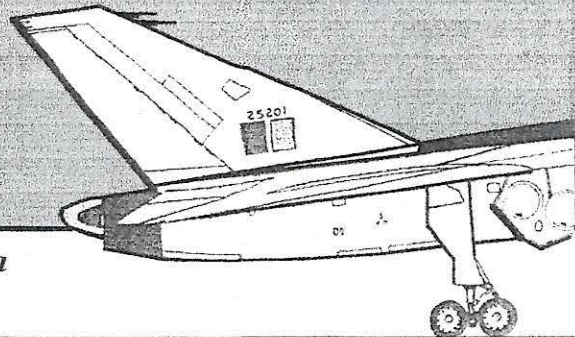


Pre-Flight



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Technician applying phenolic plastic between the templates of the rigs to within one-eighth of an inch of edges, giving a solid core for the plaster finish coat which is treated against moisture.

***PLASTIC* . . . the new production tool at AVRO in 1955**

They threw away the text books at AVRO on how to build a master model aircraft, to be used in conjunction with a mock-up. They also threw away the wood, which swells and shrinks according to the amount of moisture in the air. They used liquid plastic and topped it with a layer of plaster, which can be easily moulded. As a result of better research equipment and increased knowledge, the Arrow was designed requiring fewer changes after it was built.



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Legal Consultant Jerry Faivish
Editorial Consultant John Thompson
Air Force Liaison Don Pearsons

PRE-FLIGHT Ted Harasymchuk

President's mailing address:

9560 Islington Avenue
RR # 3
Woodbridge ON L4L1A7
905-893-8023

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Aerospace Heritage
Foundation of Canada
P.O. Box 246, Etobicoke D
Etobicoke ON M9A4X2
(416) 410-3350 www.ahfc.org

From the President:

On behalf of the Board of Directors, I wish all our members a good year in 2002. Normally, December and January tend to be a little quieter than the rest of the year. But not this time. In December, Bob Saunders and I went to Peterborough to give a presentation of the Arrow Model Recovery Project (AMRP) to a combined group of three radio control model clubs. We were well received and, of course, there were lots of questions on the subject of the AMRP.

We have written to the new Ontario Minister, Tim Hudak, requesting that he assist us by granting us the sole license for the search. Additionally, we have solicited support from nine local MPPs whose ridings were impacted by AVRO and Orenda. We await their response.

In January, we were honoured to be invited to attend the retirement festivities for Ed Patten, Chief of Operations at the Canada Aviation Museum, who has been a strong supporter of AHFC over the years. Frank Harvey and I attended, along with about 100 others, including former Director-Generals Bob Bradford and Christ Terry, who is now the President and CEO of the three Science and Technology Museums. Anthony Smyth, the new Director-General, was also there, along with representatives from the Department of Transport. Not surprising, there were many presentations, including personal greeting from the Honourable Sheila Copps, Federal Heritage Minister.

Also in January, I was able to talk to the legal counsel for Hawker Siddeley regarding copyright of AVRO/Orenda film and photographs. While AHFC, CAHS and the Canada Aviation Museum have been given permission to use such materials, Hawker Siddeley has never sold or assigned their copyright, so the copyright still belongs to Hawker Siddeley. In light of the various AVRO/Orenda materials being offered for sale by various people, things might get interesting.

AHFC Treasurer, Al Sablatnig and I visited CFB Borden for discussions with our Patron, H. Co. William Coyle, on potential future activities of AHFC. We also reviewed the restoration of the CF-100, and spoke with the Museum Curator, Col. Beeton (Retired).

We are planning on placing more emphasis on educational activities, and would welcome assistance from the membership, both for presentations and research.

Again, best wishes to all our members and for their ongoing encouragement and support of AHFC.

Plastic, cont'd.

At AVRO, probably the biggest single break with traditional practice involved taking away construction of the prototype away from the experimental section and transferring the work to Production. Because fewer changes were made after the prototype was built, it became economically feasible to proceed with tooling even before construction began, and these tools to build the prototype were used. But to get the tooling, the master model had to be built. Already the process was speeded up.

The master model's importance.

This master model served more than one purpose. In addition to being the vehicle from which stemmed tooling and general production planning, it also was the vehicle for proving the lines of engineering drawings. To build the master model, the aircraft was broken up into major sections, with each section made individually. These were later assembled to make the master model. A section built according to these "advanced" methods, starts with a central true perpendicular column or spine. On it were bolted, very exactly, ribs or formers of varying dimensions, showing the lines or shape of the section if covered with skin. Some template supports were formed around two rigid columns. All supporting units were constructed of heavy structural



steel, and the formers were cut from heavy gauge sheet aluminum. Once all former stations were in place, liquid phenolic resins were poured between the stations to within one-eighth of an inch of the finished surface dimension. This one-eighth of an inch is reserved for plaster, the final application. Plaster was used as the final coat primarily because it is easily moulded to the desired contours of a section. Otherwise the ease with which it absorbs moisture would eliminate its use. To overcome this disadvantage as much as possible, the plaster is treated with a pore sealant.

