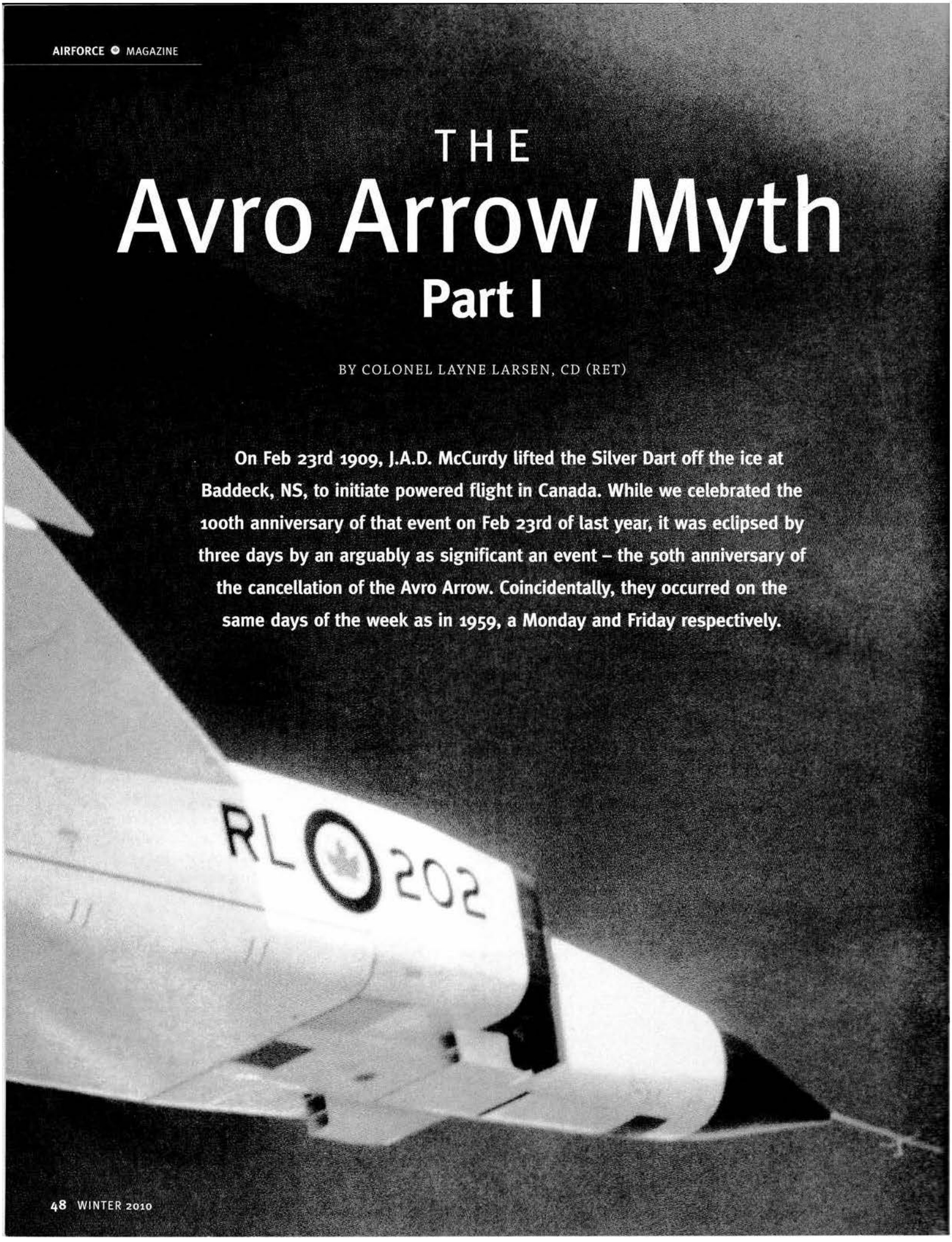
