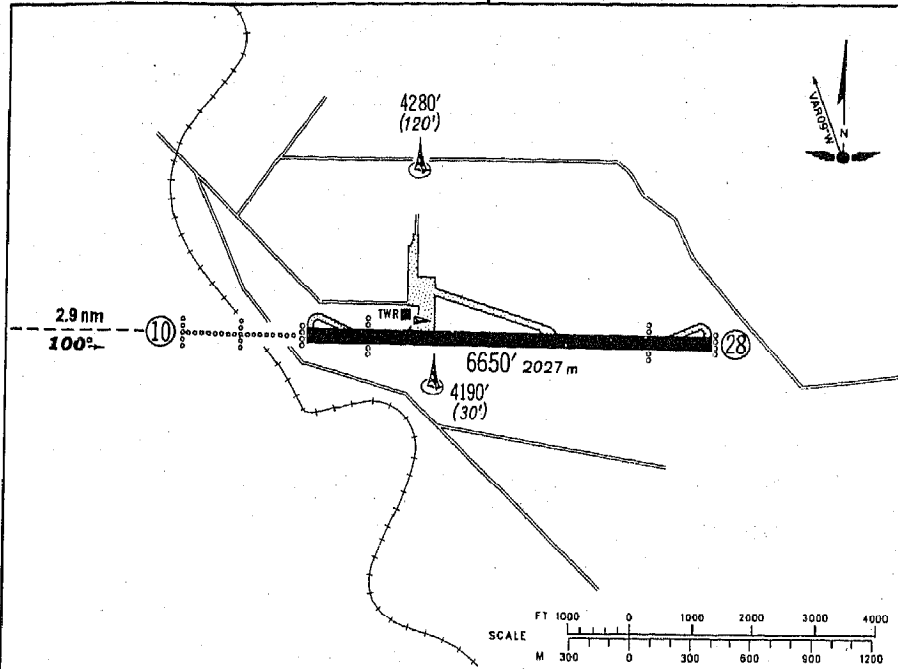
N'DOLA, RHODESIA
N'DOLA AIRPORT (CIV) 4160'
NDB

3 JAN 61 16

Airway *Manual*

LIGHTS: obstruction, flood, taxiway, runway, 10 approach.

CUSTOMS

[illegible]

HEIGHTS SHOWN IN PARENTHESES ARE QFE

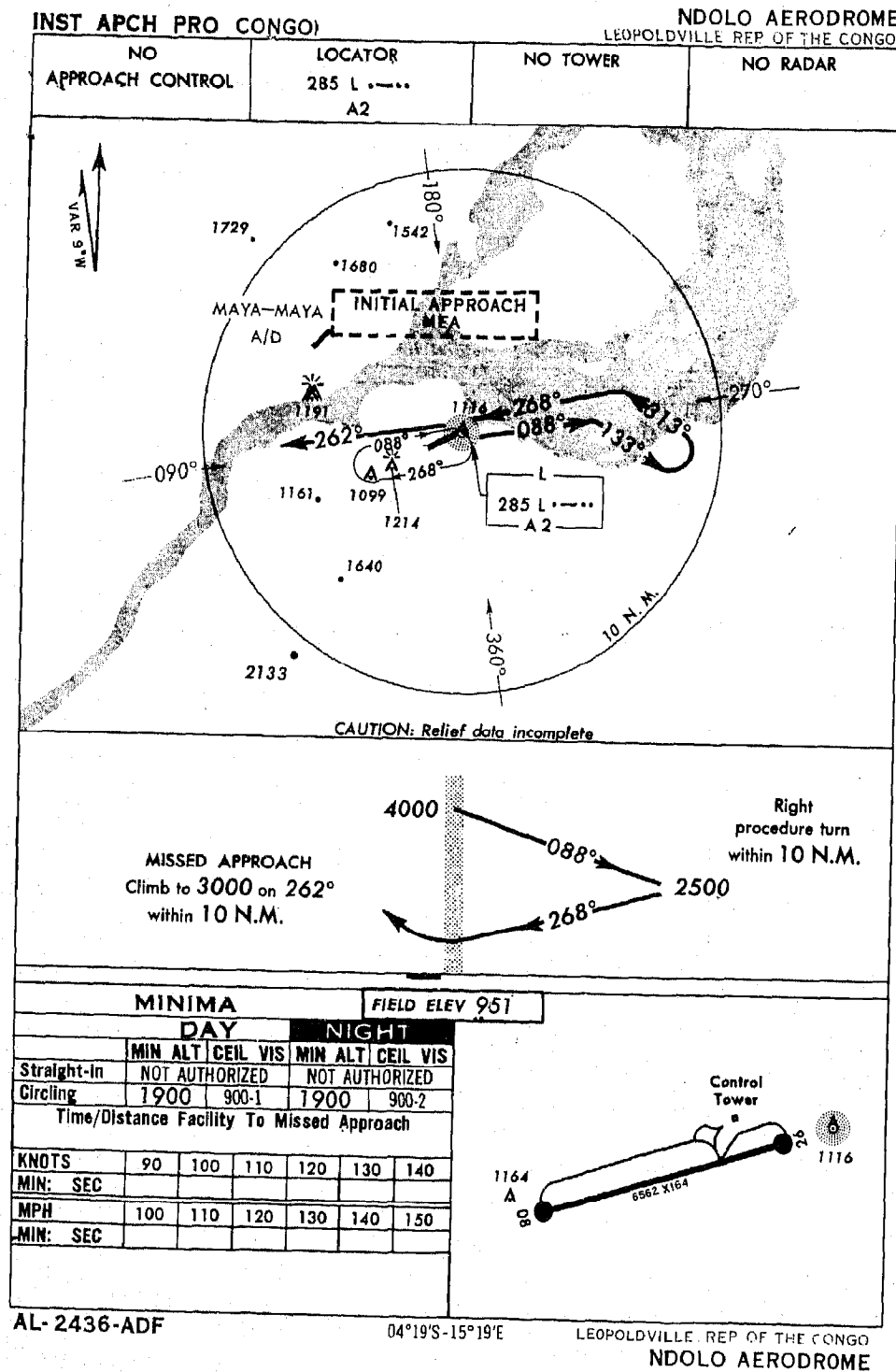
CHANGES:

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/ . . .

