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THE WEATHER AND THE FIRST SUCCESSFUL NON-STOP EAST TO WEST TRANS-ATLANTIC FLIGHT OF 1928

by
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Foreword

The occasion of the fiftieth anniversary of the first east to west non-stop trans-Atlantic flight by a heavier than air machine was marked in Ireland in 1978 by a series of lectures, newspaper articles, seminars and films of the historic event. Although the original flight was planned as a wholly German undertaking, providing aircraft and crew (Captain Hermann Köhl and Baron Von Hünefeld), Irish interest in this first flight was occasioned not only because an airfield near Dublin was chosen as starting point but also because a member of the Irish Air Corps, Commandant James Fitzmaurice, joined the flight in Dublin. Replacing another member of the original crew, he subsequently played an important part in the venture, acting as liaison officer and as co-pilot of the aircraft.* This Internal Memorandum is mainly concerned with the Meteorological aspects of the historic flight.

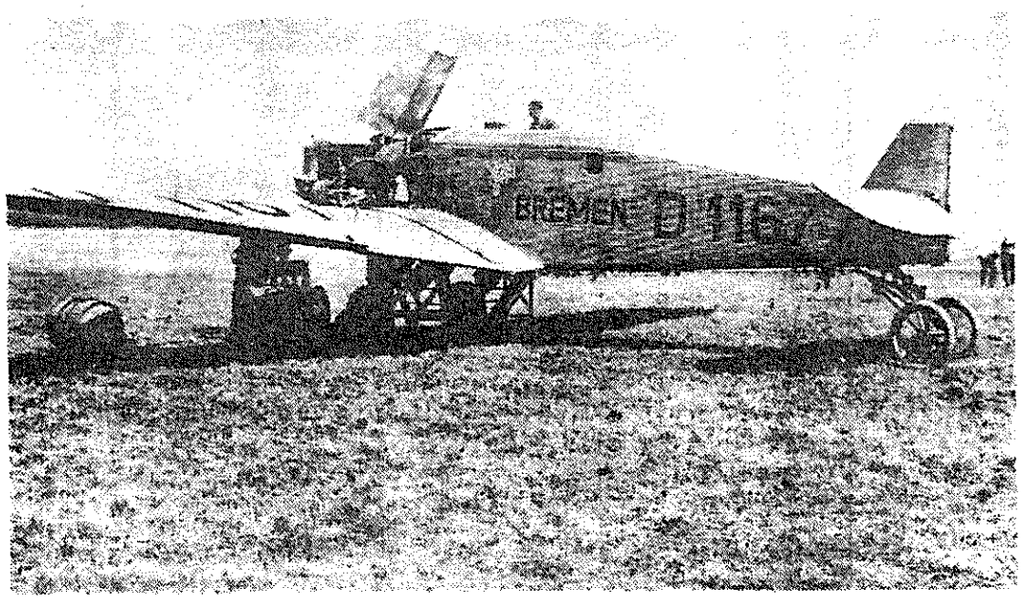

Fig 1. The Bremen at Baldonnel shortly before the historic flight on April 12th, 1928.

* The Fitzmaurice publication cited in this Memorandum was kindly provided by Colonel Bill Keane, former O.C. of the Air Corps.

Introduction

The first successful non-stop flight across the North Atlantic took place in 1919, (Alcock and Brown), from west to east. Later a westbound airship crossing took place in 1924 via the Azores, but the first westbound aeroplane flight occured when the German monoplane, "Bremen",(Figure 1) took off from Baldonnel, Co. Dublin, for New York on April 12, 1928, and made a forced landing on Greenly Island, Newfoundland,on April 13, 1928. Atlantic crossings by aeroplane at that time were considered to be no more than mostly "stunt-flights ..... adding little or nothing to our knowledge" (Parkin 1937). The exceptions, it seems, included the Alcock and Brown flight (1919), the Lindbergh flight (1927) and the first westbound crossing in the Bremen by Hünefeld (1928).

Weather Services at Baldonnel in the 1920's

Regular reporting of local weather conditions by telegraph from Baldonnel began in January, 1919. Baldonnel also acted as a Local Meteorological Forecast Centre until it was closed in April, 1922 and the duties transferred to Collinstown. These services were provided by British air force personnel. They terminated in the autumn of 1922 with the evacuation of the British Forces from Ireland. Special features of the duties at Baldonnel were the collection of weather information and the issue of reports and forecasts in connection with flights between England and Ireland.

After the formation of the new State in 1922 the Irish Air Corps was formed and based at Baldonnel. Local weather services were then provided on a more informal basis. It does not appear that regular weather observations were made there from the time it was evacuated by the British until after the Irish Meteorological Service was established in 1936. The provision of weather information at Baldonnel during the nineteen twenties rested with Father Bill O'Riordan, Chaplin to the Air Corps. He is reported to have made regular weather recordings as well as providing instruction on weather to the young cadets. In the interval between 1922 and 1937 however, the British Meteorological Office continued to hold responsibility in operating the network of weather observing stations in Ireland at places like Malin Head, Valentia and Roches Point. It also supplied weather forecasts for the Irish public.

It was thus to the British Meteorological Office the crew turned for advice on weather conditions over the North Atlantic when planning the Bremen flight.

In 1928 the British Meteorological Office, according to its Annual Report, supplied weather information to 6 trans-Atlantic flights, or projected flights, "chief amongst which was the first successful flight across the Atlantic from east to west" by the Bremen from Baldonnel on April 12, 1928. Commandant Fitzmaurice had been in regular touch by telephone with the British Meteorological Office during the period leading up to the flight.

A special forecast was supplied on the evening prior to the commencement of the flight and the probable conditions were discussed by telephone with Commandant Fitzmaurice. The 'Bremen' was not fitted with radio, so that no further weather advice could be passed to him en route.

The Development of International Meteorology in the 1920's

As early as 1919 some research on aeronautical meteorology had resulted in the production of a series of charts showing the typical and extreme weather conditions in the North Atlantic during April, May and June, and, in fact, these charts were published in the newspapers in April 1919 prior to the Alcock and Brown flight.

The type of information supplied by a forecast office to aircraft at that period consisted of:-

(1) Wind at the surface and at 2,000 ft.
(2) Weather in general terms
(3) Low cloud details
(4) Visibility
(5) State of sea, particularly local swell conditions at sea landing bases. This was of special interest to sea planes.

