



# The NStar Chronicle

## Merlin Musings

Eleventy in a series

*Ted Devey*

### Overhauling a Merlin 622

Before overhaul of No. 1 engine in July 2006, several years of preparation was done by Pierre Drapeau, a retired technician who had many years of experience working at the Air Canada workshops in Montreal overhauling and maintaining jet aircraft engines. His experience with Rolls-Royce engines made him familiar with the R-R manuals and parts listings as well as with overhaul procedures. He provided us with updated information on all parts of these engines which greatly simplified our tasks. The Merlin Crew owes Pierre a debt of gratitude for the research done in the CAVM Library and Archives and at home for the provision of updated parts listings. On various occasions, he participated in the dirty work on the engine itself.

The overhaul of the engine commenced with the removal of the Supercharger while the engine was still mounted on the Transport Stand. This reduced the necessary length of the rotary stand to which the core engine was bolted. The engine was then disassembled into basic sub-assemblies as portrayed in the picture. The crankcase upper half forms the foundation of the engine to which all other sub-assemblies are fastened. These sub-

assemblies were removed in a logical order, that is, cylinder heads, cylinder blocks, reduction gear, supercharger clutch unit, wheelcase, pistons and connecting rods, and, after inverting the engine on its rotary stand, the crankcase lower half (sump) and finally the crankshaft. All sub-assemblies were stored on nearby shelving.

The four engines to be overhauled had been residing in the Great Canadian Outdoors without having been protected in any way. Where some of the exhaust valves were open, there was access to the cylinders through the valves. There was difficulty in removing the cylinder blocks following head removal as there was corrosion of the steel cylinder liners and steel piston rings. The starboard block was removed with difficulty using slings around the bank and two hoists from the A-frame above. Liquid Wrench was poured into the cylinders (both banks), allowed to soak for several days, and compressed air was applied to each cylinder in turn to force the L/R down past the pistons. For this operation the stand was rotated such that the starboard bank was vertical. Some pistons yielded and others were more reluctant to release their grip on the cylinders. Somehow, the Starboard Block and Head came off and were stored for future treatment. The Port Block was more stubborn. In the first place, a number of the head-to-bank nuts were difficult to remove due to rusting. The 622 had special studs and nuts which were different from the earlier Merlins (they being of conventional form), and furthermore each block

### Contents of this volume:

Merlin Musings . . . . .	1	Ottawa International to London-Heathrow . .	5
Novice Pilot . . . . .	3	The North Star Sees The Light Of Day . . . . .	7
		Liaison Radios Donated to Project North Star .	8
		Miscellany . . . . .	9

