Volume 46
Number 2

Flypast

November 2011

Newsletter of CAHS Toronto Chapter
A Division of The Canadian Aviation Historical Society
http://www.cahs.ca/chapters/toronto

CAHS Toronto Chapter Meeting

Saturday, November 19, 2011 – 1:00 P.M.

Meeting Info: Bob Winson (416) 745 – 1462

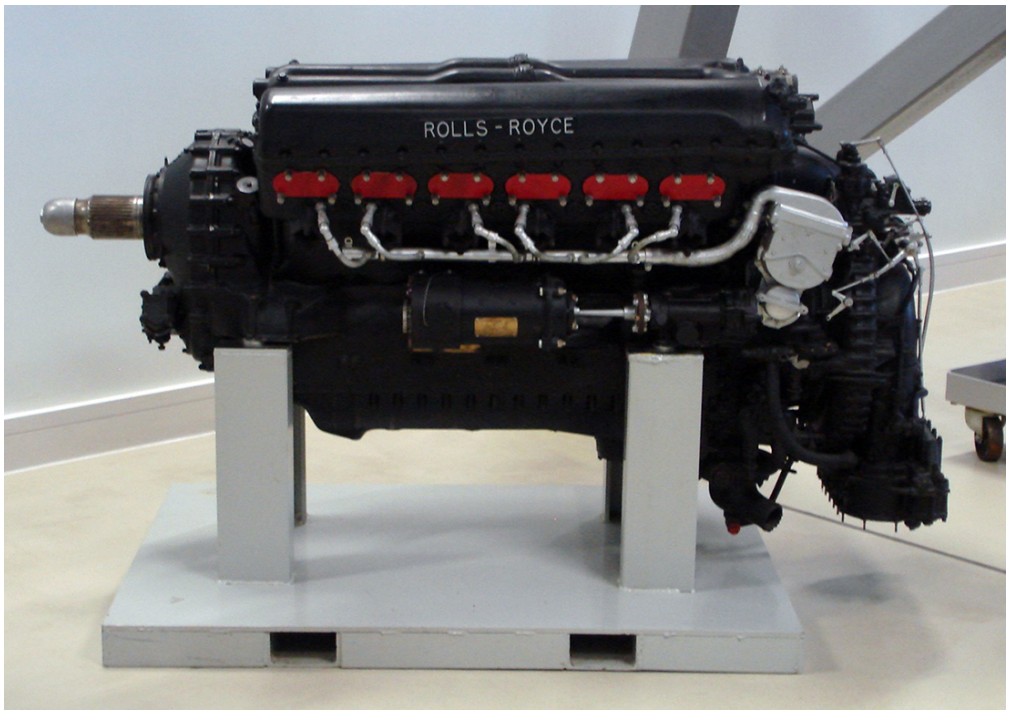
CANADIAN FORCES COLLEGE

215 Yonge Blvd. at Wilson Ave. Toronto
TTC Wilson 96 Bus to the door

All aviation history enthusiasts are very Welcome!
A "Landing Fee" of $3.00 will be charged to cover meeting expenses

Speaker: Keith Hyde

Topic: Merlin Engine



October Meeting

Topic: "Merlin engine"
Speaker: Keith Hyde
Reporter: Greg Winson

Speaker Keith Hyde
Photo - Neil McGavock

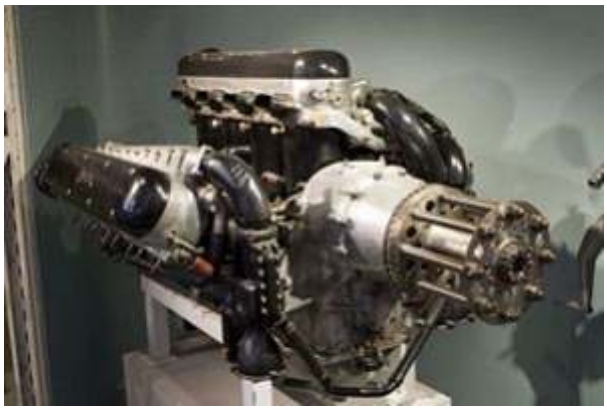
CAHS Toronto President George Topple introduced Chapter member, Keith Hyde, who provided many anecdotes about the development and success of the Rolls Royce Merlin engine from the 1920's through World War II.

