



# CANADA AVIATION AND SPACE MUSEUM AIRCRAFT

AVRO 504K

RCAF REGISTRATIONS: G-CYFG & G-CYCK



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**Introduction**

The Avro 504 was the most successful of any of the aircraft designed and built by A.V. Roe and Company in the United Kingdom during the First World War. Thousands of planes were built in its many variants, the most prolific being the Avro 504K. This airplane was designed to accommodate the rotary engine options that were available at that time and because of its excellent flying qualities it proved to be an ideal training aircraft. It was adopted for this purpose by the Royal Naval Air Service (RNAS) Royal Flying Corps (RFC), later the Royal Air Force (RAF) in Great Britain.

This document provides some historical details of the Avro 504's design, development and deployment by the early Canadian Air Force (1920-1923), later Royal Canadian Air Force (RCAF)<sup>i</sup>, focusing on the history of the Avro 504Ks that currently reside in the Canada Aviation and Space Museum (CASM) collection. These planes have a particularly interesting history, having played an active flying role during the 1967 Canadian Centennial celebrations. The enormous effort required to restore the planes to flying condition, on a miniscule budget by today's standards, is a tribute to the skills, ingenuity and dedication of the reconstruction and flying teams involved.

In 1920 Canada received an Imperial Gift of 62 Avro 504K's along with a number of other aircraft from the United Kingdom. The Avro 504K fleet was deployed at Training Depot Station Camp Borden,<sup>ii</sup> over several years, where they played a key role in the training of Canadian military pilots until the early 1930s. A few of the Avro 504K fleet were also deployed at other bases, including Rockliffe. Interestingly, neither of the Avro 504Ks currently in the CASM collection is one of the original 62 planes gifted to Canada.

**Cover Picture:**

**Avro 504K G-CYCK flying at RCAF Portage La Prairie Manitoba, Nov. 1966 (Photo via: William Ewing Collection)**

An Avro 504K was the first aircraft to test fly Canadian inventor Rupert Wallace Turnbull's variable-pitch propeller. Following a series of successful tests flights on the Avro 504, Turnbull was able to sell his patented design to a U.S. manufacturer, the Curtiss Company, who sold variable pitch propellers to aircraft manufacturers world-wide.

The following pages provide details of the origins of the Avro 504K, a history of the fleet in Canada and specific details of the Avro 504K airplanes in the museum's collection. References for further information are identified along with a bibliography.

**Origin, Evolution, Development and Manufacture of the Avro 504K**

The Avro 504 was the first airplane designed and developed by A.V. Roe and Co. to be manufactured in substantial volume. According to J.M. Bruce,<sup>iii</sup> orders for Avro 504s of all subtypes from 1914 until the First World War ended in 1918 totalled 10,694. However, significantly fewer aircraft were actually delivered, due to cancellations following the Armistice. Bruce indicates that deliveries totalled 8,707 and that wartime production did not cease until August 1919. A second postwar batch of 50 Avro 504K and 504N planes, likely built from a large inventory of spares that existed, was delivered in 1926. Due to wartime manufacturing demands a number of British firms were subcontracted to build Avro 504s to augment A.V. Roe's manufacturing capacity. These firms included: Brush, Eastbourne, Grahame-White, Harland & Wolff, Henderson Scottish Aircraft Factory, Hewlett & Blondeau, Humber, Sunbeam, and Parnall.



*Avro 504 "FG" on display at the Canada Aviation and Space Museum (CASM), Ottawa (Colin Hine Photo)*



*Avro 504K G-CYCK flying over Vancouver Island, 1967 (Photo via: William Ewing Collection)*

Imperial Gift Avro 504K Aircraft Specifications		
<b>Engine</b>	<i>Clerget</i> 130-hp.	130 horsepower
<b>Dimensions</b>	Wing Span	10.97 m (36 ft)
	Wing area	30.66 m <sup>2</sup> (330 ft <sup>2</sup> )
	Length	8.97 m (29 ft 5 in)
	Height	3.18 m (10 ft 5 in)
<b>Weight</b>	Empty	559 kg (1,231 lbs)
	Loaded	830 kg (1,829 lbs)
<b>Speed</b>	Max. @ sea level	153 km/h (95 mph)
	Max. @ 3048m (10,000 ft.)	137 km/h (85 mph)
	Cruise	121 km/h (75 mph)
<b>Rate of climb</b>	Initial rate of climb	214 m/min (700 ft/min)
	Time to altitude	5 min. to 1065 m (3,500 ft)
		16 min. to 3050 m (10,000 ft)
<b>Range</b>		402 km (250 miles)
<b>Endurance</b>		3 hours
<b>Service ceiling</b>		4,875 m (16,000 ft)

Multiple versions (types) of the Avro 504 were designed and manufactured, but by far the most successful was the ubiquitous 504K. The 504K was designed to accommodate all rotary engine types available at that time. This model proved to be an ideal training aircraft and several thousands were manufactured late in the First World War period. J.M. Bruce indicates some uncertainty surrounding the evolution of the Avro 504K type.<sup>iv</sup> Some 504Ks also incorporated a V-strut undercarriage in place of the standard Avro sprung legs and central skid.

The British government disposed of some of its surplus as Imperial Gifts to India and to the Dominions including Australia, Canada, South Africa and New Zealand<sup>v</sup>. Canada received an Imperial Gift of 62 Avro 504Ks, as well as a number of aircraft of other types in 1920. These planes were registered to the newly established Canadian Air Force (1920-1923), later the Royal Canadian Air Force (RCAF). The 504Ks were all newly manufactured, built under license by four British companies: Harland & Wolff (3); Hewlett & Blondeau (2); Sunbeam (10); and Grahame-White (47). Two additional 504Ks (C1501 and C1502) were built in Toronto by Canadian Airplanes Ltd. and several more were imported for commercial use in 1920.

