HANGAR NO. 1 NATIONAL HISTORIC SITE, BRANDON MUNICIPAL AIRPORT, BRANDON, MANITOBA

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INTRODUCTION

In 2001, the former British Commonwealth Air Training Plan (BCATP) Hangar No. 1 in Brandon, Manitoba,[1] was designated a National Historic Site. The building is significant as an "excellent and exceptionally well-preserved representative example of a British Commonwealth Air Training Plan hangar," one which remains in its original location and in a functioning airport environment. Furthermore, as the home of the Commonwealth Air Training Plan Museum, it retains a direct link with the program responsible for its design and construction.[2]

Hangar No. 1 is located at the Brandon Municipal Airport, which is the site of the former No. 12 Service Flying Training School (SFTS) of the BCATP. It is a standard BCATP double hangar, measuring 112 x 160 feet, with a flat roof, shingle cladding, and single-storey lean-tos on the east and west sides. There are sliding hangar doors on the north elevation and large, multi-paned windows at the upper levels on the west and south elevations provide natural light to the interior. Inside, but for a relatively small area of display space, the hangar continues to provide a large open space in which period aircraft and vehicles are housed.

COMMONWEALTH AIR TRAINING PLAN MUSEUM, 2002

FIG. 1. BRANDON, MANITOBA. HANGAR NO. 1, WEST AND SOUTH ELEVATIONS.

THE COMMONWEALTH AIR TRAINING PLAN MUSEUM INC.

The Commonwealth Air Training Plan Museum Inc. is the only museum in Canada dedicated solely to preserving the history and artefacts of the BCATP. Incorporated in 1981, its stated *Mission* is to "commemorate the British Commonwealth Air Training Plan by telling its story, preserving its

COURTESY OF COMMONWEALTH AIR TRAINING PLAN MUSEUM

FIG. 2. BRANDON, MANITOBA. SERVICE FLYING TRAINING SCHOOL (SFTS) 12, N.D.

artefacts, and paying tribute to the over 18,000 Royal Canadian Air Force (RCAF) personnel who gave their lives during World War II."[3] The museum is home to over 15,000 artefacts consisting of photographs, uniforms and clothing, personal papers, logbooks, station magazines, tools, equipment, trade badges, medals, and so forth. Thirteen aircraft are on display and four (The Harvard, Tiger Moth, Cornell, and Stinson HW-75) are airworthy and flown occasionally. The museum has nine other RCAF wartime vehicles on display, including: a staff car, six wheel drive crash tender, half-ton truck, Ford airfield tractor, Jeep, panel truck, stake flat deck truck, FWD snowblower, and aircraft refuelling tanker. These aircraft and vehicles (as well as other displays) are housed in the museum's most significant artefact, Hangar No. 1, one of five (two of which remain) built at No. 12 SFTS and originally used to hangar the Cessna Crane aircraft that served for pilot training.

COURTESY OF COMMONWEALTH AIR TRAINING PLAN MUSEUM

FIG. 3. BRANDON, MANITOBA. THREE PILOTS, SFTS 12, N.D.

The museum also contains a chapel featuring the Memorial Book,[4] *They Shall Grow Not Old* and private memorials placed by the families of airmen and airwomen lost in training and operations. That reflects the mission statement, which emphasizes paying tribute to the personnel who died. On June 4, 1984, the museum was officially dedicated as memorial to all of Canada's airmen and women killed in training and operations during the Second World War.

Museum membership is broadly based with over 900 members from across Canada, the United States, England, Australia, and other parts of the world. The facility is open year-round and places special emphasis on getting its message out to young people (school groups, 4-H clubs, churches, Scouts and Girl Guides) through conducted tours. The museum also participates at anniversary celebrations

and province-wide fairs and air shows, having four flying aircraft available.

Within the broader community of military and aviation history scholars and enthusiasts, the museum plays a significant role in the protection, study, and dissemination of military history (particularly that of the BCATP), through its ongoing research and preservation activities. The museum also publishes a quarterly newsletter entitled *Contact*.

THE BRITISH COMMONWEALTH AIR TRAINING PLAN

One of Canada's most important contributions to the Allied effort during the Second World War was the training of over 130,000 Commonwealth airmen at Canadian air bases constructed for the BCATP between 1940 and 1943. The agreement, signed December 17, 1939, reflected Canada's political commitment to the war effort, its role in training Royal Air Force personnel during the Second World War, its sensitivity to national sovereignty, its ideal climatic conditions for flying, and its geographical location, beyond the threat of enemy attack but close to American industry, and to Britain, via the North Atlantic shipping lanes.