Soon after the first World War ended, the circulation of collective bulletins of European weather messages was resumed. A number of ships on the main North Atlantic routes also reported weather

conditions regularly. From 1922 onwards, reports from about thirty weather stations on the North American continent were monitored by radio in France and rebroadcast to other countries from the Eifel Tower. Already at this date it was possible to draw a rudimentary synoptic weather chart covering the North American, North Atlantic and European area. By 1927 not only had communications improved but the number of reports had increased considerably; seventy five station reports from North America were sent to Europe twice daily and weather messages came in from a dozen or so ships on the direct route from England to North America and a few from other parts of the Ocean.

The British Meteorological Office had been supplying meteorological information, and forecasts for projected trans-Atlantic flights since 1926. Among the arrangements for westbound flights introduced in 1927 were:

(i) A preliminary briefing took place on the meteorological conditions to be expected over the route, including the climatological frequencies of different wind speeds and direction. This briefing usually took place during the days preceeding the start of flight.

(ii) A special weather forecast was provided, prior to the commencement of the flight. Special synoptic charts were prepared twice daily. During certain periods a daily message was received by wireless from the U.S. Weather Bureau giving conditions and forecasts for the area extending from 40°W to New York, i.e. the second half of the route. (Dr. James Kimball of the U.S. Weather Bureau was the American advisor on weather for all trans-Atlantic flights for America).

The Aviation Climate of the North Atlantic

During the early part of this century the North Atlantic Ocean was considered "the greatest natural obstacle" (Parkin 1937) with which aircraft were confronted. The chief reasons for this were the distance from land to land, some 1850 nautical miles, and the severe meteorological conditions liable to be encountered in the area. Weatbound flights in particular suffered the greatest disadvantage.

The prevailing winds of the North Atlantic are westerly in direction mainly varying between south-west and north-west. On a great circle route from Ireland to Newfoundland, the average westerly component of wind in April amounts to somewhat less than 10 knots at 2000 feet altitude, thus nearly providing an average tailwind of 10 kts to an eastbound flight or 10 kts average headwind for a westbound flight. For an aircraft cruising at some 90 to 100 kts air speed, a typical westbound trip would very likely take some 20 percent longer than an eastbound one.

Figure 2 shows the general circulation at the surface over the North Atlantic for the month of April (in this Figure the isobaric spacing is at intervals of 2.5 mb). An extensive trough stretches from the Icelandic low southeastwards to Newfoundland and the eastern seaboard of the United States. While this trough reflects the mean meteorological conditions of the area, it also reflects a tendency for most depressions encountered there to be still in a state of development as they enter the North Atlantic from continental North America en-route to the southwest of Iceland. The typical tracks of the depressions are shown by the broken lines in Figure 2. On the European side of the North Atlantic the Azores high dominates and a ridge extension of this high stretches over western Europe. This extension of the Azores high, as seen in the general circulation for April, reflects the prevalence of high pressure cells in this part of the Atlantic or a tendency for depressions to be in decline, or in a state of occlusion, by the time they have crossed the ocean. Most depressions leave the Atlantic near the north of Scotland and their associated frontal systems cross Ireland into Europe.

Certain regions in the North Atlantic are also prone to dense fogs throughout the year. For example, fog occurs much less than 10 percent of days off the West of Ireland but up to 60 percent of days near Newfoundland. The prevalence of fog on the western side is accounted for by the frequency with which moist air within depressions meet southbound cold sea currents along the coasts of Labrador and Newfoundland, the air at the surface being thereby cooled. These fogs often merge with the overlying cloud so that the normal visual flight conditions above the fog, where the horizon may be scanned, becomes impossible. Accompanying precipitation and ice conditions in Winter and early Spring are also more frequently encountered in the region of Newfoundland. Because of these meteorological considerations

eastbound flights over the North Atlantic were likely to prove less hazardous for the pioneer aviators than westbound ones, occuring as they do near the start of the flight rather than during the critical landfall period.

The 'Bremen' Flight

The aircraft arrived from Germany at Baldonnel on March 26, 1928 and waited for favourable weather conditions until April 12. Pressure had been generally below normal in the North Atlantic during the month of March. During the last 10 days of the month a complex trough of low pressure remained over the west of Ireland giving much rain. On March 29 a depression off the northwest of Ireland deepened considerably as it moved eastwards causing further rain and gales. For the two week period up to April 12 surface pressure varied little over Ireland from a mean of about 1000 mb. During the first few days of April a quasi-stationary front lying north to south over the country gave occasional rain or showers, much layered cloud and moderate southwest to southeast winds. The front gradually weakened and weather conditions improved from the 5th onwards. Showers became more scattered and with increased sunshine the conditions of the sodden airfield gradually improved, as ground conditions had been a factor in the flight delay.

On the other side of the Atlantic, New York and the Eastern States were experiencing unseasonable hot weather. Temperatures in these areas rose to 27°C, on April 6, while heavy snow still fell in the Central States. In the meantime frontal troughs passed over the Great Lakes and Central Canada and entered the North Atlantic through Labrador. They were subsequently absorbed into an older trough already present in the eastern Atlantic. Local depressions were induced near the south of Greenland and remained for a time as quasi-stationary troughs on either side of the southern tip of the vast land and ice barrier. On April 10 the last of the North American series of troughs moved into the North Atlantic at Labrador ahead of an intensifying cell of high pressure. As the complex depression in the Atlantic began to fill slowly a northwesterly airflow from the west of Greenland developed in the western Atlantic (Figure 3). The situation looked promising; a slack trough in the east Atlantic, high pressure dominating in the west, separated by a fairly strong northwesterly airflow in the mid-western Atlantic.

Arrangements had been made for obtaining weather forecasts from the British Air Ministry in London at set times daily. From his first attempt to cross the Atlantic in the previous Autumn Commandant Fitzmaurice had frequently consulted with Captain Entwhistle, a Meteorological Officer at the Air Ministey. This was of great advantage as weather briefings had to be given over a long distance phone service. Briefings took place at about 2000 GMT after the 1300 GMT reports were received from America and the Weather charts analysed. In these briefings the general synoptic situation was discussed, the wind expected at the surface and at 2000 feet, the visibility and the weather likely to be encountered. These weather forecasts were published in the Irish Times, which also reported that special arrangements were made by the Germans for getting weather reports from ships at sea. By April 7 the Atlantic weather conditions were reported to be steadily improving. The general inference issued on the evening of the 9th (reported in the Irish Times) read that the depression off the west of Ireland and in the mid-Atlantic was clearing away, and that no secondary depression was forming or coming across from the American side. Final preparations for the take off got under way. The aeroplane wings were coated in parafin oil to help prevent ice forming on them. It was decided to start at 1800 GMT on April 11 but this was called off to await the night forecast from London. This final forecast would have been based on the synoptic chart for April 11, (Figure 3).