Many Avro 504 aircraft were also supplied to other countries for both military and civil deployment: Argentina, Belgium, Brazil, China, Denmark, Estonia, Finland, Ireland, Japan, Malaya, Mexico, Norway, Peru, Portugal, Spain, Switzerland, United States and USSR. Native aircraft manufacturers in a few countries produced Avro 504Ks in some quantities. Bruce notes that in post-revolutionary Russia, production of the Avro 504K was initiated on a “Chinese Copy” principle.

In *Early Canadian Military Aircraft, Vol. 1* John A. Griffin and Anthony L. Stachiw note that the execution, flight testing and program implementation depended on the use of short-term, non-permanent airmen and aircrews. There was an abundance of equipment but a very limited budget. This might explain why there are so few surviving records to explain what was done and the appropriateness of decisions taken at that time.<sup>vi</sup>

All the Canadian 504Ks were powered by 130-hp *Clerget* rotary engines, the most powerful option available from several that could be installed. Other rotary engines used in Avro 504Ks are the 100-hp Gnome *Monosoupape* and the 80-hp and 100-hp *Le Rhones*. These rotary engines are 9 cylinder, air cooled units. Several of the Canadian Avro 504Ks were converted to Avro 504Ns with more powerful radial engines and new landing gear. Griffin and Stachiw<sup>vii</sup> note that the RCAF purchased two Avro 504N aircraft from A.V. Roe and Co. in the UK in 1924. Similar in appearance to the 504K the “N” models had improved landing gear and tapered ailerons. They were propelled by Armstrong Siddeley *Lynx* IV radial engines rated at 180-hp.



**Vickers made Avro 504N “GK” with single float  
(Photo via Bill Upton Collection)**

The RCAF made a decision to select the best of the then aging 504Ks and to convert them to 504N configuration. This overhaul work was performed by the Ottawa Car Manufacturing Company.

In July 1925 Canadian Vickers of Montreal produced the first Canadian made Avro 504N, a single float seaplane powered by a Wright J-4 engine. It initially bore the Canadian registration G-CY GK, later changed to RCAF 12 when it was converted to a landplane configuration. Canadian Vickers went on to manufacture an additional 12 *Lynx*-powered Avro 504N trainers, some of the last all wood machines to be produced. A few other Canadian Avro 504Ks were converted to Avro 504L seaplanes. The 504L type required the addition of dorsal and ventral fins to counteract vertical keel effects caused by the floats. Floats were of wood construction with six internal watertight compartments.

Considering the quantity of Avro 504s manufactured there are relatively few survivors world-wide. Many of the museum models listed in the following table are denoted as replicas (R); there are few original aircraft.

<b>Avro 504 Aircraft in Museum Collections World-Wide</b>		
<b>Country</b>	<b>Museum</b>	<b>Details</b>
Australia	Australian War Memorial, Canberra	Avro 504K H2173
Australia	Power House Museum, Sydney, Australia.	Avro 504K H2174
Australia	RAAF Museum, Point Cook	Avro 504K (R) E3747
Canada	Base Borden Military Museum, Camp Borden	Avro 504K (R) G-CYCK
Canada	Canada Aviation and Space Museum (CASM), Ottawa.	Avro 504K G-CYFG on display at CASM.

Chile	Santiago, Los Cerillos (ULC/SCTI)	Avro 504K (R) #78 – owned by Chilean Air Force.
Denmark	Dansk Veteran Flysamling Danish Collection of Vintage Aircraft	Avro 504N (L.B.I.)
Finland	The Aviation Museum of Central Finland, Luonetjärvi Air Force Base, Tikkakoski	Avro 504K E448 Ex G-EBNU (1H-49) AV-57.
New Zealand	Omaka airport outside of Blenheim in the South Island	Avro 504K, ZK-ACU - one of six 504's purchased by New Zealand Government 1925
Norway	Norwegian Aviation Center in Bodo Norway.	Avro 504K
Spain	No other details available	Avro 504K (R)
United Kingdom	Brooklands Museum	Avro 504K (R) G-AACA.
United Kingdom	Museum of Science and Industry, Manchester	Avro 504K H-2311, G-ABAA
United Kingdom	RAF Museum, Hendon, London	Avro 504K E449 (s/n 927) rebuilt from GEBKN and G-EBJE.
United Kingdom	Science Museum of London, South Kensington	Avro 504K D7520
United Kingdom	Shuttleworth Collection	Avro 504K (504N) G-ADEV
United Kingdom	Southampton Hall of Aviation , England	Avro 504J (R). C4451.
United Kingdom	The Shuttleworth Trust, Old Warden Aerodrome, Biggleswade, Beds.	Avro 504K H5199, ex-3404
United Kingdom	Yorkshire Air Museum	Avro 504K (R)
USA	Old Rhinebeck Aerodrome, New York	Avro 504K (R).
USA	US Air Force Museum, Dayton, Ohio	Avro 504K (R) G-CYEI – Previously in CASM Collection.
USA	Weeks Air Museum, Miami	Avro 504J/K

### Operational History

According to J.M. Bruce, operational use of early Avro 504s was not conspicuously rewarding<sup>viii</sup> and in *Avro Aircraft Since 1908* A.J. Jackson also notes there were only a few operational sorties by Avro 504 aircraft during the First World War. However, some of these sorties are memorable. In particular:

- A historic Royal Naval Air Service (RNAS) Avro 504 raid of the Zeppelin sheds at Friedrichshaven using four untested multiple bomb equipped aircraft on November 21, 1914;
- On December 14, 1914 a RNAS Avro 504 equipped with four 16 lb. bombs attempted to raid the Bruges submarine depot but was foiled by bad weather. Instead, an attack was made on the Ostend–Bruges railway;
- Destruction of two U-boats by a RNAS Avro 504 at a submarine depot near Antwerp on March 24, 1915 and
- A pioneer Zeppelin intercept also made by a RNAS Avro 504 on May 17, 1915.<sup>ix</sup>

Because of its excellent flying qualities, the primary role of Avro 504K aircraft deployed by the Royal Naval Air Service (RNAS) and the Royal Flying Corps (RFC), later the Royal Air Force (RAF) was for pilot training. Ultimately a large number of these aircraft were ordered.

