



# The NStar Chronicle

Project North Star Association of Canada

October 2007

## Merlin Musings

Fourth in a series

*Ted Devey*

### Merline Engine Applications

Altogether nearly 168,000 Merlin motors were built in little more than 10 years. Rolls-Royce produced 32,377 at its main plant in Derby, 26,065 at Crewe, and 23,647 at Glasgow. Ford of England built 30,428 at Manchester. Packard of Detroit, Michigan, built 55,523 Merlins, many of which were shipped to Britain and installed in British-built airframes. Packard Merlins were also shipped to Canadian factories for installation in Canadian-built airplanes, notably Hawker Hurricane fighters (Canada Car and Foundry in Fort William (now Thunder Bay), Mosquito fighter-bombers (DeHavilland at Toronto), and Lancaster bombers (A.V. Roe at Malton near Toronto). Packard Merlins also powered the illustrious P 51 Mustang built by North American Aviation in California.

Airplanes powered by Merlins will be covered in two installments; the first will deal with fighter planes, and the second will cover multi-engined aircraft, mainly heavy bombers.

### Fighter aircraft – Messerschmitt 109

Messerschmitt 109 fighters were the principal adversary of British fighters, especially during The Battle of Britain, the greatest air battle of all time. It is, therefore, worthwhile to take a look at the aircraft that proved to be such a challenge to the RAF and the British aircraft industry. Willy Messerschmitt designed and produced the prototype Me109 in 1935, which oddly enough was powered by a Roll-Royce Kestrel engine rated at about 700 HP. Ultimately the Me109 was fitted with the Daimler-Benz DB-600 series of engines. The 109 was of simple design which facilitated high production rates. It turned out to be a hot performer.

The DB 601 engine was an inverted V-12 with fuel injection which allowed inverted flight and negative-G maneuvers (quick dives) that paralyzed float-carbureted engines. With a high capacity supercharger it delivered as much as 1000 HP. The Me109E maxed out at 354 mph at 12,300 feet. It had an initial rate of climb of 3,600 feet/minute, and the service ceiling was 36,000 feet. In the late 1930's it was raced extensively. In early 1940 it outclassed the Hawker Hurricane but not the Supermarine Spitfire. By the end of WW II the German aircraft industry had produced a total of 30,573 Me109 fighter aircraft including a number of variants.

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## Hawker Hurricane

Until the early 1930s the biplane was the configuration of choice. However, almost simultaneously, about the end of 1933, three airplane designers, Sydney Camm, (Hawker); R.J. Mitchell, (Supermarine); and Willy Messerschmitt in Germany decided to investigate the potential of monoplanes, ignoring a twenty year old prejudice against such designs.

Camm and Mitchell envisaged greatly increased speeds with Rolls-Royce's new PV-12 (Private Venture) which later became the very famous Merlin. Retractable landing gear and enclosed cockpits were embraced and provision was made for heavy firepower in which the designs of Camm and Mitchell were adopted for eight machine guns with converging trajectories. The prototype Hawker airplane was flown in November 1935 with a 1,035 HP Merlin C engine. Teething problems with the new airplane and engine delayed the flight of the first production model of the Hurricane I until 1937.

During 1938 and 1939, Hurricanes were introduced into the RAF at top speed. The planes were equipped with 3-bladed variable pitch propellers. In 1939, 12 Hurricanes were shipped to Canada Car and Foundry in Montreal as patterns for future production at their plant in Fort William. During 1940-42, 1,451 Hurricanes, powered by Packard Merlins, were produced in Canada and saw service the world over.