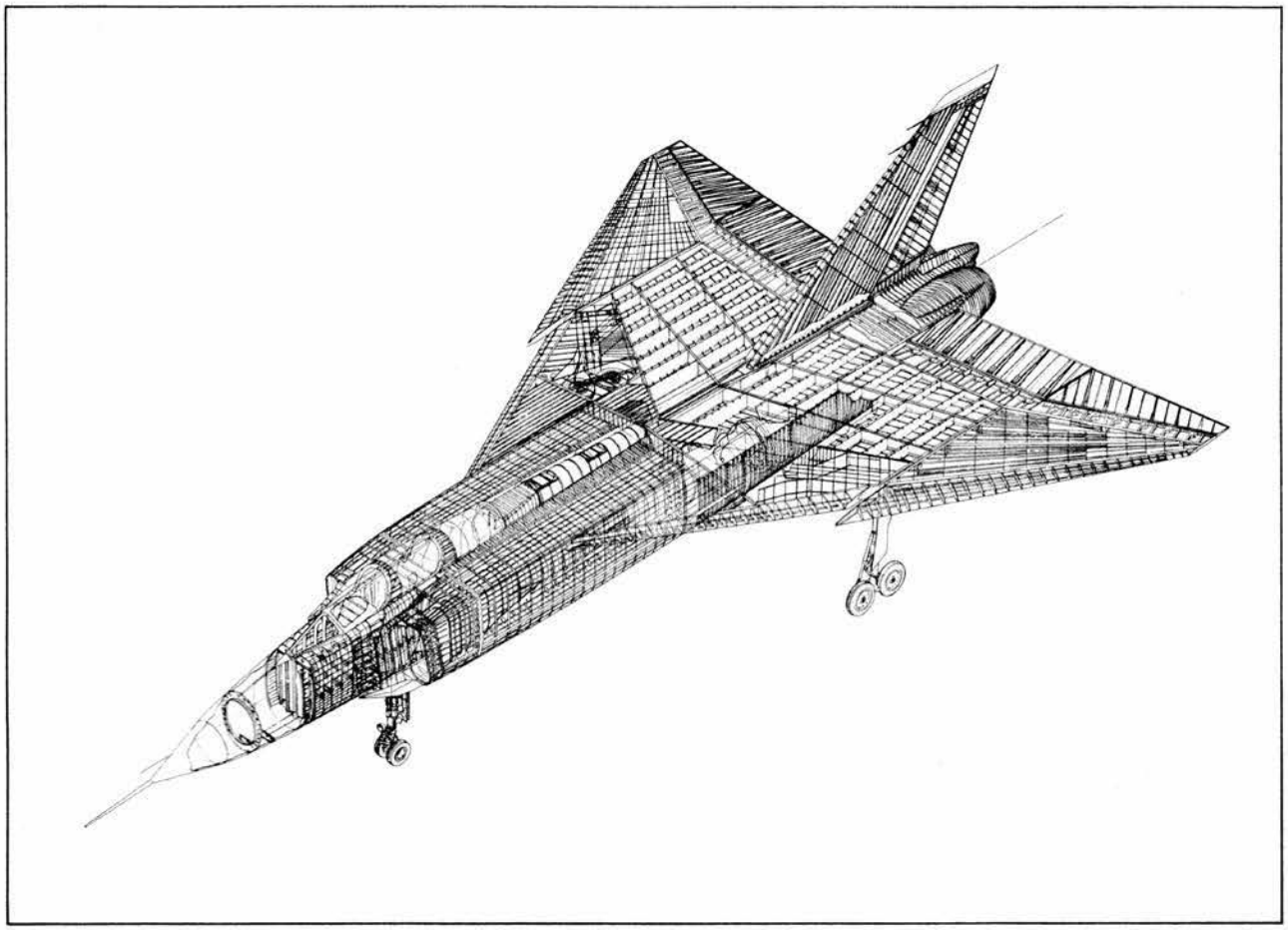
THE Avro Arrow Myth Part I