COURTESY OF COMMONWEALTH AIR TRAINING PLAN MUSEUM

FIG. 4. "BRANDON 3 MILES," N.D.

At the outbreak of war, the Royal Canadian Air Force had only five airports of its own with six more under construction.[5] Its total strength was approximately 4,000 personnel and its activities confined mainly to two stations organized under one Air Training Command.[6] Rapid expansion was necessary to meet the requirements of the plan and that was done through the cooperative effort of the RCAF and the Department of Transport (DOT). The former designed and erected buildings while the latter selected and developed airfields after RCAF's approval.[7] Eighteen airports were chosen for immediate use by the BCATP, because they needed little development other than additional buildings and 75 other sites were chosen for development, including Brandon.

COURTESY OF COMMONWEALTH AIR TRAINING PLAN MUSEUM

FIG. 5. BRANDON, MANITOBA. MAIN GATE, SFTS 12, N.D.

The training plan was divided into several units: initial training schools, elementary flying training schools, service flying training schools (SFTSs, as at Brandon), air observer schools, air navigation schools, wireless schools, bombing and gunnery schools, and operational training units. It was at SFTSs that pilots and gunners were trained. The first two SFTSs were at Camp Borden and Trenton in Ontario,[8] Brandon was No. 12. At the plan's peak, there were 29 SFTSs in operation, each of which had facilities for 240 students at a time. Courses emphasized cross-country navigational flights, instrument flying, night flying, and

FIG. 6. BRANDON, MANITOBA. AIR TOWER, SFTS 12, N.D.

reconnaissance missions, and many were associated with bombing ranges. Many SFTSs were located on the prairies because of the ideal practice areas and clear weather. Thirty-five thousand pupils received their wings at western schools.[9]

Each SFTS had a main aerodrome with three to six hard-surfaced runways laid out in a triangular form. There were two relief fields built a few miles away for emergency landing and practice. Each base required dozens of buildings to accommodate servicemen, teachers, and ground crew, as well as to provide technical airport services. The buildings were grouped according to their use–administrative, technical and/or training–and were arranged as follows:

> Buildings were, as far as possible, concentrated in one area, preferably convenient to the landing strip in the direction of the prevailing wind to reduce the amount of taxiing to the minimum and good entrance roads. Hangars were set back on a zoned line parallel to this strip with provision for a 150' taxi strip and a 200' apron in front of the hangar entrance so that aircraft could stand out for refuelling and running up, and, awaiting their turn, use the field without interference with flying operations. Clearing rights on adjacent properties were obtained where necessary and buildings, trees, power lines and other obstructions were removed to the required locations.[10]

The construction challenges faced by the RCAF were enormous. According to the RCAF's *History of Construction Engineering*,

> During the first four and one half years over 8,300 buildings were constructed, 701 of which were hangars or hangar type construction. This work not only involved a multiplicity of designs for the various types of buildings but in order to comply with the opinions of the heads of other branches and finally receive ministerial approval a complete design or layout might have to be done over several times before final decisions and approval [was] received. Likewise the specifications would have to be completely changed and in many instances these would have to be altered several times after the contracts were awarded due to the inability of manufacturers to supply the quantity of type of materials concerned. During the period 1939-44 over one and three quarter million blue prints were made and issued as well as thirty three thousand finally approved drawings.[11]

The chief purpose of those 701 hangars, "the airline's equivalent to the railroad engine house," was to provide extensive enclosed interior space without intermediate supports.[12] Besides providing areas of clear space, hangars met the main design needs for aircraft servicing and safety, these being adequate lighting, heating, and fire protection. Most BCATP hangars were constructed to a standard plan and hangar size varied according to the type of school or unit concerned and the type of aircraft and operational work

FIG. 7. BRANDON, MANITOBA. AERIAL VIEW, SFTS 12, CA. 1941-45. HANGAR NO. 1 IS ON THE EXTREME LEFT.

involved. Some standard sizes were as follows: single (112' x 126'), double (112' x 160') and double/double (224' x 320'). The bulk were built of wood, due to wartime shortages of steel, and their frameworks consisted of heavy wooden trusses with bolted joints and supported by rigidly braced wooden timber columns.[13]

The design and construction of wooden trusses for the length of span were challenging jobs. The timbers were all of Douglas fir and all connections were bolted with TECO connection rings used between all timbers, which resulted in a stronger, more rigid joint. Those flat wooden roof trusses were not designed for any interior suspended load but merely for the actual dead load plus a snow load of up to 40 pounds per square foot, and a horizontal wind load of 35 pounds per square foot.