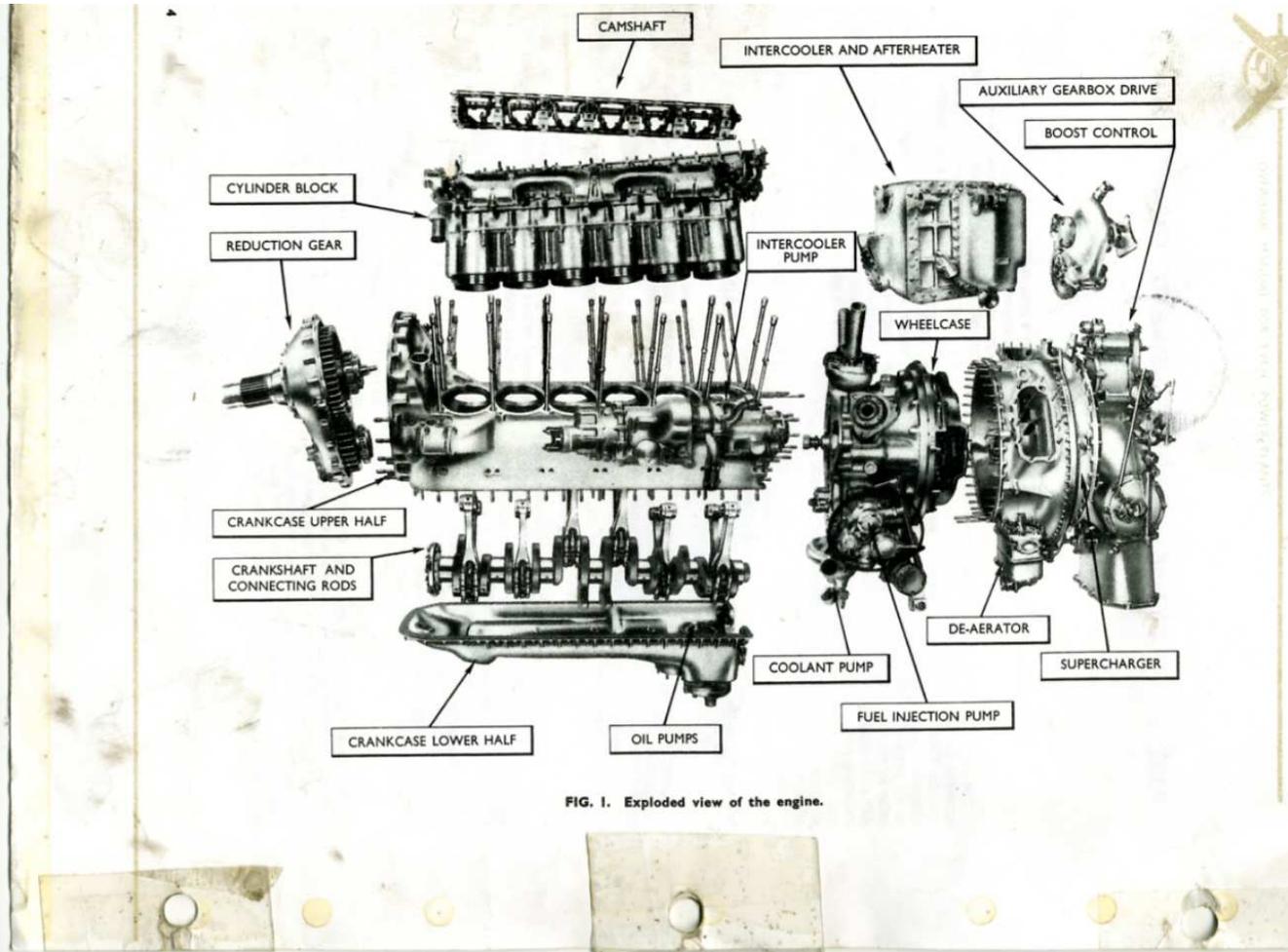


FIG. 1. Exploded view of the engine.

Figure 1.0.1: Merlin engine – exploded view

had two additional head-to-block studs at the front and rear. On the Port Block, the rear studs were so badly corroded that it was necessary to use last-resort methods for removal. In this case the wedge effect of two large slot-screwdrivers wrapped in aluminum and driven between the head and bank with club hammers was used. After much hammering, the gap slowly widened until the two rusted studs gave way and the head jumped free of the block. The remaining task was the freeing of the pistons from the cylinders. This was achieved easily for four of the six pistons, but numbers 2 and 5 were solidly stuck in place. With straps and hoists in place and using the weight of the engine and supporting frame, number 5 came loose but 2 was totally uncooperative. Drastic measures were needed and applied. With the hoists lifting the whole engine assembly and stand until the stand was barely off the deck, a large dead-blow hammer was used to pound the piston into submission. But the piston was near the bottom of its stroke and so a handy piece of aluminum rod four inches long and five inches in diameter was found and laid atop the piston (bore is 5.4 inches). John Corby swung the hammer but could not apply sufficient force from his position, so he stood on a stand about two feet off the floor and commenced swinging. The second blow did the trick, the cylinder bank jumped upwards and the frame and engine returned to the proper location on the floor. Unfortunately, our photographer was not present to record that dramatic moment! The lesson we have learned is to notify him whenever an event of this sort is anticipated so that we have visual material of interest

for this website!

Next was the removal of the pistons and connecting rods from the crankcase, followed by the crankshaft which was held in place by seven main bearings. These bearings were fastened to the crankshaft by conventional bearing caps bolted to the crankcase in the usual manner as well as by long horizontal through-bolts from one side of the crankcase to the other side through the bearing caps.

