

citizen or corporation to donate what was needed. The first flow of funds occurred in November, but with assurity of these funds, personal credit cards were used for interim purchases.

A suggested initial **schedule** was prepared for the fabrication, assembly and finishing of the Replica. Since the volunteer labour was such a major determinant for the schedule, it was a hope-filled exercise. The cockpit 'tub' was progressing led by Joe Foster; the structure for the Nose Section was started, under the leadership of Bruno Quattrin; the Outer Wings, having undergone some redesign, were underway, led by Mike Dias - things were looking good. An estimated completion date of late 1999 was possible - but not probable. Many revisions to the schedule would occur.

**Time** devoted to the project by the volunteers was increasing, with the many components underway and some volunteers coming in daily. As word spread about the Replica, folks from various locations in Canada made inquiries on how they might help. Hence, it was that components and parts commenced to be fabricated in home workshops in Charlottetown P.E.I., Halifax, Nova Scotia, Burlington and Wallaceburg, Ontario.

In late 1999, Ken Laver, President of Messier-Dowty of Canada, visited the project, and being impressed that things were happening with the project, offered to undertake the fabrication of the simulated Landing Gear - both Nose and Mains. This was a significant corporate contribution, from the company which designed and constructed the original Arrow Main Landing Gears.

It was in early 2000, when the **Nose Section** [Sta 292.0 fwd.] was coming together as the first major component for the Replica. This structure, the most contoured part of the Arrow, was nearing completion, including the Electronics Bay by Mike Holland and Radome led by Peck Duff. The structure was moved from its assembly jig onto a mobile support frame and the cockpit 'tub', with its completed canopies and windshield, was inserted in place. Skinning operations were in 'full swing', under the leadership of Peter Allnutt, and more volunteers were happily working to get this section ready for the CNE 2000. On August 17, 2000 the Nose Section took its first "flight" outside the TAM - being transported by a donated low bed tractor-trailer to the CNE. This public display of the Arrow replica was very well received both by the press and the people. It showed itself very well as a work-in-progress, with clecos holding some skins temporarily in place and some skins missing.

By September 7th, the Nose Section was back in its "nest" ready to be worked on towards its completion. The missing skins were prepared and assembled; the detailing within the cockpits continued; fine finishing of the radome and the pitot tube were all getting attention. New volunteers, from the CNE exposure, were quickly delayed

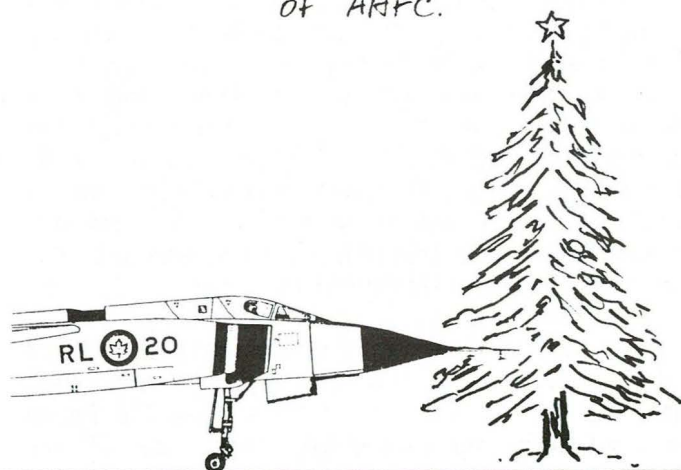
in new teams to start the design-ready Fuselage Sections. Even with the increased work effort the schedule was slipping. A **target** for the fall of 2001 was now quite possible, with continuous volunteer labour and increasing space for the fabrication and assembly of the project.

And the story continues . . .

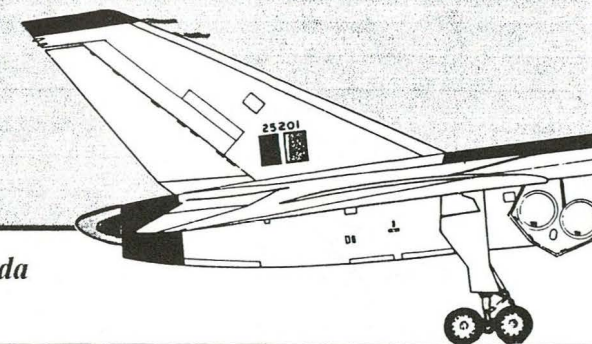
#### Postscript:

*I worked as a draftsman on the Arrow, drawing electrical circuits, panel and wiring installations. One memorable assignment, for a colleague and myself, was to measure all the wires and record them by their size. We did this work on the wooden mockup and the actual length of wire in the Arrow was over 12 miles. On Black Friday in 1959, AVRO and Canada gave me my most memorable birthday present: no job. This event changed my life, as it did many others, in that I got connected with the TTC Design Office and the development of the Bloor-Danforth and University Subways. Transportation planning became a major interest, so I undertook Civil Engineering at the University of Waterloo, graduating in 1966. A stint with a planning consultant followed, then various positions at the Department of Highways (now Ministry of Transportation). After 25 years at the MTO Office, I retired.*

*And on the occasion  
of the holiday season -  
a Merry Christmas et Joyeux Noel  
from the Board of Directors,  
to  
members, friends and supporters  
of AHFC.*



# Pre-Flight



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T O R O N T O  
**AEROSPACE**  
M U S E U M

**Claude Sherwood, P.Eng.**

Located on the former CFB Downsview property in one of the many buildings is "the new kid on the block" of museums, the Toronto Aerospace Museum (TAM). Nearby are aircraft companies (Bombardier et al.), business, government, and industries of various sizes and sorts - and also our Foundation (AHFC). TAM is dedicated to displaying all historic aviation and space activities within the Greater Toronto Area (GTA). TAM is an authorized Category "B" Museum in Canada, located in the historic building where the De Havilland Mosquito was built. Its formation, development and operations are fully supported by volunteers. A few years ago, TAM decided that it was time to display Canada's most significant aviation achievement, the AVRO Arrow, to be seen in its full-size magnificence. This is now a major project and it has brought together former AVRO and Orenda workers and Arrow enthusiasts to complete this replica. It has brought together business, industries and corporations. When the project is completed, the public will see and learn and wonder at the Arrow and be proud of the rich aviation and space heritage of the GTA and Canada.

## Building the ARROW Replica

In the beginning (June 1997), the Toronto Aerospace planned to have as its central attraction a full size replica of the Avro Arrow 25203. This objective has been pursued since its establishment at the former CFB Downsview. In February 1998, after getting a TAM brochure at the Aviation World bookstore, an e-mail reply from the CEO, Robin Murray, invited me to come to the TAM and discuss how I might help. From the brochure, I knew of the planned replica Arrow project. Thinking it might be of interest, I took with me a 1/10 scale drawing I had of the general layout of the Mark I Arrow. These original prints of the Arrow elated Robin, who had been searching for such details. His immediate desire was to reproduce them, without damaging the originals. This proved fruitless, as the forty-year-old prints were faded and delicate. After our first meeting, I realized that little had been done to actually plan for the construction of the replica. So I sat down and drafted a report on my thoughts on how this major project could be accomplished. This initial concept report was given to Robin a few days later and was well received. Robin, having had ambitious suggestions from engineers in the past, sought out an evaluation of the approach from Bombardier structural engineers. They concurred with the conceptual fabrication methods and cautioned that there were specific points of high stress that required careful attention. Later, in February, I met Robin again and we discussed starting the project. He would undertake the project directorship and I would be chief engineer. So the TAM Replica Arrow Project was born.

(cont'd on p. 2)



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**FROM THE PRESIDENT**

October was a busy month for AHFC. At the monthly meeting of Directors, Olanda Hastings from the TAM Board visited to express its appreciation of the support TAM was receiving from AHFC and to resolve some of the problems that had arisen.

On October 20 - 23, Vice-President Frank Harvey and I attended the Canadian Aeronautical Preservation (CAPA) Association Conference in Winnipeg. This organization is the umbrella for Canadian aerospace museums and groups such as AHFC, a total of 33 members. Highlights of the conference included:

- An agreement to create a Memorandum of Co-operation and Understanding to be signed by all CAPA members. This will create a national program for conservation, programing, artifact loans, etc.
- The Department of Defense (DND) briefed members on new rules for disposal of surplus aircraft, following some underhanded practices by a person who, it turns out, was not a recognized museum.
- Members agreed to put the CAPA logo on their web sites and letterheads.
- Significant interest was shown in our Arrow Model Recovery Project (AMRP) and the technical difficulties we have encountered.

The Big News is that attendance at this conference would not have been possible except for a generous donation from WestJet Airlines, which provided two free airline tickets for each CAPA member group. AHFC members should take a good look at WestJet for in-country travel plans, both east and west.

On October 25 - 26, Al Sablatnig and I travelled to Ottawa for discussions with the Canada Aviation Museum (CAM) and the Canadian Conservation Institute (CCI) on the Arrow Model Recovery Project (AMRP) and conservation, preservation plus good museum practice. Much practical support was provided by both agencies.

