

# TO THE TOP OF THE WORLD BY AIRSHIP

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IN 1958 I was senior navigator aboard the first airship to penetrate the Arctic in more than a quarter of a century. We made the 4700 nautical mile round-trip in a United States Navy ZPG-2, at no time exceeding an altitude of 2100 feet above sea level, to evaluate the use of lighter-than-air craft in supporting arctic research.

No airship had flown over the North American Arctic since the *Norge* travelled from Kings Bay, Spitzbergen, to Teller, Alaska, via the pole in May 1926. However, in July 1931 the *Graf Zeppelin*, with the late Dr. Hugo Eckener in command, flew over the Barents and Kara Seas north of the U.S.S.R.

Our departure point was the USN Air Development Centre, South Weymouth, Mass., and destination was Ice Island T-3, on which was located an I.G.Y. scientific research team. Our airship was of standard configuration, measuring 348 feet in overall length and 110 feet in height. Powered by two engines, the ZPG-2 could maintain an airspeed of 40-43 knots for 75 hours with a 14-man crew, provisions and survival equipment and about 4000 Ibs (350 cu ft) of useful lift available for cargo. The still air range was 3000 nautical miles under these conditions.

## ROUTES

Resolute Bay, Cornwallis Island, was selected as the northern base for the operation. Several factors had to be considered when choosing the route and planning the flight. For economical cruising an airship should be flown at low altitude on long-range flights. When the airship climbed, the pressure ceiling of the ballonets was usually exceeded and helium had to be released; this reduced the lift capability and an increase in engine power was required to offset the loss in lift, accompanied by an adverse effect on range. Ideally, the engines should be used for forward motion only. Air temperatures were another factor to be considered. An increase in temperature caused the helium to expand and when the pressure limits of the ballonets were reached, helium was released and the subsequent loss in lift was offset by an increase in engine power.

An inland route via Fort Churchill was chosen because of its shorter distance and prevailing light winds, although a lower-flight altitude could have been maintained on the coastal route. However, the inland route presented no altitude problem as a detailed inspection of topographical maps revealed that the route could be flown at 2000 feet or less, above mean sea level. The increase in air temperature over the land during the day was not considered sufficient to cause trouble. This, of course, was not the case as we found later.

## PREPARATIONS

All unnecessary equipment was removed from the airship to reduce the weight, and several modifications were made to adapt the ship for high-latitude operations. The gyro magnetic compass was modified to cut out magnetic slaving of the directional gyro so that the compass system could be used beyond Churchill where the magnetic heading became unreliable. An N-1 gyro compass system was also installed as a safety measure. The extra effort to install the second compass system paid off; shortly after leaving Churchill, the primary gyro compass failed and the N-1 was used to maintain direction for the remainder of the operation.

In order to use the sun for heading checks, regardless of its relative bearing, astro compass mounts were installed in four positions, two fore and two aft.

A development model of the APN-77, a doppler navigation system for helicopters, was installed to provide drift and ground-speed information when over the Arctic Ocean. Unfortunately, this equipment went unserviceable before reaching the area. Neither the APS-33 search radar, which was one of the primary navigation aids, nor the driftmeter, required modifying for use in northern latitudes.

During June and early July, a party from the Naval Air Development Unit visited Ottawa to arrange for the use of Churchill and Resolute Bay. Helium, mooring facilities, and ground handling personnel were required at both bases. Temporary masts were erected at Churchill and Resolute Bay; two flights were required to airlift the masts. Thirty men were needed at each site to assist in ground handling the airship, in addition to the seven key ground handling personnel flown in by the support aircraft. Ground handling personnel were provided by the US Army First Arctic Test Centre at Fort Churchill and the RCAF at Resolute Bay. Arrangements were made to use the limited helium supplies retained by the US Army at Churchill and the US Weather Bureau at Resolute Bay, if required.

Our airship flight crew consisted of four pilots, two navigators, two flight mechanics, two riggers, two electronic technicians, one radio man, and one electrician.

