By Dave Noland

SUPERFLOPS

Sleek and sophisticated world-beaters they were. But these two symbols of Canadian and British national pride fell before harsh economic reality.

Airplanes and politics rarely mix well. Scarcely a major American project in the last decade has escaped unscathed from some sort of political hassle—SST, C-5A, F-111, XB-70, F-14, ad infinitum. The old days are gone—the days when the pressures of war or the lure of a bullish economy swept away any barrier to the immediate goal: lots of airplanes, now, and don't worry about the money.

Well, these days, technology has so far outstripped our ability to pay for it that somebody *has* to worry about the money. And sadly for the aviation buff, new aircraft will become increasingly rare. From 1946 to 1954, no less than 48 types of American jet aircraft were designed, funded, built, and flown. How many can you remember in the last eight years? You probably won't even need to use your toes to count them.

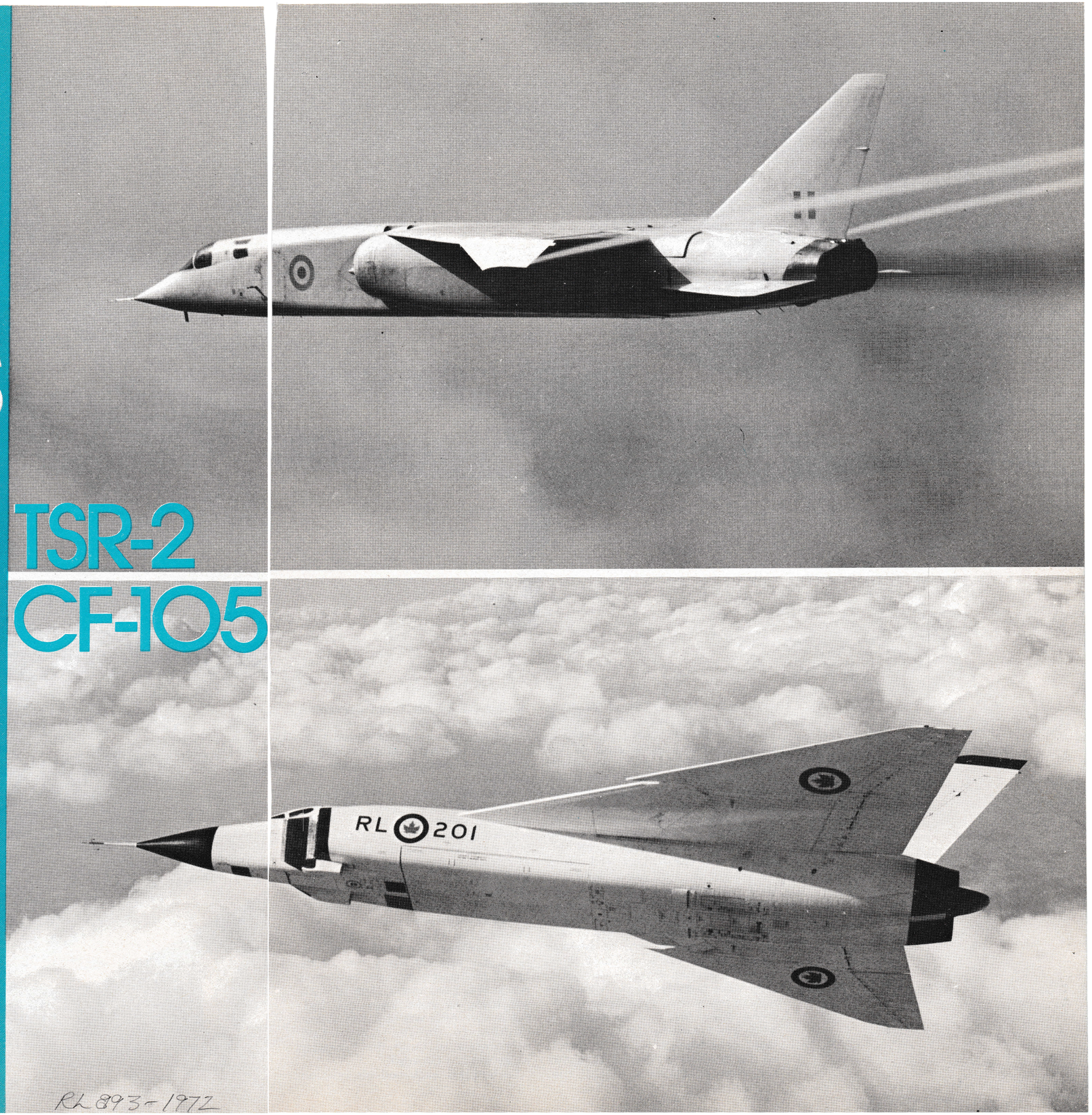
The sad part is that a lot of exotic, interesting aircraft will never fly because of dollar anemia. Or, if they do manage to get to the flying stage, they'll be quickly cancelled. Which brings us to the heroes of our narrative: two exotic, foreign, superperforming machines that brought oohs and ahs from drooling aficionados on both sides of the Atlantic, Avro Canada's CF-105 Arrow and British Aircraft Corporation's TSR-2.

