

WHO CANCELLED THE ARROW?

Finally the question has been answered!

American tactics relating to Arrow cancellation based on the research of RL Whitcomb.
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THE CURTISS-WRIGHT J-67 ENGINE FOR THE ARROW

In the 1940s and early 1950s the British were far ahead of the Americans in jet-engine design. Armstrong Siddeley Motors, a member of the Hawker Siddeley Group, produced several axial-flow jet engines which were license-produced by US manufacturers, especially for US Navy use where they were probably more British engines flying than American.

The Bristol aircraft company was also, like Hawker Siddeley and Avro Canada, one of the few manufacturers producing both engines and aircraft, although they were forced, by the British government, to abandon aircraft and concentrate on engines, after the enormous Bristol Brabazon was cancelled. They too, through the genius of Stanley Hooker and Charles Grinyer and others, were producing jet engines and turboprop engines in the early 1950s. Grinyer, who later came to Avro Gas Turbines/Orenda Engines Ltd., was responsible for the successful type-test certification of 10 engines at Bristol, all on the first attempt. An unheard of feat. One of the engines he certified was the Bristol Olympus, a large capacity engine which, in my statistical analysis, was the second best engine in the world after the Iroquois, and after Iroquois cancellation, probably the best high-thrust turbojet in the World until at least the 1980s. Not a bad run for an engine that first ran in the early 1950s.

The Americans were very keen on this engine at first, and had Curtiss-Wright embark on developing an afterburning license-built version of the Olympus. It was slated to go into a variety of US aircraft at the time, including the F-106, the XF-103, and, I believe, the F-108.

The interesting thing is, it is "rumoured" that the J-75 was simply their old J-57 from behind the compressor to the nozzle, and used, essentially, the J-67 (or Olympus) compressor section. It seems reasonable to assume that, if not the original intent, "acquiring" Olympus technology for American manufacturers became the end result.

Most US sources claim the J-67 was abandoned in 1955. Yet development of the XF-103, which used the J-67 and an intriguing bypass ramjet design that at high speed bypassed the main engine and dumped ram-compressed air into the afterburner section of the J-67.

Mysterious stuff. One wonders if Avro was told the engine was cancelled in 1955 was intended to cast doubt on the Arrow programme.

THE SPARROW 2D MISSILE

First of all, the Sparrow 2D was an active guidance weapon, or, in the jargon of our times, a “fire and forget” missile. This means that it had its own radar transmitter and could find its way to the target on its own, without assistance from the launching aircraft’s radar. The Sparrow 3, which was used and still is used from about 1960 on, and is the Sparrow most people know, was not an active-guidance weapon. It required the aircraft’s radar transmitter to “illuminate” the target, while the missile’s receiver would pick up the radar return and home in on the illuminated target. This required the aircraft to keep pointing its radar at the target, meaning, generally, the launching aircraft had to keep closing on the target, potentially exposing it to the target’s own defensive weapons. In other words, Sparrow 2D was a far more advanced concept.

In reality, the AMRAAM, which is also based on the Sparrow missile’s airframe, is identical in concept and more to the Sparrow 2D – yet the Americans weren’t able to make it a viable weapon until around 1990! It wasn’t offered to America’s allies for several years.

So much for background. In the mid 1950s Raytheon was working on the Sparrow 1, which was similar to the Sparrow 3 by Douglas, and Douglas was working on the Sparrow 3 and the Sparrow 2, which obviously were missiles using different concepts and technology. (They were also working on the Sparrow X, which had a nuclear warhead. Canada, however, as late as the time of Arrow cancellation, stated that no nuclear Sparrow was possible, and thus the Arrow with the Sparrow 2 would not have a modern, high-potency weapon. (AMRAAMs in 1960 is not modern?) In fact, in 1957, if I recall the date correctly (I will check this later), the Canadians were told by American authorities that no nuclear air to air weapon would be available until around 1962-63, and was being reserved for the F-108 Rapier. Of course, the F-106 got the Hughes MB-2 Genie nuclear air to air weapon long before that date. Was this another ploy to try to convince the Canadians that the Arrow wasn’t worth the bother and that Canada should just buy American?

At any rate, AVM Easton, Chief of Operational requirements (and probably the Arrow’s number one enemy within the RCAF itself), specified the Sparrow 2 and stuck to his guns to the bitter end, despite that fact that the miniature, high-speed, digital processing technology (ie the microchip) required for the Sparrow 2 was far in the future. Right after this weapon was specified for the Arrow, the US Navy, who had been developing it with Douglas, cancelled the Sparrow 2D, probably because they realised the technology just wasn’t ready.