According to the Irish Times, (April 12, 1928), the final weather forecast from the British Air Ministry stated that the wind out to near mid-Atlantic was mainly between south and east at 10 mph up to 5,000 feet. Further west the wind gradually increased from 15 mph at the surface to 30-35 mph at 2,000 feet blowing from west to west-north-west. West of longtitude 30°W winds were expected to continue strong but decrease towards New York. Furthermore the general weather conditions in the forecast gave the sky cover as mainly threequarters to fully overcast, cloudbase mainly at 1,000 to 2,000 feet and a prospect of slight or moderate rain about mid-Atlantic. Visibility was to be generally from 5 to 10 miles apart from rain or showers and there was no danger of ice or fog.

Two routes over the ocean had been under consideration for the flight. One, a Great Circle route to St. Johns in Newfoundland, was the shorter sea route and the other some 300 miles south of this track, although a longer sea route, lay along the shipping lines. The weather conditions reported on in the Irish Times applied to the Great Circle route only, the route finally chosen by the aviators. Further south it was stated that the winds were stronger and that weather conditions were worse (because of an oncoming depression off the eastern seaboard of the U.S.). The depression then between Greenland and Canada, giving stronger winds, would not, it was stated, affect the airmen and that Newfoundland and Nova Scotia would be clear of fog. The paper added that so far as developments in forecasting then existed it was thought at Baldonnel that the weather was as good as could be expected for the time of the year.

A final conference with Professor Martin of Dunsink Observatory on astronomical matters took place. Just after midnight on April 12 confirmation on the weather came through on the telephone. Commandant Fitzmaurice then retired, the others already having done so earlier that evening, leaving instructions to be called at 0330.

Soon after sunrise (which occured at 0531 GMT) on April 12 the 'Bremen' took off from Baldonnel at 0538 GMT. Weather at take-off was clear and the wind was calm. When half way across the country the airmen reported that the ground was covered in fog and that the mountain tops were clear above, a condition which was typical of the slack trough situation over Ireland in the early Spring morning (Figure 4). The plane was reported over Galway at 0705 GMT and later left the fog covered coast of Ireland at Slyne Head light house, flying at 500 feet and heading west. For the next 200 miles the aircraft maintained an altitude of 1,000 feet but on encountering a minor trough axis at 20°W at about 0900 GMT a descent to 50 feet was made because of an increasing west to southwest wind, heavy overcast skies and some drizzle. Later a fresh northeast wind developed for a time and they ascended to an altitude of 3,000 feet.

The first drift check was also made about this time. This was accomplished by dropping two smoke bombs on to the ocean surface at timed intervals, turning completely back and making a run over the smoke bomb track, taking a drift reading and checking the ground speed. These drift checks were carried out at three hour intervals throughout the day.

Table 1

The probable wind speed and direction, averaged over 5 degree intervals of longitude, which the Bremen flight encountered on its route from Baldonnel to Newfoundland/Labrador at various flight levels, derived from the surface analyses 12/1300 (Fig. 4) and 13/0100 (Fig. 6). (Wind directions are in degrees true from north).

Longtitudinal Zone °West	05°-10°	10°-15°	15°-20°	20°-25°	25°-30°	30°-35°	35°-40°	40°-45°	45°-50°	50°-55°	55°-60°
Average Wind Flight Altitude	Dir.Sp. ° KTS	Dir.Sp. ° KTS	Dir.Sp. ° KTS	Dir.Sp. ° KTS	Dir.Sp. ° KTS	Dir.Sp. ° KTS	Dir.Sp. ° KTS	Dir.Sp. ° KTS	Dir.Sp. ° KTS	Dir.Sp. ° KTS	Dir.Sp. ° KTS
50 ft. or less	180 10	180 10	190 10	220 10	240 12	280 17	270 28	240 38 Max. 50 Kt.	300 40 Max. 50 Kt.	300 20	Light Variable
100 ft.	180 11	180 11	190 11	220 11	240 13	280 20	270 33	240 44 Max. 55-60 Kt.	310 46 Max. 55-60 Kt.	23	Var. 10
1,000 ft.	180 12	180 12	190 12	220 12	250 15	290 23	280 35	250 50	320 52	310 25	Var. 10
2,000 ft.	180 15	180 15	200 15	230 15	250 17	290 25	280 40	250 55	320 58	320 28	Var. 10

From the surface analyses for 12/1300 and 13/0100 (Figs. 4 and 6) the winds likely to have been encountered by the Bremen have been derived. These are listed in Table 1. This shows that the wind was light southerly as far as 20°W. Over the next 10 degrees the wind veered southwest to west, still mainly light. Throughout this first half of the sea journey isolated showers, some of them heavy, were encountered as well as a fair deal of sunshine. When the wind was favourable they climbed to higher altitudes but when it became adverse, height was reduced to 50 feet. Although, as Table 1 shows, the average zonal (5 degree) winds were initially from the south and later gradually veered more to the west, nevertheless, because of the presence of showers or minor troughs, the wind proved to be quite variable locally through much of the day, e.g. a southeast wind of 15 Kts was blowing near 30°W. Aircraft height therefore was changed accordingly from

50 feet to 3,000 feet. In addition, where possible the aircraft was flown around many of the showers. A position fix at local noon time, which occured at 1345 GMT, shows that the airmen had reached 27°W on a Great Circle track, Figure 5. With freshening headwinds after 30°W a flight level of 50 feet was maintained for much of the afternoon. Consequently with reduced ground speed, somewhat slower progress was made. With these considerations it appears likely that the aircraft position was still not far from 35°W at 1700 GMT.