Hangar roofs were covered with two layers of tarred felt, covered in fibreboard, then tarred and gravelled. Hangar doors were either the lifting or the horizontally folding type.[14] In order to provide access for personnel without having to open the large doors, pilot or wicket doors were installed in the large doors, one at each side of the hangar.

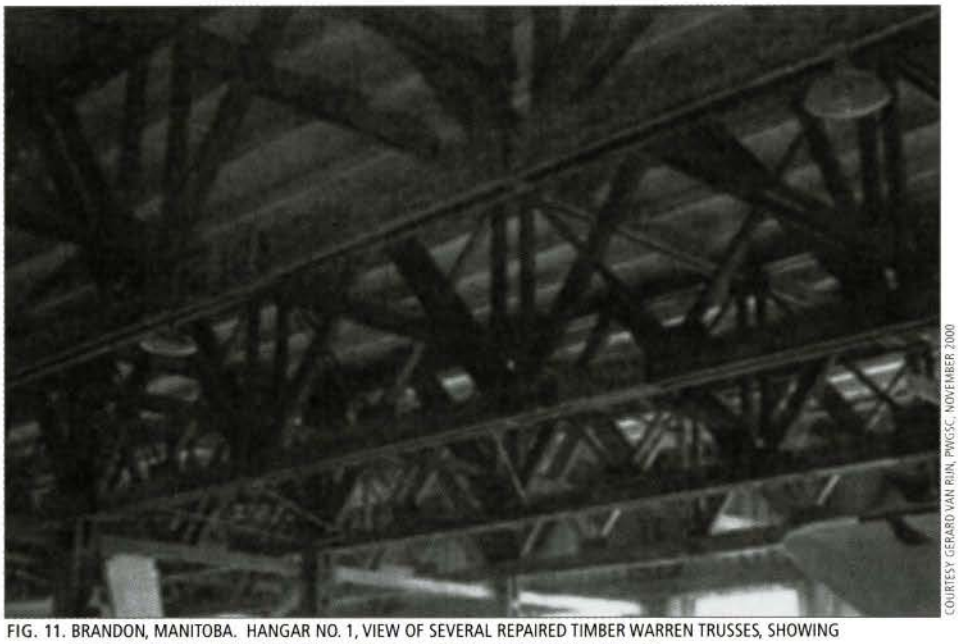
The most common siding material used was cedar shingles over diagonal sheeting.[15] Significant natural lighting was provided by large windows placed at a height of approximately 18 feet above floor level on the sides and six feet above the floor on the closed end of the building.

Hangar floors were of concrete, poured in sections to a depth of five inches. Reinforcing steel (either rods or mesh) was used during 1940 and early 1941, but it was later discontinued due to shortages. By late 1943, however, steel reinforcing of concrete was once again generally allowed.

FIG. 8. BRANDON, MANITOBA. HANGAR NO. 1, NORTH ELEVATION | STEPHEN HAYTER, 1999

FIG. 9. BRANDON, MANITOBA. HANGAR NO. 1, SOUTH ELEVATION | STEPHEN HAYTER, 1999

FIG. 10. BRANDON, MANITOBA. HANGAR NO. 1, SOUTH AND WEST ELEVATIONS | STEPHEN HAYTER, 1999



COURTESY GERARD VAN RIJN, PWGSC, NOVEMBER 2000

FIG. 11. BRANDON, MANITOBA. HANGAR NO. 1, VIEW OF SEVERAL REPAIRED TIMBER WARREN TRUSSES, SHOWING THAT REPAIRS ARE UNOBTRUSIVE AND DO NOT ALTER THE HERITAGE CHARACTER

Single or, in some cases, double hangar lean-tos were built on either one or both sides of the hangars. These were divided up into offices, equipment stores, washrooms, heating plants, and so forth. Lean-to floors were constructed of three inch concrete and sections that were used for offices were covered with hardwood. Washrooms and toilet rooms were surfaced with a mastic floor.

The standard plan hangar developed by the RCAF met not only the functional requirements of a large, open space for the servicing of aircraft, adequately lit and heated, but also dealt successfully with wartime constraints and requirements such as material shortages and the need to erect enormous numbers of such buildings in a very short time.