BY COLONEL LAYNE LARSEN, CD (RET)

On Feb 23rd 1909, J.A.D. McCurdy lifted the Silver Dart off the ice at Baddeck, NS, to initiate powered flight in Canada. While we celebrated the 100th anniversary of that event on Feb 23rd of last year, it was eclipsed by three days by an arguably as significant an event – the 50th anniversary of the cancellation of the Avro Arrow. Coincidentally, they occurred on the same days of the week as in 1959, a Monday and Friday respectively.





CF-105 (J-75 ENGINE) STRUCTURE CUTAWAY

In the 50 years since the Arrow's demise, it has spawned multiple fan web sites, been the subject of a television mini-series, launched more than a dozen books and initiated thousands of magazine and newspaper articles and letters to editors – very few of which were written from a fully objective viewpoint. The writers have often blended fact, fiction, rumour and wishful thinking, flavoured with more than a *soupçon* of emotion, such that the aircraft has become mythologized.

In the first installment of this two-part series, I am going to provide a chronological summary of the program from inception to cancellation with a minimum of editorializing. Part II, in the next issue of *Airforce* (spring, 2010) will examine some myths, objectively evaluate the aircraft (i.e. was it really as good as its fans claim?) and explain why the project was doomed to failure almost from inception.

In 1951, although the RCAF had yet to receive its first operational CF-100 Canuck interceptor, A.V. Roe Canada – Avro – submitted three possible options for the follow-on to the CF-100. After consideration of these options, in 1952 the RCAF issued specification AIR 7-3, to which Avro responded with a detailed proposal for the conceptual CF-105, powered by the Rolls-Royce RB-106 engine.

From this point:

• *Apr 1953 – Avro receives a design contract for $200K;*

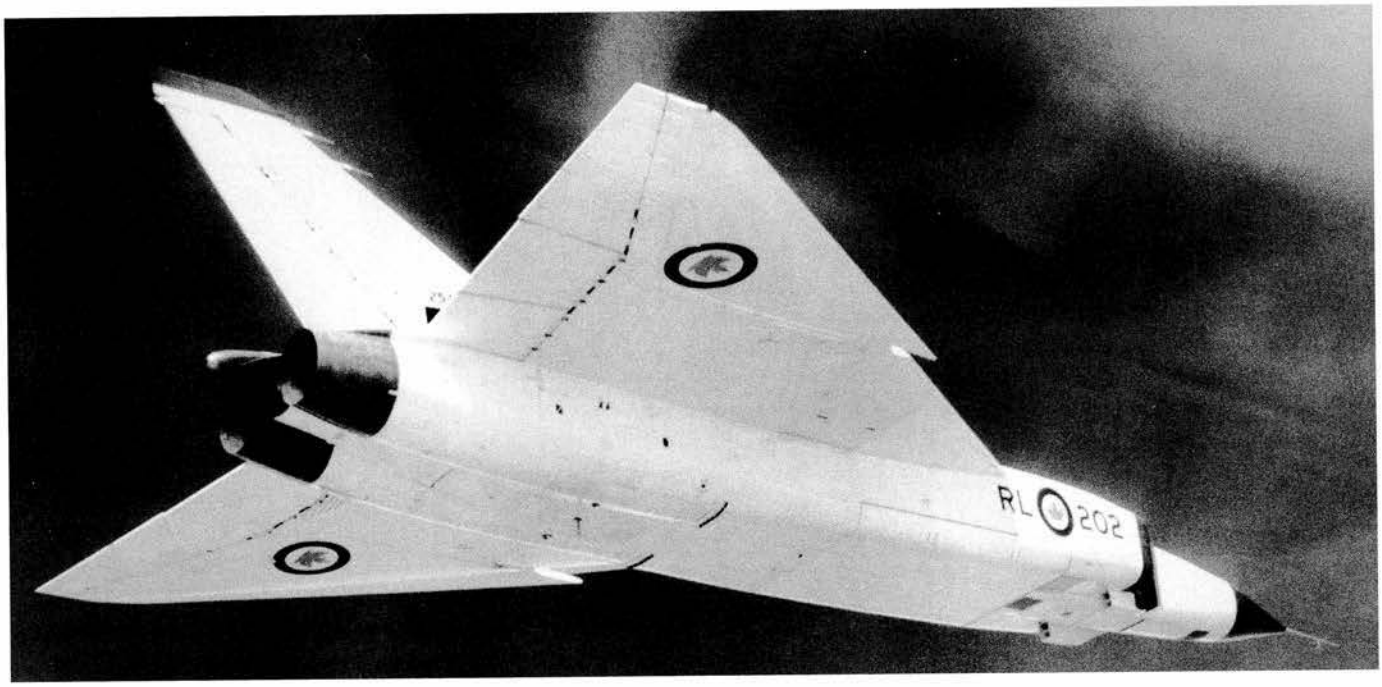
• *Aug 1953 – the contract is increased to $500K;*