As evening passed, the aircraft then at 3,000 ft. was flying over an extremely large bank extending "as far as the eye could see" away to the north and to the south. This report of fog may have been in-correct and what was seen was low level prefrontal cloud, the remains of a bent back occlusion in the northwesterly airflow. Fitzmaurice's account seems a bit unclear and the aviators were predisposed to expect such fog as they neared Newfoundland.

The U.S. Weather Bureau 1300 GMT analysis for April 12, 1928 (Figure 4), does not show any distinct trough in the northwest airflow in mid-west Atlantic. Nonetheless, a detailed analysis of the surface wind and temperature changes over southern Greenland during April 11 and 12 seems to support the existence of such a trough in the area off the west coast of Greenland. From the analysis on April 11 (Figure 3) the weather report on the west coast of Greenland shows an east wind of 15 kts and a relatively warm temperature of 03°C while on the south coast of Greenland the wind is from the north and temperature is also 03°C. On April 12 (Figure 4) the wind on the west coast has backed to the north and temperature has fallen by 10°C to -7°C while the wind on the south coast reports was east at 20 kts and the temperature still at 02°C. These changes are consistant with a southward moving trough in the area. This trough would have been advected southwards in the northerly airflow which had recently developed over the area. With such a development likely the analysis chart for 0100 GMT, April, 13, (Figure 6) has been constructed showing a wind pattern due to the presence of such a trough in the mid-west Atlantic. The windflow derived from this analysis between 35°W and 55°W has been used in Table 1.

As darkness approached, about 2130 GMT, at an estimated position of 42°W, see Figure 5, not only had the airmen to contend with increasing headwinds but they were also confronted with an extremely frightening black cloud bank reaching up to an estimated 20,000 feet. As ice threatened to be the greatest menace they descended to 50 feet but the mountainous waves forced then to climb again, climbing to 6,000 feet apparently in the hope of clearing the cloud sooner. They continued flying in a westerly direction "rocked and buffed by the force of the storm area (they) had entered. It was pitch black darkness ..... as hour followed hour without any let up" (Fitzmaurice 1953).

To add to the difficulties, when completely relying on their instruments the cabin lights failed and they then had to rely on the luminous dials of these instruments and on the unsatisfactory use of torches. Course was altered to the southwest to try to clear the area before heading west again. Soon the aircraft was icing up rapidly. With no de-icer on board it was necessary to descend again to a lower level. Later the engine was found to be loosing oil badly. In an endeavour to locate the cause of the oil loss, Commandant Fitzmaurice carefully made his way to the rear of the aircraft. Failing to stop the leak they feared engine seizure. As they expected to be over the open sea south of Newfoundland, they altered course (Figure 5) so that land could be reached as soon as possible. Flying northwestwards they continued their "desperate struggle with the storm and the night" (Fitzmaurice 1953).

After five or six hours of blind flying in "most abominable weather conditions constantly dodging ice" (Fitzmaurice 1953) they suddenly found that they were in the clear. After the nightmare it took some time for them to realise that they were through. The stars were visible and while Fitzmaurice refers to the magnificent Aurora Borealis which lit up the cold northern sky, he does not refer to the moon which it seems was 3rd Quarter and had arisen at local midnight. The only bright planet visible during the night was Saturn, which was fairly high in the sky at midnight. The position of the aircraft at that stage would appear to have been near 52°N 51°W at 0400 GMT. Climbing again and flying due west for two hours (Flight, 1928) they noticed black and white patches which they first took to be fog over the ocean but, flying low and with the aid of a white signal flare, they then discovered to be a snow covered wooded hill.

Uncertain of their position overland, whether they were over Greenland or Labrador, and not wanting to find themselves back in the storm again they climbed again and maintained course to await the arrival of the dawn. Unknown to them the depression off the eastern coast of the United States was deepening and moving northwards towards Nova Scotia. Ahead of it a south to southeast airflow was developing over Labrador. Upper level cloud too must also have spread across the skies obscuring once again the stars from view. With no knowledge of the wind pattern and with the uncertainty of compass flying over Labrador (Fitzmaurice also refers to discovering an error of some 40 degrees in the compass when dawn came) the airmen seem to have travelled a considerable distance to the northwest overland. 55°N, 67°W, seems the most probable estimate of their position soon after sunrise at 0930 GMT, (Figure 5). This position also agrees well with the accounts of the flight after that.

Realising that they must have travelled far to the northwest they altered course to the southeast in the expectation of finding the coastline. Finding a large frozen river in that direction, they flew along its banks well throttled back to conserve fuel. They passed over several large frozen lakes and through several snow storms. Figure 7 shows that they were also entering an area of freshening winds and deteriorating weather associated with the depression which was approaching the St. Lawrence river from the south. After several hours they were flying through a very heavy blizzard. Progress must again have been slow in this blizzard. In addition they had to climb to a higher altitude in order to avoid high ground. Eventually in a clearance in the storm they saw what appeared at first to be an iced-in ship but which later proved to be a lighthouse on Greenly Island situated on the Strait of Belle Isle, in the Gulf of St. Lawrence. Judging from Figure 7 an occluded fromt very likely passed through the area between 1600 GMT and 1700 GMT.

Dropping a smoke bomb they estimated a wind of 40 mph (approx 35 kts) which agrees well with the observed prefrontal wind on the 13/1300 GMT analysis (Fig, 7). Judging by the direction of this wind it is apparent that they arrived at Greenly Isle before the front cleared the area - had the front already passed, the wind would have abated and veered towards the southwest. Finally landing at about

1730 GMT (1230 EST) on a frozen lake, they had been in the air some 36 hours. The ice broke causing damage to the aircraft making further flight impossible. The crew were hospitably received by the lighthouse keeper and his family. After a well earned rest they awoke the following morning to find such conditions of visibility, which had they been present the evening before, would have made the task of finding St. John's airfield more probable.

Conclusion

While the detail in the accounts available of the first east to west successful trans-Atlantic flight are at times somewhat blurred, nevertheless a coherent picture of events does emerge from a range of sources. It was therefore possible to reconstruct in some detail what seems a fairly realistic time track of the flight and a reasonable picture of the weather encountered en route. That they encountered an intense trough in the mid west Atlantic is in little doubt; the source and extent of the trough has been analysed and described in this Memorandum. Having survived this first nightmarish storm in the Atlantic, the pioneer aviators had to battle once again with another blizzard overland on the following morning.