It's hard for Americans to fathom the national pride that courses through projects like these. So we build the world's greatest airplane. Big deal. Aren't we number one, and haven't we always been? It's different elsewhere. Look at poor Britain. An island the size of Wyoming that keeps coming up with bright ideas that somehow always end up languishing in the shadow of the Americans. The Comet beat the 707 into the air by five years, and the Trident was conceived well ahead of the 727. And what's the airliner most preferred by veteran transatlantic passengers? Britain's VC-10.

And Canada. Only 20 million people, and before 1958, she'd never built a swept-wing airplane. Their CF-100 was 100 percent Canadian, by God, but it was also subsonic and out of the '40s. The CF-105 Arrow, claimed the politicians and the PR men, would bring Canada to the forefront of the '60s with "the most advanced combat aircraft in the world." And it looked as if they might have been right.

The Arrow certainly looked its highly touted part. It was huge for an interceptor, 78 feet long (bigger than a B-17), sleek and awesome. A long-range interceptor, it was designed expressly to protect the vast expanses of Canada from Russian bombers coming over the pole.

The Arrow's thrust-to-weight ratio was unheard of. The first five Arrows had twin J-75s (17,000 pounds thrust dry, 24,000 with afterburner), but the production Mark 2 Arrow was to have had the Orenda Iroquois, which churned out 30,000 pounds of thrust