After the 1918 Armistice some Avro 504Ks remained in service with the RAF for several years but a large number of unneeded aircraft were supplied to India and to the Dominions:

- Australia,
- Canada,  South Africa and  New Zealand.

After the Armistice the British government also sold-off a large quantity of unneeded military aircraft, including Avro 504Ks through The Aircraft Disposal Company (ADC), a Handley Page controlled firm. *The Great Warplane Sell-off* by Arthur W. J. G. Ord-Hume records the details of this government strategy. ADC marketed the Avro 504s as 'Avros' which resulted in a lawsuit from Avro claiming that their name should not be mentioned as many of the aircraft were built by other companies (and thus any deficiencies or poor quality workmanship might reflect badly on the parent company's reputation).

Avros took out an injunction to prevent ADC from selling any aeroplanes or goods as Avro products unless of A.V. Roe's own manufacture. This apparently simple law case eventually became very complex and resulted in a legal opinion that *"nobody was entitled to sell them (as 'Avro' aircraft) and the interim injunction ought to be continued, but so as not to prevent (the) defendants from selling Avro 504K as 'Avro type'"*.

The 62 Avro 504Ks given to Canada were sent to Training Depot, Station Camp Borden where they performed in a training role for several years. A few were deployed for standard operational uses, including forest fire suppression patrols away from Camp Borden.

An English Air Ministry letter dated 8<sup>th</sup> August 1921 obtained through United Kingdom National Archives<sup>x</sup> suggests a possible discrepancy in the number of Avro 504K airplanes to be supplied to Canada by the English Air Ministry. These records indicate that 64 Avro 504s were to be supplied and serial numbers of 64 airplanes are listed. In *Avro Aircraft since 1908*, Jackson indicates that there were 63 Avro 504Ks included in the Imperial Gift, differing from the accounting of 62 airplanes recorded by Griffin and Stachiw. Also, Jackson indicates that the 63<sup>rd</sup> airplane (D8842) was imported for commercial use by Bishop-Barker Aeroplanes, Toronto in 1920. No records were found concerning a second airplane (H9713). In *The Great Warplane Sell-off*, Arthur W. J. G. Ord-Hume also records that 63 Avro 504Ks were gifted to Canada.

The planes were initially stored in hangars and were taken on service over some 9 years. Griffin and Stachiw provide many details of the progressive deployment of these airplanes.<sup>xi</sup> They indicate a fairly high attrition rate for the 504K fleet as shown in the following table.

Avro 504K Service Deployment at Camp Borden					
Year	Quantity TOS	Quantity SOS	Cat A Crashes	Cat B Crashes	Cat C & Others
1920	29				
1921	14	8	6	1	1
1922	0	6	6	0	0
1923	4	2	0	0	2
1924	7	0	0	0	0
1925	1	8	1	2	5
1926	2	5	5	0	0
1927	1	0	0	0	0
1928	0	8	2	0	6
1929	0	4	0	0	4
1930	0	10	0	7	3
1931	0	2	0	1	1
1932	0	1	0	1	0

1933	0	0	0	0	0
1934	0	1	0	1	0
Number not registered	4 <sup>xii</sup>				
Totals	62	55	20	13	22
<b>Notes:</b>					
<ol style="list-style-type: none"> <li>1. TOS = Taken on Strength;</li> <li>2. SOS = Struck off Strength;</li> <li>3. Cat. A Crash = write-off;</li> <li>4. Cat. B Crash = repairable;</li> <li>5. Cat. C Crash = repairable at unit or base level.</li> <li>6. Deployment records for Avro 504K aircraft that were converted to 504L and 504N types appear to be incomplete following their conversion.</li> <li>7. There were at least 20 un-repairable crashes, a high proportion resulting from engine failures.</li> </ol>					

### The Museum's Aircraft

Throughout 1966/67 RCAF Master Warrant Officer (MWO)<sup>xiii</sup> Harry Tate led a No. 6 Repair Depot (RD) team in Trenton, Ontario to rebuild or replicate two Avro 504K biplanes that would fly during the Centennial celebrations in 1967. An article on the project written by MWO Tate in 1968 indicates that a decision to restore and preserve the only 504K in original condition for the aviation museum in Ottawa resulted in a third completely new 504K replica being constructed.<sup>xiv</sup>

The technical files held at the Canada Aviation and Space Museum (CASM) contain incomplete histories of the Avro 504K aircraft currently in the museum's collection. The following table summarizes the history of these two planes and Avro 504K(R) G-CYEI that was part of the museum collection at the time. Notes on Canadian 504Ks originally assigned these registration numbers are included.<sup>xv</sup>

Type/Serial Register	Manufacturer/Details
Avro 504K G-CYCK	<input type="checkbox"/> Grahame-White Aviation Co. Ltd. 1918, RAF registration D8971; <input type="checkbox"/> No records found of history between 1918 and 1961; <input type="checkbox"/> Purchased from Mrs. G.H. Gallup, Connecticut by Maj. J.S. Appleby, Torrance, California 1961; restoration started, approx. 70% completed; <input type="checkbox"/> Purchased by RCAF, delivered Trenton 24 May, 1966; <input type="checkbox"/> Restored 6 RD, Trenton (Crew Chief MWO H. Tate) May – Oct 1966; <input type="checkbox"/> Finished in markings of G-CYCK (RCAF), Taken on Strength (TOS) 5 Oct. 1966; <input type="checkbox"/> Flown by RCAF at Centennial Flying Displays across Canada, 1966-1967; <input type="checkbox"/> Transferred to National Aeronautical Collection (now CASM) 13 March, 1968; <input type="checkbox"/> Registered CF-CYC Ottawa, May 1969. <input type="checkbox"/> Note: 504K RAF registration H9717, originally assigned Canadian registration G-CYCK, struck off strength (SOS) at Camp Borden, 8 Mar. 1922 <sup>xvi</sup> .