It was reported that the aviators had originally decided to take off from Baldonnel at about 1800 GMT on April 11. Had they done so it seems likely that they would have missed much of the extreme weather in the Atlantic, and have reached Newfoundland under pleasant high pressure conditions. Skirting the depression off the east coast of the United States, they would then have been aided by a tailwind overland down to New York. They decided however, to await the final forecast that night. In the event, good piloting, dedicated team work and good fortune ensured the success of the Bremen flight across the Atlantic ocean. For his part in the venture Commandant Fitzmaurice was promoted immediately to Major (April 13, 1928) and later that year (August 24,1928) to the rank of Colonel.

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6. The German Irish Atlantic Flight, Flight, Vol. 20 April 1928.

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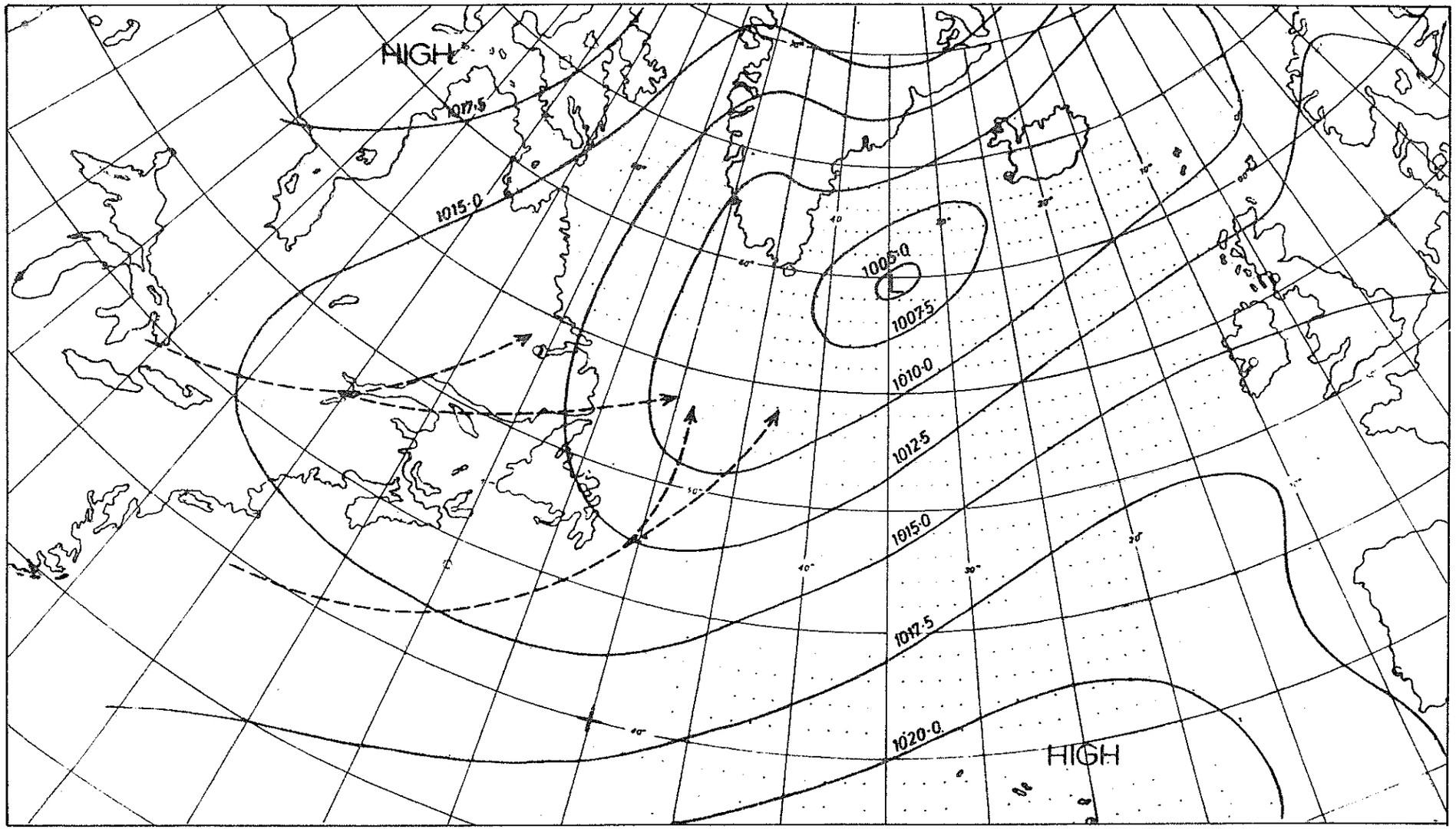

Figure 2. The general circulation at sea level for the month of April. Isobars are at intervals of 2.5 mb (solid lines). The typical tracks of depressions entering the North Atlantic from the North American continent are shown (broken lines).