B

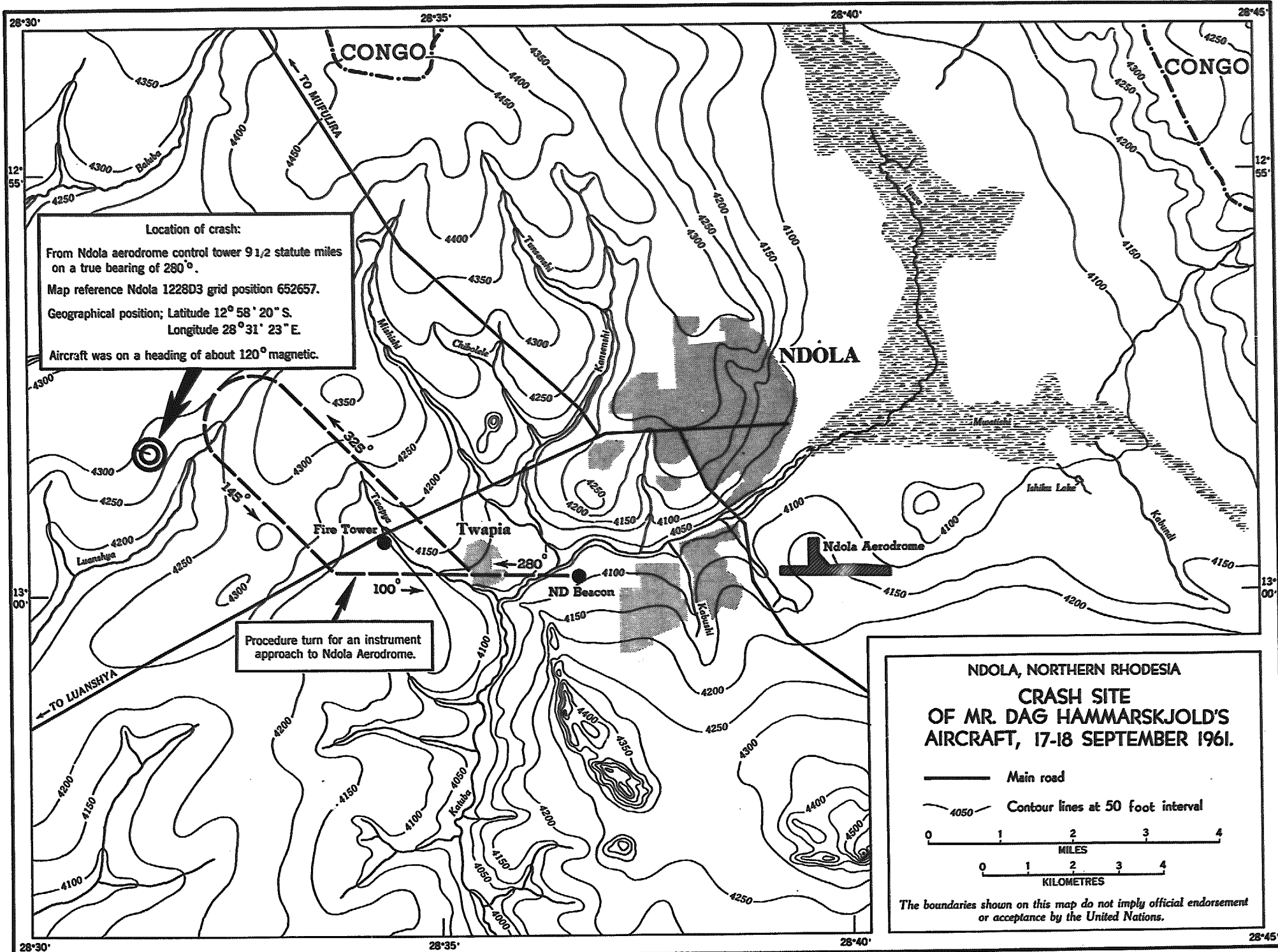
Ndolo (Leopoldville) chart from United States Air Force -
United States Navy Flight Information Manual*



* Flight Information Publication Terminal (Low Altitude) Africa and Southwest Asia, 15 July 1961.

C

Ndola chart superimposed on map of Ndola area
showing crash site



ANNEX V

WRECKAGE PLANS

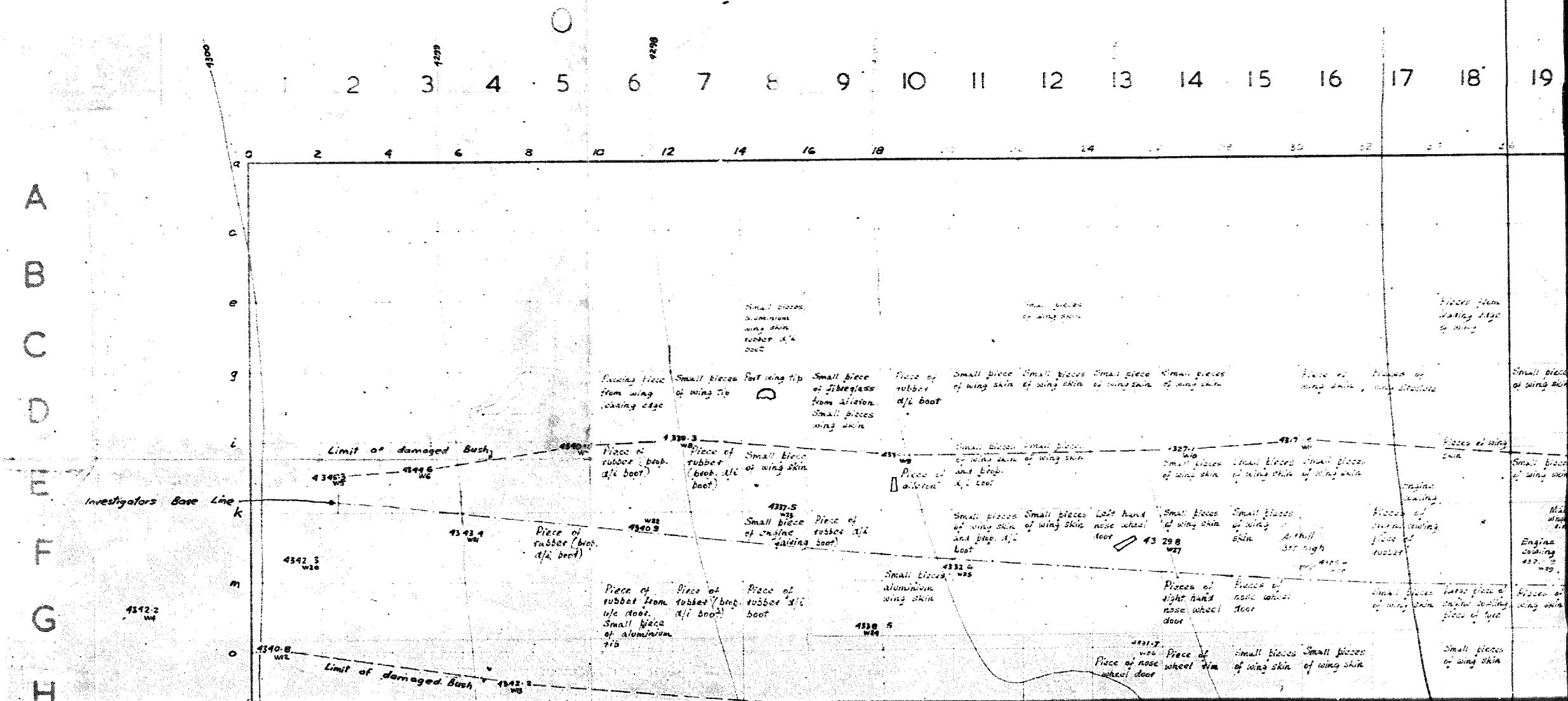
- A. Wreckage plan (scale 1 inch to 30 feet)
- B. Enlarged wreckage plan