Easton desperately wanted this weapon, and went about seeing if Canada could take over the development. The American authorities encouraged Canada to do so. I have a document from Jim Floyd’s files describing their reaction to the decision to “patriate” the Sparrow 2D development. One should remember that Sparrow and ASTRA, despite being paid for by Canada, were owned by the United States. Floyd’s document proves the US encouraged Canada to take on the weapon, and it seems clear from this document that Easton and/or the RCAF felt that the American encouragement meant that the technology was feasible, and that it was a nice gesture of support for the Arrow programme and

Canada's defence efforts generally. Jim Floyd saw it somewhat differently. To paraphrase what he wrote: "Of course they are encouraging Canada to develop a new missile for the United States free of charge." ASTRA most definitely appears to fit the same mould.

THE ASTRA RADAR/FIRE CONTROL SYSTEM

This programme was even more bizarre. Avro originally wanted to use the MA-1 system by Hughes, which the USAF was developing in an enormously expensive effort to be their "wonder" radar of the 1950s and 1960s. An article in January 2004's issue of *Airpower* shows they were keen to get this radar into a higher capacity interceptor than the F-106 (it had been slated for the F-102 but development difficulties made this impossible) and it had been specified for the XF-103, which was projected by Republic Aviation to be capable of Mach 4. (However a USAF technical evaluation said it would only be a Mach 2.5 aircraft, which seemed good enough to them until 1957 when it was cancelled in favour of the LRIX aka F-108, perhaps because they knew the Arrow 3 would embarrass it?)

Avro quite logically specified the MA-1 system for the Arrow, and the RCAF seemed to go along with that until 1956. After consulting with the Americans, Easton decided that the Arrow should have an extremely sophisticated, fully transistorised, all-can-do radar that would be integrated with the navigation system, the flight control system, have ground mapping capabilities, home on jamming, angle on jamming, electronic countermeasures, and integrate the world's first infra-red detection and targeting system. It was also to incorporate a radar altimeter, which would have allowed terrain following and would, with the ground mapping capability, have given the Arrow serious bombing capabilities. How Easton became convinced such a system would be feasible, is a very good question.

Hughes was the leader in radar fire control systems. The RCAF wanted them to develop ASTRA. Hughes, for whatever reasons, refused. The USAF suggested they contract RCA to develop it, partly because, they said, they wanted a second source for this kind of equipment to reduce their dependency on Hughes. (They certainly could have secured a second source by picking up the phone and calling Westinghouse which made most of the US Navy's radar/fire-control system.) The RCAF dutifully complied, for inexplicable reasons, other than perhaps excellent salesmanship and blind trust. At this time RCA was building, under license from Hughes, several radars, including the MG-3 which was used in the late CF-100s and early F-102s. The MG-10, however, was "developed" by RCA for the later F-102s, and RCA considered it "their" proprietary technology. Hughes apparently disagreed, feeling it was only a development of their MG-3 system, and a lawsuit was either threatened or actually carried out. Floyd's documents describe a meeting he had with the head of RCA over this system and it is troubling to read the note to file he produced as a result. RCA told Avro that the ASTRA system was going to be, essentially, a development of the MG 10 radar. Floyd was quite worried that it would never come to be because of Hughes' technology, and the reassurances of the RCA chief, as described in the note to file, are not convincing and indeed seem evasive.

However, if you read the RCA progress reports on ASTRA, you quickly come to appreciate that it was very, very advanced technology for those days, in fact most people today aren't aware that this technology existed then. While RCA may have used the MG 10 as a starting point, by the time the first ASTRA 1 development sets were available, it bore no resemblance to the MG 10 system.

On reading the ASTRA progress reports, it becomes clear that there were to be two ASTRA versions. A fully transistorised, but analogue Mk.1 set, and a fully transistorised, fully digital, pulse-Doppler version. This meant it would have become the first "shoot-down, look-down" radar in the World. Most people think the Tomcat had the first "shoot-down, look-down" radar in the World. Yet it's radar, the AWG-9 by Hughes, was not fully transistorised, and was not digital.

Floyd's documents also reveal that RCA's President told him that RCA had won, with the ASTRA 2 system, the contract to produce the radar/fire control system for the LRIX, aka the F-108. It is known that, once the F-108 was cancelled, the avionics from it went directly into the YF-12A interceptor version of what became the SR-71 Blackbird. Yet this radar is known to have been built by Hughes, and was called the ASG-18. Nobody seems to think that this radar was pulse-Doppler, or "look-down, shoot-down", however, again, Floyd's documents reveal that it was – many years ahead of the AWG-9 and Tomcat. Tests of the ASG-18 in the YF-12A credit it with the amazing detection range of 500 miles.