• *Oct 1953 – the Minister of National Defence (MND) orders all work on the project halted; Avro is ordered to concentrate all its efforts on fixing the problems with the CF-100. This directive also had some peripheral effects on Avro's C-102 Jetliner project and;*

• *March 1954 – the project is re-instated at $1,325K to cover two prototypes plus one airframe for static testing. The Curtiss-Wright J-67 and Pratt & Whitney J-57 are added to the list of engine options.*

In mid-1954, the RCAF, uneasy over problems with the CF-100 and Avro's ability to cope with an even more complex aircraft, asks the Defence Research Board (DRB) and the National Aeronautical Establishment (NAE) to evaluate the CF-105 design. Both agencies report that Avro's performance estimates are too optimistic, while some individuals believe that the design itself may be deeply flawed (some go so far as to predict airframe disintegration at supersonic speed).

Nonetheless, in Feb 1955, Avro receives a cost-plus contract for 40 aircraft at a base price of $191M plus $70M for engines. The company proposes to use the Cook-Craigie method of production which Convair used to produce the F-102 (and is using for the F-106) for the U.S. Air Force. The traditional method is to



produce a few hand-built prototypes, test them thoroughly, engineer the necessary changes, then produce the production tooling and move into series production. The Cook-Craigie method proceeds from mock-up directly to production tooling, but production occurs at a reduced rate while the first models, essentially the prototypes, are tested. If changes are necessary, these can be implemented right on the line at the same time as serious production is ramped up. Although it is higher risk (and potentially higher cost) than the traditional method, it could put aircraft into operational service a year or more sooner:

• June 1955 – the RCAF agrees with Avro on Cook-Craigie, and calculates that 37 aircraft and 1,700 flying hours will be required to prove the aircraft and its systems for operational service;

• July 1955 – the contract is reduced from 40 to 37 aircraft in accordance with RCAF calculations;

• July 1956 – all three foreign engine projects have either been cancelled or have severe problems. Orenda proposes its PS-13 Iroquois, then in advanced development. The RCAF agrees that this is the best engine available and the best option for Canadian industry;

• Oct 1956 – RCAF program office proposes the name Arrow *for the CF-105.*

• Dec 1956 – Avro agrees to deliver the first eight aircraft (five P&W J-75 powered Mk I, three Iroquois powered Mk II) by Dec 1958, and the remaining 29 Mk IIs by early 61; the cost has now risen to $242M + engines;

• Aug 1957 – newly elected Conservative government puts austerity program in place, cancels CF-100 Mk VI;

• Oct 4th 1957 – roll-out of Arrow No. 1, RL201;

• Dec 1957 – RCAF complains of mismanagement at Avro relating to changes in performance, scheduling, etc, that are not being reported to the program office;

• Jan 1958 – Avro Engineering Section is re-organized, possibly in response to RCAF complaints;

• March 25th 1958 – first flight of RL201 with Jan Zurakowski at the controls;

• May 1958 – Avro submits revised cost estimates of $350M + engines;

• June 11th 1958 – First accident. RL201 undercarriage collapses on landing, aircraft sustains minor damage.

In the mid-1950s, the RCAF is convinced of the potential superiority of RCA Corporation's developmental *Sparrow* missile compared to the Hughes Falcon in operational service with the U.S. Air Force. For its part, the latter is interested in an alternate supplier/second missile for its inventory (although it's not a participant in the RCA program) and encourages the RCAF to join the U.S. Navy in Sparrow development. In June 1958, the U.S. Navy drops out of the program and the RCAF opts to "go it alone" and forces Avro to go along with the ASTRA integrated fire and flight control system and its associated Sparrow II missile. This pushes total program cost for aircraft, engines, electronics, test and ancillary equipment and spares to $789M. The RCAF "brass" has been concerned for some time about rising costs and other problems, such as the slow pace of test flying, Avro's lack of concern over maintainability issues and shifting delivery dates (e.g. only five of the eight aircraft promised for Dec 1958 will actually be delivered). In addition, senior officers are deeply split over the threat from the manned bomber and the issue of missiles versus manned interceptors. They ask for a study on the option of cancelling the contract after the delivery of the 37 aircraft and using the latter to form two squadrons of 10-12 aircraft each in the Ottawa area. The study concludes that the magnitude of the logistic support that would be required far exceeds the operational value of the asset. The minimum operational

nexus is calculated as five squadrons (80-100 aircraft):