The upper crankcase was then removed from the stand and taken outdoors and steam-cleaned in the freezing weather of Ottawa in February 2007. This was a spectacular operation by Bill Tate and me in the midst of great clouds of steam. (Again our photographer was unavailable to record this spectacular scene!) Steam cleaning removed most of the oil and muck, but not all of it. The steam bath was followed by scrubbing the crankcase inside with Scotchbright pads soaked in lacquer thinner, then finally cleaned inside and out with glass bead blasting. This was very effective in giving the aluminum casting a clean and bright appearance. As a preservative measure to counteract future corrosion, the outside of the casting was sprayed with a clear-coat finish and the inside was coated with flyway oil. The upper crankcase was then remounted onto the rotary stand to receive other sub-assemblies as they were treated and overhauled. This preservative procedure was applied to all castings and internal components on re-assembly.

The treatment of other sub-assemblies and components and engine re-assembly will be covered in future chapters of Merlin Musings.

PNSAC

## Novice Pilot

### Part two

*Ted Slack*

As indicated in the last issue of the Chronicle, I arrived in Vancouver in 1950 and discovered that UBC had an aero club. Commercial air travel was not that common in the immediate post WWII years and, coming from a railroad family, I had free train travel so I had never been in an aircraft when I arrived in Vancouver. However, I was fascinated with aviation, having read many books on military aviation. And when I learned that I could get a pilot's license for approximately \$30.00, I just had to join the UBC Flying Club. So it was not until a couple of years after I obtained my pilot's license that I had my first ride in an aeroplane as a passenger.

In 1950, civilian pilot training was not nearly as

developed as it is today and my ground school training was almost nonexistent. There were about five of us who needed a ground school course at about the same time, and we appeared at an abandoned butler hut at the appointed time for our first lesson. The ground school instructor finally showed up about 30 minutes after the appointed time. He had spent the time from when he finished his normal workday and the time when class was to begin over at the other side of the airport in the military mess. He had problems trying to remember his name and why he was at the butler hut; we had a very short session. The second night, he again arrived late and for the same reason; this time he fell coming up the stairs to the butler hut and split his head open. We had to send him to the hospital in an ambulance, and that ended our ground school. In spite of these ground school problems, our formal flying training was excellent as

all our instructors were ex-military people.

On my dual cross-country flight, we were flight-planned to go from Vancouver Sea Island Airport via the Fraser Valley to Hope, then the Fraser Canyon to Boston Bar and direct to Vancouver. As we started up the Fraser Canyon, the cloud base was below the mountain tops and it started to get lower the further we went. The instructor said, "We had better get out of here, do a 180 at the next widest point". When we turned around and looked back down the canyon, it sure didn't look very promising. The instructor confirmed that he didn't relish the thought of trying to backtrack down the canyon and said, "There is a hole in the clouds above us, we'll go on top, I have control". When we eventually broke out on top. it was solid clouds below us in all directions, not even a mountain peak poking through; and we were nordo (no Radios) and our only navigation instrument was a compass. The instructor said, "There will be holes out over the ocean, you have control, fly west". After what seemed like an eternity, I saw some water through a hole in the clouds, yelled "WATER BELOW" and the instructor responded with "DOWN". When we broke out under the clouds, it appeared as if this patch of water was surrounded by mountains and the instructor confirmed it by saying, "It's a lake and a lake has to have an outlet, so there will be a notch in the mountains which we can follow out". And I can tell you today that there was. So we arrived back in the Fraser Valley but did require an unscheduled landing to empty aching bladders.

In the spring of 1952 (after exams were over), I helped organize a UBC Outdoor Ski Club two-week trip into Garibaldi Park. We needed about one-and-a-half tons of supplies for the two weeks and there were no roads into the Park (you have to go by boat, train and hike/ski to get in there). So we chartered an Anson to aerial-drop the supplies on the Black Tusk Meadows. Since the meadows were still covered with 10 to 12 feet of snow, it would be a low-level free drop (no parachute) and we would have a small advance party on site to watch where the boxes fell and to dig them out. I went along in the Anson to make sure that they dropped the supplies in the correct place and to help throw the boxes out. In 1953 we tried to plan a similar trip, but the smallest aircraft available was a DC-3 and the price was \$165.00, a lot of money to a bunch of broke university students. A bit of number crunching indicated that if the Aero Club of BC would rent me their Stinson Station Wagon, I could, in several trips, fly the supplies into Garibaldi cheaper than the DC-3 and have the enjoyment of the free flying. I only had about 37 hours in my log book, but I was long on nerve and approached the Manager of the Club to ask if I could rent the Station Wagon for the aerial drops. He responded by saying, "Can't do it. The Station Wagon