Very confusing stuff. Originally ASTRA was projected to cost 72 million dollars to develop. By 1958 that projection had leaped to 208 million dollars! That is roughly as much as was spent developing and building the Arrow up to first flight with developing the Iroquois up to cancellation. No wonder Fred Smye railed against ASTRA and predicted it would result in the end of an independent RCAF, and the end of the Arrow program. With the signing of NORAD and with Black Friday, he was proven correct. A gentleman who worked on ASTRA at CARDE told me in North Bay that he was personally responsible for dismantling 6 completed ASTRA 1 sets, and that they worked fine. CARDE also evaluated the Arrow with ASTRA 1 and commented in early 1958 that the combination appeared "very promising". This evaluation was classified and, according to author Palmiro Campagna, not released to anyone until 1960, when it was too late. He also told me that the infra-red detection and tracking feature of ASTRA 1 and 2 was proprietary Canadian technology (I think it was one of Gerald Bull's creations), and that the United States was so desperate to acquire this technology for ICBM launch detection, that they started jacking the price of ASTRA through the roof to get it. Apparently it worked. In mid 1958 Diefenbaker cancelled ASTRA and Sparrow, and the USAF was then able to do with it as it pleased.

ASTRA 1 and the APQ-72 of the F-4 Phantom bear incredible similarities, right down to the "switchology". US documents I received from Westinghouse's Historical Electronics Museum in Linthicum Maryland state it cost them merely one million dollars and a single year to develop the APQ-72. Canada dumped at least 40 million into ASTRA. It is listed

as the “second” radar in the West to incorporate infra-red detection and tracking, and the first one to use a shock-isolated, retractable, rack mounted system. In reality ASTRA 1 was first on both counts. Westinghouse was, of course, a subcontractor on ASTRA.

So what happened? I believe ASTRA 1 was repackaged and dumbed down slightly to become the APQ-72, and the nose of the Phantom was drastically enlarged to accept it. I suspect that ASTRA 2 was given to Hughes to perfect, and evolved into the ASG-18 system of the YF-12A. RCA got out of the radar/ fire-control business. Mario Pesando, who was a senior engineer at Victory Aircraft and Avro Canada, later ran RCA’s space efforts, including PROJECT SAINT, which was for a space-based SATellite INTerceptor, which was shortened to SAINT. He told me that if anybody could have pulled off ASTRA 1 and ASTRA 2, it was the RCA division where it was designed. He told me that it wasn’t designed at RCA Camden, as most people believe, but at a secret advanced research facility in New York State.

And Canada paid for the whole thing, and in the end received no thing. No wonder Gerald Bull became disenchanted with Canada, and the United States. (He was also the brain behind the successful, but cancelled, Velvet Glove missile.)

THE USAF LRIX PROGRAMME

1) From 1951 to 1953 the Arrow was only a project study. During the RCAF investigation into US and British manufacturers, both nations were told that Canada would buy a plane from either country if they produced something comparable to the RCAF specification, even after the Arrow program was started. They seemed to retain this attitude until 1955 when the Arrow project was well underway. The Arrow studies were cancelled in late 1953, then the programme was re-started in 1954. Once it was re-started, the USAF promptly informed Canada that they had let out a design study competition for a long range interceptor (LRIX) and asked Canada to provide the Arrow specifications to them so they could compare the Arrow to the US manufacturer’s submissions. It appears from later documentation that this information was provided, but that Canada didn’t, at the time, receive the LRIX specifications. So the possibility exists that they were using the Arrow specifications to devise specifications for their LRIX that the Arrow wouldn’t meet, thus providing the USAF with a reason not to buy the Arrow, and providing Canada with an alternative, and reason to cancel the Arrow.

2) In 1954 the Canadian National Aeronautical Establishment estimated the Arrow would have about 15% higher drag than Avro estimated and some other minor criticisms, but stated that Avro’s projections were nevertheless reasonable and well done. Then the NAE, DRB and RCAF descended on NACA Langley to discuss Aerodynamic Problems of Avro CF-105 Aircraft. It seems NACA was extremely critical of the Arrow design (due no doubt to the incredible difficulties the F-102 was facing) and suggested that:

a) It probably had at least twice the drag Avro was projecting and therefore probably wouldn’t be supersonic.

