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The R.100 in Canada

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Introduction

Today, airships are seen as impractical flying machines, as flying dinosaurs useful only during the World Series. The image of the German rigid airship *Hindenburg* bursting into flames at Lakehurst, New Jersey, in May 1937 is the only knowledge many people have of airships. It was not always this way.

Small non-rigid airships, later known as blimps, were used in many early air shows, like the one at Lakeside (now Pointe-Claire) near Montreal, held between 25 June and 5 July 1910, Canada's very first air show. In July 1919, a British rigid airship, the R.34, became the first flying machine ever to cross the Atlantic from east to west, between England and the U.S., and the first to make a round trip between England and North America. During the late 1920s and early 1930s, the large rigid airship was seen as the only practical way of carrying passengers and mail across the Atlantic and the Pacific. Many schemes were considered; the German transatlantic airship service, made possible by the *Graf Zeppelin* and the *Hindenburg*, is by far the best known among them.

This Knabenshue airship was flown by Cromwell Dixon at the Montreal air meet.

The Graf Zeppelin *in a hangar*

The R.34

Handling a large airship like the Graf Zeppelin *was no easy matter.*

The Imperial Airship Scheme

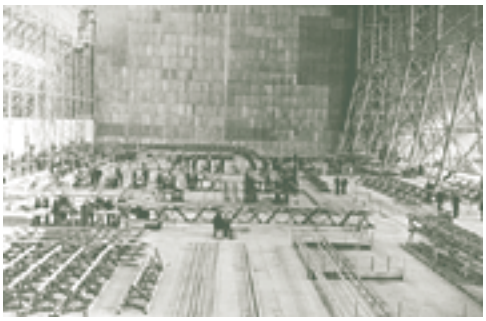
Some of the buildings at Cardington

What people tend to forget is that Great Britain had such a scheme, the Imperial Airship Scheme, put forward in 1924 after an extensive political tug-of-war by Ramsay MacDonald's first ever Labour government in Britain. The man behind the scheme was the new Labour Secretary of State for Air, Lord Thomson of Cardington. The original idea for the scheme had, in fact, come from proposals put forward in 1922–1923 by an ex-Royal Navy officer, Charles Dennistoun Burney.

The 1924 scheme was to include both research programs and the manufacture of two very large rigid airships, the largest in the world at the time. These airships would be the R.100, designed and built by a private company, the Airship Guarantee Company, a subsidiary of Vickers headed by Burney, at Howden; and the R.101, designed and built by the Royal Airship Works, a government concern controlled by the Air Ministry, at Cardington.

The ultimate goal of the scheme was to create a commercial airship service between the far flung Dominions and the mother country, which would bind the Empire closer together, reduce the isolationist tendencies of some Dominions, and keep it commercially competitive with the United States on a worldwide basis. At that point, the road to India was of primary interest; Canada was hardly considered at all, because of the risks involved in crossing the North Atlantic. In 1924, it was estimated that the two airships would be completed by 1927, but both design teams soon ran into technical, financial and political snags; the R.100 team also had to deal with two strikes.

Building the R.100 at Howden



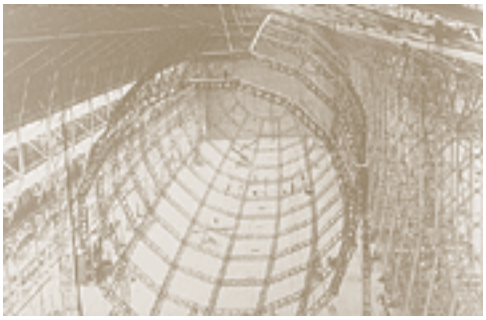
Some structural elements of the R.100 in the Howden hangar.

From the start, there was also little co-operation or exchange of information between the designers of the R.101, "the Socialist airship," and the designers of the R.100, "the Capitalist airship." Among the many reasons for this were the apparent lack of tact of the design team at the Royal Airship Works; the poor organization at the highest level of the Air Ministry; the rivalry and competition between government and private enterprise; and the abrasive temper and abrupt frankness of the chief designer at the Airship Guarantee Company, the now-famous Barnes Wallis, creator of the Wellington bomber, the bouncing bomb used by the Dam Busters, and the Grand Slam and Tallboy earthquake bombs.