Keith took the RAF apprenticeship in aero-engines and related systems at No. 1 Technical School. He later served with 54 Squadron of Fighter Command servicing the Rolls-Royce Avon engines on all marks of Hawker Hunters. Later he spent one year with the Borneo Campaign servicing Bristol/RR-Napier Gazelle gas turbines, one of the worlds first dedicated designed helicopter engines. Keith experienced endless troubles in servicing and starting the engines in the extreme heat and humidity conditions in the jungle. After service, Keith did contract work with Bristol aero-engines and Rolls-Royce at Derby and Hucknell, on the Olympus, Conway and Spey engines. In Canada Keith did contract work for Normalair UK on cabin air-conditioning recycled air systems turbines for North American carriers using the BAC-111 airliners. Through mergers, Normalair became part of Garrett Air Research and Keith continued contract work on gas turbines. He was hired as senior technical rep for Chicago Pneumatic Systems of Troy, Michigan and sold specialized aerospace tooling to McDonnell Douglas Canada, deHavilland, Standard Aero, Air Canada, RR-Montreal and Pratt & Whitney Canada.

Following ten years with Chicago Pneumatic he enrolled in Ryerson's photo-journalism course and started a new career direction. He travelled the world on assignment to Europe, Asia and the Middle East covering transportation, trains, boats and planes. He had a great time and accumulated a collection of over 100,000 35mm slides. He also was a contributing writer to the CAA, AAA, Hamilton Spectator and the Halifax Herald, etc. He continues to give speaking engagements on his travel experiences to Colleges and other learning centres. He never lost his interest in aviation, especially aero-engines, and has developed a number of aviation historical programs for the Toronto Public Library Board (TPL), which he continues to expand. He is currently teaching an eight-week course for the George Brown College, "Living and Learning Series". He will do two upcoming lectures for the University of Toronto (U of T) lecture series on aviation history. He has spoken to the U of T faculty on the RR-Merlin engine. His favourite subject is the, "Allied Bombing Campaign over Germany", since it still remains one of the most controversial subjects of WWII. He is now researching for up-coming lectures on the B-29 fire bombing raids over Japan and the Vietnam Air War. Keith has also acted as a tour guide at the Canadian Air & Space Museum for the last five years. He is as well a dedicated member of CAHS Toronto Chapter and assisted at the Chapter's table during the 2011 Wheels & Wheels Heritage Festival.

Keith described the Merlin engine as one of the great stories of aviation, particularly in power plants. He marveled at the dramatic horsepower increases achieved with the engine during World War II, starting from 890 horsepower and rising all the way to 2000 horsepower when fitted with a two stage, two-speed supercharger.

The development of what was to become the Merlin was inspired by a prestigious marine aviation competition commonly known as the Schneider Trophy. In 1913, French businessman Jacques Schneider offered a 1000-pound prize to the fastest plane to fly a closed circuit with two loops and two returns over 400 kilometers. The first nation to win three consecutive races would keep the trophy in perpetuity. England had some success in these competitions, winning the 1914 and 1922 events, but was upset in 1923 and 1925 by American entries using Curtiss biplanes and engines. England would return to glory, spurred on by the efforts of a new young British aeronautical engineer, R.J. Mitchell. He was working for Supermarine Aviation Works, a relatively small company until acquired by Vickers in 1928. The United Kingdom took the 1927 Schneider Trophy flying a Mitchell-designed Supermarine S.5 powered by the Napier Lion engine. Keith stated the W block engine produced 890 horsepower, and was likely in production longer than any other aero engine, from 1917 right up until the 1930s.