- b) The plane should be area ruled. (Area rule was formalized by Dr. Richard Whitcomb at NACA in 1953 and the USAF endeavoured to keep the theory secret according to Bill Gunston.)
- c) The intake wouldn't work.
- d) The delta wing was a poor choice for range.
- e) The delta wing was a poor choice for induced drag.
- f) The delta wing was a poor choice due to serious pitch-up problems.
- g) The Arrow would be directionally unstable, more so than any aircraft in the USA and that it shouldn't rely on electronic stability augmentation. (This was actually a lie, as a secret document from Avro on Zurakowski and Potocki's visit to the USA to fly the F-102 reveals. Zura pointed out that the F-102 was unflyable due to directional (yaw) instability at low speeds and absolutely required a stability augmentation system. It was pointed out that the 102 had a tube technology non-redundant stability augmentation system, whereas the Arrow had a solid state system that was more than double redundant. The documents from Avro show that Jim Floyd went through the roof when he learned these nuggets.)
- h) The Arrow would probably benefit from using elevons rather than separate elevators and ailerons. Avro didn't want to do this because the Arrow wing had negative camber in the inboard sections changing to positive camber at the tips (with droop for washout to prevent tip stalling and aileron reversal) and planned to use aileron trimming along with elevator trimming to achieve the lowest possible trim drag.
- j) The Arrow shouldn't use negative camber on the wing because it would hurt drag and thus range, and would result in higher trim drag to boot. Meanwhile Chamberlain had added the negative camber to improve longitudinal stability, prevent tip stalling (which caused pitch-up) and reduce trim drag

I previously thought that it was the NAE who had sold NACA on their criticisms, it now appears that NACA were the ones who really disparaged the Arrow and the NAE and DRB etc. became convinced to oppose the Arrow due to their influence. This internal bureaucratic opposition spread along with the rumours, and did the program serious harm. They were also proven wrong by the Arrow, and by history, in their assumptions.

10) In 1955 North American Aviation won the design study contract for the LRIX. It is interesting that the North American design was initially supposed to be a long range escort fighter, and all the US references state this, while Canada was told it was to be a long range interceptor. The design at that time looked like a miniature XB-70 Valkeyrie, with three fins and a canard. It had a plain intake that would not have been suitable for anything over, perhaps, Mach 1.8.

SALES EFFORTS WITH THE USAF

The RCAF tried to interest the USAF in the Arrow in 1955, as they did with the Royal Air Force. From Jim Floyd I have a copy of the US reasons for declining on the Arrow, and they were:

a) They had in progress the F-106 and F-101 which they felt would be adequate until their LRIX was ready (the NAA F-108), which they stated would be in service in 1962 or 1963. (This was a ridiculous assertion, most credible people now state it wouldn't have made it into service until at least 1965.)

b) They stated that the F-106, while not comparable to the performance of the Arrow, would be good enough for US purposes. They further stated that they felt the Arrow would be too much more expensive than the F-106 based on a dollars per pound of airframe assumption – if the Arrow weighed twice as much as the F-106, it would cost twice as much. This didn't turn out to be the case, in fact as of September 1958 the Arrow, with armament and radar, was only priced at 3.5 million per aircraft, while the USA spent 3.3 million apiece for the F-106.

c) This document also exaggerated the range of the F-106 by about 25% and stated that the F-108 had a RANGE (not radius) of 1,000 nm, and would be in service in 1962 or 1963. The combat speed of the LRIX was only listed as Mach 2 (.5 mach higher than the Arrow's specified combat speed).

In 1955 the wind tunnel testing of the Arrow was done in earnest, some of it at NACA Langley. It seems that the NACA folks became quite amazed by how the Arrow and its intakes, which they had formerly criticized, performed in the wind tunnel. It also appears that this data was shared with the other US manufacturers, and it is known that the evolving F-4 Phantom had its intakes and wing planform changed to match the Arrow at this time.

Once the Arrow showed its potential in the wind tunnel, the USAF Chief Scientist Dr. Courtland Perkins arrived at Avro to look at John Frost's flying saucer designs AND the Arrow in early 1957. He told Avro that the LRIX might not make it into production, and that Avro should prepare some Arrow versions, but NOT a new aircraft, to see if it could go some way towards meeting the LRIX specification. Jim Floyd told me that he and Fred Smye then took Perkins aside and pumped him for the LRIX specification, which he spilled. In the late 1980s Palmiro Campagna contacted Perkins and he said "I had nothing to do with the Arrow, then or now." At any rate Avro cooperated and proposed the Arrow Mk. 3, a Mach 3.5 capable aircraft with air to air refuelling and a combat speed of Mach 3, using new materials including carbon fibre composites, a glass microballoon filled insulation contained in a composite honeycomb core. (This appears to have become the heat shield for Mercury and Gemini.) At that time however, they were only specifying a combat speed for the Mk.3 of Mach 2.5 since even Avro was then overestimating the drag of the Arrow airframe. It is worth pointing out that the F-100 originally suffered from pitch up and poor longitudinal stability, with Chuck Yeager saying it was so unstable it couldn't be flown in close formation. Shortly thereafter the North American F-108 configuration changed to essentially become an Arrow Mk. 3, without air to air refuelling. In fact the idea of air to air refuelling seemed to be a revelation to Perkins at the time since most high performance fighters at that time were difficult to control adequately for precision refuelling. In fact it was still experimental at that time with, I believe, only the F-100C trying it experimentally. The specification for

the F-108 also appears to have changed from a combat speed of Mach 2 and a radius of 500 nm to a combat speed of Mach 3, and a radius of 1,000 nm, which, in my estimation and the estimation of Avro's Mario Pesando at the time, appears to be ludicrously high performance for the aircraft configuration, power and fuel capacity.