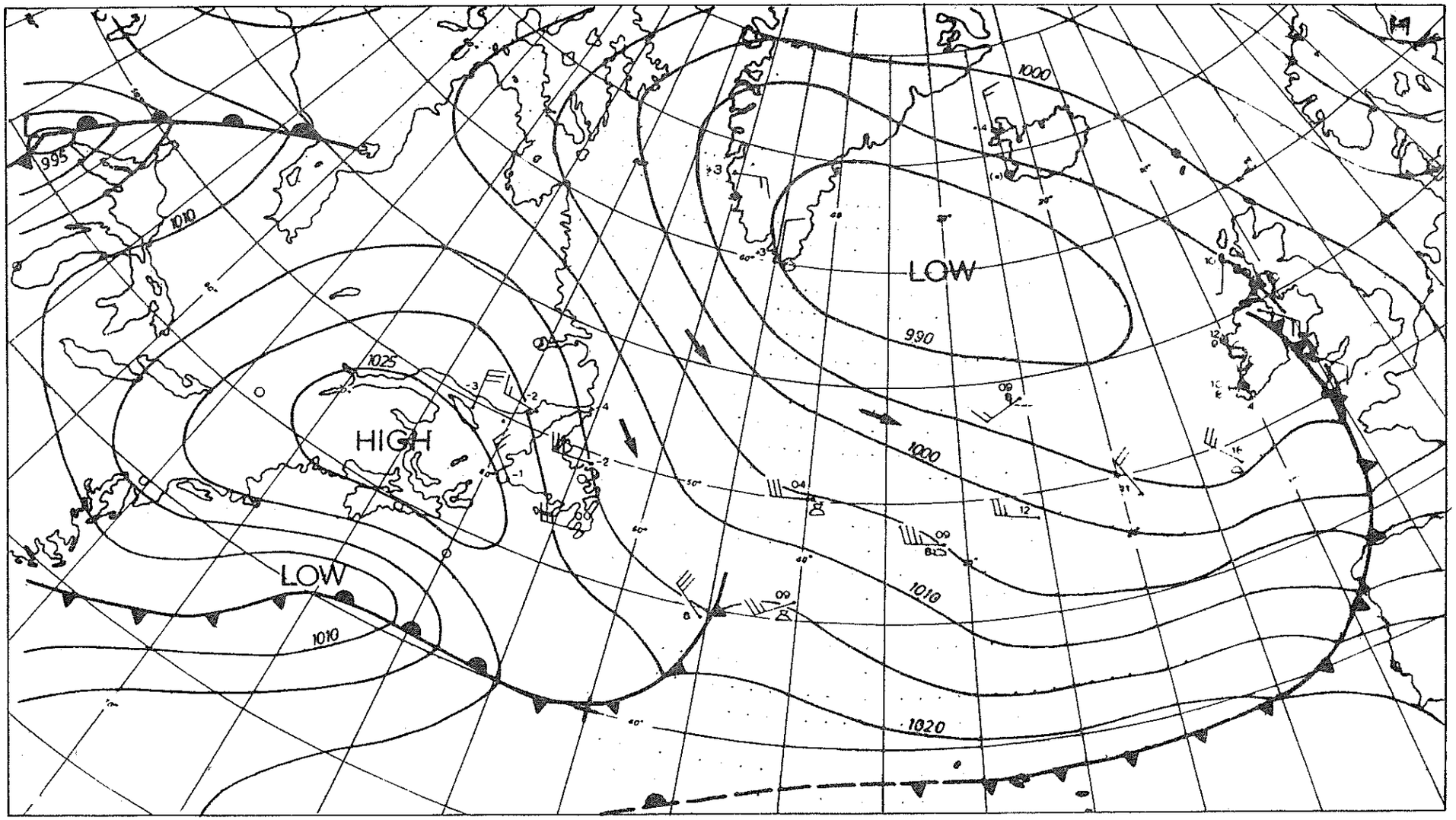

Figure 3. The surface synoptic analysis for the North Atlantic and adjacent land areas at 1300 GMT on April 11, 1928 (reproduced from the U.S. Weather Bureau Synoptic Weather Maps, Sea Level). Isobars are at intervals of 5 mb.

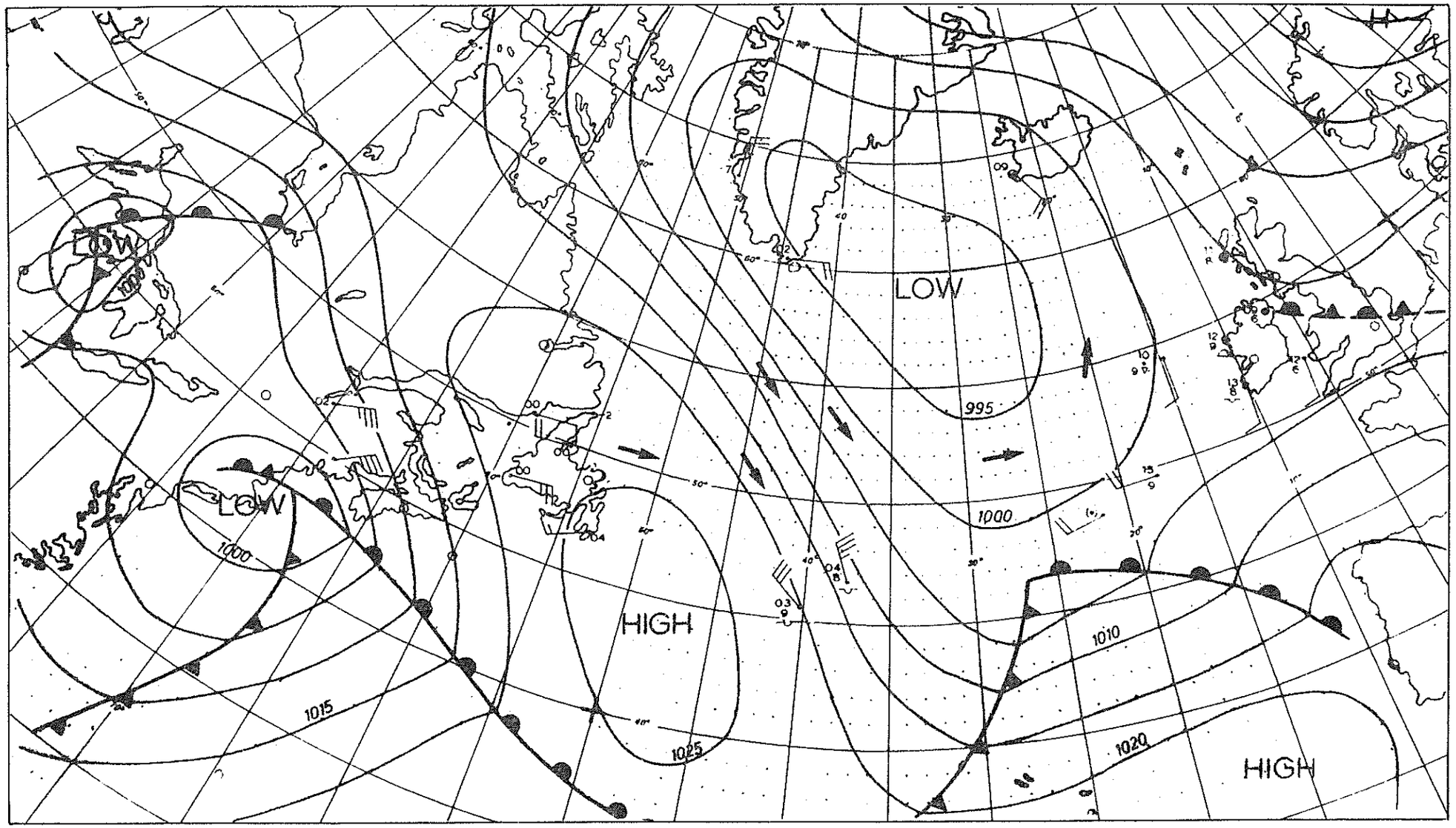

Figure 4. The surface synoptic analysis for the North Atlantic and adjacent land areas at 1300 GMT on April 12, 1928 (reproduced from the U.S. Weather Bureau Synoptic Weather Maps, Sea Level). Isobars are at intervals of 5 mb.

