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## Arrow Firsts

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You've wondered about the firsts the Arrow was designed with, here are a few. These are all discussed in Randall Whitcomb's book Avro Aircraft and Cold War Aviation. Remember the year was 1958.

The Avro Arrow CF-105 Interceptor was:

- 1) First a/c designed with digital computers being used for both aerodynamic analysis and designing the structural matrix (and a whole lot more).
- 2) First a/c design to have major components machined by CNC (computer numeric control); i.e., from electronic data which controlled the machine.
- 3) First a/c to be developed using an early form of "computational fluid dynamics" with an integrated "lifting body" type of theory rather than the typical (and obsolete) "blade element" theory.
- 4) First a/c to have marginal stability designed into the pitch axis for better maneuverability, speed and altitude performance.
- 5) First a/c to have negative stability designed into the yaw axis, to save weight and cut drag, also boosting performance.
- 6) First a/c to fly on an electronic signal from the stick and pedals. i.e., first fly-by-wire a/c.
- 7) First a/c to fly with fly by wire AND artificial feedback (feel). Not even the first F-16's had this.
- 8) First a/c designed to be data-link flyable from the ground.
- 9) First a/c designed with integrated navigation, weapons release, automatic search and track radar, datalink inputs, home-on-jamming, infrared detection, electronic countermeasures and counter-countermeasures operating through a DIGITAL brain.
- 10) First high wing jet fighter that made the entire upper surface a lifting body. The F-15, F-22, Su-27 etc., MiG-29, MiG 25 and others certainly used that idea.
- 11) First sophisticated bleed-bypass system for both intake AND engine/exhaust. Everybody uses that now.
- 12) First by-pass engine design. (all current fighters have by-pass engines).
- 13) First combination of the last two points with an "ejector" nozzle that used the bypass air to create thrust at the exhaust nozzle while also improving intake flow. The F-106 didn't even have a nozzle, just a pipe.
- 14) Use of Titanium for significant portions of the aircraft structure and engine.
- 15) Use of composites (not the first, but they made thoughtful use of them and were researching and engineering new ones).
- 16) Use of a drooped leading edge and aerodynamic "twist" on the wing.
- 17) Use of engines at the rear to allow both a lighter structure and significant payload at the centre of gravity. Everybody copied that.
- 18) Use of a LONG internal weapons bay to allow carriage of specialized, long-range standoff and cruise missiles. (not copied yet really)
- 19) Integration of ground-mapping radar and the radar altimeter plus flight control system to allow a serious strike/reconnaissance role. The first to propose an aircraft be equally adept at those roles while being THE air-superiority fighter at the same time. (Few have even tried to copy that, although the F-15E is an interesting exception.)
- 20) First missile armed a/c to have a combat weight thrust to weight ratio approaching 1 to 1. Few have been able to copy that.
- 21) First flying 4,000 psi hydraulic system to allow lighter and smaller components.
- 22) First oxygen-injection re-light system.
- 23) First engine to have only two main bearing assemblies on a two-shaft design.
- 24) First to use a variable stator on a two-shaft engine.
- 25) First use of a trans-sonic first compressor stage on a turbojet engine.
- 26) First "hot-streak" type of afterburner ignition.

27) First engine to use only 10 compressor sections in a two-shaft design. (The competition was using 17!!)

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The Avro Arrow was one of Canada's finest aviation achievements, even though it never entered service.

Source [www.AvroArrow.org](http://www.AvroArrow.org)