7) Nevertheless senior officers in the USAF kept expressing interest in the Arrow and Iroquois. In August 1957, as the Conservatives were settling into power, the military cutbacks started. The Chief of Air Staff said to a meeting of the Chiefs of Staff Committee:

Whether or not we stay with the 105 (Arrow) depends largely on getting the U.S. to come in with us during the next two months, before November when we go to the government.

It seems clear from what remains of the paper trail (most given to me by Avro people) that the Americans again declined on the Arrow 2 and also the Arrow 3, because they couldn't maintain Mach 3 long enough. (Avro was projecting, based on their materials testing to that point, that the Mk. 3 could maintain Mach 3 for 20 minutes.) Avro was then approached again by either the RCAF or Canadian government to propose a higher performance Arrow for the USA, which they did. This was the PS.2 and Mk.4 which were basically Arrow 3 with titanium skin, using 4 auxiliary ramjets, each giving an extra 16,000 pounds of thrust and operated as fuel tanks until the fuel was burned out of them, the fuel bag ejected, and the ramjet combustors lit up. This probably sounds like a pie in the sky Arrow version, and that is what I thought until I read Avro documents pointing out that Curtiss Wright had this basic ramjet sitting on their shelves as paid for surplus, since they had been designed for the NAVHO missile programme, which had been cancelled. These were proposed in November 1957, and in very early 1958. Suffice it to say that this aircraft would have had about twice the thrust to weight ratio of the F-108, roughly the same drag (the F-108 was slightly larger due to having engines with 44% larger frontal area than the Iroquois, while having roughly the same thrust) and there is no doubt in my mind that it would have had better range especially since it had air to air refuelling.

Suffice it to say that the US told Canada that it couldn't maintain Mach 3 long enough and therefore killed the last attempt to sell Arrows to the USA. Meanwhile, in accordance with the Truman statement of economic cooperation, with the PJBD, NORAD and every precedent to it in bilateral defence, the US said it would buy from their allies if the equipment was the best available. This meant they should have bought the Arrow 2, or even the Arrow Mk. 1, rather than proceeding with the F106, let alone the F-108, F-107, Thunderchief, etc.

MISSILES VS. FIGHTERS

1) When the first post war joint defence board was set up, the MCC, their first policy paper stated that the threats to North America in the foreseeable future would be from

first, Soviet jet bombers, and second, from Soviet ICBMs, and that Canada and the USA would work first to deal with the bomber threat, and then add missile defence to the agenda. So the idea that the ICBM came out of nowhere and shocked the allies and totally upset their defence plans is entirely mythological. Canada had also decided to equip with the BOMARC missile long before the Conservatives came to power, along with SAGE and an interceptor. Indeed by the mid 1950s the Douglas Aircraft was already designing the NIKE-ZEUS Anti-Ballistic Missile system, which was deployed in the mid 1960s. By this time Canada was so disenchanted with bilateral defence issues that they refused to buy any, and didn't participate in development.

2) The Canadian Ambassador was invited to a dinner meeting with the Secretary of the Air Force James Douglas and some senior US officers on January 30, 1958. At this meeting the Canadians were told the F-108 would make the Arrow look like something which might be picked up in a department store. This meeting is totally misconstrued in Peter Zuuring's Arrow Scrapbook since the Secretary of the Air Force said the US might be convinced to buy a couple of squadrons of Arrows for Canada. On reading a detailed transcript of the meeting, it is clear that this was a red-herring, and that the offer was only a personal musing of the Secretary of the Air Force. They knew Canada would not accept this because Canada had remained aloof from lend lease in WW II, and because it was Canadian policy to be a net contributor to Western Defence, not a beneficiary. Furthermore Cabinet minutes show Diefenbaker stating that it had always been the policy of the Conservative party to meet Canadian defence needs from within Canada. The Ambassador told Douglas all of this and declined on the spot. Douglas reaction was that he knew Canada accepting such an offer would cause many, many problems. It was also pointed out at this meeting that the US was not going to develop any more interceptors after the F-108, and felt bombers would not be any threat after about 1963, and that they were turning their attention to anti missile systems. (Remember that NIKE ZEUS was already underway, and I know of no other ABM system the US developed in those days.)