Napier Lion Engine
Photo: Canadian Aviation Museum

Mitchell, however, felt that the Napier Lion had reached its limits. He approached Henry Royce to develop a very powerful engine he felt necessary to win these races for England. Royce was reluctant at first, but felt that the new engine would be a major gain for his company. Rolls-Royce looked to the Kestrel and Buzzard engines and looked for ways to improve the power of them. Many companies were getting into supercharging engines at this time. Royce took a Buzzard engine, switched it to a four block and added a single stage supercharger, managing to get 1500 hp from this configuration. Next, Rolls-Royce redesigned the engine liners and valve mechanisms (four-valve heads). Rolls-Royce also experimented with exotic fuels such as ethanol, and they were able to boost output to just under 2000 hp. The subsequent developmental Rolls-Royce 'R' engine went on to power the Supermarine S.6 to victory in the 1929 Schneider Trophy race, giving the United Kingdom its second consecutive win. However, Mitchell was looking for an even higher output. Rolls responded with back-to-back superchargers – amazingly, the engine could run at full power for an hour at 2500 hp before the engine disintegrated. The British team set a new world speed record to take the 1931 competition, winning the Schneider Trophy outright for the United Kingdom.

Rolls-Royce Buzzard R-Engine
Photo R Winson

With the success of the Rolls-Royce 'R', Rolls-Royce began developing what eventually became the Merlin engine starting in 1932. The Air Ministry at the time was not interested in putting money into a new aero engine, so the engine development was financed privately by Rolls-Royce (and

initially went by the moniker PV-12.) Following the Rolls-Royce convention of naming its piston aero engines after birds of prey, the new engine was named the "Merlin". The Merlin is a small Northern Hemisphere Falcon. No engine used during World War II powered such a wide variety of aircraft. The best combination was the Merlin engine with the Spitfire, Hurricane, the Lancaster, all variations of the Mosquito, and later the P51 Mustang. However, the famous and glamorous Spitfire is and always will be the most closely associated aircraft with the Merlin engine starting with its maiden flight in 1936. Spitfires MKs 1-3 were built with Merlin engines with 1000 hp, fitted with the British S.U. carburetor. By the time the MK5 Spitfire rolled out, Rolls-Royce had increased the power of the Merlin to 1400 hp. At the time, the Merlin upright V12 liquid cooled engine had a rival in the Daimler-Benz inverted V12 engine. As late as 1938, both sides were visiting each other's aero engine plants. A German contingent on a tour noticed an inverted Merlin on the bench. There was no evidence at the time that an inverted V12 was any benefit over the upright version. Nonetheless, Daimler-Benz opted to proceed with inverted engines, the most famous being the 601. Where the Germans had an advantage was placing the supercharger on the side – it was attached by only eight bolts. By comparison, the complex Merlin was made up of 15,000 parts. Keith speculated that Rolls-Royce had doubts about their engines, possibly because of the failures associated with the Vulture engine, and therefore had a tendency to over-engineer their engines. One of the things that gave the Merlin a performance boost during the war was being able to obtain 100-octane fuel from the United States.

Rolls-Royce Merlin
Photo R Winson


Daimler Benz 601 Inverted Engine
Note Supercharger on Left Side
Photo - Courtesy Bison Books Ltd.

As World War II dragged on, great pressure was put on Rolls-Royce to increase production of the Merlin engine. During the Battle of Britain, British Prime Minister Winston Churchill created the Ministry of Aircraft Production and appointed Lord Beaverbrook as the first minister.

