

Miscellaneous

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Front Page

[Editorial](#)
[News](#)
[Events](#)
[Engineering Society](#)
[Opinion](#)
[A & E](#)
[Sports & Recreation](#)
[Miscellaneous](#)
[Humour & Satire](#)

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Looking Back on the Avro Arrow

By Andre Beltempo

3A Mechanical

On October 4th, 1957, Avro Canada unveiled Canada's first, last and only made-in-Canada supersonic interceptor, the CF-105, dubbed the "Arrow". Less than two years later, in February of 1959, the Arrow program was scrapped, and over 30,000 employees were suddenly left jobless. In the years that followed, myth, controversy, resentment and legend melded into the story of how Canadians dared to dream, and then shot themselves in their collective feet. Conspiracy theories abound as to how the U.S. torpedoed the Arrow, since it was superior to their own aircraft, and they couldn't allow that to occur. In this article, I'm just going to run down the facts of the airframe, engine and fire control system.

Firstly, in the 50's everyone was going higher, farther and much, much faster, with their aircraft. The turbojet engine revolutionized aircraft, and designers and engineers were having a wonderful time throwing new stuff into new airframes, finding lunatics (known as test pilots) to see if they'd work, and then trying again when they didn't. As an example, the top of the line aircraft in 1952, the F-86 Sabre, had a top speed of maybe 650 mph, no radar, and could fly at maybe 40-45,000ft. The F-100 only 5 years later could go supersonic at 50,000ft, and by 1962, the F-104 and F-4 both exceeded Mach 2 at 60,000 ft. The altitude and speed records were getting broken every other week, and the unspoken thought was that by the mid-60's, combat would be occurring at hypersonic (Mach 3+) speeds, and passengers would certainly be traveling supersonically by the 70's. In fact, the fabled 747 Jumbo Jet, the double-decked behemoth that even today symbolizes air travel, was only started by Boeing because they believed that the large design could be easily converted to cargo when passenger service went supersonic. So everybody thought planes would be moving fast in the future.

What does any of this have to do with the Arrow? Well the Arrow was designed right in the middle of this craze. Let's look at it from a standpoint of requirements. The Arrow was designed to operate without ground support and at supersonic speeds, to intercept potential supersonic bombers coming over the North Pole from the Soviet Union. This was a perceived requirement, and the Arrow was the perfect aircraft to do this. The high-wing delta design was and still is perfect for high-altitude highspeed flight, and, due to some excellent Canadian aerodynamicists, the Arrow airframe performed exceedingly well in this area of its flight envelope. As an example, the Arrow, equipped with American J-75 engines (19,500lbs afterburning thrust), traveled at Mach 1.98 at approximately 48,000 ft. These engines were heavier than the Canadian designed Orenda PS-13 Iroquois, which was an absolutely phenomenal design for the time, and provided approximately 26,500lbs of afterburning thrust. In fact, the Iroquois engine was powerful enough to get the Arrow supersonic without afterburner, a feat that the Americans have only duplicated in the F22, which won't even be in service until 2005! The great 'what if' is how high and fast the Arrow could have flown with Iroquois engines, and the sad fact is we'll never know. Most people predicted Mach 2.5+ at 60,000 ft, which is about equal to the current U.S. interceptor, the F-15. The 'what if' people point to the fact that, with minor modifications, the Arrow could easily have flown to Mach 3 at 80,000ft, and all this is true. When compared to today's fighters, for example, Canada's current fighter, the CF-18, the Arrow has comparable if not better performance numbers. This has led many to believe that, therefore, the Arrow was outright 'better' than everything else since.

One of the enduring myths surrounding the Arrow cancellation is that the Arrow was cancelled due to the perceived fact that missiles and 'pushbutton' warfare would replace aircraft. This myth about the Arrow is made all the more bitter by the fact that less than two years after the cancellation, Canada bought 75 used F-101 Voodoos from the U.S., which could barely go supersonic, because we needed some type of fighter. The truth is that the development of missiles did 'kill' the Arrow design, just not in the way people think. Traditionally, everyone points to the fact that even today, men are 'in the loop' with aircraft, and missiles didn't replace aircraft, only complemented them. This is all true, but the original requirement for the Arrow was to intercept Soviet supersonic bombers coming over the North Pole. Everyone envisioned fleets of these things flying south to lay waste to North America, and the Arrow as the shield. The problem was, when the Soviets started building missiles, they realized that they were cheaper to operate and maintain than manned bomber fleets, and the doomsday fleet of Soviet aircraft never materialized. This means that even if development of the Arrow had proceeded, and the aircraft had reached service, its primary mission would have failed to present itself. Secondly, the development of missiles, particularly the surface to air (SAM) kind, abruptly changed the development of fighter aircraft, and the race to go higher and faster suddenly became one of survivability in a SAM environment. Since a missile could always go faster than planes, it didn't matter how high and fast they went, they could still be killed. This changed requirements and purposedesigned aircraft, such as the Arrow, gave way to 'multi-role' aircraft, with missiles and bombs being interchangeable on exterior hard points, and airframes optimized for a variety of profiles. The Arrow was a supersonic design through and through, with 'clean' lines to achieve high supersonic speeds and a large internal weapons bay, and although this would have allowed some multi-role capability, in a dogfight or at anything approaching low-level the Arrow airframe would've handled like a pig. It simply wasn't designed for that mission. The CF-18's we have today can deliver a variety of ordnance from all altitudes, as well as hold their own in a closein dogfight.

You may ask why I would make the unfair comparison between aircraft designed 30 years apart, but this is precisely what people do when they compare the Arrow to contemporary aircraft, such as the F-22, and lament the fact that the Arrow can fly just as fast or as high. That's all well and good, but the F-22 can make a 9G turn in the dark at 50ft in between trees, as well as showing up on radar


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about as well as the average sparrow. Not to mention that it has much better fuel economy than the Arrow, and still delivers more power overall to the aircraft. Realistically, it makes sense that today's aircraft should outperform the Arrow; after all, it was designed literally 50 years ago.

The greatest lament about the entire project in my mind is not the loss of the Arrow, for had it not been cancelled, it probably would've been as historically interesting to the general public as the CF100 'Canuck' is today. That the technical skills and acumen for designing and highperformance airframes and engines was lost in Canada is the greatest lament. Canada retained the capability to build stuff under license, i.e. we can build anything with plans ready supplied, but a fully Canadian design base went away, and was never really recovered, until Bombardier, Canadair and deHaviland Canada started building smaller aircraft. Now the design base is slowly being built back, but does not even come close to Boeing or Airbus in terms of world-class airframes.

In the 50's Canada literally was at the top of the class for any airframe it chose to build. The Avro Canada C-102 Jetliner, which was built and designed before the Boeing 707, and was a better design than the BOAC Comet (the first passenger jet aircraft in the world), was the first jet passenger aircraft to fly in North America. However, due to bad timing, the big passenger companies ended up holding out for the 707. This was, again, a classic error on the part of Avro Canada, and another nail in the coffin for an independent Canadian aerospace sector.

In conclusion, although the Arrow was an incredible airframe, we should lament not so much about the loss of the particular aircraft, and more so about the loss of the best and brightest in Canada's aerospace sector, at a time when Canada had the fleeting potential to actually take the lead in a world-class field. We can only hope that the next time a choice such as this comes along the government is willing to spend the ridiculous sums of money required to keep things afloat.

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