Two Canadian observers took part in the operation, namely, Commodore O.C.S. Robertson, RCN, Canadian Joint Staff, Washington, and Mr. N. Gray, Dept. of Mines and Technical Surveys. All observers took part in the arctic portion of the flight, but several of the group travelled to and from the area with the support group personnel in a Constellation.

## **SOUTH WEYMOUTH TO AKRON**

We planned to fly all the way to Churchill under 2000 ft. above sea level by following the Hudson Valley to Albany, the Mohawk Valley to Lake Ontario, across the Rideau Lakes to the Ottawa River, up the Ottawa Valley to Earlton, and then direct to Churchill, a distance of about 1460 nautical miles. The flying time would be 36 hours under normal cruise conditions, and without a headwind.

The airship departed for Churchill at 2300 hrs. on 27 July, so as to take advantage of the lower night temperatures for the initial stage of the flight when the airship would be at maximum weight. Higher air temperatures and more widespread fog and cloud than had been forecast were encountered shortly after take-off. The possibility of navigating the Hudson Valley at the flight plan altitude of 1500 ft.

was ruled out and the airship was diverted to Lakehurst Naval Air Station, the most favourable base. The ceiling at South Weymouth had dropped below minimum.

Favourable winds and slightly lower temperatures were forecast for 30 July and we took off at 0500 hrs. The flight up the Hudson and Mohawk valleys was made in daylight in good visibility at an altitude of 800 ft; at noon the airship passed over Kingston, Ontario, and headed for the Ottawa Valley. Again, high air temperatures plagued the operation and helium had to be released frequently to keep within the pressure limits of the ballonets. Higher and higher power settings had to be used as the lift capability was reduced. This raised the fuel consumption beyond acceptable limits and made it impossible to reach Churchill. A decision was made to divert to Akron, Ohio, where the Goodyear Aviation Co. had suitable facilities. Cleveland was reached at dark, but severe thunderstorms along the south shore of Lake Erie throughout the night prevented mooring until 0900 hrs. the next morning. The night was spent over Lake Erie, a safe distance off shore.

At Akron the ship was lightened to the maximum extent commensurate with flight safety and crew fatigue. The crew complement was reduced by one pilot and four technicians, and about 1000 lbs. of equipment was unloaded. The two failures to reach Churchill clearly indicated that another attempt should not be made until surface temperatures along the route dropped from the mid-80's to the low-70's.

#### **AKRON TO CHURCHILL**

By 2 August the temperature had dropped, and with a forecast of favourable winds the airship departed Akron airport at 0130, 3 August, and headed across Lake Erie and western Ontario to Lake Huron. The Akron-Churchill flight was planned to take advantage of the lower temperatures over the water, by following Lake Huron to Sault Ste Marie and across Lake Superior to Lake Nipigon, and then direct to Churchill. Arrangements were made by the support group, waiting at Churchill, to refuel at Lakehead Airport if fuel consumption was again higher than predicted. In the afternoon, 15 hours after departing Akron, the airship was over Lake Superior abeam Lakehead Airport. Although the flight was proceeding as planned, it was decided to take advantage of the excellent weather at Lakehead Airport and take on extra fuel as an added precaution.

The airship landed on the runway and was refuelled on the taxiway without mooring. A fuel truck with an extra long hose was used to refuel and the airship was kept in position by means of the engines assisted by about 25 ground handlers. The operation, which included taking on 1000 gallons of fuel, extra oil and two relief pilots, was accomplished in 40 minutes, much less time than that required to untangle the traffic jam on the roads leading to the airport caused by the airship's arrival.

After refuelling, the airship departed for Churchill via Lake Nipigon and Trout Lake, arriving at 0730 on the morning of 4 August, 32 hours after leaving Akron.

While circling the Churchill area, waiting for the ground handling crew to assemble, we saw a herd of at least 200 white whale, including many calves, in the mouth of the Churchill River and in the bay to the east of the river mouth. After our second pass over the river mouth at 50 ft. the whales became alarmed and headed for the open bay. The airship provided an excellent platform for observing their activities. By 0900 the mooring operation had been completed.