HANGAR NO. 1

Hangar No. 1 is a standard BCATP "double landplane hangar" designed by the Construction Engineering Branch, RCAF. It was built in 1940-1941, under the British Commonwealth Air Training Plan, for the training of aircrews from Canada and Commonwealth countries for service during World War II. It is rectangular in configuration, measuring 112' x 160', with a two-storey high elevation, green shingle cladding, and a single storey lean-to on the east and west sides. There are sliding hangar doors on the north elevation and large, multi-paned windows at the upper levels on the west and south elevations provide natural light to the interior.

The hangar has a flat roof of 112' clear span, supported on heavy timber Warren trusses of Douglas fir with bolted joints and TECO split ring connectors–a standard connection ring, developed in the 1930s. The split ring connectors provide a strong and rigid joint, permitting an increase in span lengths. The Warren truss is a patented (1848) bridge and roof truss, which consists of parallel upper and lower chords with web members inclined throughout to form a continuous series of equilateral triangles. The roof trusses are strengthened and interconnected, with sway and cross bracing at right angles to better resist wind loads, and are supported on rigidly braced wood columns. The chords and columns are of select structural Douglas fir, and the truss diagonals and end verticals are of common grades. When erected, the truss timbers were treated with either creosote or zinc chloride. The roof covering was specially designed to withs-

FIG. 12. BRANDON, MANITOBA. HANGAR NO. 1, WEST (FRONT) ELEVATION | STEPHEN HAYTER, 1999

tand the suction lift of high velocity winds passing over the hangar, as well as to resist ruptures by preventing any ballooning effect caused by interior air pressure generated by high winds blowing through open doors and penetrating through gaps in the roof sheeting.

The wide-span, interior column-free space was necessary for housing the training aircraft which were stored and maintained in the hangar, while the lean-tos along the sides of the hangar accommodated offices, workshops, and equipment storage areas, washrooms, and heating plants.[16]

INTEGRITY

Hangar No. 1 is remarkably unaltered and intact. It is typical in its framing, cladding, arrangement of doors and windows, and single-storey side lean-tos. Most of the original features and finishes remain. The interior has been altered somewhat with the addition of some partitioning to create display and office space, but this is unobtrusive and reversible. The most notable changes to the building include the filling in of large windows on the east side, the replacement of random panels of lost window glass by wood, and the addition of museum related signage.

In the 1990s, truss failure became a concern and sympathetic repair was an issue. It was done through utilizing the new steel truss insertion approach developed elsewhere for repairing and strengthening timber hangar trusses. At Brandon, three failed trusses were repaired by building a steel truss piecemeal within the existing timber truss to form a composite truss capable of sustaining the roof design loads. Elsewhere, a number of timber trusses showing less serious deterioration were repaired through placing clamps and/or steel splice plates over weak joints, and through replacing failed web members in kind with glue-laminated wood pieces of the same dimensions. Although the laminated pieces are not a totally accurate replication of the solid wood pieces they replaced, they are of the same material and difficult to distinguish.

COMPARATIVE CONTEXT

It is difficult to determine how many of the 701 Second World War BCATP hangars constructed by the RCAF remain across Canada and to determine the condition of those that do. An original list of these hangars and their location may never have been compiled.[17] In 2001, when Hangar No. 1 came before the Board, 41 BCATP hangars were identified[18] and it was assumed there were others. Not surprisingly, many of the remaining hangars, now in private hands, have evolved as to function (or are vacant) and are in a deteriorated and/or altered condition. Those hangars, which continue in use and in much the same function (for example, those owned by flying clubs and the Department of National Defence–DND), tend to be in good condition but have often been much altered, most frequently by new cladding and new roofs.

Perhaps the closest functional comparison to the Brandon hangar found to date is the Alberta Aviation Museum in Edmonton. Dedicated to the collection, preservation, restoration, research, and display of the history of aviation in Alberta and the city of Edmonton, the museum is housed in a double-wide, double-long BCATP hangar, said to be the only surviving hangar of its type.

CONCLUSION

Faced with the enormous challenge of constructing huge numbers of hangars in a limited time and hampered by wartime shortages of material, the RCAF perfected a standard plan, wood frame, Warren truss hangar, which was constructed by the hundreds across the country. Today, most of those buildings have been lost and many that remain are in poor condition and used for unrelated functions. Within the context provided by known survivors, Hangar No. 1 is exceptional for its

cumulative merits. It is largely unaltered, in very good condition for its age, on its original site (which is still an airport), associated with other wartime structures at the site, and it retains both its functional integrity and an ongoing and close association with the BCATP due to its function as a museum.