Our hats off to Mr. Chris Terry, Director-General of the Canada Aviation Museum, for facilitating this important meeting. Our sincere thanks to his staff and those from CCI who gave us the benefit of their experience.

**Arrow replica cont'd.**

The **original design** criteria used in my approach was quite simple and achievable. The Arrow replica was to be a full scale, non-flying, accurate replication of the Arrow 25203 with no active systems. It was to have the structure segmented for ease of fabrication and tear-down, if that was ever necessary. The outside shape and details were to be replicated to museum quality, with the wheel wells and cockpit areas fully detailed for visual accuracy. The replica's materials were to be squared steel tubing for the basic structure, with aluminum sheet as skins and some fibreglass components where necessary. As this replica was to be a static display model, limited loading conditions were to be considered.

(cont'd on p. 3)

**Arrow replica, cont'd from p. 2**

As time passed, numerous additional design criteria were applied. Many thought the control surfaces should be functional for realism, so a compromise was to make the control surfaces as separate components which were to be frozen to structure, but could, if desired later, be freed and modified for operation. As well, it was desired that the replica Arrow should have some form of self-contained power that would allow it to taxi at a slow speed. This would make the roll-out ceremony more dramatic. With this criteria, it was also necessary to have directional and braking controls. This desired internal system was explored and design details developed by Bill Tee, a former AVRO and de Havilland technician. Later still, it was felt that it would enhance the static display if some dynamic features could be included while the replica was in TAM. Hence, details were developed to have a simulated Sparrow missile deployed from the weapons pack, with access doors and missile positioning arms activated by electrical actuators controlled from a floor console. In similar fashion, the speed brake panels were fabricated to be activated.

To become a reality, much had to be organized for this major project. Not only were drawings required, volunteer workers, corporate sponsors and some funding, were all necessary for success. Engineering details for the replica fabrication were started both at home and in a second floor "Arrow Headquarters" at TAM. In May 1998, an initial general meeting was held for all who were interested in this project. About 40 enthusiasts attended and many were anxious to get started. As a result, a number of component leaders were identified and a volunteer pool was started. Many contacts were made by Robin to solicit corporate help for the project and a substantial number responded with materials and services gratis. A listing of these corporations are displayed in TAM to give these generous corporations some credit. Funding was also pursued on many fronts. Small sums were donated by individuals and corporations and government support programs were asked for financial help.

**Materials** were essential to construct the Replica Arrow. The original concept for the TAM Arrow structure was to use 1" squared steel tube with an aluminum skin. But that was changed by generosity. Out of a presentation on the project to the Toronto Model Engineers Assoc. came the offer of stainless steel tubing from Associated Tube Industries, of Markham. They manufacture such tubing and had some surplus which, in March 1998, 7000' of 1"x0.6" tube and 3000' of 1"x 0.25" tube were delivered. Later in August 1999, another substantial donation was received. Alcan Aluminium of Canada shipped 250 sheets of 0.040" aluminum - enough for all of the Replica's skin.

**Equipment** for project progress was still limited within the TAM. Additional TIG welding equipment was required and Associated Tube Industries gave us one of their standby Hobart TIG units. Later on, Lincoln Electric of Canada, in Leaside, made a long term "demo" loan of one



Claude Sherwood and the Arrow replica.

of its TIG units. Fortunately, we had two experienced volunteer welders to commence the actual assembly of the first major structural component - the Nose Section.

**Progress** was steadily being made on the Replica from August 1998, as the Cockpit "tub" was underway. This simulated cockpit sub-assembly would be later inserted into the structure of the Nose Section. Joe Foster, a practicing Dentist and pilot, provide the leadership in the fabrication of the "tub" - which included the full outfitting of the pilot's and navigator's areas, the clam-shell canopies and windshield.

**In early 1999**, the organization of the project changed somewhat. Robin Murray left the project for other pursuits, and since the Replica Arrow was so important to the TAM and the volunteers, I undertook the responsibilities of the Project Director. At about the same time, a retired ex-AVRO engineer, Stan Porter, joined the Engineering "team" with talents and experience in structural and general aircraft design. Later on, an active volunteer, Paul Cabot became the Project Production Manager, to marshal the volunteer forces into teams, support and encourage progress on the many component assemblies.

**Funding** for the project was sparse until mid-1999. In April 1999, an agreement was signed with the Millennium Bureau of Canada that they would provide a grant to fund a portion of the Replica Arrow Project under their Canadian Millennium Partnership Program. This grant of \$35000. was a welcome contribution from the Federal Government. These funds would allow the purchase of incidental materials and equipment/tools required for project progress, rather than having to wait for some benevolent

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