Wallis was not the only well known personality working at Howden on the R.100; the team's chief calculator was none other than Nevil Shute Norway, who later gained an international following as Nevil Shute, author of *A Town Like Alice*, *On the Beach*, and many other novels.

The R.100 in flight over England

Even though the original specifications for the two airships were identical, the R.100 and the R.101 were significantly different.



The light alloy structure of the R.100; two workers can be seen on top of the ship.

The R.101

The workmanship on the R.101, as well its general appearance, was clearly superior; unfortunately, the same could not always be said of the materials used. The airship was also full of untried gadgets and ideas, very often heavy, unworkable and quite superfluous. Its first flight, on 14 October 1929, proved without a shadow of a doubt that it was both seriously overweight and under-powered. To this day, the R.101 remains surrounded in controversy; opinions vary from "the crudest piece of design they had ever seen" to "one of the best airships ever constructed."

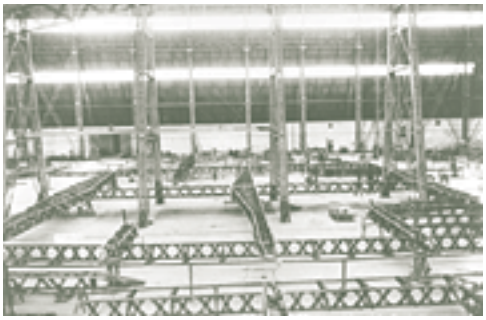
In November 1929, after a series of ten test flights, the R.101 was returned to its shed. There, it was lightened by removing some structural elements, and the "harness" surrounding its gas cells was loosened to allow an increase in the volume of hydrogen inside them. When testing resumed in June 1930, the engineering team discovered considerable chaffing, which was causing significant leakage of hydrogen. It was determined that further improvements were required. In late June 1930, in order to give still more lift for the long and arduous trip to India, the R.101 went back into a shed at Cardington to be lengthened by almost fourteen metres. This process was only completed in late September 1930; the alterations were little more than a qualified success.

The R.100 near the mooring mast at Cardington

The R.100

On 16 December 1929, seven weeks after the R.101's first flight, the R.100 was gingerly taken out of its shed at Howden by four hundred soldiers; the first flight was a great success. It very quickly proved its superiority as a flying machine over its rival, the R.101.

A seven-month period of exhaustive testing followed, including seven successful test flights, one a fifty-four hour endurance flight over England and the surrounding waters. It was during the R.100's sixth flight, in May 1930, that its tail cone collapsed because of air pressure. After that, its tail was rounded and shortened by approximately four metres.



Some elements of the R.100's hull

By definition, an airship is a very impressive piece of engineering; a large rigid airship especially so. Described by one author as a "flying cathedral" because of the impression of lightness and spaciousness created by its internal structure, the rigid airship could also be described as a series of balloons inside a very long birdcage.

The main components of an airship like the R.100 are a streamlined hull, to house the gas cells that contain the hydrogen gas needed for lift; a control car, to house the controls and command crew; engine nacelles, to house the engines and their mechanics; and cruciforms, that is, cross-shaped tail surfaces, that provide stability and control.

The R.100's hull was composed of a lightweight metal structure made up of rings and longitudinal beams braced with kilometres of metal wire. This framework was covered with doped (that is, varnished and waterproofed) linen fabric. Inside the hull were the fifteen gas cells, made up of cotton fabric and gas-tight material, in this case goldbeater's skin (the outer membrane of the large intestine of cattle). The gas cells, built by a Zeppelin company subsidiary in Germany, were filled with hydrogen, a gas much lighter than air; a balloon filled with 100 m^3 of hydrogen can lift a mass of 109 kg. The lower part of the hull contained room for both the crew and passengers.

The passenger coach and the control car of the R.100

One of the passenger cabins

Accommodation for the 100 passengers was on two levels, in 14 two-berth and 18 four-berth cabins, just above the crew's quarters. The 56-seat dining room, by far the largest room in the ship, was found on the lower level. On either side were cabins and a passageway leading to a balcony promenade from which the passengers could see the view below. The upper level included a gallery overlooking the dining room and, on either side, more blocks of cabins, a passageway and a smaller balcony promenade. A double set of staircases connected the two levels of the passenger coach.

