

No. 23BOAC HERMES IV. Forced Landed in French West Africa
on 26 May 1952

(Note. - The inquiry was conducted by France in accordance
with Annex 13 of the Convention of ICAO)

Circumstances

The aircraft took off on a scheduled service from Tripoli to Kano with a crew of eight and ten passengers. The weather forecast indicated fine weather en route and thunderstorms in the Kano area. Due to faulty use of the variation setting control on the Gyrosyn compass and the inability of the crew to determine the aircraft's position properly by the standard methods, the aircraft, with practically no fuel and over the desert, made a wheels-up landing in a wide depression littered with shifting sand-dunes surrounded by rocky escarpments. The port wing was torn off and the remainder of the aircraft slewed left and came to a standstill without breaking up. No fire resulted and all passengers and crew were evacuated without difficulty. Six were slightly injured but the First Officer died five days later as a result of exhaustion brought about by strain and heat.

Investigation and Evidence

The weather forecast for the flight, drawn up by the meteorological office at Castel Benito, indicated fine weather en route and thunderstorms in the Kano area. On the whole, reports of actual weather received from the aircraft during flight bore out the forecast. The report adds that weather conditions had no direct bearing on the accident, apart from the fact that thundery conditions caused atmospheric conditions which greatly hampered radio communications.

Ground facilities available for the flight included (in British territory) non-directional beacons and radio direction-finding at Accra, Castel Benito, Jos, Kano, Lagos and Wheelus, radio responder beacons at all the airports mentioned with the exception of Jos, and radio range at Wheelus. Ground aids primarily available in French territory included the following:

Atar (non-directional beacon and MF/DF), Bomako (MF/DF), Dakar (radio range, non-directional beacon, MF/HF DF, responder beacon, locator beacon and approach control), Gao (non-directional beacon and MF/HF DF), Niamey (non-directional beacon, MF/DF and locator beacon), Port Etienne (non-directional beacon, MF and HF/DF), Tunis (non-directional beacon, radio range and HF/MF and VHF direction finders). Secondly, and only on request or on several hours' prior notice, further aids were available at other airfields in French territory. Airborne navigational aids carried by the aircraft were as follows:

(radio) Marconi HF standard STR VHF, Marconi ADF, RAF homing and approach, Ultra intercom: (navigational) Hughes periscopic sextant, butte sextant MK. 9B, CL2 Sperry Gyrosyn compass, P.12 reflecting magnetic compass, and drift-meter. In addition to the appropriate maps, charts and operating manuals, the aircraft carried a start chart, airspeed correction table, Air Almanac (May-August, 1952), rapid navigational tables and star tables for air navigation.

Outlining the ground aids used in the flight and discussing their efficiency, the report says that the identification signal on the Gao beacon was received but the strength was not sufficient to allow a bearing to be taken. The Port Etienne beacon and DF aids at Bamako, Port Etienne and Dakar, however, had provided a large number of valuable position data and bearings. The station at Tamanrasset had acted on its own initiative as a relay between the aircraft and Kano, but was not asked for a bearing; the radio operator had even entered an interrogation mark in his log against this (to him) unknown station - which was nevertheless shown on the airborne navigation chart. The investigator comments that "the scarcity of radio facilities on the Tripoli-Kano desert route casts celestial navigation for an important role on this sector and should, at all events, prompt the fullest possible utilization of the conveniently contactable radio facilities at the point of take-off".

The investigator continues: "We note, however, the existence of available radio facilities which were not utilized, in particular those at Tripoli, use of which might have prevented the aircraft from going astray at the outset, and those at Atar aerodrome which, at a pinch, the aircraft might have been able to reach".

On the functioning of telecommunications the following comment is made: "Serious difficulties in radio communications were encountered both by the aircraft's radio operator and by the ground stations. They were due mainly to the heavy atmospherics resulting from the thunder conditions that night, intensified in the aircraft's case by an unsuspected remoteness due to its error in navigation and complicated at the critical moment of daybreak by the familiar anomalies in propagation".