3) Once the Arrow started flying however, some US authorities, politicians especially, started telling Canada that bombers were on the way out and ICBMs were going to pretty much completely replace them, making the Arrow obsolete about half way through its expected lifespan. (Their representations stated the F-108 would do the same thing.) This was forced into the consciousness of Minister of Defence Pearkes and Finance Minister Fleming during their visit to NORAD HQ in April 1958.) Some British politicians particularly were reinforcing this view. By 1956 the leaders of the Canadian Army were totally opposed to the Arrow and were totally sold on missiles. When asked which missile however, they had no answer. They also had no answer on how they were to tell if an intruder was really an intruder or an airliner off course. They also had no answer on how they would defeat flood and carcinatron jamming, which the Soviets were known to already possess.

4) Once it was clear that the US would not purchase any Arrow version, the Canadian government decided it could not afford SAGE, Bomarc, AND the Arrow. They asked the United States what they would do if Canada didn't buy the BOMARC, and were told that the US would site their own, along the US Canadian border. This meant that nuclear

ground to air missiles would be detonating over Toronto, Ottawa, Montreal and Quebec City, among others, in the case of a Soviet attack. Once Canada bought the BOMARC however, the USA sited BOMARCS along the Canadian border with Ontario and Quebec anyway if my sources are correct. (Need to verify this, although it isn't really relevant.)

5) So in July 1958 Minister of Defence Pearkes went to Washington to try the charity angle. They hoped to get the Americans to fund part of the Arrow programme under the NORAD agreement and told the Americans that we couldn't afford Arrows, SAGE and BOMARC, and asked for a hand out. They were told that Canada producing the Arrow by themselves, plus its engine by themselves, plus its radar/fire control system themselves, plus its fire and forget missile themselves, itself totally went against the joint defence concepts of NORAD. In other words, if Canada wanted assistance in defence funding, it should show goodwill by cancelling the Arrow and helping fund American programmes and equipping with the result. They also appear to have pointed out that there was no way Avro would get any American contracts because the technology would find its way to Britain through the Hawker Siddeley Group. With this food for thought hot and on the table, the Americans then proposed a Defence Production Sharing Agreement with Canada.

DEFENCE DEVELOPMENT AND PRODUCTION SHARING

1) In August 1958 President Eisenhower and Secretary of State John Foster Dulles came to Canada with their Defence Production Sharing offer. Chronology shows that Canada was not offered any assistance with BOMARC or SAGE etc. until they were certain that the Arrow was dead. The Canadians were told that the USA was well disposed in principle to granting defence and development sharing contracts to Canada. Canada agreed to never go it alone on a major weapons system again. This is all clear from Cabinet minutes dating to August 1958. It is also pointed out in those minutes that they decided to keep the Defence Development and Production Sharing agreement secret for a while, which they did until the time of Arrow cancellation some six months. It is worth pointing out that pretty much everything to do with these meetings is still classified. But the following American document isn't:

“MEMORANDUM ON PRODUCTION SHARING PROGRAM -- UNITED STATES AND CANADA

“The current program dates back to at least 1941 and the Hyde Park Agreement. This agreement provided generally that each would produce in areas of greatest capability. In 1950 a Statement of Principles of Economic Cooperation was issued by the Truman Administration. It advocated, among other things, a coordinated program of requirements, production and procurement; the exchange of technical knowledge and productive skill; the removal of barriers impeding the flow of essential defense goods. In 1950 a DOD Directive on Defense Economic Cooperation with Canada was issued. A Presidentially approved NSC paper, 5822/1, dated 30 December 58, reaffirmed the

Statement of Economic Principles and provided for equal consideration to be accorded the business communities of both countries.

“Prior to the NSC paper, and following a visit of the President to Canada in July 1958, Canada took the following actions with the understanding that her defense industry depended largely upon the U.S. channeling defense business into Canada: cancelled the CF 105 and related systems contracts; decided to make maximum use of U.S. developed weapons, integrated into NORAD; worked with the U.S. toward a fully integrated continental air defense.

“The U.S. in turn established a Production/Development Sharing Program with Canada with the first quarterly meeting in October 1958. Since then, policy obstacles impeding a free flow of business have been modified in a number of areas such as: Buy American Act; duty free entry of defense goods; security requirement; etc.. Also, working groups have been set up on programs of mutual interest (for example, BOMARC); cost sharing agreements have been worked out; and possible joint development programs are being explored.

“The last quarterly meeting of the Production Sharing Policy Group was held on 25 May, Despite all efforts, over the period 1 January 59 through 31 March 60, Canadian defence business in the United States almost doubled that placed in Canada. Canada is not satisfied with these results, nor do they appear acceptable from our view.