is going to be our IFR aircraft and it will be down in Seattle having a Radio-Range receiver installed. But why don't you use one of the Fleet Canucks with a climbing prop". That was rather discouraging since the Weight and Balance Report for the little Canuck didn't have much payload room with myself and my "Loadmaster" (to heave the boxes out) on board. I thought about it for a while, then went back again to the Manager and said, "Ben, how much payload do you think the Canuck will carry with two on board?". He replied, "Try it with 200 pounds the first trip!" His math was better than mine and made the whole exercise appear possible. There was one more little(?) problem to solve; I had to go to Transport Canada and get their permission to throw things out of an aeroplane. With my logbook, and all of 37 hours flying experience in hand, I headed for the local Transport Canada office. While riding the street car to their downtown office, I was trying to decide if after hearing my proposal they would just faint or turn red in the face and shout "NO WAY". Actually they were quite calm and said, "No problem, but you will have to sign accepting all liability". They were afraid that I might drop a box on a caribou. I was a bit concerned about jeopardizing all my worldly possessions (my pilot's sunglasses and my slide rule); however, as soon as I could steady my hand I signed.

The airport at Vancouver is on an island and is six feet above sea level. The three runways were in the standard WWII format enclosing a grass triangle. Nordo training aircraft operated on lights from the grass triangle and commercial aircraft with radios operated on the runways. In the spring, the grass triangle was extremely soft and could not support a heavily loaded Canuck. We had to get the tower's permission to take-off from the runway using light signals. When returning after an aerial drop mission, we could not land on the runway nordo, but since we were now lightly loaded, we could land on the grass.

The exercise was carried out without any major hitches, although the people in the control tower obviously wondered why a Fleet Canuck sometimes was using more than 2500 feet of runway to get airborne. On one trip, which was not with our heaviest load, we climbed to about 4000 feet but couldn't get any higher. So I said to my 'Loadmaster', "We can't go back to Vancouver and land on the grass with this load. We will have to fly into Alta Lake, which should still be frozen, and drop some boxes to lighten our load. Then when we get to the Meadows and drop the rest of our load, we will also have to drop a note to the advance party telling them what has happened and that they will have to hike over to Alta Lake to pick up the rest of the supplies". As we started for Alta Lake, I noticed that we were starting to climb again. I was puzzled at first, and then realized that I had just received another lesson in moun-

tain flying. When the aircraft wouldn't climb, we were on the leeward side of the valley. And now that we have crossed the valley, we are on the windward

side of the valley. (Mountain Flying Lesson: Always be aware of where you may encounter ascending and descending air masses .)

PNSAC

## Ottawa International to London-Heathrow

### A Flight from the Ottawa International Airport to London-Heathrow with Captain Bill Tate Air Canada 767 Pilot

*Glenn Cook*

I first met Bill Tate at the Canadian Aviation Museum where we both volunteer albeit in different capacities. Bill, between airline route flying, works on the restoration of the venerable North Star. An enormous undertaking, volunteers are attempting to return this aircraft to exhibit condition. I volunteer working in the library doing research on the existing aircraft on display. It was while having lunch one day that I mentioned I had an Air Canada reservation to London, Heathrow on the 23/24 March of this year (2009).

The following Tuesday Bill mentioned that he could bid on flights for the next month and speculated that he might be able to fly me to London Heathrow himself. I found this to be a most generous offer. Needless to say I would go as a passenger, he as Captain. Shortly thereafter, Bill confirmed by Email that he had successfully bid on a monthly "package" that would see him as the Captain of the Boeing 767 for A/C Flight 888 on 23/24 March. Several days later he suggested that we meet in the Ottawa International terminal about 1 1/2 hours before the departure time which was scheduled for 11:00 p.m. I made sure I cleared security well on time, met Bill, and he took me through password protected doors into an Air Canada flight planning center where the flight plan to London Heathrow had been previously prepared. I was surprised to find out that flight planning had not changed much since my days as a Navy pilot. However, the technology by which the flight plan had been produced and delivered was, in my opinion, light years ahead of the way we did it in my days of military aviation.