After normal briefing at Castel Benito, at which the only outstanding points were the possibility of thunderstorms (as mentioned previously) and unreliability of the Kano non-directional beacon, the aircraft took off at 2203 hrs (GMT). On levelling out at 12,000 feet the captain noticed a 25-degree difference in the readings of the two compasses and asked the navigator to check the true course by astral observation. The navigator reported that the CL2 (201 degrees) was correct and the P.12 (226 degree) was in error. Meanwhile the captain and engineer tested, without result, the various electrical circuits which might have caused deviation in P.12. No attempt was made to check, by means of radio aids, track made good. The captain decided to proceed with the flight, steering by means of the CL2 compass and rejecting the P.12 as unserviceable. At 0124 hours, after a series of star fixes, the aircraft was thought by the crew to be about 12 miles east of the direct track and a little over halfway between Tripoli and Kano. By this time the difference in compass reading had increased to 54 degrees but the P.12 readings were being ignored. At 0324 hours, a two-star fix indicated that the aircraft was 100 miles west of Kano and as the ETA was 0402 hours, the navigator attempted to tune in to the MF beacon but without success. Meanwhile, the radio officer had been passing the hourly Pomars to Malta and Kano and had received meteorological information from the latter airport which indicated that it was experiencing electrical storms; no storms were, however, seen by the crew.

At approximately 0400 hours the engineer officer noticed that the variation setting control on the CL2 Master Unit was set at 60 degrees W. The navigator, it was discovered, was under the impression that the setting was 6 degrees W. The VSC which enables true courses to be steered, is not normally in use. On this occasion, however, the navigator did use it but had mis-read the graduation and had initially set 30 degrees W., increasing progressively to 60 degrees W. during the flight. The error was immediately reported to the captain and when the VSC was reset to zero the reading of the two compasses agreed. Throughout the flight of six hours the navigator's astro-shots had been made on the wrong stars; this, the report notes, should have been indicated by the difficulty he had experienced in lining up on pre-computed settings. (The periscopic sextant gives a limited field of vision and it is necessary to know the approximate position of the aircraft to calculate altitude and azimuth of a given star from the astro-navigation tables.)

Reconstruction of the flight shows that the aircraft was then probably about 900 miles N. W. of Kano, 800 miles E. of Port Etienne and 400 miles N. W. of the airfield at Gao, with sufficient fuel aboard for about four hours' flight at cruising power.

A dead-reckoning position had been estimated, but this had indicated that the aircraft was very much further north than it actually could have been, since it was based on a 60-degree course-error instead of an error increasing progressively from 27 degrees to 54 degrees. The first recorded alteration of course came at 0444 hours, when the captain decided to fly east. At about this time he instructed the engineer officer to reduce power in order to conserve fuel.

The following summary gives the sequence of events as reconstructed in the report in approximate order. 0454 hours, Course altered to 55 degrees. 0515 hours, Course altered to 180 degrees; no decisive action taken during this time. 0535 hours, Decision apparently taken to head for Port Etienne (whose beacon was picked up on the radio compass) although navigation chart carried aboard Hermes stopped over 600 miles short of Port Etienne. 0438-0554 hours, Aircraft called successively Accra, Lagos and Kano on various frequencies but received no reply. 0532 hours, Emergency procedure adopted. 0557 hours, Gao confirmed that MF beacon was switched on. 0558 hours, SOS procedure adopted; Hermes probably still within 400 miles of Gao heading west. No acknowledgment of first SOS message although stations at Niamey, Kano and Tessalit were communicating with one another on the subject of the Hermes. 0615 hours, First reply (from Accra and Kano) to distress message from Hermes stating its estimated position and that it had two hours' fuel left and was heading for Port Etienne. 0621 hours,

Accra accepted control of aircraft at request of radio operator. 0658 hours, Aircraft stated that it was one hour from coast "thereby completely upsetting any calculations which might have been made regarding its progress". 0722 hours, Aircraft first contacted Dakar; thereafter true bearings were passed regularly by Bamako, Dakar and Port Etienne. 0812 hours, Dakar logged first distress signal from aircraft "which had at last realized the impossibility of its reaching the coast". 0845 hours, (approximately), Aircraft descended and after a circuit of a native village belly-landed at a point approximately 71 miles SSE of Atar (the captain had asked the engineer to warn him when there was only enough fuel for descent, two overshoots and landing, which was made when this moment arrived).

Discussing the evidence, the report states that identification of the stars actually shot by the navigator and the utilization of the corresponding measured altitudes should have permitted a close reconstruction of the route flown. This was attempted but without complete success... "It is to be feared that the 1st/Officer was content with shooting stars of minor importance provided merely that he succeeded in lining them up with his presetting."