Messerschmitt Me109E fighters were superior in performance to Hawker Hurricanes at most altitudes but they were fragile, having a weak landing gear often giving trouble in take-offs and landings. The Hurricane was more sturdy and withstood battle damage better than the Me109E. The Me109E was faster and could out-climb and out-dive the Hurricane. Because of the inferior combat performance of the Hurricanes, they were allocated the task of dealing with the Luftwaffe bomber formations which seldom flew higher than 17,000 feet. The bombers were like sitting ducks, so the number of aircraft being shot down by Hurricanes exceeded those shot down by Spitfires. This was because the Spitfire, with its higher speed, rate-of-climb and better maneuverability engaged the fighters escorting the raiding bombers. Hurricane I's and later Hurricane II's were involved in the the Battle of Britain. The Hurricane IIs had Merlin XX engines delivering 1,260 HP, giving higher speeds and rates-of-climb, thus closing the gap with the Me109E's. Hurricane IIA's with improved Merlins and heavier firepower did serious battle with the Luftwaffe.

The Hurricane structure comprised a very sturdy wing box extending either side of the fuselage to which the metal covered wings were bolted (2 spars in each). The retractable landing gear was fastened to the outer sides of the box, and the fabric-covered

fuselage was bolted on top of it. Like the fuselage, the tail assembly was fabric-covered.

Merlin engines were float-carbureted and were subject to G (gravity equivalent) forces. The plane could not fly inverted, or perform a complete loop, and negative-G forces. as experienced in a sudden dive, would interrupt fuel flow to the carburetor. Hurricanes, Spitfires and Mustangs were subject to these limitations. Fuel injected engines had the advantage that fuel flow was not affected by G forces. It is interesting to note that Merlin 622s as fitted in North Star DC4 aircraft were fuel injected with fuel applied directly to the supercharger intake.

## Supermarine Spitfire

Supermarine engaged in the developed racing monoplanes on floats using the Rolls-Royce "R" (for racing) engine which led to the Merlin. Along with Hawker, Supermarine Aviation (a subsidiary of Vickers Aviation Ltd) became involved in the design of a new fighter. The design team led by R.J. Mitchell applied the experience gained from building the seaplanes that won the Schneider Trophy several times in the late '20s and early '30s.

The configuration of the Spitfire was similar to the Hurricane but it proved to be faster with a higher climb rate and better handling characteristics. Spitfires were of all-metal construction.

There were production problems with earlier Spitfires, because for example, ME109s, Hurricanes and Mustangs had straight leading and trailing edges on the wings, while Spitfires had curved edges. This of course gave the Spitfire a graceful appearance but made manufacture somewhat more difficult. The Spitfire nevertheless had larger wing area thus reducing wing loading in tight turns.

## P51 Mustang

Early in 1940 when the Battle of Britain was rapidly shaping up, the RAF approached North American Aviation (they built Harvards) in the USA to build a number of Curtis P-40s under license to augment fighter production in Britain. North American urged the RAF to allow them 120 days to design a new fighter from the ground up which would far exceed the P-40's performance. In about 117 days a prototype airplane was ready for flight, equipped with an Allison V-12 in-line water cooled engine. The RAF called it the "Mustang", and the US called it the P-51, so it became known as the P-51 Mustang. The RAF ordered a number of them and they performed exceptionally well at low and intermediate

altitudes, Above about 20,000 feet, the Allison engine performance declined rapidly. The RAF then contracted with Rolls-Royce to retrofit 5 Mustangs with Merlin engines. Rolls-Royce selected a engine equipped with a 2-stage of high performance supercharger, which compressed air so much that an aftercooler had to be interposed between supercharger and intake manifold. With this engine the Mustang performed extremely well at higher altitudes.

About that time, the British Government made arrangements with Packard of Detroit to produce Merlin engines. Packard Merlins were shipped to Britain to augment British production, to Canada for installation in Canadian built Hurricanes, Mosquito fighter-bombers and Lancaster bombers. A large numbers of Packard Merlins were installed in Mus-

tangs

The Mustang sported a number of interesting features. The wings were of narrow cross-section resulting in laminar flow of air, allowing higher speeds, and were also straight-edged for simple manufacture on the production line. The landing gear retracted inwards to give a wider stance on the ground for more stable handling (less tippy). A large fuel capacity gave the aircraft such a long range that Mustangs could escort bombers on their raids well over Germany and engaged defending fighters anywhere on the way. The airframe was built up of metal stampings fastened together. All surfaces were metal covered. With the Merlin engine fitted, the Mustang has been declared the most outstanding fighter aircraft of World War II.