Bill downloaded about ten pages of data which included the latitude and longitude of several major way-points which tried to emulate a great circle flying route between Ottawa and London. On query,

Bill mentioned that the difference between a great circle route and the one we would actually fly was greater by about 213 nautical miles. We then discussed en-route aircraft separation both horizontally as well as in altitude. The weather maps indicated that there were two major weather fronts en-route, the first slightly west of Greenland the second east of Iceland. I knew these fronts would be accompanied by some turbulence caused by the colliding air masses

While I didn't understand all the Air Traffic Control requirements to be met en-route I did enjoy confirming that the manner in which Air Canada performs its flight planning is both thorough and efficient. Close to the end of this exercise the First Officer joined us and proceeded to carry out certain responsibilities associated with this transatlantic flight. Subsequently he went to the aircraft to conduct a pre-flight inspection at which time Bill took me past the gate numbers and down to the Boeing 767 cockpit.

I seated myself in the co-pilots seat and looked around to see if I could recognize anything. Surprisingly, and within a very few minutes, the instruments and their location slowly fell into place. I enjoyed the high resolution "glass" cockpit with an AHRS<sup>1</sup> and an HSI<sup>2</sup> stacked vertically in front of both pilots. This is the instrument panel configuration I am planning for my homebuilt Vans RV 7A currently under construction. The engine information was center-stacked and I noticed the console configuration was laid out with all auto-pilot functions available to both pilots. The overhead console was a myriad of utilities and switches for the APU<sup>3</sup> as well as for lighting, radios and operation of other modern avionics required by the air transport industry. I was quietly pleased to note that it all made sense to me in some primitive way.

About this time one of the female Flight Attendants stuck her head in the cockpit just at the moment I was moving to the jump-seat located behind the center console. She looked at me aghast and said something which sounded like "and who are you?" Bill introduced me and I didn't feel quite so conspic-

<sup>1</sup>AHRS – Attitude Heading and Reference System. This system presents the pilot with his aircraft attitude in flight.

<sup>2</sup>HSI – Horizontal Situation Indicator. This instrument is much like an automated map and allows the pilot to orient the aircraft relative to a myriad of navigation aids.

<sup>3</sup>APU – Auxiliary Power Unit. This device provides necessary power to the aircraft to operate the aircraft systems when the engines are not operating. It's a small jet engine located in the tail of the aircraft.

uous. The entire crew, including me, then went back into the passenger cabin where the crew introduced themselves to each other. There followed a briefing by Bill regarding special safety procedures.

Since I had to enter the aircraft as a passenger, I was led from the aircraft to the holding gate where I showed my boarding pass and boarded the aircraft in the conventional manner. I made my way to a series of cubicles which could be configured, through moveable cushions into a reclining bed. I looked at the many switches which managed the entertainment system, including seven push-buttons to place the seat (or seat cushions) in any number of body twisting contortions, and tried to figure out how the food tray operated. Frankly I would have felt more comfortable with Bill in the cockpit. I started to push the many seat positioning buttons but was gently admonished to cease and desist until the aircraft was airborne.

In retrospect I should mention that the purpose of my trip to England was to visit my son-in-law who is a Major General in the Canadian Air Force. Along with a test-pilot colleague John "Stretch" Arnold we were also looking for long dead relatives as part of respective genealogy projects. John, who lives in Victoria, was on a non-stop flight from Edmonton to London Heathrow and was scheduled to arrive in London on Flight 898, fifteen minutes ahead of the Air Canada 888 captained by Bill Tate. I had mentioned this to Bill while going through the pre-start cockpit checks earlier. About an hour after take off the head Flight Attendant appeared and told me that Captain Tate had made inquiries and had found out that flight 898, the aircraft my colleague was flying in, was delayed about an hour. She handed me a message which went something like this:

*Flight 898, you have a passenger on board by the name of John "Stretch" Arnold who will be meeting one of my passengers at London Heathrow. Since you're running late, could you provide this passenger with an expedited customs clearance form to minimize Custom delays at Heathrow.*

A short time later a delicious meal was served along with copious quantities of Bordeaux red wine which I enjoyed between unsuccessful efforts at uncovering the logic of the buttons that changed my seat position. Several minutes later I rationalized that the difficulties trying to figure out how these buttons worked was intentionally designed into the system. The reason was that they wanted to "challenge" the incumbent as a method of entertainment.