ACCIDENT TO DOUGLAS

SCALE: 1 INCH TO 30

NOTES

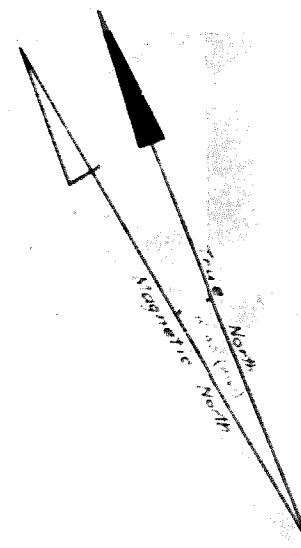
1. Datum ground level at peg uo adopted as 4300 feet from Federal Trig Survey 1 in. 30,000 Series Sheet 1228 D₃
2. Ground level contours are indicated thus: _____ 4398
3. The heights of the highest damaged points of a few selected trees (W4 - W56) are shown thus:- eg 4346 4
W3



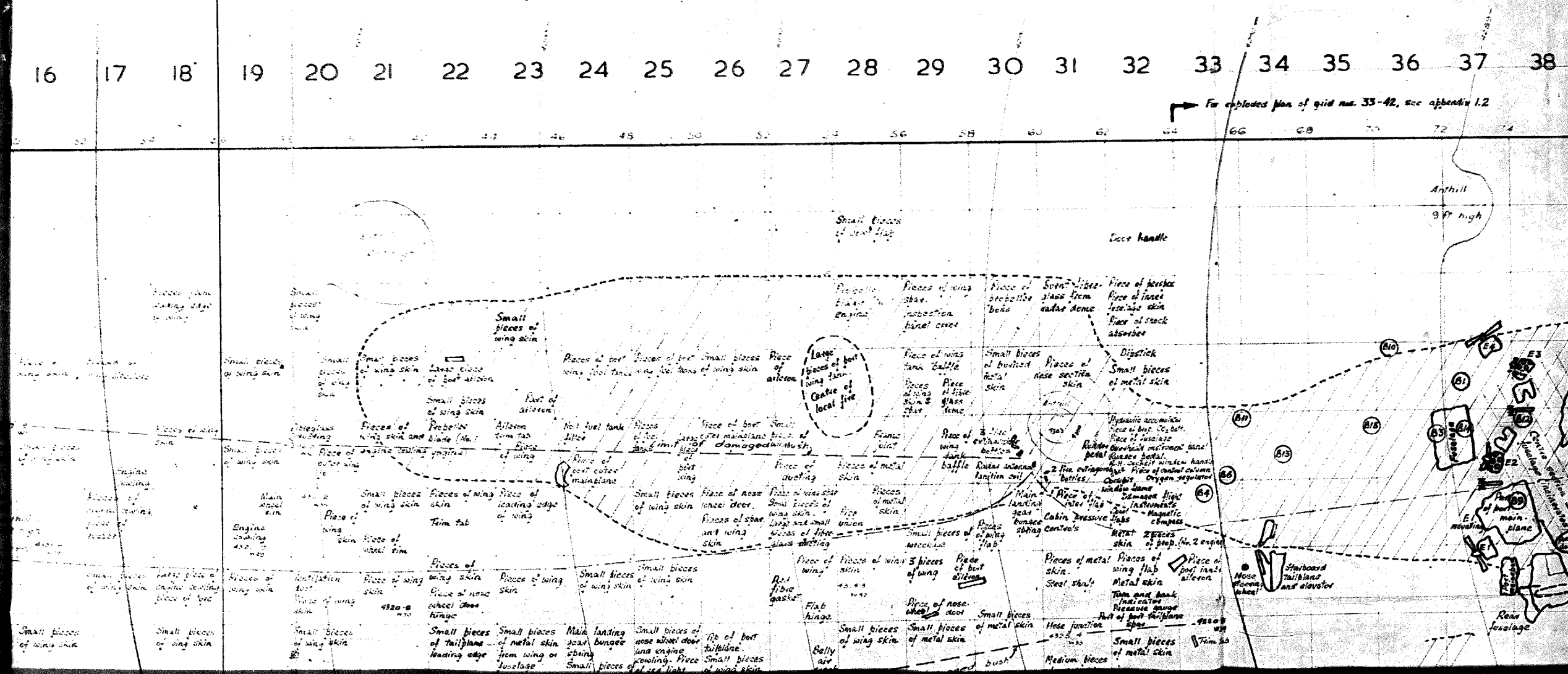
PACKAGE PLAN

DOUGLAS DC-6B SE-BDY

1 INCH TO 30 FEET.



The Magnetic Bearing of
the line 20/084 is 120°



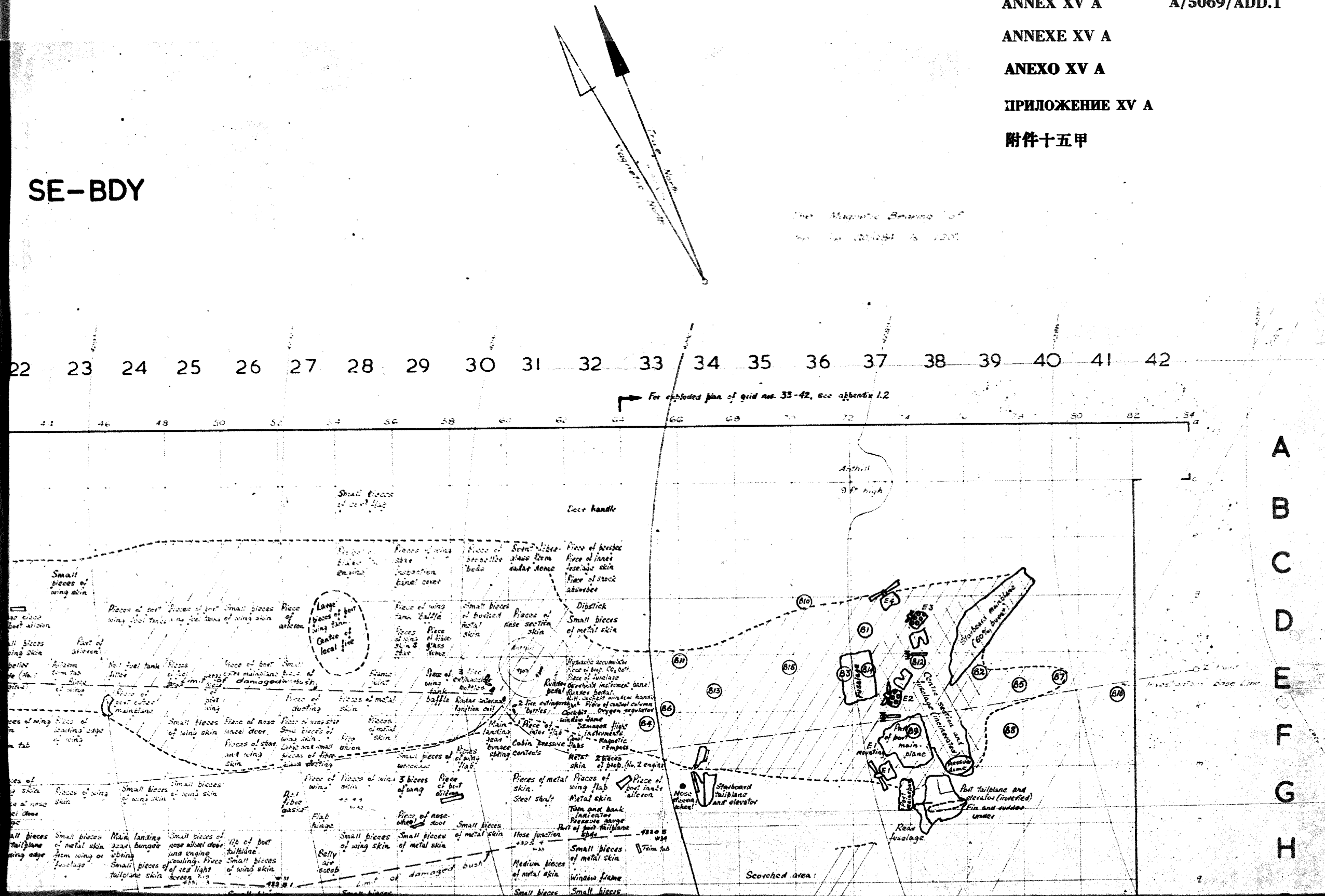
A/5069/ADD.1