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## Interview – Charles Baril

*Although there is only one North Star-a new star has been added to our constellation of restoration workers-Charles "Chazz" Baril. An Ottawa native, he is currently a student at Algonquin College where he is studying Applied Museum Studies.*

*What schools did you attend before enrolling at Algonquin? What were your interests during this period?*

I attended a local Christian High School and the University of Ottawa ( the Mechanical Engineering Program). During this time my primary interests were: history, drama, and creating detailed drawings of planes and spacecraft. Other interests included current events, military history, and activities with the air cadets.

*You are now studying Applied Museum studies. How did you decide on this particular course? What type of employment will you be seeking on graduation?*

After three years at the University of Ottawa, I decided that the museum course would allow me to combine my interests in drawing, history and aviation into an enjoyable career, a career I hope will extend into one of Ottawa's museums.

*How did you learn about Project North Star? What attracted you to the project? Describe the process you went through before you were cleared to work on the project.*

I learned about Project North Star from my par-

ents; they found the project's website and knew that I would be interested. I couldn't wait to start ! I was drawn by the possibility of working on an actual aircraft and restoring it to a flying or display state. In order to be cleared to work on the project I completed fall arrest and waste and hazardous material handling courses. I learned how to label hazardous material and when and where to use proper safety equipment. About two weeks later I got a nice new card with my certification and I was honoured to be accepted by the project.

*You have been working on the project for several weeks now. Describe your on job experience to date: tasks performed and lessons learned.*

So far I've done some paint stripping, air brushing stencils (cutting and applying), glass beading riveting (pneumatic and mechanical), felt cutting and aluminum polishing. The lessons to date: take your time with everything, and know that when polishing you will be the butt of Ted's jokes "The one that polishes the most is the fleet admiral !" Always listen to instructions from Mike Irving, always have a line ready for Jim (I do enjoy his jokes). No complaints so far and I am thrilled to be part of it all.

*From your point of view, what are some of the more interesting aspects of your involvement with Project North Star?*

Well, getting to know the rest of the crew, and learning about the North Star through the anecdotes of the flyboys and crew members.

*How do you rate your experience on Project North Star?*

My experience with the North Star and the PNS crew have been very rewarding and will help me

with my course in September. Everyone has been helpful with the guidance necessary to execute the many restoration techniques required. I will always have wonderful memories of this Project and the people I have had the pleasure to work with.

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## Frank (Paddy) Moran

MORAN, Francis Walter "Paddy" CD  
May 4, 1932-July 1, 2007  
RCAF (436 Squadron)

PNSAC members came to know "Paddy" as our original Project Manager on the North Star. His background included service time in the RCAF and as a ground training instructor at First Air. "Paddy's" experience and training served us well during our early days, working outside on the North Star, and, he

saved us considerable expense by running our safety training programs at First Air.

"Paddy" was always cheerful and ready to help any of us who needed help. He wouldn't ask anyone to tackle a job he was not willing to do himself, and, was always willing to lend a hand, no matter the demands on his health.

We knew, of course, that his time with us was limited but the Board members appreciated all the time he gave us so unselfishly. He will remain with us in our memories.

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## RCAF North Stars – 1962-1965

*Larry Stewart*

In 1962 the North Star Squadron, 426 Thunderbird Squadron, was stood down and all but five of its aircraft were retired from service in the RCAF. The remaining five, including 17515, were retained in service until 1965. Larry Stewart describes how these aircraft were tasked.

Generally, once 426 (T) Squadron folded, the five re-assigned North Stars based at CFB Trenton picked up most of the assignments that were being carried out by 426 at its close. Even though the aircraft operated under the umbrella of the Transport OTU, the North Star operational crew training pretty well ceased at the end of November, 1962 when I was the lone crew member posted to the Transport Flight following completion of the OTU training. Operational flights included the picking up of some service flights (SF) within Canada; including, positioning routine flights (SF) and moving service people and supplies within Canada. Flights typically flew into and out of Downsview, Dorval, St. Hubert, Quebec City, North Bay, Winnipeg, Edmonton, Vancouver, Comox, Port Hardy, Churchill, Bagotville, Cambridge Bay, Yellowknife, Frobisher Bay, Resolute Bay,

Thule, Alert, Goose Bay and Gander.