“We must: re-emphasize the program of development sharing activities; encourage American industry to subcontract in Canada; and seek out other legitimate techniques to stimulate the program. Canada should be encouraged to energize her industry which has not displayed the necessary aggressiveness.” [underline and bold text added]

2) The Canadians told the Americans that they still needed a manned interceptor since the missile could not do the whole job, and bombers would remain a threat for a while, and that they couldn't buy the F-106 or F-101 because the defence establishment in Canada, and the politicians, had always maintained that these aircraft would be inadequate. So the Americans offered Canada a comparable interceptor, the F-106C, which could be manufactured in Canada by Canadair, which was then 100% Convair/General Dynamics owned. They were also told it would cost about half as much as the Arrow, and would be ready for service several months sooner than the Arrow. This is ludicrous because the Arrow was already into development flying, and because the F-106C didn't exist! I was a paper airplane. The Chiefs of Staff Committee were asked to consider the F-106C. They rejected it as not being comparable to the Arrow and reiterated that the RCAF needed something equal or superior to the Arrow. The Canadian government nevertheless made a defence production sharing offer to the United States involving trading Convair aircraft for Convair aircraft: The Argus or Yukon for F-106Cs. A few days later they were told the F-106C had been cancelled.

3) During the meetings the Canadians also were told that if Canada cancelled the Arrow and equipped with BOMARCS, that the USA would be pleased to defend Canada with US interceptors, either as a forward deployment during times of crisis, or on PERMANENT BASING in Canada. A 1967 interview with former MND George Pearkes, by Dr. Reginald Roy in British Columbia, which has only recently been released, shows that Pearkes secretly agreed to this plan. The USAF was invited up to Canadian air bases to defend us, but the RCAF and Canadian people were told it was only for joint defence exercises. Pearkes admitted in the interview that this was kept secret because the RCAF and Canadian people would not have accepted being an obvious protectorate of the United States. The USA was trying at the time and ever since, to get as many bases of the US military on foreign soil as possible. The book Blowback by Chalmers Johnson describes some of the tactics, history and fallout resulting from these policies. My standing here today is, in fact, blowback from old US policies we are discussing now. Pearkes was also told by the US Undersecretary of Defence regarding the Arrow that the US had “lots of interceptors that could be used in the defence of Canada”, preferably with permanent basing, but failing that in a forward deployment mode, and that he “wouldn’t spend all that money on that airplane if I were you.” Pearkes stated “and that convinced me more than anything else.” Some way to decide defence policy!

I wonder how many people in this room know that Bagotville and Cold Lake are, or at least were until the collapse of the Soviet Union, SAC refuelling and USAF AWACS bases with the Canadians being required to abandon their fields and deploy farther North in times of hostilities. Of course it would have been the Canadians bearing the brunt of the Soviet attack, with the USAF taking up the rear.

4) During those meetings John Foster Dulles, when again told Canada felt it needed interceptors, said that he could make available some intelligence which might prove Canada actually didn’t need interceptors. His brother, Allen Dulles, ran the CIA at the time. So, while NORAD and other defence experts were convinced that the Soviets had between 1,000 and 2,000 intercontinental bombers, he told Pearkes that the Soviets only actually had 160, based on U-2 overflights. While the figure of 2,000 bombers was absurdly high, 160 seems absurdly low. In fact in Congressional hearings on air defence in the United States, held coincidentally shortly after the Arrow cancellation, (8 months later) NORAD CINC Earl Partridge and USAF General White said that the only way the Soviets had, and for years hence would have, of attacking North America with their fleet of between 1,000 and 2,000 intercontinental bombers. One is left wondering why the CIA wouldn’t share such intelligence with the CINC NORAD if they believed it to be true. Unless, of course, they wanted to fuel the arms race.

OF COURSE, it didn’t dawn on the Conservatives that if they didn’t need the Arrow, then they certainly didn’t need the BOMARC, and also didn’t need SAGE.

5) Between August 1958 and Black Friday, a staggering variety of cost sharing and defence sharing offers were made back and forth. USAF Colonel Daniel C. Murray, who was attached to Avro for the saucer program, stated to Les Wilkinson, one of the

Arrowhead authors, that after the F-106C was cancelled, that Canada was offered a defence production sharing deal on the F-108. Murray stated that Canada accepted the offer and then cancelled the Arrow. I cannot find corroboration of that in the Cabinet minutes, but that doesn't mean much, believe me. There is a passage however, from three days after they cancelled the Arrow, that might be the item in question. In Cabinet minutes dated February 23rd, 1959, a single day before the government planned to announce "a large defence production sharing order for Canadian radar picket aircraft, (CL-44s)" the Canadian government was told by the United States that this order would not happen "because American manufacturers would not stand for it." I also checked to see if the United States bought any radar picket aircraft at the time (the role was being filled by a Lockheed Constellation variant at that time) or shortly after and they did not. During the run-up to cancellation the United States also offered to relocate some of their Western BOMARC sites North in to Canada. After the Arrow was cancelled, the US reneged on this offer by stating that the BOMARC was obsolete and that the US was not equipping with any more of them, and that Canada needed to buy interceptors. Let me just say that from my research, it appears that virtually everything Canada was promised at that time was reneged on once the Arrow was gone.