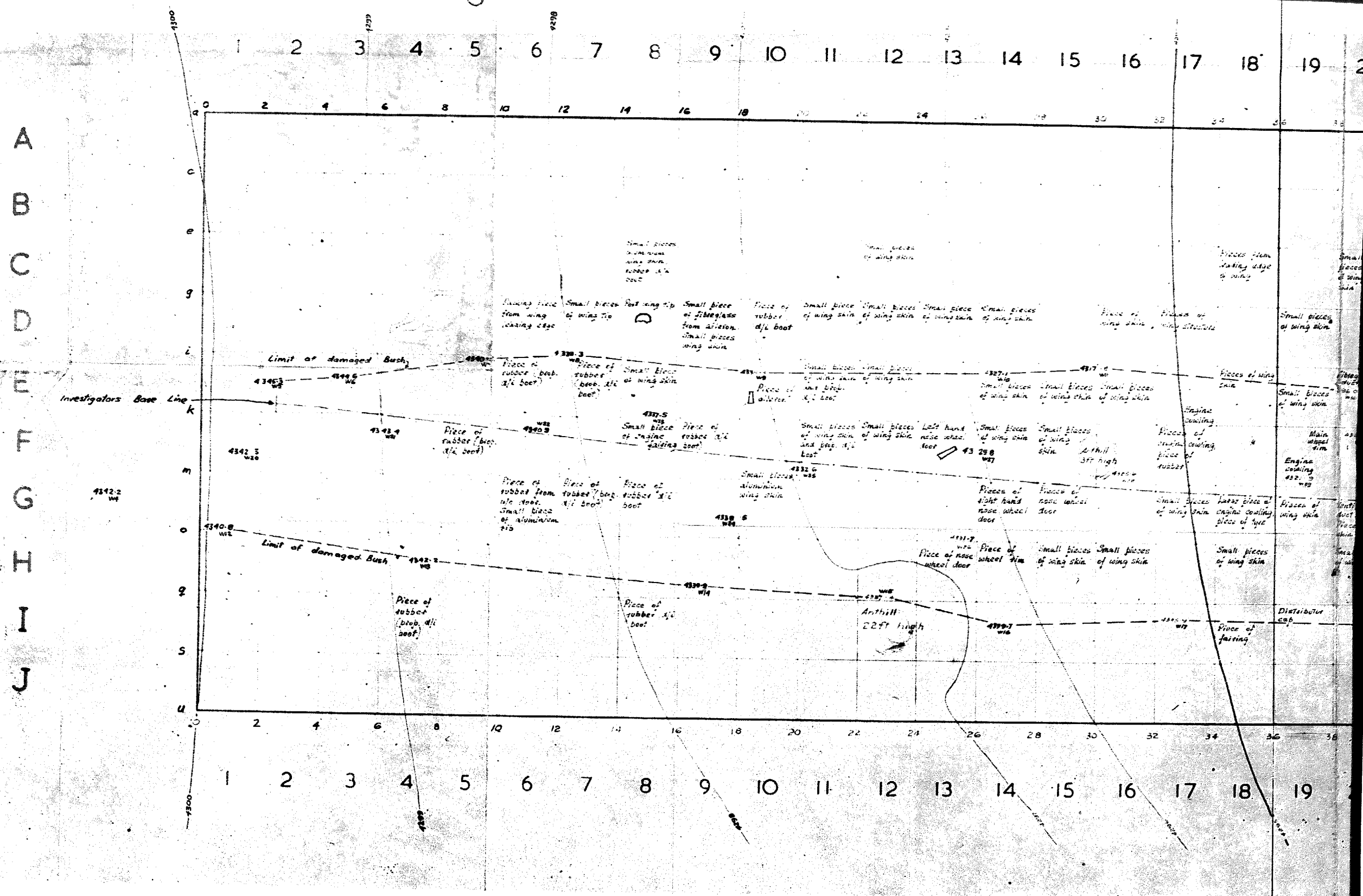
ANEXO XV A

ПРИЛОЖЕНИЕ XV А

附件十五甲

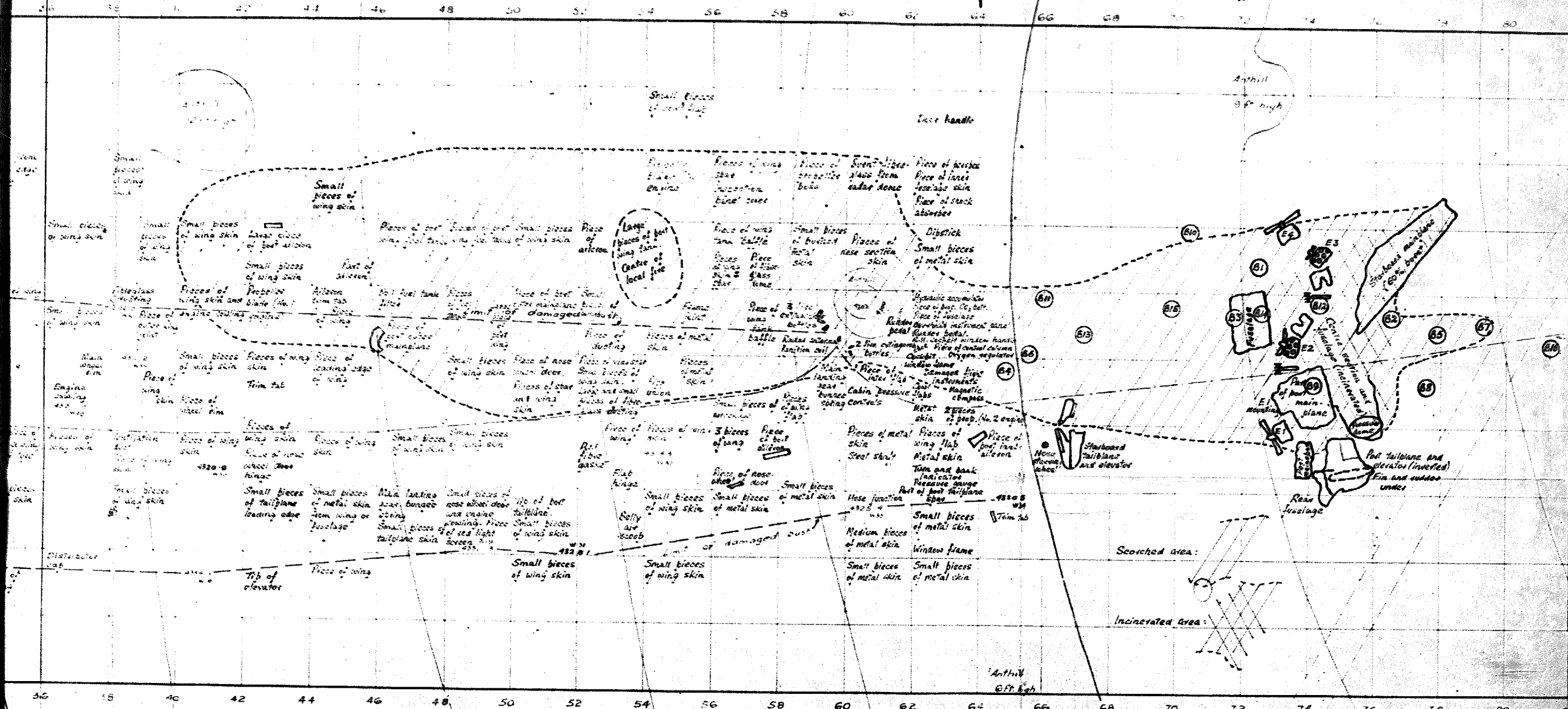
SE-BDY





19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41

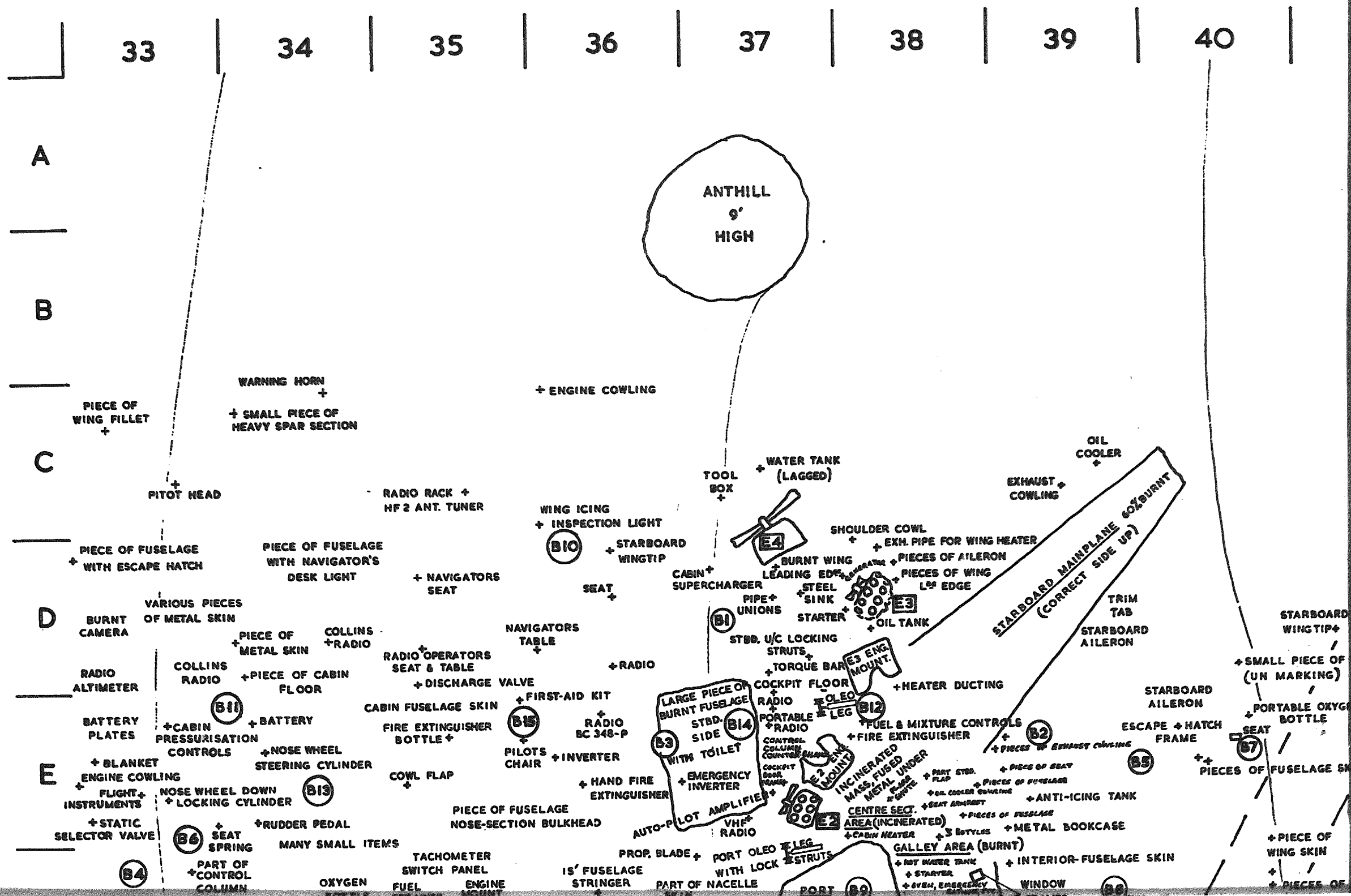
For exploded plan of grid nos. 33-42, see appendix 1.2