<p>Avro 504K(R) G-CYEI</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Replica by No.6 RD, Construction #1 (Crew Chief MWO H. Tate), finished in markings of G-CYEI, RCAF, May 1966-Feb 1967, TOS 3 Mar. 1967;</li> <li><input type="checkbox"/> Flown by RCAF at Centennial Flying Displays across Canada, 1966-1967;</li> <li><input type="checkbox"/> Transferred to National Aeronautical Collection (now CASM), January, 1969;</li> <li><input type="checkbox"/> Now owned by and on display at the USAF Museum, Dayton, Ohio,<sup>xvii</sup> previously on display at Western Canada Aviation Museum, Winnipeg;</li> <li><input type="checkbox"/> Note: 504K, RAF registration E9666, originally assigned Canadian registration G-CYEI, was taken on strength Oct. 1921, converted to type 504N July 1927, SOS 15 Oct. 1928.</li> </ul>
<p>Avro 504K G-CYFG</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Manufactured by Avro in England 1918 (Mfr. No. A958), RAF registration H2453;</li> <li><input type="checkbox"/> Frank F. Valcourt, Pawtucket, Rhode Island, U.S. civil registration #5918, fitted with <i>LeRhone</i> engine 1928;</li> <li><input type="checkbox"/> Roosevelt Field Museum, early 1930's;</li> <li><input type="checkbox"/> J.H.C. Palen, Rhinebeck, N.Y., U.S. civil registration N8736R 1951 (used for flying displays U.S. and Canada);</li> <li><input type="checkbox"/> Purchased by RCAF, delivered Trenton, 19 May, 1966;</li> <li><input type="checkbox"/> Rebuilt 6 RD Trenton (Crew Chief MWO H. Tate) 1966-1967, TOS 1 June 1966;</li> <li><input type="checkbox"/> Assembled Rockcliffe, Clerget engine from National Research Council of Canada (NRCC) installed 12 Dec., 1967;</li> <li><input type="checkbox"/> Now on display at CASM, equipped with Turnbull Variable-pitch Propeller.</li> <li><input type="checkbox"/> Note: 504K, RAF registration H9555, originally assigned Canadian registration "G-CYFG," TOS May 1924, converted to 504N 24 July 1927, SOS 30 May 1930.</li> </ul>

Avro 504K, manufacturer's serial number A958, built by A.V. Roe and Co. (Avro) in England in 1918, was received at No. 6 RD May 19, 1966. The plane was purchased from Cole Palen of Rhinebeck, New York. The original plan was to restore this aircraft to flying condition; but as it was then some 49 years old and still contained its original wood and metal structural components, fatigue was evident everywhere. A decision was therefore made to build a completely new 504K replica for flying and to restore and preserve A958, as the one and only original 504K for the CASM collection in Ottawa.



**Wallace Rupert Turnbull exhibit at CASM  
(Colin Hine Photo)**

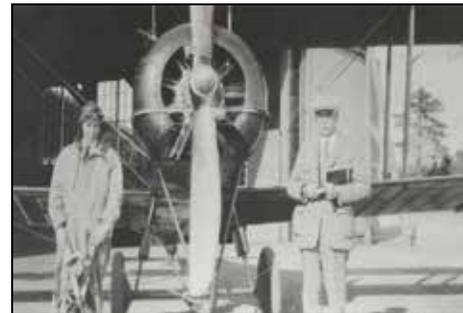
The Old Rhinebeck Aerodrome by E. Gordon Bainbridge, Exposition Press, 1977 provides a history of aviator Cole Palen and his museum in Rhinebeck New York. Palen bought several vintage airplanes from Roosevelt field, Long Island, New York in 1951, one of these being Avro 504K manufacturer's serial number A958. It turns out that this airplane and a number of other aircraft that Palen was restoring were seriously damaged one winter when a hangar collapsed under a heavy weight of snow accumulation. The Avro 504K was severed by a falling beam. After its second restoration it was flown a few times before being sold to the RCAF in 1966. The book indicates that although Cole Palen loved his Avro 504, he really needed the money. He was apparently pleased that the plane would be *"in good hands when the Canadian government purchased it for their museum."* According to Bainbridge, as Palen loaded the plane aboard his truck for shipment to Ottawa it was one of the few times when Cole *"...felt a little choked up."*



*Turnbull Propeller on Avro 504K, "FG" at CASM  
(Bill Upton Photo)*

The plane was assigned Canadian registration number G-CYFG. The original 504K bearing this serial registration, RAF H9555, flew at Borden in the School of Special Flying, under No. 1 Wing. It was converted to a 504N in 1926.

G-CYFG on display at CASM in Ottawa is fitted with the original variable-pitch propeller developed by Canadian inventor Rupert Wallace Turnbull. This particular propeller exhibit was originally flight tested on another Avro 504K (GCYFL) at Camp Borden in 1927. A series of flight tests was conducted the propeller was then removed and taken to Ottawa for detailed inspection. The Turnbull propeller was installed on G-CYFG for display in Ottawa some time prior to the opening of the new museum at Rockliffe in 1988. It has remained on exhibition there since that time.