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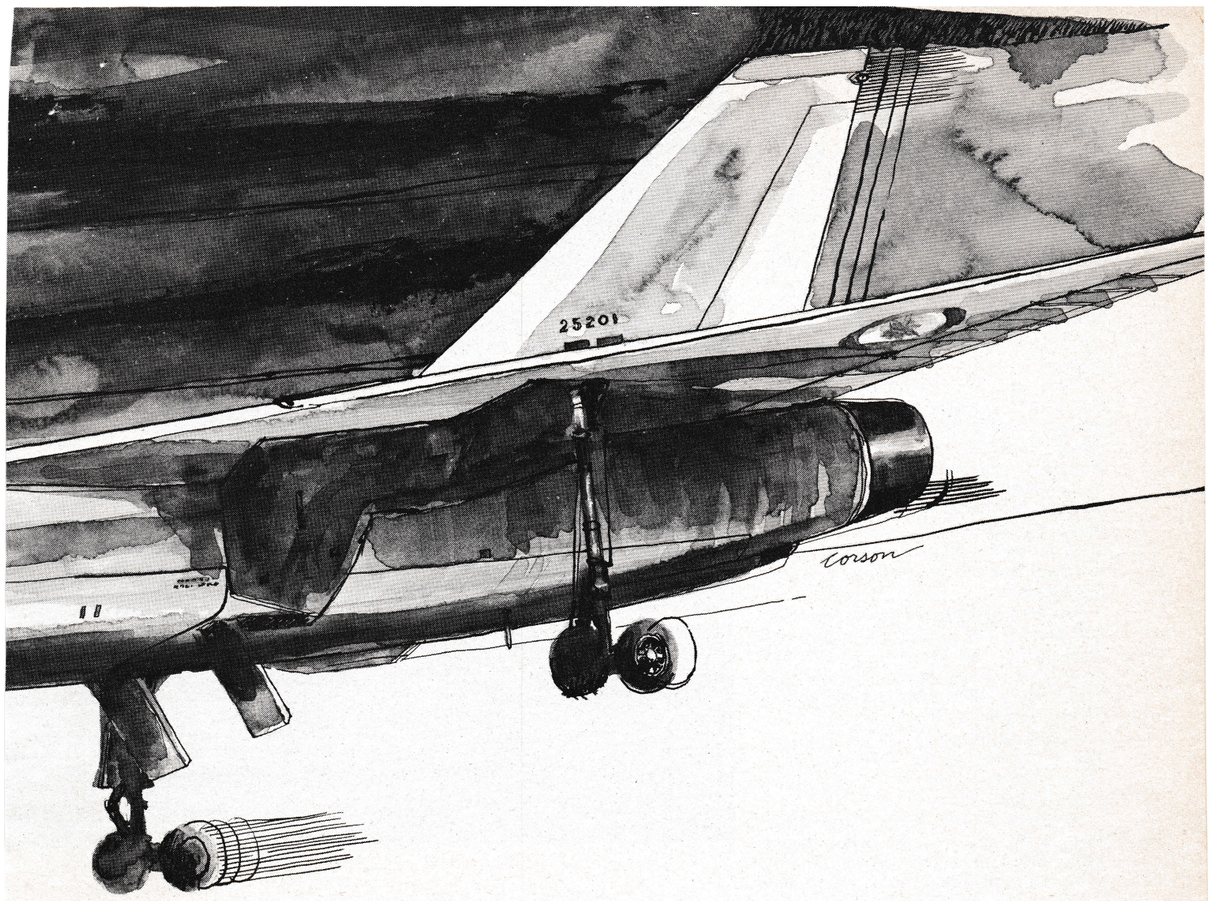


with reheat. Normal takeoff weight of the prototype was about 57,000 pounds, with the Mark 2 expected to be somewhat less because of the lighter Iroquois. So we've got maybe a 55,000-pound airplane with an available thrust of 60,000 pounds. Now think about that for a while. We are confronted with the rather awesome prospect of a loaded Mark 2 Arrow being propped up on its tail, lighting the afterburners, and taking off straight up, right out of sight, until it runs out of air at 60 or 70,000 feet. It would have left a Phantom rocking in its wake turbulence. Design top speed was officially quoted at Mach 2.5, limited not by available power, but by the temperature limits of the aluminum airframe. The whispers were that the Arrow would be able to top Mach 3 in short bursts.

The Arrow first flew on March 25, 1958, amid national fanfare. ("First flight news blankets world!" trumpeted the headlines). Pilot Jan Zurakowski, after a 3,000-foot takeoff run, steered the CF-105 to an uneventful 35-minute first flight, and within a month the prototype had passed 1,000 mph. The second prototype Mark 1 had just reached Mach 2.3 when the axe fell.

Prime Minister John Diefenbaker, perhaps influenced by Britain's notorious White Paper of 1957, which forecast doom for manned interceptors, decided to entrust the defense of Canada to the Boeing Bomarc missile. So, on February 20, 1959, Diefenbaker shot the Arrow out of the air, after spending $250 million.

Pandemonium ensued. Avro claimed the government had given them absolutely no warning, and the same day laid off every one of its 13,800 production workers and engineers. The government claimed Avro was trying to make them look bad. But in fact, Avro was left with almost nothing to do—the consolation subcontract to build the Bomarc's wings went to Canadair.

Diefenbaker explained his position this way: "The production of obsolete weapons as a make-work program is an unjustifiable expense of public funds."