The dining room

The lower and upper balcony promenade on the port side of the R.100

The upper level overlooking the dining room

The double staircases connecting the two levels of the passenger coach

The R.100's control car

The control car, very spacious and with a spectacular view, was attached to the lower hull, just below the crew's quarters. The three engine nacelles were also attached to the lower part of the hull, to the rear of the control car. Each of them contained two reconditioned Rolls-Royce Condor IIIB liquid-cooled V-12 engines of 650 hp, mounted in tandem. The control surfaces were located at the rear; they consisted of both fixed areas for stability and moveable ones for control. Their internal structure was identical to that of the airship's hull; the covering material used was also fabric.

Two of the engine nacelles

The original pointed tail of the R.100

Prime Minister King (second from left) and other officials at Cardington in 1926

St Hubert

Canada really became involved in the Imperial Airship Scheme during the 1926 Imperial Conference, when Prime Minister William Lyon Mackenzie King, showing an unusual amount of enthusiasm, pledged Canada's assistance to the mother country. Patriotic duty was not the only thing he had in mind—King was certainly counting on an increase in foreign trade if the program came through. Ironically, of all the Dominions, only Canada and South Africa, the two isolationist black sheep, showed any inclination toward the Airship Scheme; the Air Ministry's well-rehearsed presentation had fallen somewhat flat, since Australia, New Zealand and Ireland were not convinced of its value.

Despite problems at the House of Commons, money was set aside for the construction of an airship base, airport and mooring mast in eastern Canada. British experts came over in May 1927 to choose a site; they visited a number of locations in Ontario, Quebec and Atlantic Canada, finally settling on a piece of land on the south shore of Montreal, at St Hubert, and officially announcing this decision in August 1927. Work on the airfield began almost immediately and St Hubert's first airmail delivery took place in November 1927. It was also during the summer of 1927 that the Air Ministry decided to send the R.100 to Canada, and the R.101 to India.

The airport at St Hubert in 1930

The mooring mast at St Hubert was a gigantic structure, sixty metres high, which enclosed all the complex machinery required for mooring, refuelling and servicing future airships coming to Canada. Design work was done in Canada by the Department of Public Works while Canadian Vickers of Montreal received the building contract. To ensure proper handling, and at the request of the British authorities, a small team from the Royal Canadian Navy spent eighteen months training at Cardington.

The mooring mast of St Hubert under construction

The St Hubert mooring mast

Preparations were also made to handle the huge crowds, 600 000 people or more, which were expected to flock to see the R.100. In anticipation, the Canadian National Railway (CNR) ran an extra siding into St Hubert; elaborate traffic regulations were prepared and published in the papers; special flights in and out of the airport were duly planned; and a special camp was established for the six hundred troops needed for traffic and crowd control.

Media coverage was on a scale never seen before in Canada; the CNR, the Canadian Pacific Railway and other groups set up observation posts in a number of places, in both Quebec City and Montreal. It was agreed that bilingual official commentators would be on hand, but only after a fair amount of pressure was applied by some newspapers and Quebec Members of Parliament. The mooring tower was finally completed in May 1930. The flight of the R.100 to Canada was originally scheduled to take place in May or June 1930, but was delayed. Unfortunately, one of the R.100's fins was damaged in April 1930, and the ship's tail cone was damaged in May. By the time these were repaired, the event had to wait until after the Canadian federal election, in late July.

One of the observation posts

Some of the equipment used to broadcast the arrival of the R.100

The Flight to Canada

After the numerous delays, the R.100 began the journey for Canada on 29 July 1930; there were thirty-seven crew members and six passengers on board, including the recently knighted Sir Charles Dennistoun Burney.

The crew of the R.100

The officer in charge of the flight, Major George H. Scott

The transatlantic passage was smooth but the airship ran into difficulties over the St Lawrence valley on a couple of occasions. Near l'Ile aux Coudres, the R.100 was buffeted by shifting winds like never before. A number of very large tears appeared on three fins and the engines had to be stopped for eight hours so that repairs could be made. The people of Quebec City, forty thousand or more, cheered and waved as the airship slowly flew overhead. A second incident occurred closer to Montreal as the R.100 flew through storm clouds, and very strong updrafts caused more damage to the fabric of the fins.