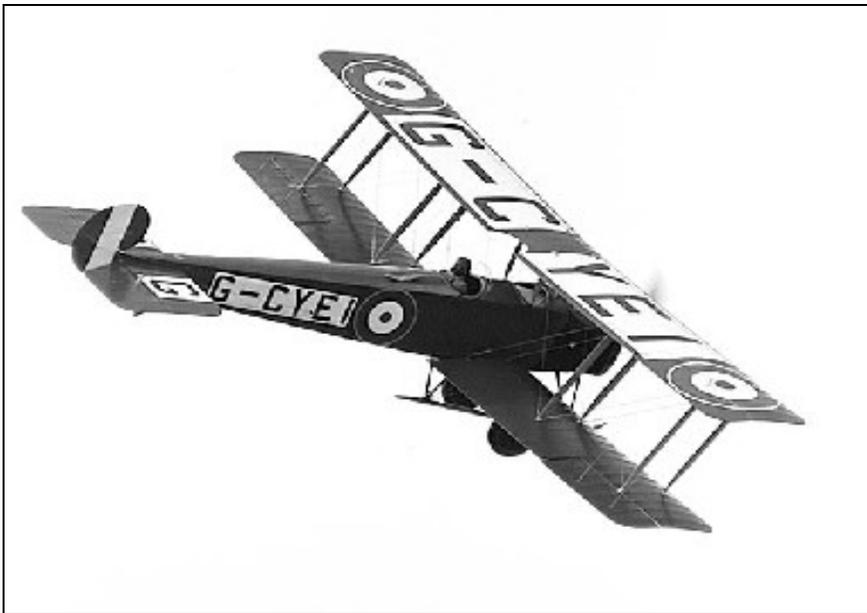
*F/L G.E. Brookes and R.W. Turnbull  
(Photo via NRCC Archives)*

Adjacent to the 504 exhibit at CASM is an exhibit that provides historical details of Wallace Turnbull's achievements in aviation. Turnbull's pioneer work on the variable-pitch propeller was not taken up by the Canadian government or manufacturers as there was no domestic market, given the small size of the aircraft industry in Canada at the time. However, it was taken up by other aircraft manufactures internationally and this invention helped advance the effectiveness of aircraft propeller technology making it possible to exploit the performance capability of propeller driven aircraft.

The success of the flight tests conducted on the 504K led Turnbull to sell his patents on variable pitch technology to the Curtiss-Wright Corporation. Turnbull's concepts were subsequently incorporated in the Curtiss Electric range of variable-pitch propellers<sup>xviii</sup> and later by Rotol Airscrews in the United Kingdom. It is a fitting tribute to this Canadian scientist and inventor that the 504K exhibit at CASM is equipped with Turnbull's propeller and remains on display in Ottawa.

Avro 504K, serial number D8971 was received on May 24, 1966. This plane was manufactured by Grahame Wright in 1918. The RCAF purchased it from James S. Appleby of Torrence, California. Appleby was in the process of rebuilding the aircraft but reconstruction was only completed after it was shipped to Canada. It turned out that so much work needed to be done that the rebuilt aircraft is truly a replica of the original machine. First flight of the rebuilt 504K was at Trenton, October 5, 1966. The replica aircraft was given the registration G-CYCK, from one of the original Canadian Air Force 504s (RAF H9717) that crashed at Borden, November 14, 1921. <sup>xix</sup>

The Avro 504K replica that now bears the registration G-CYEI was manufactured from new material throughout. Every metal fitting, wooden strut, undercarriage piece, throttle assembly, engine control, etc., was fabricated at 6 RD; an amazing feat of craftsmanship and perseverance. On March 1, 1967 G-CYEI was transported by RCAF C-130 *Hercules* to Patricia Bay Naval Air Facility, British Columbia for air tests. It first flew on March 3 but engine problems delayed further testing until March 20. CK and EI participated in formation flying on March 24.



**Avro 504K G-CYEI piloted by Flight Lieutenant George Greff at Canada's Centennial Year Celebrations. (Photo via Canadian Forces)**



Harry Tate - wing assy.



Bob Fisher - rib stitching



George carpenter, Bob Fisher - wing covering



Tom Fitzpatrick - aileron assy.



Harry Tate, Dave Merrett - wing assy.



"Whitey" Whiteway, Danny Jones, fuselage construction

**Avro 504K construction, Trenton, summer 1966**

*(William Ewing Photos).*



**6 RD Crew and Road Crew with G-CYCK ready for first flight (William Ewing Photo)**



**Avro 504 G-CYCK fly-past, Abbotsford Air Show 1967, piloted by F/L Gord Brown (William Ewing Photo).**



**Avro 504K G-CYCK at Camp Borden, 1966. In the background is one of the original Canadian Air Force hangars now designated Federal Heritage building (William Ewing Photo).**



**G-CYCK & G-CYEI at Abbotsford Air Show 1967 (William Ewing Photo)**

In his article *“And how did you celebrate Canada’s Centennial year, airman?”* Corporal William (Bill) Ewing comments that among the few original components used in these replicas are the rotary engines<sup>xx</sup>. While the decision to use original engines resulted in numerous problems throughout the Centennial flying program, its eventual success is a tribute to the skills, ingenuity and dedication of the reconstruction and flying teams<sup>xxi</sup>. Bill Ewing’s log book for G-CYCK includes many entries describing engine problems experienced during the Centennial flying display tour. Here are a few examples:

*“8 May, Downsview. Inspection finds worn valve guide in # 9 cylinder. Cowlings & cylinder removed...Cylinder taken to 6 RD for installation of new guide. 6 RD personnel also de-carbonized cylinder. Cylinder returned and reinstalled.”*

*“12 May, Oshawa to Downsview. Moto-stat carried out on engine. Two cylinders in red, one red-lined, and one in yellow – very poor! Hope to fly to Trenton tomorrow and have engine overhauled...”*

*“13 May, Downsview. Remove cowling and pull engine. Trenton shipping new engine by road...New engine finally arrives 14:30. Installed with prop and cowling. (Engine) run-up unsatisfactory - timing off (900 rpm maximum). Timing adjusted, second (engine) run-up also unsatisfactory. Engine will not peak and extremely rough. Again 900 rpm max...Magneto removed, set up and reinstalled...Engine again u/s. Some cylinders overly hot upon shut-down...Engine removed for shipment back.”*

*“14 May, Downsview. Original engine dismantled and overhauled. All cylinders decarbonized. Change rings on #2 and #3 cylinders. Exhaust valve guide on #9 cylinder replaced. All valves ground. Run-up on test stand - serviceable”.*

And so it went....