6) Once the Arrows and production lines were scrapped, the F-108 was also cancelled. I believe that had it been produced it would have been realized that the F-108 was really no better than the Arrow Mk.2a, and Canada had been had. This cancellation made Dief and Pearkes sleep easier since it appeared to vindicate their decision to cancel the Arrow. However, by this time the A-12, which became the SR-71, was in design, and it got the go ahead at the same time as the F-108 was cancelled. In 1960 they secretly began work on an interceptor version of the Blackbird, called the YF-12A.

7) Once all this secret nonsense went down, it becomes abundantly clear why Diefenbaker soured towards the United States. In 1960 acting US Secretary of the Air Force Charyk wrote to US Undersecretary of Defence while discussing a new production sharing offer:

"As I have previously mentioned, a sensitive political situation has arisen in Canada due to a series of events involving the CF-105 cancellation in favour of BOMARC and SAGE joint procurement with the U.S., followed by [unilateral U.S.] reductions in BOMARC and SAGE super combat centres."

The US Secretary of Defence Gates then came to Canada and pressured Canada to accept a CL-44 for F-101 Voodoo defence production sharing bid. The prices? 1.4 million a piece for CL-44s, and 4.4 million for the last 66 Voodoos off the line at McDonnell. Talk about the final insult! The Voodoo used the ancient J-57 turbojet, had about half the thrust to weight ratio of the Arrow, had three times the wing loading, had a pitch up problem, had structural problems, and more. It, like the F-106, never saw combat in Vietnam, perhaps because its Falcon missiles were junk. Obviously the government couldn't publicly pay more for Voodoos than for Arrows and they declined. Even though Gates told them that it was too good a deal to pass up and that the Canadians had best jump at the offer before the US manufacturers got wind of it. In the end the

Conservatives accepted 66 second hand Voodoos retired from ANG service, in a complicated deal that hid the price of the Voodoos. Former AVM John Plant, who became Avro's President, later mentioned that for 60 million dollars, plus the Arrow termination penalties, they could have had an equal number of Arrows. The actual price paid for these Voodoos, minus weapons and spares and ground support equipment, is thought to be over two million dollars each. SAGE costs, which the Arrow didn't require but the Voodoo did, were over and above these costs.

"MEMORANDUM ON PRODUCTION SHARING PROGRAM -- UNITED STATES AND CANADA"

"The current program dates back to at least 1941 and the Hyde Park Agreement. This agreement provided generally that each would produce in areas of greatest capability. In 1950 a Statement of Principles of Economic Cooperation was issued by the Truman Administration. It advocated, among other things, a coordinated program of requirements, production and procurement; the exchange of technical knowledge and productive skill; the removal of barriers impeding the flow of essential defense goods. In 1950 a DOD Directive on Defense Economic Cooperation with Canada was issued. A Presidentially approved NSC paper, 5822/1, dated 30 December 58, reaffirmed the Statement of Economic Principles and provided for equal consideration to be accorded the business communities of both countries.

"Prior to the NSC paper, and following a visit of the President to Canada in July 1958, Canada took the following actions with the understanding that her defense industry depended largely upon the U.S. channeling defense business into Canada: cancelled the CF 105 and related systems contracts; decided to make maximum use of U.S. developed weapons, integrated into NORAD; worked with the U.S. toward a fully integrated continental air defense.

"The U.S. in turn established a Production/Development Sharing Program with Canada with the first quarterly meeting in October 1958. Since then, policy obstacles impeding a free flow of business have been modified in a number of areas such as: Buy American Act; duty free entry of defense goods; security requirement; etc.. Also, working groups have been set up on programs of mutual interest (for example, BOMARC); cost sharing agreements have been worked out; and possible joint development programs are being explored."

Prior to the NSC paper means PRIOR to December 1958 the Arrow was, as the USA was clearly aware, CANCELLED.

Since the first Defence Production Sharing joint meetings were in October, the Arrow was cancelled prior to October. So it wasn't done in November when they deleted the Arrow from 1959/60 fiscal year budget projections.

It is now AIR TIGHT that they canned the Arrow due to the machinations of John Foster Dulles, Ike and others in JULY 1958!!

So we now know when the Arrow was killed, and WHY.

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