The R.100 made a successful, and very fast, mooring at St Hubert shortly after sunrise on the morning of 1 August 1930; the flight had taken almost seventy-nine hours.

Arriving at St Hubert

Montreal mayor Camillien Houde, with the cane and panama hat

Upon its arrival, Montreal simply went wild; there were dozens of VIPs on hand, and a huge crowd. Companies used the visit to advertize everything from beer to cigarettes; there were signs everywhere, not to mention special R.100 songs, in both English and French. The forty-six–by–nine-metre sign erected by the Sun Life Insurance Company was by far the biggest. Two dozen aircraft transported sightseers by the hundreds. According to some estimates, more than one million people came to see the R.100 at St Hubert; three thousand actually had a chance to tour the airship, many of them "borrowing" souvenirs along the way. The visit may have been a rare pleasure, but the half-metre gap between the airship's gangway and the tower's platform gave quite a scare to many visitors.

Some of the people who flocked to St Hubert

A postcard sold during the R.100's visit

The R.100 moored at the mast

A number of aircraft transported sightseers

Climbing aboard the R.100 was not for the timid.

There were banquets too, ten or so in all, in Montreal and Toronto, where Burney and Air Ministry representatives extolled the virtues of airship travel, and greater Imperial co-operation.

The two sides did not always see eye to eye; the British officials promoted the Air Ministry's ideas, while Burney put forward his own. All offers of help by the U.S. Navy were politely but decisively turned down by the federal authorities; this was, after all, Canada's day.

New fabric panels for the damaged fins were prepared by Canadian Vickers, which also did some interior repair work.

Numerous speeches were made and broadcast.

The Flight Over Southern Ontario

Flights over southern Ontario, Quebec and the Eastern Townships had been planned from the start, but had to be postponed and modified due to the damage to the fins. On the evening of 10 August, the R.100 left with a number of senior military officers, government officials and one journalist, eighteen people in all. During the next twenty-six hours, it flew over Ottawa, southern Ontario, the Niagara Peninsula and most notably Toronto, where the R.100 caused horrendous traffic jams. Everything worked perfectly, until the reduction gear of one of the engines failed just before mooring, and the propeller spun away into the St Lawrence River. Repairs could not be made since the special derrick needed to hoist the engine had been left in England; the R.100 had to fly home on five engines instead of six. The R.100 started back to England on 13 August, as thousands cheered it on; many were expecting to see it return within a few months.

Some of the officials who flew on the R.100 on 10 and 11 August

The R.100 at St Hubert

Inside the control car

Niagara Falls

Toronto seen from the air

The R.100 above the St Lawrence River near the Thousand Islands

The R.100 over Toronto

Shadow of the R.100 over the Welland Canal

Over Montreal

Passengers admiring the view

The R.100's new rounded tail

There were thirteen passengers, including nine journalists, among the fifty-six persons on board. The journalists' articles provided a fascinating description of life aboard the R.100 during the return flight though, far from being excited, they found the whole trip somewhat boring. The trip was uneventful for the most part, but because of a short circuit in the electrical system, the passengers and crew had to make do with cold lunches, not to mention no hot water!

Thanks to a tail wind, the transatlantic flight took only fifty-six and a half hours; the crowd waiting at Cardington was disappointingly small, only two hundred cars or so, because of an England-Australia cricket match.

After its safe return to England, on 16 August, the R.100 went straight into a shed at Cardington to be thoroughly examined, repaired and overhauled in preparation for other long-distance flights.

A few dignitaries

The press hangar at St Hubert

A few officers and passengers in the control car

The dining room

The kitchen

Calculating the R.100's position required the navigator to climb to the top of the ship.

The Flight to India

While this was going on, the Air Ministry kept prodding the staff of the Royal Airship Works at Cardington, urging them on. As far as they were concerned, the R.101 had to fly to India and back in October 1930; the timing was crucial. The Air Ministry was working on a new, expensive airship development program and Great Britain could no longer afford to pay for it alone. An Imperial Conference was to take place during that time and, with the world's economy taking a nose-dive on all fronts, the best way to convince the Dominions to invest in the new scheme was to stir their Imperial pride. There was also talk that the Secretary of State for Air, Lord Thomson of Cardington, was slated to become the next Viceroy of India. The engineers at Cardington, as well as some of the airship's officers, were somewhat pessimistic, but they may have kept silent in order to save the entire program being cancelled.