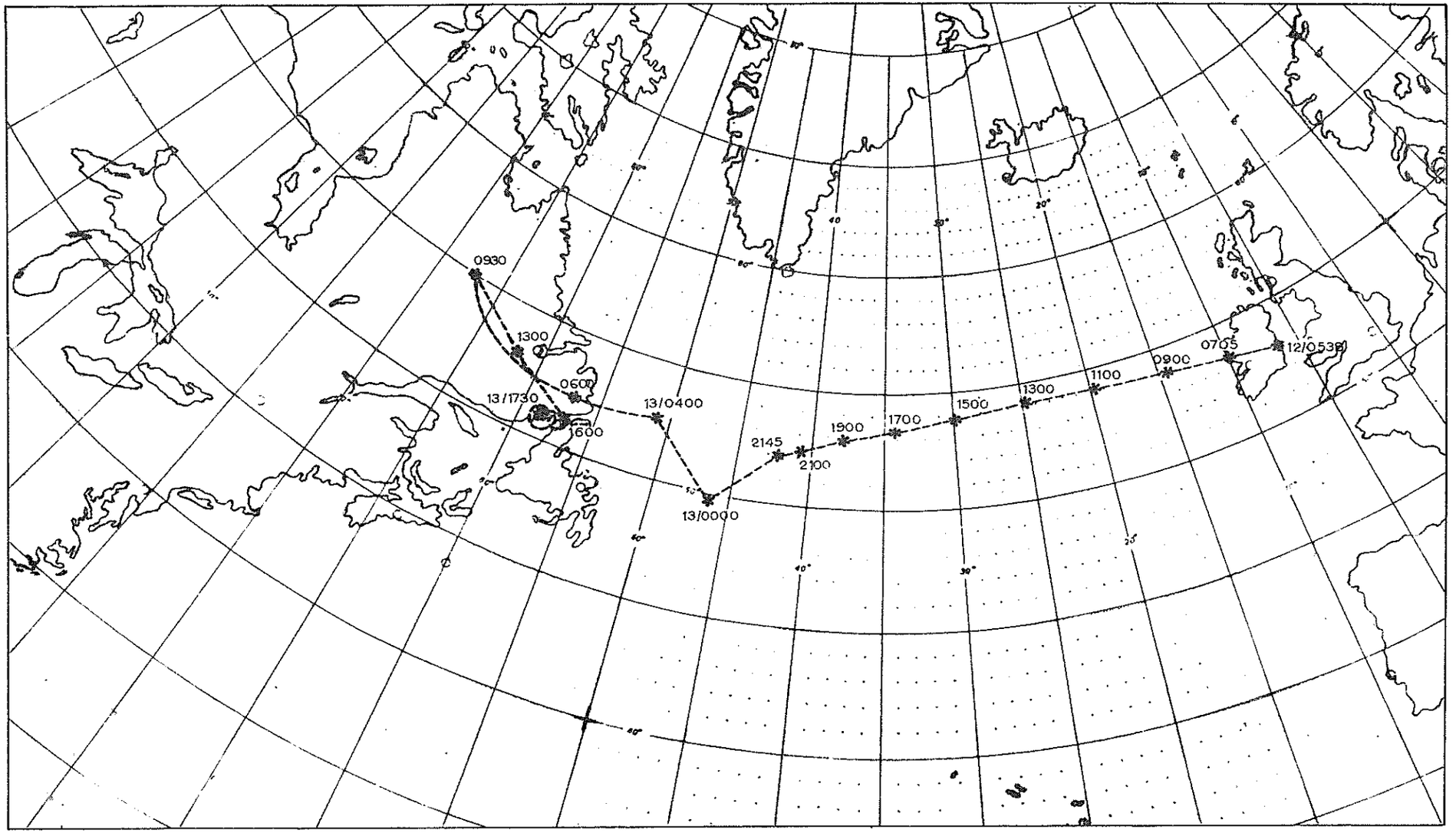

Figure 5. The probable Flight and Time-Track of the Bremen when it crossed the North Atlantic on April 12 and 13, 1928, reconstructed from the various sources listed in the index.