Members of No. 6 RD Crew that undertook the reconstruction included:<sup>xxii</sup>

**WO2 Harry Tate** – Crew chief, procurement, inspection, certification of materials, sub-assembly and major assembly, final certification and inspection before flight.

**Sergeant George Carpenter** – Fabrics and refinishing; a highly qualified tradesman in this field.

**Cpl. Daniel “Danny” Jones** – Aero Engine – Airframe job was building G-CYEI’s fuselage. This Cpl. built his own private bi-plane and held aircraft mechanic and pilot’s licenses. He was well qualified to handle any job in building an old aircraft.

**Cpl. “Whitey” Whiteway**

**Cpl. Crighton** – Aircraft refinisher, fabric worker, took over from Sgt. Carpenter.

**Stewart Killbank** (civilian) – Chief woodworker, highly skilled individual, he manufactured spars, skids, etc., designed and carved replacement propellers.<sup>xxiii</sup>

**Flight Sergeant “Hub” Hubley**

**Cpl. Tom Fitzpatrick**

**Cpl. Kivemacki**

**Cpl. Hill**

**T. Gauthier** (civilian)

**Cpl. Dave Merrett** – Airframe repair, cables.

**Cpl. Bob Fisher** – airframe repair and fabric work.

According to Bill Ewing in a 27 October 1971 letter to the editor of the Canadian Aviation Historical Society (CAHS) Journal, responding to Harry Tate's article on the 504 construction, the "road crew" for the Centennial year flying displays included:

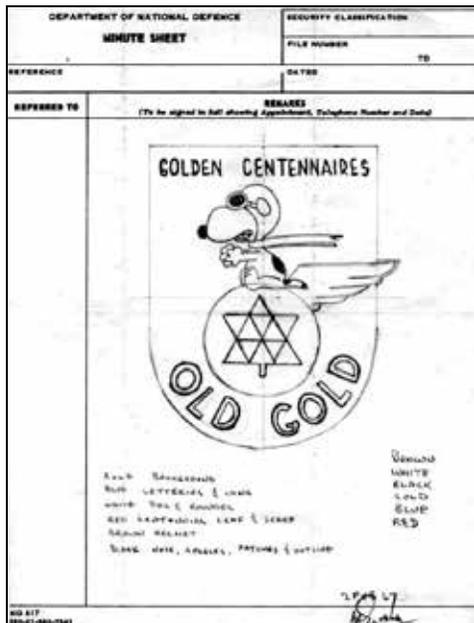
**G-CYEI "Old Gold 1" G-CYEI**

Flt. Lt. George Greff (pilot)  
 Cpl. Denny Brooks (engine)  
 Cpl. Bill Randall (airframe)  
 Cpl. Larry Legault (airframe)  
 Cpl. "Mickey" Trimm (airframe)

**G-CYCK "Old Gold 2" G-CYCK**

Flt. Lt. Gord Brown (pilot)  
 Cpl. Joe Chermishnok (engine)  
 Cpl. Frank Doherty (airframe)  
 Cpl. Bill Ewing (airframe)

To gain practical experience, these personnel also assisted in construction of the two aircraft at Trenton. In order to understand the magnitude of the task these individual undertook, and the many trials and tribulations they endured to make the Centennial flying displays a success, it is worth reading Harry Tate's CAHS article as well as Bill Ewing's letter to the editor and his article *And how did you celebrate Canada's centennial year, airman?*



*Bill Ewing's original design sketch for the Golden Centenaire team's crest (via William Ewing).*



*The final Golden Centennaires team's crest (William Ewing Photo).*

A copy of Flight Lieutenant Gord Brown's log book and flying time records held in the CASM library contains detailed records of his flights in Avro 504K G-CYCK and G-CYEI, including test flights and air show demonstration during the 1967 Centennial Celebration season. One entry of particular interest simply reads:

*"June 4, 1967 G-CYCK, 10 minutes – PRANGED at RC (Rockliffe)."*

The letter and article by Bill Ewing referenced above record the story behind this entry.

After being transported to Ottawa G-CYCK was re-assembled at the RCAF station at Uplands. During a post-assembly test flight, pilot Gord Brown decided to survey the site of the upcoming air show at Rockliffe. Meanwhile some minutes later back at Uplands the phone rang. The call was for Corporal Ewing:

*"Bring the guys and your tools to Rockliffe. We got a problem."*

The “problem” was that in order to check the levelness of the field at Rockliffe, Brown decided to try a roller landing. Unfortunately the 1914 pilot’s guide for the Avro 504 specifically cautions against using this maneuver. Added to this G-CYCK had always proved to be tail heavy and a 30 pound lead weight had been bolted to the front undercarriage strut to compensate.

The Rockliffe field cannot have been too level because during the landing, the weighted strut dug into a small hummock. The strut broke and the plane tipped forward onto its nose. Resulting damage to the aircraft included a shattered propeller, a destroyed undercarriage, an engine cowling damaged beyond recognition and the engine itself was rolled back under a now broken fuselage. Fortunately, Brown suffered only a minor injury, a scratch on his nose along with a severe beating to his pride! What to do now? MWO Harry Tate had his crew up from Trenton in what seemed to Ewing like minutes and they quickly took over. The aircraft was pulled back into a more presentable position, dismantled and shipped back to Trenton.



Avro 504K “PRANG” at Rockliffe 4 June 1967 (William Ewing Photo)

After many long shifts over a six week period the plane was put back into flying condition; an amazing effort by the crew at No. 6 Repair Depot. Interestingly, during the rebuild the original cause of the tail heavy problem was discovered and corrected. G-CYCK was originally rebuilt before all of the original design drawings were received from A.V. Roe and Company in the United Kingdom. After reviewing the drawings it was evident that the tail plane vernier block that allows for longitudinal trim had been installed incorrectly (Murphy’s Law in action, Ewing suggests).