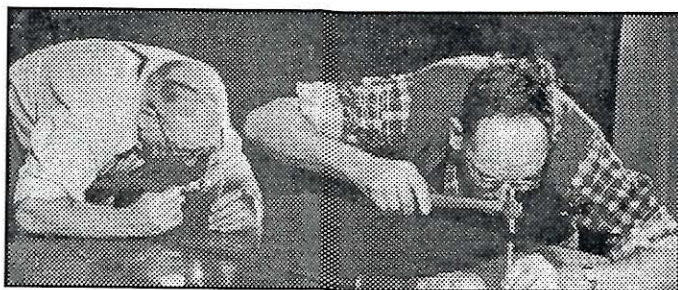
Building an additional station.

An interesting feature at AVRO was the building of an additional station at each end, than actually is required for that section. Thus a section overlaps the section next to it, decreasing the chance of adjoining sections not mating when joined together. Because any future aircraft will be supersonic, manufacturing tolerances will need to be close, closer than they ever had been before. If these were not, even slight imperfections of manufacture would add up to unneeded drag in flight, reducing the aircraft's speed. Key work on the Arrow master model - erecting the spine and ribs - were done to tolerances of thousandths of an inch.

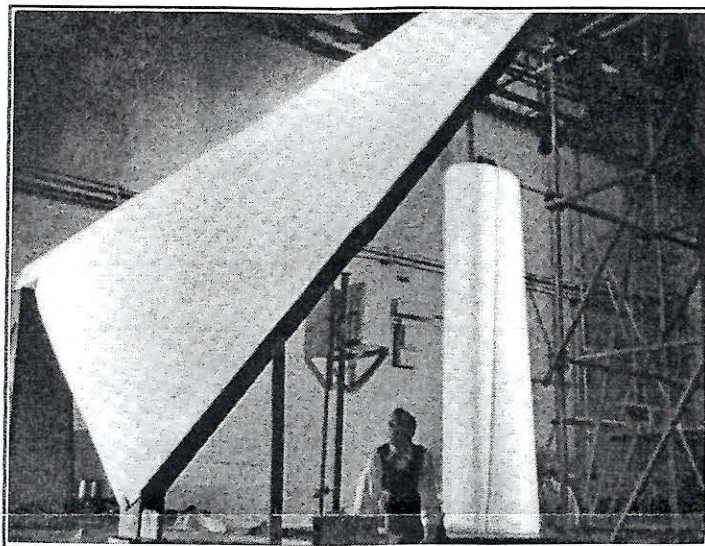
The phenolic resin and plaster technique was used in manufacturing a large portion of production tools. Form blocks, routing fixtures and drill baskets especially were easily made with this "new", time-saving technique. The female shape of a section was obtained in the usual manner by pouring plaster ("splash") around the master model section to be duplicated in tool form. When hardened, this became the female section. Plaster then poured into the female and allowed to dry, resulted in a male form which was a replica of the master model section, which in turn became the production tool.

A recent innovation at AVRO

Introducing phenolic resins was a comparatively recent innovation in 1955, possessing several advantages over other materials previously used. Most important were



Master technicians laying out templates on heavy-gauge aluminum which eased hand-working to exact tolerances.



Completed master models, painted white and ready for lines layout for positioning skin panels, rivet pitching and skin trims on the actual finished Arrow.

increased stability, no need for finishing, lightness and ease of incorporating design changes. The last-mentioned advantage is a major one. Whether the master model or production tools are affected, design changes are easily incorporated by simply chipping out the portion to be reworked, pouring fresh phenolic resin and plaster, and reshaping.

The new approach.