The RCAF had wanted 100 Arrows, and the government said it would cost $781 million (Avro claimed, perhaps a bit optimistically, that they could build them for only $400 million). The Bomarc program, on the other hand, would cost only $111 million, since the U.S. was paying for two-thirds of it. (After all, we benefited from a good Canadian defense system.)

As it turned out, the Bomarc was more trouble than it was worth (the vibration of a passing truck could disorient the guidance system), and the nuclear warheads didn't arrive until five years later (interim warheads: sandbags). So Canada bought McDonnell F-101Bs, which are still its first-line interceptors.

Meanwhile, on the other side of the Atlantic, the RAF's ancient Canberras were getting older every day. And simultaneously with the Pentagon, Whitehall was beginning to see the vulnerability of high-altitude bombers to Russia's rapidly advancing missile technology. (Gary Powers and his U-2 had done much to solidify that notion.) America and Britain came up with a similar approach to bomber penetration: high speed, low altitude, under the radar. Our answer, of course, was the F-111. Britain's was the TSR-2.

TSR stood for tactical strike and reconnaissance, and the 2, as it turned out, meant too expensive. The TSR-2 did indeed have ambitious performance targets: Speed at altitude, Mach 2-plus; speed on the deck, transsonic; combat radius, 1,000 miles; takeoff distance, 600 yards from unpaved strips. Also called for was total terrain-following capability.

After getting the development contract in 1960, BAC engineers decided to forego the swing-wing approach, despite the fact that de Havilland's Barnes Wallis had done much of the basic research in that area in the '40s. They chose a tiny, highly loaded delta for simplicity and good gust response at low altitude, then strung full-span blown flaps along the trailing edge for short-field performance. Which presented a sticky problem: where do you put the ailerons? On the tail, of course. (North American's shipboard Vigilante also uses this all-moving "taileron" approach.) And then, for goodness' sake, they put flaps on the tailerons.

Like the F-111, the TSR-2 had terrain-following radar. Built by Ferranti, it could even pick up powerlines (good for finding general aviation airports, perhaps). The inertial guidance system was incredibly sophisticated—mission profiles punched out on magnetic tape could be fed into the TSR-2's computer, and it would obediently fly the whole mission automatically with no help from the pilot. Which was a shame, because he was provided with all sorts of goodies like head-up displays and moving

map readouts. All in all, the TSR-2 was the most ambitious bit of technology ever undertaken in Britain.

The engines were Bristol-Siddeley Olympus 22R Mk 320s, each providing 33,000 pounds of push with reheat. The 22R version of the Olympus was the last version before the Concorde's Olympus 593, and approaches it in performance. So you can imagine what you get if you put half the Concorde's power into something a third its size.