Shortly after the meal I managed to get the seats configured for a bit of a snooze. I then realized it might be prudent to use the aircraft plumbing sys-

tem. In the unlikely event that I should fall asleep, I wouldn't be awakened by a chronically weak bladder. After leaving the washroom at the front of the aircraft I saw Captain Bill Tate, with an enormous smile on his face, standing just outside the cockpit door. He asked if I had a camera in any of my belongings and mentioned he would take some photos of the forthcoming sunrise in an hour or so. I then proceeded to my seat reaching into my brief case to get the camera, and noticed Bill standing directly behind me. I'm sure the passengers in the cabin were wondering why the aircraft Captain would want to talk to an obviously older (but not yet senile) passenger.



Figure 3.0.1: Sunrise over the North Atlantic

After finally graduating (cum laude) from my two hour self-taught course in learning how to adjust the seat cushions into a (more or less) horizontal position I attempted to doze. About this time we encountered the first of the two cold fronts, this one located west of Greenland and I knew intuitively my airborne transatlantic location from the weather maps before take off. I felt the turbulence gently rock the aircraft<sup>4</sup>.

About an hour out of Heathrow, the Flight Attendants turned on the lights and served juice, eggs benedict, rolls and coffee. I declined, preferring to fill out my Customs form as well as trying to visualize the Heathrow terminal configuration earlier provided to me by my daughter who commutes to London on a frequent basis. While looking out the window, I observed a scattered undercast condition about 15,000 ft below. The last hour seemed to go by very quickly as the Flight Attendants cleaned up and prepared passengers for the forthcoming descent. Over the cabin intercommunication, Bill told us that our arrival time would be within five minutes

<sup>4</sup>After the flight Bill mentioned that the forecast turbulence required that he divert South of the flight planned route to avoid the more severe aspects of the jet stream

of that flight planned and we would be commencing an en-route descent in about fifteen minutes. He also mentioned that the weather was somewhat cloudy in London but with little or no rain.



Figure 3.0.2: Approach into Heathrow

The approach to London Heathrow was over the Thames River and one could easily make out the meandering river, the adjacent parliament buildings not to mention the enormous gondola that serves

as a tourist attraction and provides visitors with a superb view of the City of London.. Minutes later the aircraft landed and was quickly marshaled into a docking station. Bill was standing in the passageway immediately behind the cockpit door with another enormous smile on his face<sup>5</sup> I shook his hand, thanked him for the trouble he went to in order to fly me to London Heathrow and, somewhat reluctantly, stepped over the combing and started my journey to search for the footprints of relatives who had died many years ago.

It was only later that I looked at the images that Bill and his First Officer had taken during the flight. Not only were there photographs of the early morning sunrise, there were complete pictures of every portion of the inside of the cockpit with all instruments indicating the condition of flight at the time they were taken. Also, there were magnified images of the approach into London Heathrow. I have flown on commercial aircraft for many years but have never had an Air Canada Captain offer to arrange a transatlantic flight to personally "take me over". As a consequence, I will reflect on this once in a lifetime experience for a very long time.

From one pilot to another: Thanks Bill!

PNSAC

## The North Star Sees The Light Of Day

*Bruce Gemmill*

After months of preparation, the North Star was rolled out of the storage hangar at the Canada Aviation Museum so that much needed restoration work can be done in the cockpit. Volunteers worked for weeks to 'birdproof' the aircraft so that birds and small animals would not once again make it their home. All holes, large and small, were covered with wire mesh and aluminum tape. The cargo doors were lubricated so the aircraft could be closed up and secured while outside, and the aircraft was jacked up and the wheels rotated to ensure a smooth rollout.