High winds delayed our departure for Resolute Bay for two days. Normally, local high winds would not have affected take-off; however, due to a deep ditch and rough ground near the mast, the airship could not be safely manoeuvred. Several times during the delay gusts up to 50 m.p.h. were measured. Although the temporary mast was not designed to withstand winds over 30 m.p.h., it held the airship with no apparent difficulty. A crew remained aboard during the blow in case an emergency arose.

By the morning of 7 August, the winds had decreased to almost a calm and the en route weather was favourable; nothing worse than a crosswind component was forecast. The flight plan distance via Roes Welcome Sound was 1080 nautical miles and the flying time was estimated to be about one day.

Take-off was made in fog. At 500 ft. the airship emerged on top and we set course for Roes Welcome Sound. In the vicinity of Marble Island the fog and cloud dissipated and the weather remained clear until we reached the Gulf of Boothia. Shortly after leaving Churchill, the primary compass system failed and the N-1 system, installed for such an emergency, was used for the remainder of the flight.

We noticed several polar bears on the pans of ice off Chesterfield Inlet. As soon as the airship approached, they became panic stricken, diving and swimming first in one direction and then the other. One bear dived into the water dragging a partially eaten seal.

Roe Isthmus was crossed in twilight and clear weather. On entering Committee Bay, fog covered the water area and the remainder of the flight was made at 800 ft. while flying between the fog bank and intermittent layers of stratus. The N-1 Gyro held a steady heading during the many hours when no sun sight was possible. It was fortunate that the primary direction system failed when in good weather over Hudson Bay and not while flying between layers in Prince Regent Inlet. Radar bearings from prominent landmarks were used to maintain track.

At Resolute Bay the ceiling was 300 ft. and the radar was used to assist the instrument approach. An excellent landing was made under adverse conditions at 0830 on 8 August, 24 hours after departing Churchill.

#### **RESOLUTE BAY VIA T-3 TO CHURCHILL**

The temporary mooring mast had been erected 300 yards to the west of the Resolute Bay runway. The RCAF personnel, on short notice, had done an excellent job of grading the mooring area and preparing a taxiway. In the process, however, the permafrost had been exposed and the surface was muddy and soft in spots.

Taxiing to the mast and the mooring was carried out without difficulty, but the problem of getting the airship, with maximum fuel load, back to the runway over the soft taxiway caused some concern. Several flights out of Resolute Bay had been planned, but in view of the poor condition of the taxiway, it was decided to make only one 40-hour flight: crossing the Archipelago to T-3 at 79N 121W and then proceeding to Ellesmere Island before returning to Resolute Bay.

Light winds and clear skies were forecast for the next 36 hours for the western part of the Archipelago and along the route to T-3. Hence, only a 12-hour stop was planned and take-off was set for 0900 local time. As had been expected, difficulty was experienced in getting the airship from the mast to the runway. At one point, even a forklift was used to help extract the starboard undercarriage from a soft spot in the taxiway. As a result, the take-off was delayed four hours.

On reaching an altitude of 500 ft. we set a westerly heading for the southwest tip of the Bathurst Island group. When off Cape Cockburn, we set course direct to Mackenzie King Island passing to the east of Byam Martin Island. This route was the shortest low-altitude flight path across the Archipelago to T-3. Ideal weather prevailed, the winds were light and the visibility unlimited. No open water or leads were seen between Byam Martin Island and Mackenzie King Island. Six caribou were observed a short distance inland from the east coast of Mackenzie King Island.

Low stratus and fog covered most of the remainder of the route to T-3. Tops of the clouds and the fog varied between 300-800 ft. No icing was encountered when flying through the ragged tops of the layers as the air temperature was several degrees above freezing. The fog and clouds were broken sufficiently to permit drift observations and to make heading checks by using the reflection of the sun on open patches of water. The configuration of the airship prevented observing the sun direct when checking the heading. The final alteration of course was made with the aid of a radio compass bearing on the beacon at T-3. On reaching T-3, altitude was reduced to 200 ft. but visibility was poor and no attempt was made to unload the scientific gear; however, bags of mail were dropped.