The aircraft's estimated position at 0600 hours, which was already too optimistic, was 460 miles from Port Etienne. At 180 kt (the speed given in the distress message received at Accra and Kano at 0615 hours) the aircraft would not have been able to reach Port Etienne until 0835 hours, yet the message stated that it had only two hours' fuel left. Having accepted control of the aircraft at 0621, Accra (the report implied) should have warned the captain that his chance of reaching Port Etienne was slight and should have told him of the possibility offered by Atar. This omission, says the report, "is the more inexplicable in that Kano ATC - later on, it is true - specifically drew Accra ATC's attention to this point in a message at 0730 hours". The highly optimistic DR positions given by the aircraft during this period are not explained by the shots first on Jupiter and subsequently on the sun.

As the Hermes did not send a repetition of its state of urgency until 0812 hours, the latter control centre had no apprehensions regarding the disastrous inadequacy of the aircraft's range. However, Accra, for its part, did not make sure that Dakar was acquainted in time with all the factors in the problem or that the aircraft possessed information about the potential usefulness of Atar; moreover, Accra's request that the aircraft should communicate with it by R/T for nearly an hour precluded the use of radio bearings during that period.

Summing up, the report states "the investigation has established that the aircraft, crew and Corporation were in order with respect to the legislation in force, that the airworthiness was not in question but that, in varying degrees, the aircrew members, with the exception of the engineer officer and cabin personnel, did not display the full measure of competency required for the accomplishment of their mission. There is no doubt that defective telecommunications constituted a circumstance promoting the occurrence of the accident".

Causes of the accident, in chronological order, are set out by the report as follows:

- (1) Faulty use by the navigator of the variation setting control on the CL2 Gyrosyn compass.
- (2) Faulty checking of compasses by incorrect astral bearing and without the aid of radio bearings.
- (3) Incorrect inference drawn by the captain in pronouncing the CL2 Gyrosyn compass correct and the P. 12 magnetic compass unserviceable.
- (4) Fault on the part of the captain in not returning to Tripoli when the P. 12 compass was regarded as unserviceable (in breach of BOAC regulations).
- (5) Inability of the crew to realize that astro shots were being taken on the wrong stars.
- (6) Inability of the crew to determine the aircraft's position properly by the standard methods when the VSC setting error was discovered.
- (7) Lack of decisive action on the part of the captain once he knew he had lost his way.
- (8) Ignorance, on the part of those on board, of the assistance which could have been afforded by Atar airfield.

The report makes nine recommendations, as follows:

- (1) The graduation of an instrument should not cause confusion and if the figures indicate tens instead of units, it is desirable that this should be clearly indicated by a characteristic sign. (The VSC of the CL2 compass on board was marked in tens but did not have the sign "X10", which the manufacturer on his own initiative had added on the more recently manufactured instruments).
- (2) Use of the periscopic sextant, which has a very restricted field of vision, should form the subject of special precautions with a view to the certain identification of the stars shot.
- (3) In-flight checking of a compass by an astral bearing should rest only on a reliably identifiable star.
- (4) On long-range aircraft the carrying of a second magnetic compass of simple and robust design would constitute a wise precaution in anticipation of difficulties similar to those which were the source of the loss of G-ALDN.
- (5) The captain should always be competent to judge the quality of the navigator's work.
- (6) Possession of an official navigator's licence by a member of the crew* should be required for long-range flights over areas indifferently equipped with ground aids, such as those we have been considering. (At present, United Kingdom regulations require the carriage of a licensed navigator for a flight over water of at least 1 000 nautical miles or for a non-stop flight of more than 1 500 nautical miles over land. The distance from Tripoli to Kano is 1 264 nautical miles.)
- (7) An increase in the number of ground aids on the Tripoli-Kano stage is desirable. The practical realization of the projects to equip Rhadames, Rhat and Agades with continuous-operation radio beacons would meet the requirements revealed by the abnormal flight discussed in this report.
- (8) Against the preceding recommendation it must be pointed out afresh that any inadequacies in the equipment of an air route render it incumbent on users to make the best possible use of the existing facilities available, which, in the present instance, was not done in respect of the radio aids at Tripoli on take-off.
- (9) Examination of the communications exchanged between the ground radio stations reveals the need for closer liaison between the British and French control centres in Africa. Thus the failure to make use of the possibilities presented by Atar airfield appears to have been the result of insufficient co-operation between Kano, Accra and Dakar.

* The navigator held a Commercial Pilot's Licence with Instrument rating. He had failed to obtain the Navigator's Licence on the Senior Commercial Pilot Licence but he held a navigating officer's certificate issued by BOAC.