Figure 4.0.1: North Star rollout

Meanwhile, inside the cockpit all remaining equipment items and insulation was removed in preparation for the restoration work to follow. A tool chest and complete set of tools was purchased and placed inside the aircraft, as this will be our restoration shop for the next few months. An electrical panel and water supply were installed on the taxi-

way for easy access. An air extraction system has been purchased that will ensure a safe and environmentally friendly work space. Finally, large tarps were installed over the three remaining engines and the cockpit to protect the North Star from the elements.

Finally, on May 27th, Mike Irvin, our Project Manager, hooked up the mule to the North Star's nose wheel and began the big move. With volunteers Charles Baril, Ted Devey, Rolf Geiger and Bruce Gemmill acting as guides, the big aircraft was inched

out of the storage hangar and onto the taxiway. It was positioned close to the security fence near the main museum building, and the wheel chocks put in place.

Over the next three months, the cockpit will be refurbished. We will also take the opportunity to steam-clean the engines, wheel wells and other areas that need heavy-duty cleaning that cannot be done inside the storage hangar. Completion of this work will mark a major milestone in the restoration of the Northstar.

PNSAC

## Liaison Radios Donated to Project North Star

The RCAF North Stars were fitted with state of the art (1948) high frequency liaison radios for long range communications. The receiver and transmitter, shown above, were located at the Radio Officer's position on the port side of the flight deck. The ART 13 transmitter had 10 pre-tuned channels and could be operated in continuous wave, modulated continuous wave, or voice. These radios, especially the BC 348 receiver, have been very popular with amateur radio enthusiasts and are extremely difficult to find.



Figure 5.0.1: Liaison radios

It was through a notice placed in the 426 Thunderbird Squadron Association Newsletter that the radios were located at the Nanton Lancaster Society Air Museum. Pete Sayers, a former 426 Squadron Flight Engineer, Bryan Nelson, Curator of the Greenwood Aviation Museum, and several members of the Canadian Aeronautical Preservation Association contributed to the search effort that eventually led to John Phillips at Nanton. He had the radios in question and was willing to donate them to Project North Star.

John, a long time HAM, is still using the BC 348 receiver and ART 13 transmitter equipment. He wrote, "A friend of mine in Lethbridge and I are attempting a two way contact on 80 metres using my ART 13 and BC 348, both dynamotor powered, and, 59' of wire to somewhat simulate a B 17 or B 29 aerial. .... He tells me I am laying down a very good signal into Lethbridge."

Fortunately for Project North Star, John was willing to part with some of his collection of radios. He has passed on a BC 348 receiver he inherited from the Nanton Air Museum and has donated one of his three ART 13 transmitters for eventual installation in North Star 17515. The radios have been received and are awaiting restoration. A great big "Thank You" to John for his generous contribution to Project North Star.

PNSAC

# Miscellany

## Photographs

All photos in this section by Chris Payne.



Figure 6.0.1: Murray and Ron planning next step for exhaust shield restoration



Figure 6.0.2: Rolf working on supercharger



Figure 6.0.3: Chazz preparing North Star for hangar exit

## Cockpit chatter

British Airways flight asks for push back clearance from the terminal. Control tower replies: "And where is the world's most experienced airline going today without filing a flight plan".

Tower: "Have you got enough fuel or not?" Pilot: "Yes." Tower: "Yes what?" Pilot: "Yes sir."

Cessna 152 reports at Flight level three thousand, seven hundred (3,700,000 feet). Controller: "Roger, contact Houston Space Center."

Beach Baron: "Tower, verify you want me to taxi in front of the 747." Tower: "Yes, it's OK. He's not hungry."

## PNSAC schedule of events

- June 13, 2009. Annual General Meeting in the Bush Theatre of the Canada Aviation Museum commencing at 10:30 a.m.
- July 1, 2009. Canada Day at the Canada Aviation Museum.
- August 23, 24, 2009. Classic Air Rallye at the Canada Aviation Museum.
- September 5, 2009. Members Meeting in the Bush Theatre at the Canada Aviation Museum.

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The NStar Chronicle is delivered to members by e-mail or by regular post to members not having e-mail addresses.

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