After spending about an hour in the vicinity of T-3, we headed for Resolute Bay via Borden Island, the Findlay Group and the Bathurst Islands. By returning direct to Resolute Bay we had sufficient fuel to continue on to Churchill if the weather were favourable, thus avoiding the hazardous ground conditions at Resolute Bay. Stratus cloud and fog, topped at 500-800 ft., prevailed until reaching Borden Island where the skies became clear. We observed 12 caribou on Lougheed Island, and eight muskox and a polar bear inland from the head of May Inlet, Bathurst Island.

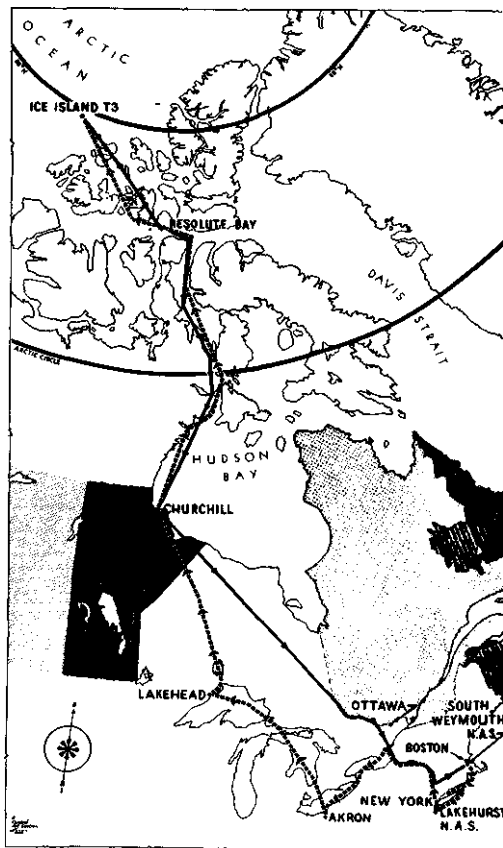
Seventeen hours after departing, the airship was again over Resolute Bay. After consultation with the meteorological officer by radio, we decided to proceed direct to Churchill as 36 hours fuel remained and the flight time to Churchill was estimated to be 27 hours in good weather. The flight crew, as well as the support personnel, were greatly relieved at not having to face a second landing at Resolute Bay with the possibility of encountering serious trouble taxiing to and from the mast. Weather conditions were excellent along the return route, and on the evening of 10 August Churchill came in sight, 44 hours after the original departure from Resolute Bay.

## **CHURCHILL TO SOUTH WEYMOUTH**

Radio reports received while approaching Churchill indicated that the favourable flight weather over Ontario would hold for another 36 hours. As a result, it was decided to depart for South Weymouth immediately after refuelling. The airship was held on the runway by the engines and ground handling personnel. Sufficient fuel for the flight to South Weymouth was pumped on board. I checked the weather charts and filed the flight plan during the refuelling.

At 2240 hrs. we cleared Churchill and set course for South Weymouth. Shortly after sunrise, the Severn River was crossed and at noon the airship passed over Cochrane, Ontario, causing considerable excitement. Nearly everyone in town was out in the streets. During the evening, several thunderstorms were circumnavigated north of Mattawa, Ontario, but otherwise the flight across Ontario and down the Ottawa River, across the Rideau Lakes to Lake Ontario, and down the Mohawk Valley and Hudson Valley, was uneventful. At 0825, 12 August we landed at South Weymouth, 32 hours after departing Churchill, and almost 78 hours of continuous flight after taking off from Resolute Bay on 8 August.

The operation demonstrated that a ZPG-2 airship can provide low altitude, slow speed, visual and photographic reconnaissance over a wide radius in the Arctic, and, in addition, it is an excellent platform for scientific investigations.



The route flown by W/C Greenaway and the crew of United States Navy airship ZPG-2. ZPG-2 lands for re-fuelling.