With accurate drawings to refer to, the vernier block was now installed correctly. This made pilot Gord Brown extremely happy. Aircraft handling was vastly improved and he was at last able to fly the plane hands-free.



Golden Centennaires Avro Tutors & Avro 504K G-CYCK in flight circa 1967 (via Bill Upton)



*Overhead shot of G-CYFG showing original fuel tank location of on upper wing centre section. This tank was removed on G-CYCK and G-CYEI and replaced by an internal tank to facilitate safer disassembly and transportation during the 1967 flying display season (Bill Upton photo).*

## **Conclusions**

In Great Britain the Avro 504K proved to be one of the most successful training aircraft deployed during the First World War and immediate post war period. The history of the Avro 504K biplane in Canada dates back to 1920 when 62 Avro 504Ks were received from Great Britain as part of the Imperial Gift of aircraft. In Canada, the primary role of this aircraft also proved to be pilot training. Some of these planes were later converted to Avro 504Ns. Others were converted to Avro 504L floatplanes, suitable for operation on Canada's many lakes and waterways as well as for forestry patrols.

Interestingly, the two remaining Avro 504Ks in the CASM collection are not part of this original inventory. Two of them (G-CYCK and G-CYFG) were purchased from owners in the USA in 1966. Also, the third plane (G-CYEI), now in the USAF Museum collection in Dayton Ohio, is a replica built entirely by an RCAF crew at # 6 Repair Depot, Trenton. Canadian registration numbers assigned to these airplanes were originally used on planes in the Imperial Gift collection.

The Avro 504K on display at CASM is the only one of the RCAF restored Avro 504Ks that is of truly original construction and components. The others are replicas built or reconstructed using original A.V. Roe & Co. design drawings. Both of the replica planes flew at displays across Canada during the 1967 Centennial celebrations. Both airplanes were equipped with original engines.



In 1927 an Avro 504K at Camp Borden (G- CYFL) was used for flight testing of Rupert

Pencil sketch of AVRO 504K G-CYFG at CASM by Max McGrahn July 2013 Wallace Turnbull's variable-pitch propeller.

The variable pitch propeller made it possible for airplane developers and manufactures to fully exploit the flying capabilities of propeller driven aircraft world-wide. Turnbull's contribution to the technology represents a landmark in Canadian aviation history that is not always recognized.

The work accomplishment of the RCAF construction team at No. 6 Repair Depot, Trenton in reconstructing the two Avro 504Ks now in the museum's collection and the efforts of the "road crews" to keep the two display aircraft flying during the Centennial year celebrations are a tribute to the skills, ingenuity and perseverance of all members of the crews involved (military personnel and civilians).

Arguably, "Old Gold 2" could once again be restored to flying condition. One cannot help but speculate about the possibility of G-CYCK or a new replica<sup>xxiv</sup> flying at Canada's 150th anniversary celebrations in 2017 and at the 2067 bicentennial celebrations. These would indeed be a wonderful events to witness.

## Endnotes

i

According to the Report on Civil Aviation by the Air Board, the Canadian Air Force was created under power of the Air board Act Feb. 18, 1920. The Air Board was merged into the new Department of National Defence (DND) Jan. 1, 1923. The Royal Canadian Air Force came into being officially on April 1, 1924.

ii

Following formation of the RCAF the name was changed from Training Depot Station Camp Borden to RCAF Station Camp Borden - *Early Canadian Military Aircraft – Acquisitions, dispositions, colour schemes and markings, Vol. 1* Aircraft taken on strength through 1920; John A. Griffin, Anthony L. Stachiw.

iii *Avro 504K*, J.M. Bruce – Introduction, Extended Service, page 4.

iv

*Avro 504K*, J.M. Bruce – Introduction/Modifications, page 1: "Precisely when and by whom it was suggested that the 504 should be modified to be capable of accepting any of the currently available rotary engines is uncertain. Tradition attributes it to Smith-Barry, but one suspects a possible confusion with the conversion, at Gosport, Hampshire, U.K. of 504J B3157 to have an overhung installation of a 130-hp Clerget engine....."

v

According to J.M. Bruce, other 504Ks went to many foreign countries and in some cases the type was produced by native aircraft industries - Introduction, page 4.

vi

*Early Canadian Military Aircraft – Acquisitions, dispositions, colour schemes and markings, Vol. 1* Aircraft taken on strength through 1920; John A. Griffin, Anthony L. Stachiw, page 29.

vii

*Early Canadian Military Aircraft – Acquisitions, dispositions, colour schemes and markings, Vol. 1 Aircraft taken on strength through 1920*; John A. Griffin, Anthony L. Stachiw, page 21.

viii

*Avro 504K*, J.M. Bruce - Introduction, page 2.

ix

*Avro aircraft Since 1908*; A.J. Jackson, pages 56-57.

x

Letter from The Secretary Disposals and Liquidations Commission, English Air Ministry concerning The War Cabinet decisions on the gift of aeroplanes to the Dominions. A copy of this letter was obtained with the assistance of Mr. Andrew Pentland: <http://www.goldenyears.ukf.net/home.htm> (2012).

xi

*Early Canadian Military Aircraft – Acquisitions, dispositions, colour schemes and markings, Vol. 1 Aircraft taken on strength through 1920*; John A. Griffin, Anthony L. Stachiw provides details of the progressive deployment of these airplanes.

xii

In *Early Canadian Military Aircraft – Acquisitions, dispositions, colour schemes and markings, Vol. 1 Aircraft taken on strength through 1920*” page 28, the editor speculates that the four unregistered aircraft were destroyed in fires at Borden in Aug. and Oct. 1923. There is no reference to these four airplanes and no records have been found. It is also possible that other Avro 504Ks with incomplete records were lost in fires.

xiii

Throughout the 1966/67 period Harry Tate’s military rank was Warrant Officer 2 (MWO2).