The assignments also included picking up some of the assignments flown by the C-47s and Bristol Freighters of the Transport Flight based at 1 (F) Wing, Marville, France. These flights were between 1 (F) Wing at Marville to the NATO-shared weapons training airfield at Decimomanu, Sardinia, the Air Movements Unit (AMU) at Pisa, Italy, but also included Gatwick and Lyneham in the UK.

Other than the Canadian operations, support was provided to our troops on United Nations assignments, as well as some transport for other UN forces. Positioning flights (with some transport of supplies back and forth) saw the North Stars periodically rotated to and from Air Division from Trenton to Gander or Goose Bay, Keflavik, Shannon and Marville. UN troop rotations flew out of Marville or the AMU at Pisa, Italy. After the Yukons began regular rotations in 1963, the UN troops would be rotated through the Canadian Army-run AMU at Pisa. Troops were flown to the Canadian UN part of the El Arish, Egypt airport via Athens, Greece. The troops would then be transported to the Gaza Strip. Some of the returning UN troops saw us flying into Gutersloh, Germany, Gardermoen (Oslo) in Norway and Stockholm, Sweden.

The September, 1963 war in Yemen brought the

Transport Flight a further assignment in that we carried personnel and supplies to the Canadian UN Observation Support Flight (Caribous from El Arish) which was quickly established in Sanaa, Northern Yemen. These North Star flights flew from Marville to Pisa to Athens to El Arish to Jeddah (Saudi Arabia) and, finally, into the mountainous terrain of the Sanaa airport. Needless to say, our flights, particularly into Sanaa, were eagerly received by the flight and support staff in that backward part of the coun-

try.

I don't have any more personal history with the North Stars of the 4 (T) OTU Transport Flight, as I, and a few others, were some of the first to leave the RCAF in the Summer of 1964 after the Minister, Paul Hellyer, decided to start trimming the payroll of the Air Force. From there on until their final flights, the role of the North Star gradually wound down. I hope this will be helpful to you in understanding the role of that good old workhorse—the North Star.

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# Miscellany

## Photographs



Figure 1: Canada Day visitors to the North Star



Figure 2: Canada Day crew



Figure 3: Visitors line up to see North Star



Figure 4: Ted Devey explains ...



Figure 5: Classic Air Rallye – nose art



Figure 6: Classic Air Rallye visitor



Figure 7: Bruce Gemmill has completed the restoration of the B3 drift meter.



Figure 8: Gordon Webb and model of North Star 17512



Figure 9: Gordon Webb with a replica of North Star 17512 in which he and his crew set a new cross Canada speed record, Vancouver to Halifax, on January 16, 1950. He presented the model to PNSAC, Tim Timmins accepted on behalf of the Association

Photos in figures 1 to 7 by Chris Payne.

Photos in figures 8 and 9 by Jacques Menard.

## Newsletter distribution

The NStar Chronicle is delivered to members by e-mail or by regular post to members not having e-mail addresses. This issue was unavoidably delayed but the next will be published on schedule, December 1, 2007.

## Member's meeting

A member's quarterly Meeting was held at the Canada Aviation Museum on 22nd September. It featured a slide presentation on Project North Star produced by Chris Payne. The next meeting is scheduled for the 8th December.

## Reader's comments

Future issues of our Newsletter will include a reader's comments section. The Editor will select

items for publication. Submit your comments to the Editor at e-mail address listed below.

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<sup>1</sup>This newsletter is typeset using L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>. The style package used for the newsletter (PNSAC.sty) is a modification of GRASSnews.sty belonging to the Geographic Analysis Resources Support System (GRASS). The modification was made possible by kind permission of the Editor-in-Chief of GRASS-News.