NOTES

1. Brandon is in southwestern Manitoba, 197 kilometres west of Winnipeg.
2. Historic Sites and Monuments Board of Canada, Minutes, June 2001, p. 37-38.
3. Quoted in *Commonwealth Air Training Plan Museum, Background Material* (n.d.), p. 6.
4. The Memorial Book contains the name and short biography of each of the Canadian airmen and women lost in training and operations during World War II. Also included are the names of airmen from other countries who served and died with the RCAF. That book contains over 18,000 names and is displayed in the Museum's Chapel. The first edition published in 1992 sold out and the second edition was printed in 1996.
5. Douglas, W.A.B., *The Creation of a National Air Force: The Official History of the Royal Canadian Air Force, Vol. II*, 1986, Toronto, University of Toronto Press, p. 220.
6. Canada, National Defence, Directorate of History, 1945, *Final Report of the Chief of the Air Staff to the Members of the Supervisory Board BCATP*, April 16, p. 7.
7. Canada, National Archives of Canada, 1939-1940, RG24, vol. 4775, File HQ103-74/68, vol. I.
8. Trenton is the eastern Canadian site of the HSMBC plaque to the BCATP.
9. Hatch, F.J., 1983, *Aerodrome of Democracy: Canada and the British Commonwealth Air Training Plan, 1939-45*, Ottawa, Department of National Defence, p. 141.
10. Wilson, J.A., n.d., « Aerodrome Construction for the British Commonwealth Air Training Plan 1940 », in Canada, Department of Transport, *Development of Aviation in Canada, 1879-1948: Articles by J.A. Wilson, C.B.E.*, p. 32.
11. Canada, National Defence, Directorate of History, n.p., « Hangar Construction », in RCAF, *History of Construction Engineering* (manuscript on file).
12. Condit, Carl W., 1961, *American Building Art, The Twentieth Century*, New York, Oxford University Press, p. 6.
13. A large number of the earliest BCATP hangars constructed across the country in the fall and winter of 1940 were exposed to exceptional winds and suffered deformation or rupture. As a result, sway and "X" bracing was required, a standard design was prepared and the bracing was installed on existing hangars.
14. Most of the former were electrically activated. The latter were of two styles. One was suspended on a track from a specially designed end truss and made up of narrow sections, which folded back on each other at the sidewalls. The other style had much larger doors supported on parallel tracks mounted on a concrete wall running completely across the end of the hangar and sufficiently far beyond it to permit the doors to pass giving full clearance to the end of the hangar opening. The doors were activated by a hand wheel chain geared to open off the travelling wheels on the track.
15. There were a few other types of sidewalls used, such as hollow tile, with or without stucco.
16. For a more detailed description of the structural details of a standard BCATP hangar, see Department of National Defence, DHIST 74/3, *History of Construction Engineering, Hangar Construction*, p. 18-24, structural evolution chronology compiled from file 100-4-6, vols. 1-10, February 1940 - October 1943.
17. We know the location of the BCATP flying schools and that during the lifetime of the plan some 359 schools were in operation. At the end of the war, 89 BCATP sites were declared surplus and disposed of by sale while nine went to civil flying clubs. The remainder rested with the Federal Government for RCAF postwar use. Given their airport siting and military function, it might reasonably be assumed that many of the remaining hangars would be in the hands of either National Defence or Transport Canada. Other possibilities included the Royal Canadian Mounted Police (RCMP) and Public Works Government Services Canada (PWGSC). Unfortunately, Transport Canada has devolved most of its airport properties to the municipalities and could not provide any assistance. The RCMP indicated that it was not aware of any such hangars within its inventory, PWGSC had no easily accessible inventory but National Defence was able to identify a number of potential sites. Three aviation history organizations were also contacted, notably: the Commonwealth Air Training Plan Museum, Inc., the Canadian Aviation Historical Society, and the Western Canadian Aviation Museum. Staff of these organizations suggested a number of locations at which BCATP hangars survived.
18. Known BCATP hangars remain at Esquimalt, British Columbia; Edmonton, Lethbridge, and Vulcan, Alberta; Moose Jaw, and Regina, Saskatchewan; Winnipeg, Gimli, Virden, Carberry, Dauphin, and Brandon, Manitoba; Ottawa and Trenton, Ontario, and Shearwater and Greenwood, Nova Scotia.