19. CHART SHOWING ENVIRONS OF
SCENE OF ACCIDENT

Stage by lorry. _____
Stage on camel-back. - - - - -

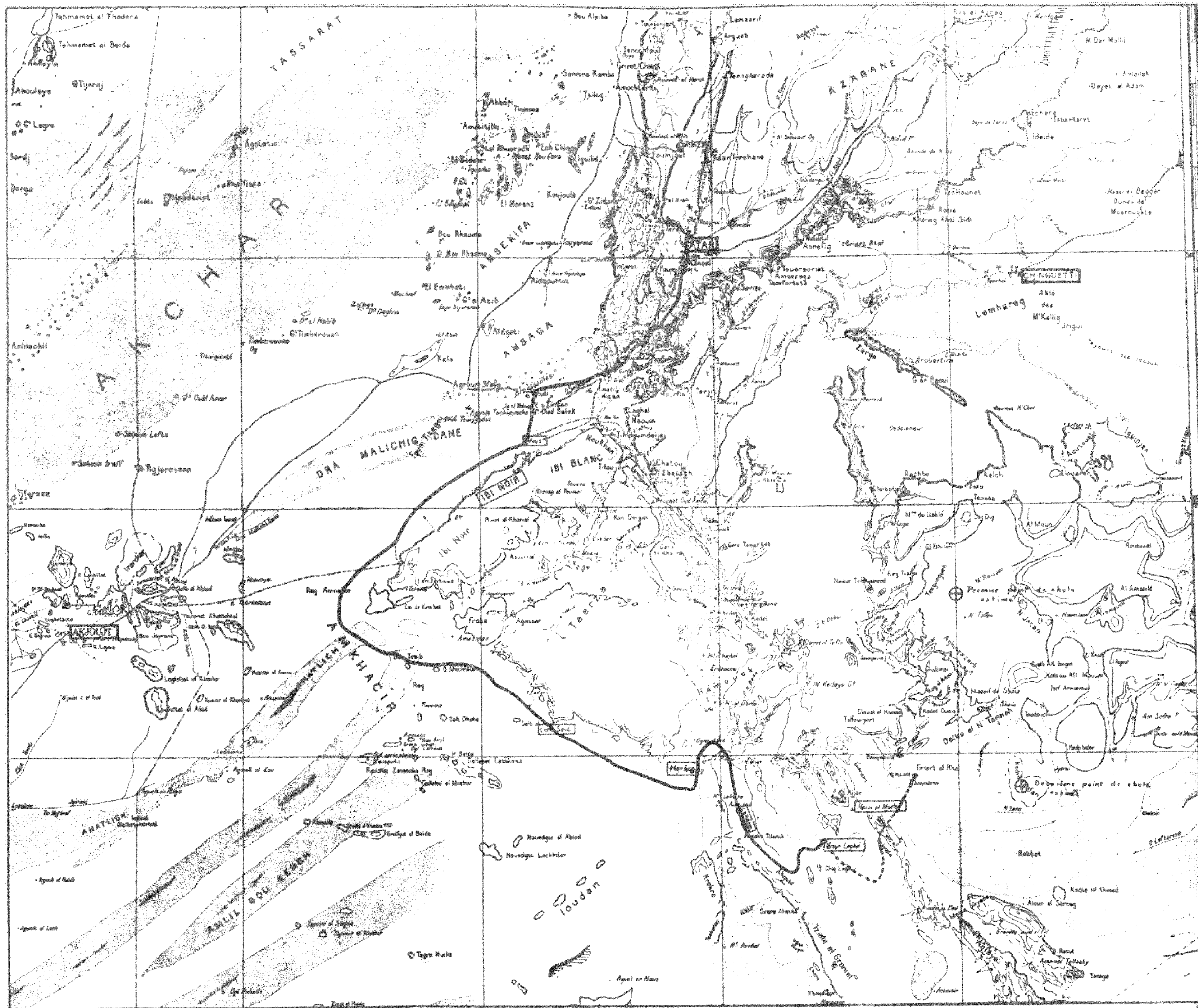
19. CARTE INDIQUANT LA SCENE
DE L'ACCIDENT

Trajet en camion. _____
Trajet à dos de chameau. — — —

19. MAPA EN QUE APARECEN LOS
ALREDEDORES DE LA ESCENA
DEL ACCIDENTE

Trayecto en camión,

Trayecto en camello,



Dress. dress. et alio par le Service Géographique de l'AGE à Dakar en 1961. 1^{er} volume de 1961

Scale - Echelle - Escala : 1:500.000



SCENE OF ACCIDENT TO HERMES AIRCRAFT G-ALDN.
DESERT OF MAURITANIA (FRENCH WEST AFRICA).