The R.101 departed the mooring mast at Cardington on the evening of 4 October 1930; the long-awaited trip to India had begun. Even though this was to be the second time it had flown since being lengthened, a temporary certificate of airworthiness was only handed to its captain just before departure. There were fifty-four people on board, including Lord Thomson, the Director of Civil Aviation and the Director of Airship Development; the weather, with rain and wind, was quite bad.

After seven and a half hours in the air, the R.101 had covered only 355 km; an engine had failed temporarily and the weather was worsening. At approximately 02:10, near Beauvais, France, a large tear appeared in the outer cover, near the nose, exposing the gas cells to severe chaffing and buffeting. As hydrogen gas poured out of the enormous gash, lift decreased and the R.101 went into a steep dive, from which it recovered; it dove a second time and gently made contact with a small hill.

Suddenly, the R.101 burst into flames; it was all over in a matter of minutes. Only eight people managed to walk away form the wreckage, two of them dying the following day. Among the victims were all the VIPs, including Lord Thomson. People across Canada expressed their sorrow; flags flew at halfmast at armouries, public schools and city halls.

The state funerals given to the victims did nothing to reduce the national state of shock and the feeling of impending doom hovering over the entire scheme. With the gradual closure of the Howden airship base, the engineers at the Airship Guarantee Company found themselves unemployed. A public enquiry was held, but its 1931 report could not pinpoint the exact cause of the accident. It did say, however, that public policy decisions had played a part in the early departure, and subsequent crash, of the R.101.

Despite all hopes and efforts within the Air Ministry, the R.101 disaster signalled the end of the Imperial Airship Scheme, and of all work on rigid airships in Great Britain. As in all cases before, the British government decided to terminate its airship activities without any prior consultation with the Dominions; Canada, like the others, was simply told that it was all over. As a result, the R.100 was broken up between December 1931 and February 1932; the structure was dismantled, flattened with a steamroller and sold at scrap value.

One of the control wheels of the R.100

Epilogue

The two hangars at Cardington stand to this day, a silent reminder of a long forgotten dream; the mooring mast was dismantled during the Second World War because of the metal shortage in the United Kingdom. As its builder had wanted and predicted, St Hubert became the first modern airport in Canada. The Canadian mooring mast eventually came down in January 1938; it was useless and had become a hazard to air traffic.

One of the control wheels and a berth from the R.100 are among the many artifacts in the custody of the National Aviation Museum in Ottawa, Canada.

Airship Specifications (1929)

	R.100	**R.101**
Overall length	719 ft 9-1/2 in (219.38 m)	731 ft 3 in (222.9 m)
Maximum diameter	133 ft 4 in (40.64 m)	131 ft 3 in (40 m)
Hydrogen capacity	5,156,000 cu ft (146 000 m^3)	4,893,740 cu ft (138 575 m^3)
Number of gas cells	15	16
Gross lift	350,610 lb (159 040 kg)	332,775 lb (150 950 kg)
Weight, empty	236,365 lb (107 215 kg)	254,465 lb (115 425 kg)
Disposable load	114,245 lb (51 820 kg)	78,310 lb (35 520 kg)
including water ballast and crew	40,325 lb (18 290 kg)	40,310 lb (18 285 kg)
fuel, oil and payload	73,920 lb (33 530 kg)	38,000 lb (17 235 kg)
Powerplant	6 Rolls Royce Condor IIIB 12 cylinder	5 Beardmore Tornado III 8 cylinder
Total power	3,900 hp	2,600 hp
Speed, maximum	81.5 mph (131 km/h)	70 mph (112.6 km/h)
Speed, cruising	64 mph (103 km/h)	61.5 mph (99 km/h)
Still air range with payload of 6,720 lb (3 050 kg)	4,095 mi (6 590 km)	2,585 mi (4 160 km)
Endurance	64 hrs	42 hrs