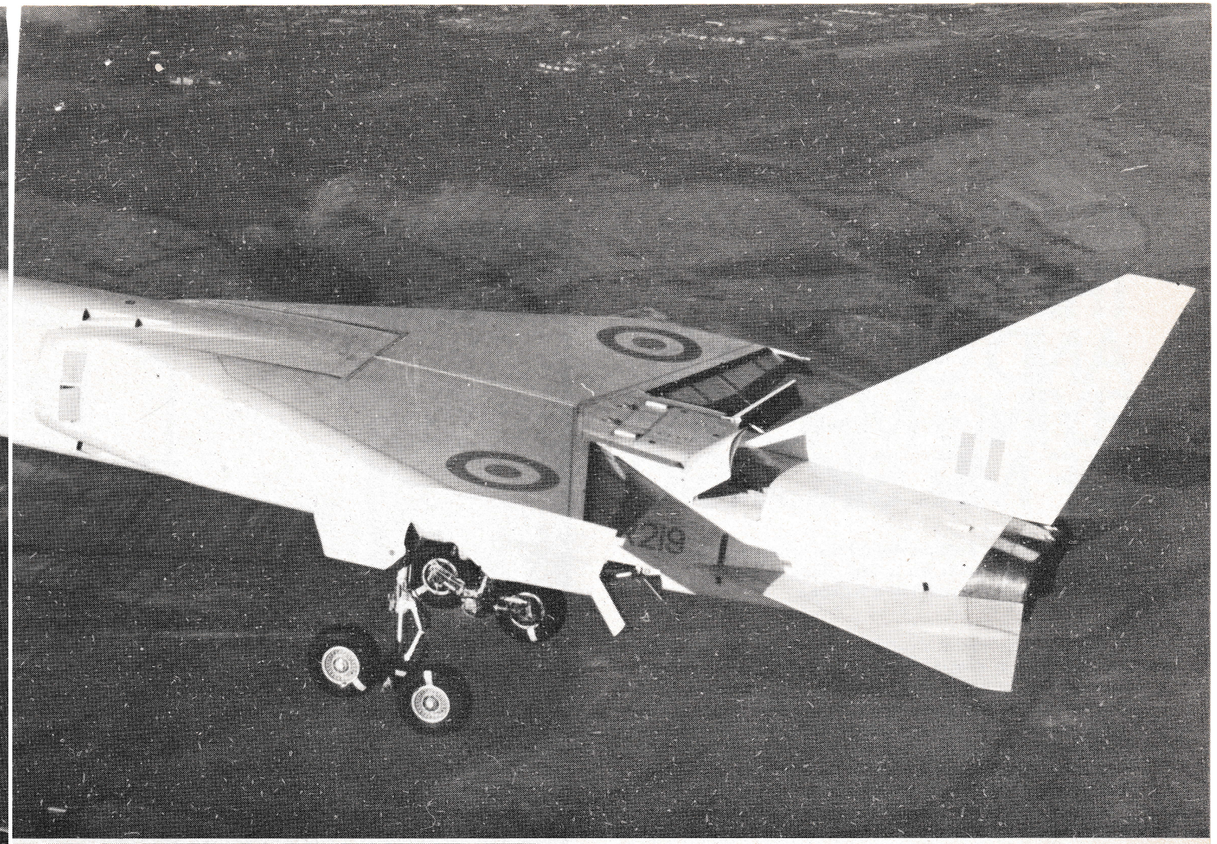
The TSR-2 was rolled out in 1963, but the first flight was frustratingly delayed until September 27, 1964. BAC's Bea Beamont made two quick circuits of the field with gear down for a total flight time of 14 minutes. The second flight, another 14 minuter, didn't happen until three months later—the engines had used up all their overhaul time in taxi tests, and had to be replaced.

The frustrating early delays gave the TSR-2's critics plenty of time to mount the opposition, which was based mainly on money. And they had a point. R&D costs had ballooned from a projected 90 million pounds to 300 million pounds ($720 million), and the total cost for 150 production TSR-2s had grown to 750 million pounds ($1.8 billion).

Meanwhile, the TSR-2 was beginning to do some useful flying. There were minor problems with fuel sealants, overstressed turbine shafts, and a balky landing gear, but the gear was finally retracted on February 6, 1965, and the prototype began flying several times a week. Pilot Beamont, obviously aware of the project's precarious status, lavished praise on its handling. But to no avail.

Harold Wilson's newly elected Labor government didn't share the Tories' concern for national prestige and advancing the state of the art. In February, Wilson cancelled two major projects (the HS 1154 VTOL fighter and the HS 681 transport), sent an evaluation group to Texas to look at the F-111, and gave the TSR-2 a temporary reprieve pending further study. But it proved to be only temporary, and a March 31 Cabinet meeting killed the TSR-2 for good. Britain would buy F-111s at $5 million apiece (each TSR-2 would have cost $12 million), the howls of anguish from Britain's stunned aerospace industry notwithstanding.

The prototype TSR-2 became a target at an RAF strafing range; another was handed over to eager students at Cranfield's College of Aeronautics for dismantling. And of course the F-111 had a few overruns of its own, the price went out of sight, and Britain's main tactical aircraft of the '70s will remain the ubiquitous Phantom. □



Above, the first prototype TSR-2 lets it all hang out. Full-span blown flaps gave good short-field performance. Below, welders cut up the 750-million-dollar machine for scrap. The carcass ended life as a gunnery target.