xiv

This paper was published under the title *On Building the 504K* in the Fall Edition of the Canadian Aviation History Society (CAHS) Journal in 1968.

xv

Additional information relating to the history of the original aircraft bearing these registrations was provided by Mr. Andrew Pentland, on-line refer to: <http://www.goldenyears.ukf.net/home.htm> (2012).

xvi

*Early Canadian Military Aircraft – Acquisitions, dispositions, colour schemes and markings, Vol. 1 Aircraft taken on strength through 1920*; John A. Griffin, Anthony L. Stachiw; page 27.

xvii

Ownership of Avro 504K G-CYEI was transferred to the USAF Museum Dayton, Ohio as part of a collection exchange in 1998. Part of the exchange saw WSK Lim-2 (Polish built MiG-15) come to CASM. The G-CYCK replica is now displayed as Avro 504K (D9029) flown by the U.S. Army Air Service at Issoudun, France in 1918.

xviii

i

Refer to *Early Canadian Military Aircraft*, Vol. 1, p.p. 23

xix

G-CYCK was transported to Portage La Prairie in November 1966. According to Bill Ewing initial flights there proved to be something of a disaster. “It wasn’t just cold it was b\_\_ cold!” says Ewing. First

attempts to start the *Le Rhone* engine resulting in the plane being hauled back into the hangar, positioning it under one of the hangar heaters and starting the engine in the hangar. Then, with a pair of “brave souls” desperately hanging onto the wingtips brakes, pilot Gord Brown taxied the 504K out for take-off. Brown was dressed in multi-layers of clothing, but still arrived back frozen.

Lt. Col. O.B. Phelps, head of the Golden Centennaire Aerobatic Team from its foundation in 1966 until disbandment in January 1968. arranged for G-CYCK to be transported to the VU33 (Navy) hangar at Pat Bay Airport, Vancouver Island, B.C. in December 1966. The plane made a number of flights there, prior to the arrival of G-CYEI in March, 1967.

xx

In his article Ewing notes that the decision to use these 50 year old engines caused numerous problems throughout the centennial flying program. Similar comments are offered by Tate in his article.

xxi

Cpl. Bill Ewing's *Air Show Log for Avro 504K G-CYCK, Golden Centennaire Aerobatic Team Air Show Tour Summer of 1967* includes many entries relating to engine problems.

xxii

Comments were obtained from CASM technical files as well as articles by MWO Harry Tate and Cpl. Bill Ewing.

xxiii

According to Bill Ewing, Stewart Killbank's design and construction skills helped solve problems the crew experienced achieving recommended RPM settings for the *Le Rhone* engines.

xxiv

There are several organizations that construct replicas of Avro 504K airplanes from original A.V. Roe and Company drawings; among them Blue Swallow Aircraft LLC, Keswick, VA, USA <http://www.avro504.org> (2012), <http://www.BlueSwallowAircraft.com> (2012).

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## Acknowledgements

Writing this short history of the Avro 504Ks in the CASM collection brought me in contact with new acquaintances (friends) in Canada and overseas. I have enjoyed working with fellow volunteer members of the historical research group at the Rockliffe museum under the leadership of Mr. Robert (Bob) Murray. I particularly appreciate the help provided by volunteer Mr. Bill Upton for familiarizing me with the museum's collection and his advice on preparing this history, also for his photographic skills.

Members of the museum staff have been of great assistance, in particular Mr. Renald Fortier - Curator, Aviation History; Mr. Marc Ducharme - Director of Operations; Mr. Ian Leslie – Library Assistant; and Mr. Cédric St-Amour – Coordinator, Volunteer Services.

Mr. Steven Leclair – Archival Services Officer at the National Research Council of Canada (NRCC) assisted me research the Rupert Wallace Turnbull collection in the NRCC Archives. His knowledgeable and timely assistance is much appreciated.

Particular thanks go to Mr. Andrew Pentand (<http://www.goldenyears.ukf.net/home.htm> - 2011) for helping me clarify details and history of original Avro 504s bearing the registration numbers that are now displayed on the museum's airplanes. His help was invaluable and he responded to my email requests promptly; even when he was involved in an 800 Km north to south walk across the French Alps in the summer of 2011 and later while he was on a walking expedition in New Zealand in March 2012!

I really enjoyed the helpful assistance offered by Mr. William (Bill) Ewing, a member of the G-CYCK "road crew" during the 1967 Centennial flying displays (<http://www.vintagewings.ca/en-ca> - 2011). Bill freely offered me access to the records he has maintained over the years, as well as to his inventory of photographs.

Other members and family of the 1966/67 construction and flying crews and members of Vintage Wings also provided assistance and access to photographic records; in particular Mr. Dave O'Malley, Mr. Dan Dempsey, Ms. Mary Lee, and Mr. Daniel Jones (son of Danny Jones). Mrs. Joan Whiston, Volunteer Research Assistant, Air Force Heritage & History, 1 Canadian Air Division, Winnipeg, Manitoba also provided research assistance. Also, thanks to my consulting associate and long-term friend, Mr. Hugh Carter, for encouraging me to be more adventurous with my conclusions.

I am grateful to eleven years old Max McGrath a CASM summer camp participant for his sketch of Avro 504K G-CYFG. He created this drawing in five minutes or less while on a tour of the museum exhibits on July 23, 2013. According to his mother, Alison McGrath, has been an ardent aviation enthusiast since he was six years old; clearly he also has some artistic talent.

In a past life I worked for A.V. Roe & Co. (later Hawker Siddeley Aviation) in Manchester, England. Now that the name Avro has disappeared into the annals of history it is a privilege to be able to play a small role helping keep the company name visible and alive. The Avro name invokes particularly strong ties with Canada. Who can forget Avro Canada's achievements, the Avro C102 *Jetliner*, CF-100s, CF-105 *Arrow* and the many other notable achievements of this once great Canadian company?

Colin Hine, Ottawa, Canada, August 2013