• Aug 21st 1958 – Minister of National Defence (MND) George Pearkes and Chief of the Air Staff (CAS) Air Marshal Hugh Campbell agree that the RCAF requires the CF-105;

• Aug 25th 1958 – the Joint Chiefs recommend to the MND that the Arrow program be cancelled and replaced with missiles, specifically the Bomarc B;

• Aug 28th 1958 – Cabinet makes no decision on the Joint Chiefs' recommendation, but the program will be kept under review with a decision by Mar 1959;

• Nov 5th 1958 – Air Marshal C. Roy Slemon, deputy commander of NORAD, states that there will be a need for manned interceptors for the foreseeable future. The Cabinet and many MPs are very upset with his statement!

• Nov 11th 1958 – second accident. RL202 undercarriage collapses on landing. Avro claims malfunction of the flight control system as the cause; the RCAF maintains it is pilot error and demands Avro remove test pilot "Spud" Potocki from the program.

Throughout Dec 1958 into Jan 1959, the Cabinet, caught between the proverbial "rock and a hard place," vacillates. Its members are well aware of the economic (up to 25,000 jobs at 400 Canadian and 250 U.S. sub-contractors), social and political impacts of cancelling the project, and a number of options are discussed and rejected since the service chiefs are adamant that they neither need nor want the aircraft. During this period, Avro tries desperately to avoid cancellation, and offers to discuss freezing airframe costs for future deliveries:

• Feb 14th 1959 – Avro asks for an additional $40M. This is the final straw and Cabinet unanimously votes to cancel the project;

• Feb 20th 1959 – "Black Friday" – Prime Minister John Diefenbaker makes the formal announcement in the House of Commons. Avro lays off 14,000 employees;

• Mar 1959 – the possibility of NAE using the aircraft as research vehicles is studied; the conclusion is that this is not a viable option. There is some discussion about retaining RL206, fitting the Iroquois engines, and going for an absolute world speed record. This is dropped as too expensive and to what end?

• Apr 7th 1959 – CAS (Campbell) formally recommends to MND that they proceed with destruction of everything associated with the Arrow; MND agrees;

• Apr 14th 1959 – CAS advises Department of Defence Production that the destruction contract must specify that everything is to be cut up before being sold for scrap unless a better price can be obtained by not doing so;

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• May 1959 – the National Aviation Museum pleads for an Arrow, or at least major components, and an Iroquois engine. There are also requests from civilians to preserve at least RL201 as part of our aviation heritage.

The scrapping of the airframes proceeds quickly and by July all six finished aircraft are reduced to junk. The exception is the nose section of RL206 which is spirited off the Avro ramp during the night to the Institute of Aviation Medicine (IAM) in Toronto for use as a research tool. Reportedly, a hole had been cut in the wall of a building at IAM to allow the piece to be moved inside, and the hole repaired the same night. (This item is now on display in the Canada Aviation Museum (CAM) in Ottawa.) In total, there were 1,244 tonnes of scrap that fetched a total of $304,370 – 24.5 cents per kilogram.

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• Production engine Iroquois Mk II No. X-104 went from Orenda to NAE, then to the CAM;

• In the mid 1980s, one of the developmental engines, having been rendered inoperative by holes cut in the compressor and turbine casings, was found in a scrap yard in Moncton, NB. It is currently the property of the Canadian Warplane Heritage Museum in Hamilton.

• There is some evidence to indicate that a third engine was provided to Bristol-Siddley (Avro's U.K. parent) and currently lies in pieces in an RAF storage facility. ✈

(Ed note: Retired Col Layne Larsen of Kingston, Ont, is a retired RCAF and CF pilot. He is the editor of Aerial Views, *the newsletter of the Canadian Aviation Artists Association, and is a member of the Air Force Association of Canada.)*