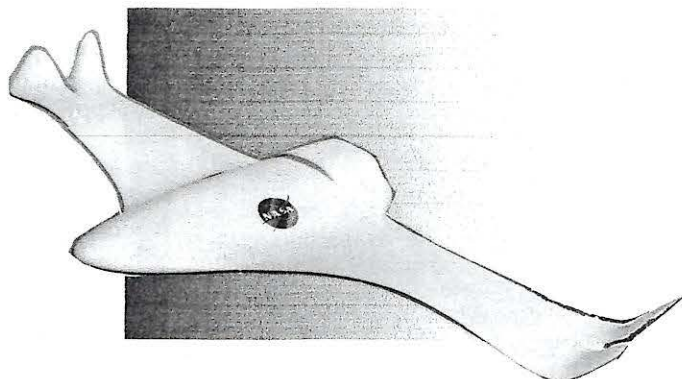
Toolroom people were especially happy with the new approach. For the first time, they were in on the ground floor of new design production. For the first time they were given an opportunity to create new tools. This is a big feature. It holds true for the entire team. This approach harmonizes as never before the efforts of project engineers, stress or aerodynamic engineers, production planning engineers, tool design engineers, people on the tool room and production floors.

Many and important benefits.

By close consultation through the various stages in the development of a project, they became familiar with the problems of one another, learned to reasonably curb, where there is an over-all benefit in doing so, enthusiasm for their own branch of work out of consideration for others also involved.

- The above is a shortened version of the article by Lorne Frame in "Jet Age", Spring & Summer 1955 published quarterly by A. V. Roe Canada, Limited, for its member companies.

MORPHING SURFACES



AIRCRAFT PIONEERS at the turn of the last century often observed flight patterns of birds, and the manner in which the configuration of their wings and bodies changed to maintain lift. They saw how the feathers spread to make the wings broader, how the wings themselves curved to increase the flow of air over their top surfaces, increasing the lift. From the Harvard to the 747, today's aircraft do a limited imitation of the same thing using mechanical flaps. NASA has high hopes of changing the process by constructing aircraft wings of material that has a characteristic of stretching and curving to mimic natural flight. The Morphing Project underway at the Aeronautics Laboratory in Hampton, VA, has set its sights on a new generation of so-called bio-mimetic aircraft that might be in commercial service in this mid-century. We won't live to see

it, of course. Still, it is an interesting thought; certainly more probable than flapping wings.

The concept has an airframe constructed of carbon-fibre composites rather than metal. Boeing and Airbus are currently using some of these, while exploring further composites for future airliners. Morphing material in the NASA craft's wings would make them bend and twist to extract aerodynamic advantage. The material covering its fuselage is designed to be almost like, or even more than, human skin. In fact, it could detect corrosion in the frame, outside air pressure, including any incoming electric or magnetic pulses. And like human skin, it would heal itself after a penetration.

The challenge is mainly in scaling up technologies presently proven in the laboratory. There's a Canadian connection. Pascal Hubert worked in the Hampton lab, but now is at McGill in Montreal. He actually saw the self-sealing skin in action. He said that a bullet is fired at a sheet of the special material, and you can watch the bullet hole close.

Other Canadians are doing work on morphing surfaces. Sensor Technology Limited, located in Collingwood, is working on a model space antenna that contains morphing material. The purpose is to counteract warping from the intense heat and cold. It also has a working partnership with the University of Victoria. Its space engineer Afzal Suleman and the Portuguese Air Force, are working on a small unmanned prototype aircraft with morphing wings and tail. In his spare time, Suleman is using this same magical material to construct a robotic tuna.

A morphing jetliner. No problem, indeed!

- Source - MacLean's, August 20, 2001

(modified)

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MEMBERS MATTER!

Our President, Ian Farrar, pointed out in his message to the members of AHFC, that the focus will be more on the area of information and education. This is valid today, especially since people (and here we stress those 10 to 21 years of age) have very limited knowledge of Canada's contribution to the development of aeronautics, from the last century to the present day. With the exception of those who are members of organizations such as AHFC and related aerospace groups, the information out there has not reached the general public.

However, there is one exception. The Arrow. Irregardless of what aero-pundits in their collective wisdom proclaim, this was the apogee of aircraft design and construction, not only in Canada but the world. The AVRO Arrow still captivates people across the demographic span. As a group, they may not know that much about the Arrow. To many, it has an enduring

mystique about it. But all know and realize that we were there; we stood on the top podium but that circumstance conspired against it. AHFC wants to put more information out there for students, especially those in primary and secondary levels. If there are members interested in helping, organizing, presenting, please contact AHFC. Training will be provided. After the first session or presentation, the rest will be the proverbial piece of cake!

Your *annual reminder of membership* is included with this issue. Please take note of a few changes, such as AHFC now offering life membership: \$1000. This includes a Vanderhorst *Numbered Print*, plus an appropriate tax receipt. Please take the time to fill out your renewal and send it on to us. Have you considered a *gift membership*? Health and good fortune in 2002! Wear your Arrow crest and/or pin proudly!

Nicholas Doran