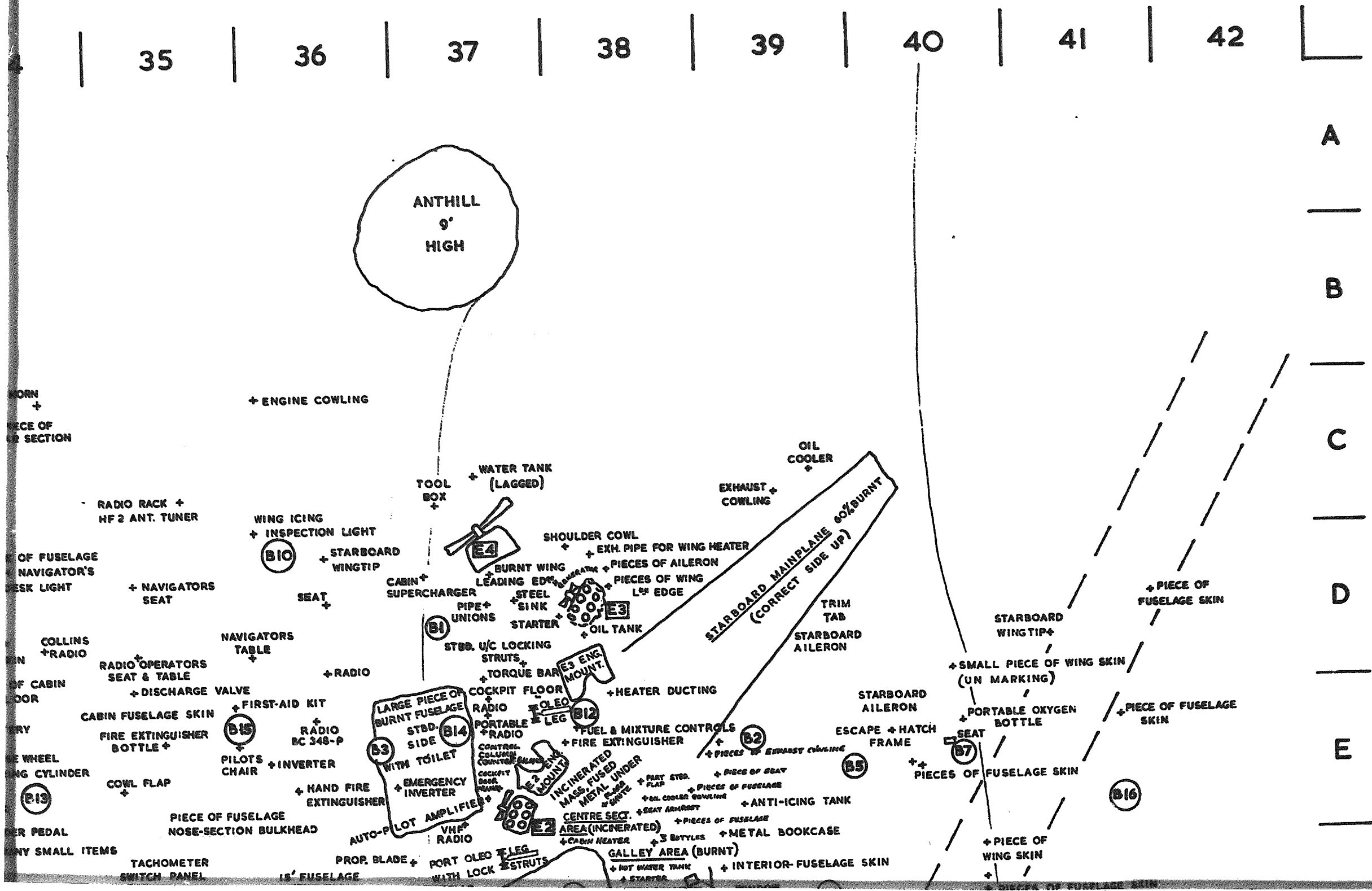


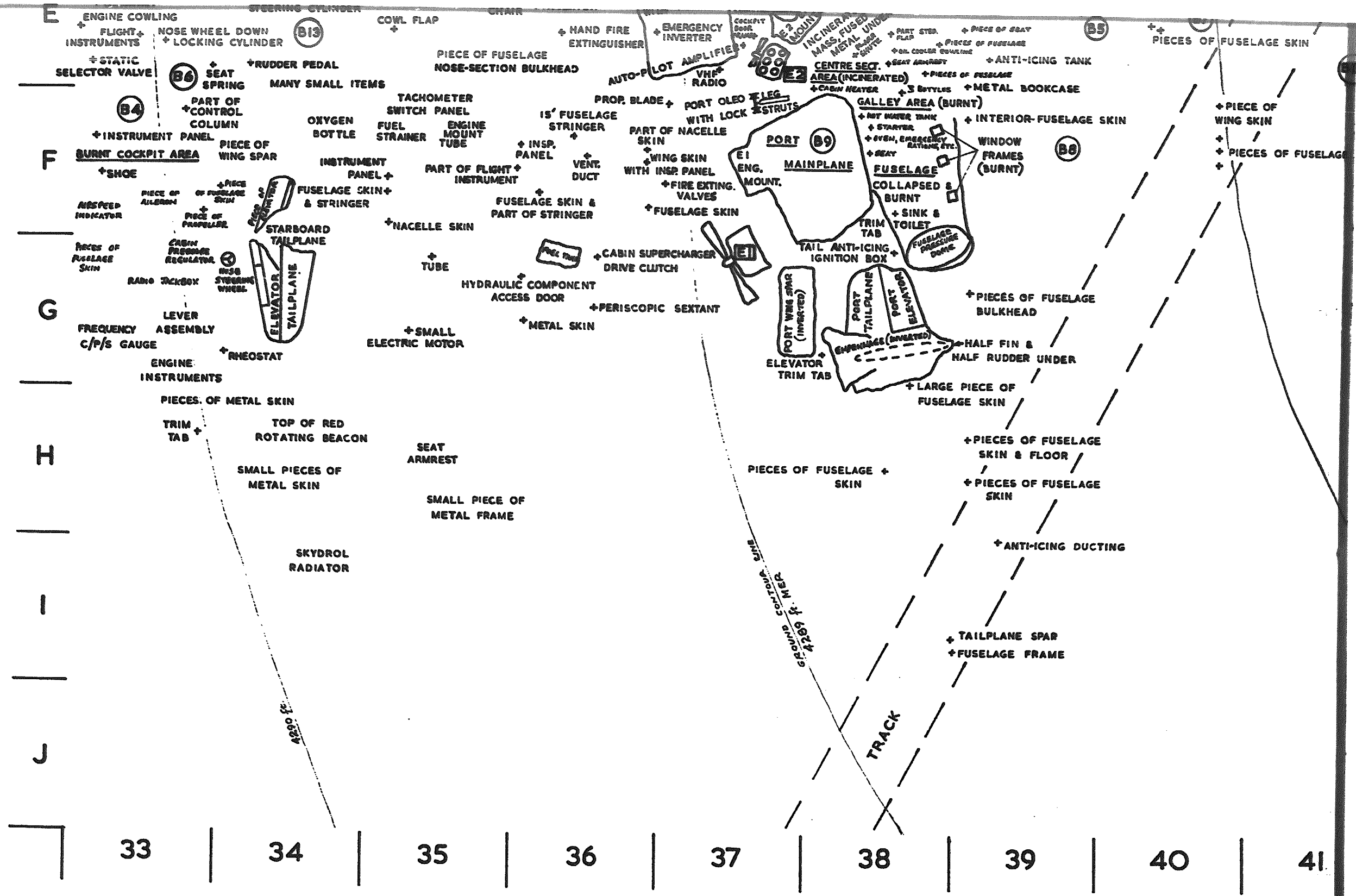
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41