The decision to appoint Beaverbrook was controversial. Three British MPs cornered Churchill, and asked why he put 'that bloody Canadian braggard' in charge, stating he knew nothing about aircraft production. Churchill replied, "That's just the point. I didn't want anybody who knew about aircraft production. I wanted somebody who could get the job done." Keith commented on the dissimilarity of two of the principal people during the Battle of Britain, Beaverbrook and Air Chief Marshal Sir Hugh Dowding, the commander of the RAF Fighter Command. Dowding called Beaverbrook one evening with an emergency request saying that he was down to 400 Merlin engines and 650 Spitfires and Hurricanes. Dowding demanded 500 Merlin

engines by the end of the month. Beaverbrook calmly reassured Dowding that his request would be fulfilled. Beaverbrook 'brow-beat' Rolls-Royce into completing the engines on time.

Beaverbrook also had an antagonistic relationship with Henry Ford. It started in 1939 when the French government approached the British government and Rolls-Royce to build the Merlin engine in France. The Ford Motor Company had a plant in France called Ford Air. Henry Ford however, did not want to build British engines, preferring to stay neutral in the days leading up to World War II. This did not bother Rolls-Royce – general manager Ernest Hives never believed Ford or the French government were serious about building the Merlin. Beaverbrook would prove to be less forgiving. As World War II continued, Churchill and Beaverbrook looked to increase the production of Merlin engines outside of the United Kingdom. Henry Ford was convinced that he would win the contract to produce the engine in the United States. Beaverbrook, however, remained suspicious of Ford, and instead looked to Packard. The Packard Motor Car Company was a small automotive engineering company with a lot of expertise, having built the Liberty engine during World War I. Beaverbrook famously visited Henry Ford in person to tell him the news that he had awarded the contract to Packard.

Some of the engines built by Packard were shipped to deHavilland at Downsview for installation in Mosquitoes. Packard simplified the engine from the original Rolls-Royce design, and opted to use Bendix carburetors instead. Starting in 1941-42 Packard-built Merlins were also shipped to the Canadian Car & Foundry Company Limited in Fort William, Ontario (now Thunder Bay) who were building Hawker Hurricane fighters. Shipping delays and losses of engines from Rolls-Royce in England forced the switch to the US source. Packard Merlins used in Canadian-built Hurricanes were designated as Merlins 28 & 29. One disadvantage the Merlin engine had was the use of carburetors. Only Daimler-Benz and BMW were building engines with fuel injection. Planes with the Merlin engines equipped with a float-controlled carburetor were unable to pitch nose-down into a steep dive, as doing so would cause a loss of power or even a complete engine shut down, giving German fighter planes a tactical advantage. As a short-term solution, a simple washer device with a hole in the middle was placed in the fuel line between the pump and the carburetor over the float chambers to help cure fuel starvation.

There was continuing pressure from the British government to increase the horsepower of the Merlin engine, particularly for Royal Air Force photo reconnaissance missions. Rolls-Royce responded with a two stage, two-speed supercharger. The engine generates tremendous heat – the problem is the amount of heat generated from the compressed air / fuel mixture and how to prevent this mixture from becoming too hot. If not controlled pre-ignition and dangerous backfiring could occur. Rolls-Royce countered this by adding an intercooler. However, then the intercooler also needs to be cooled down. The solution is to circulate water, similar to the way a radiator works. This requires two pumps. With this addition, the Merlin engine tops 16,000 parts. Keith described the the intercooler on the Merlin engine looking like a milk crate sitting on top of the engine. When they came to fit it into the Spitfire, the supercharged engine was nine inches longer, requiring modifications to the already tight space in the Spitfire to accommodate the upgraded engine.

The supercharged engine made the American P51 Mustang very successful in the last eight months of the war. The updated engine gave the Mustang tremendous range at high altitude.

During WWII, the Merlin engines averaged 250-260 hours in the air before the engine had to be removed and stripped down for overhaul. Today, maintenance on turbine engines is extended to 35,000 hours. Total production of the Merlin engine was 135,000 including ones built by Packard in the United States. Packard continued building Merlins up to 1950. Keith was presented with a gift on behalf of the Chapter by Programs Volunteer Bob Winson for an interesting presentation and look at the history of the Merlin engine.

Our next Chapter meeting will be November 19 at 1:00 PM, also at Canadian Forces College.