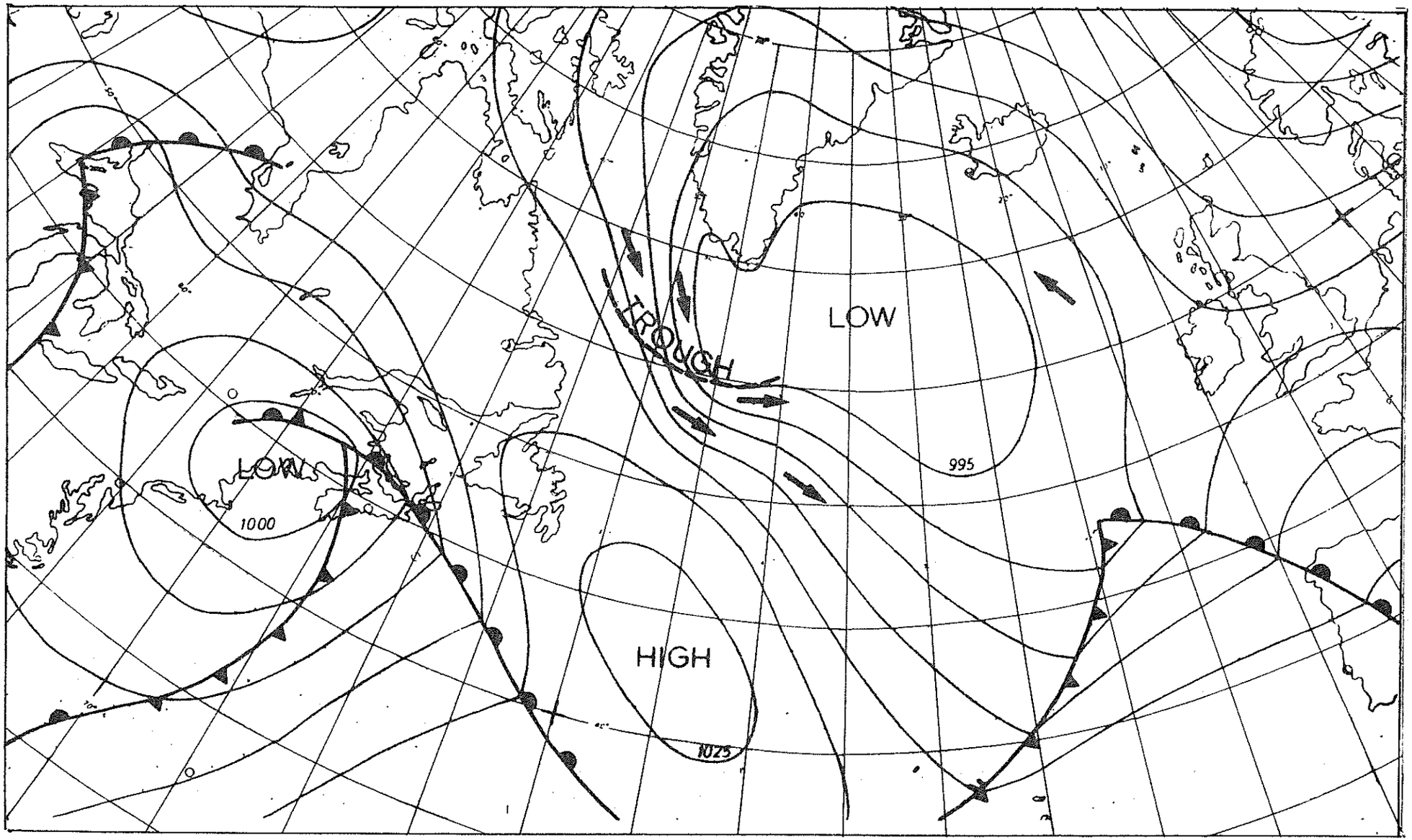

Figure 6. A surface analysis for the North Atlantic which approximated the synoptic weather situation at 0100 GMT on April 13, 1928 (see text). Isobars are at intervals of 5 mb.

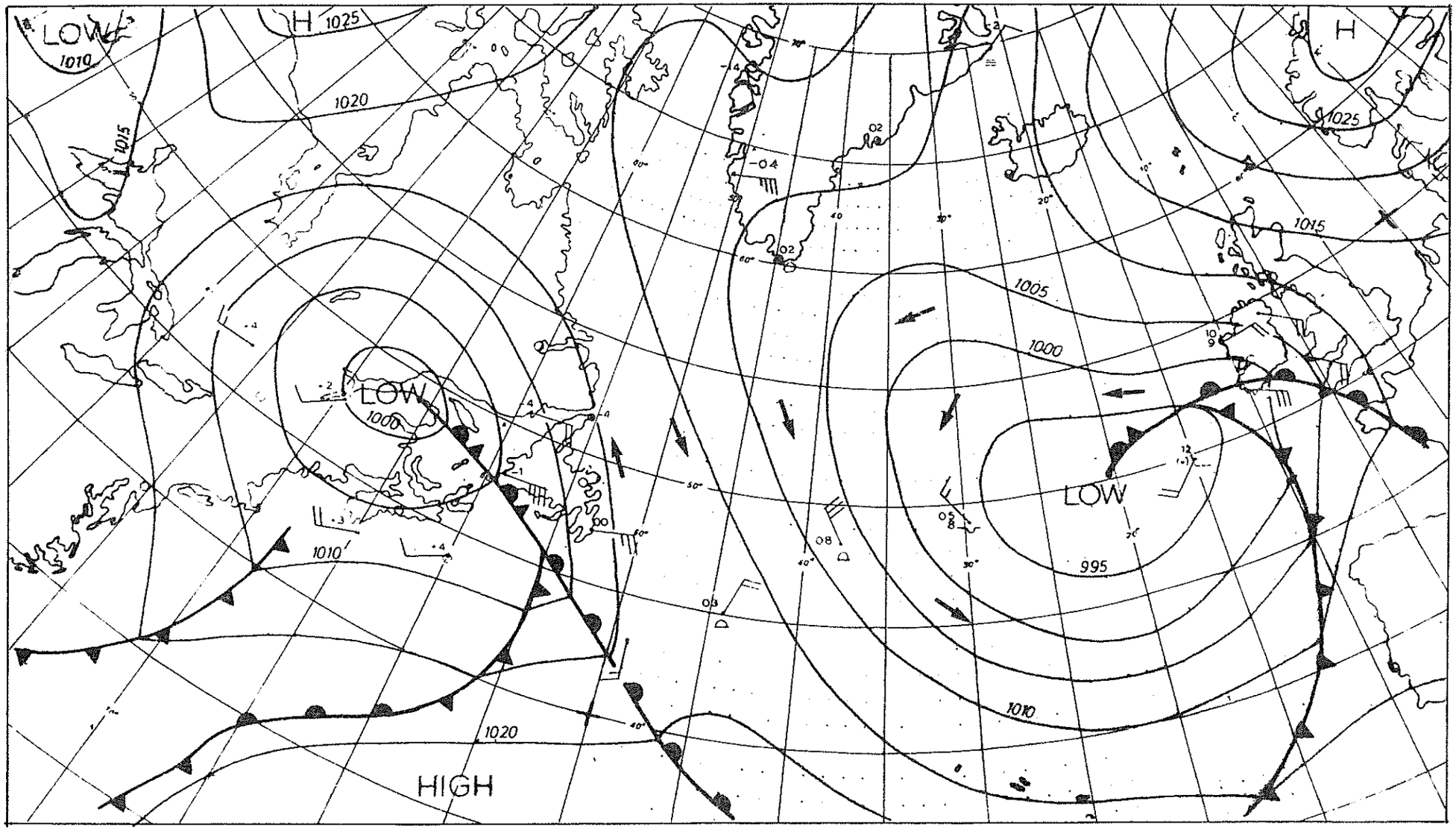

Figure 7. The surface synoptic analysis for the North Atlantic and adjacent land areas at 1300 GMT on April 13, 1928 (reproduced from the U.S. Weather Bureau Synoptic Weather Maps, Sea Level). Isobars are at intervals of 5 mb.