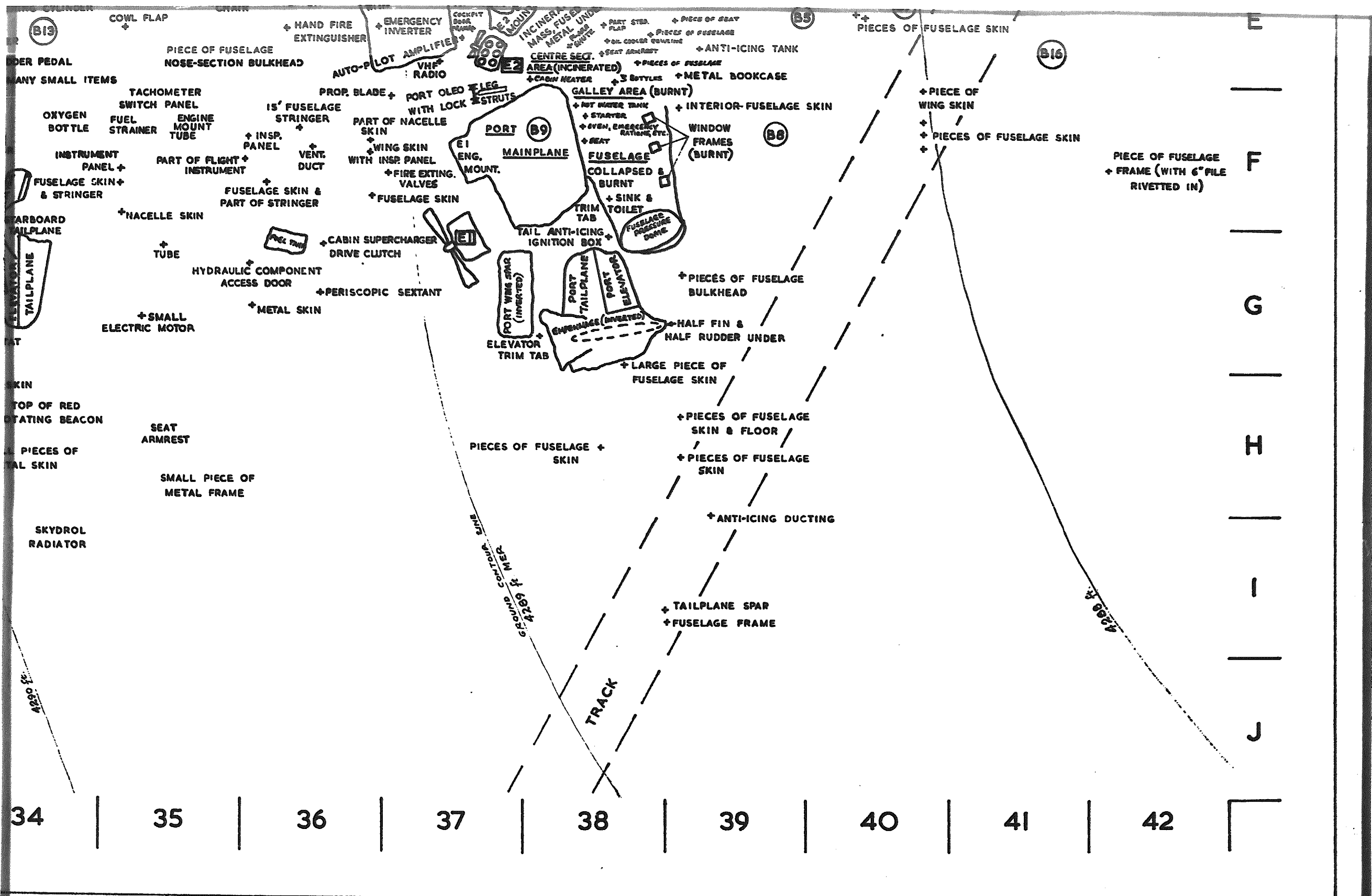
EXPLODED PLAN OF GRID Nos. 33-42

ANNEX XV B — ANNEXE XV B — ANEXO XV B — ПРИЛОЖЕНИЕ XV B — 附件十





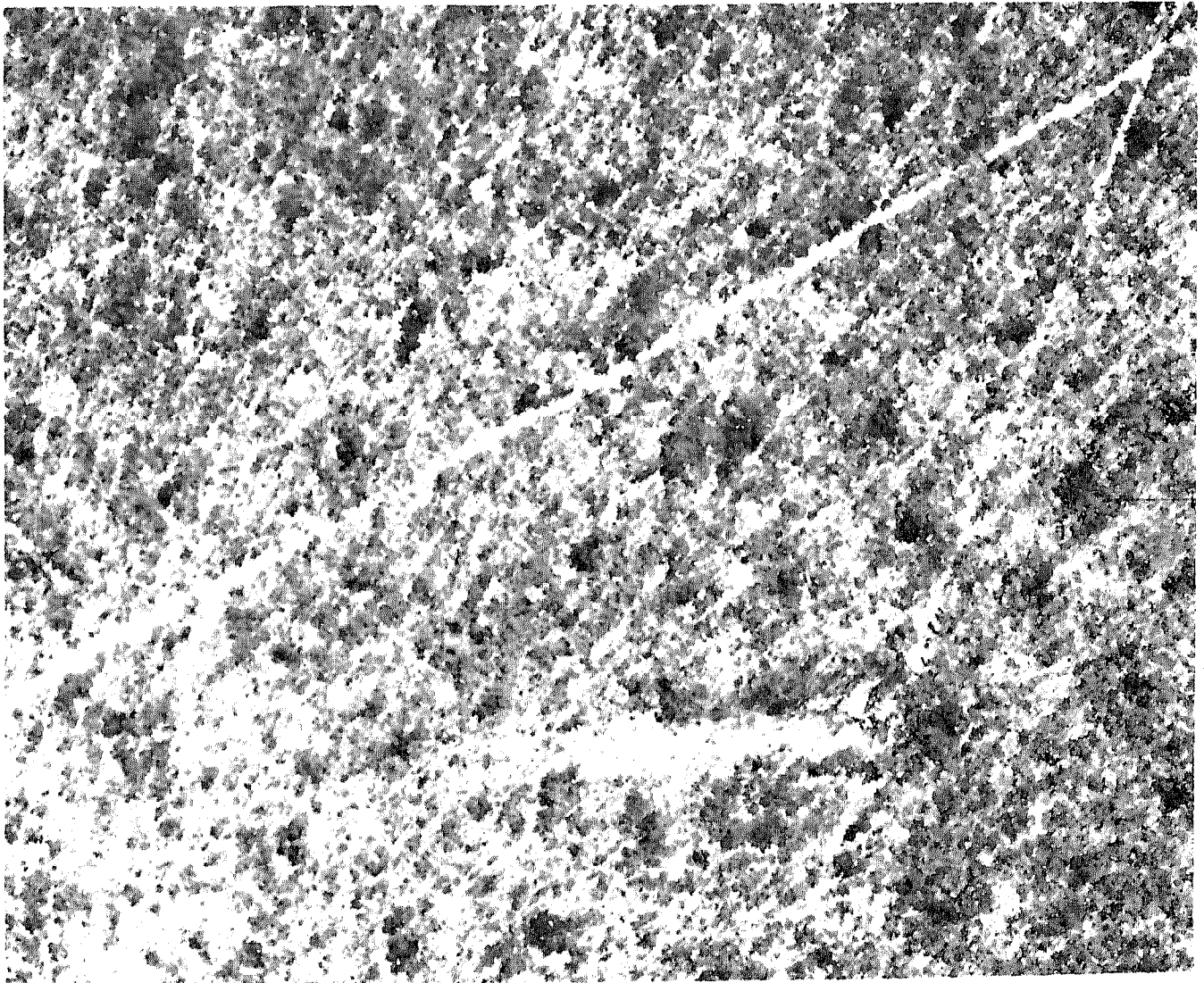




ANNEX XVI

PICTURES OF CRASH SITE AND WRECKAGE

1. View of the crash site (centre foreground) from the air indicating shallow angle of approach and showing forest tracks which facilitated access to the site.



2. View of wreckage and approach path from direction of approach.



3. View of crash site (after clearance of wreckage)
from ground looking back along line of approach.
Main wreckage lay immediately behind the camera.



4. View of wreckage.

