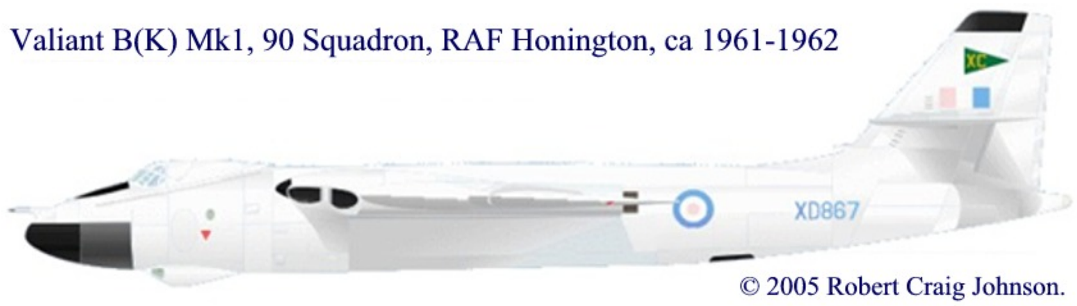
Chandelle Article: Abortive British Blackbird: The English-Electric P.10

It was a peculiarity of the Second World War that the Allied air forces emerged victorious from a conflict that had rendered them all obsolete. The awesome destructive power of massed formations of explosive-laden, piston-engined heavy bombers and tactical fighter-bombers that had, in the eyes of their proponents at least, won the war could, at war's end, be eclipsed by a mere handful of nuclear-armed, radar-equipped, jet airplanes or rocket-propelled ballistic missiles. In the immediate, post-war years, therefore, each of the victorious powers scrambled to replace seemingly useless war-era arsenals with examples of the new technologies, with little thought for the integration problems that radical innovations posed for traditional services. But, once the first post-war generation of weapons was itself approaching obsolescence, in the late 1950s, these problems came to the fore in military planning. Nowhere were these issues clearer than in the case of the strategic bomber.

At first, most post-war air forces relied on their best war-time bombers while drawing up requirements for what were, essentially, jet-propelled equivalents. But, by the mid-'50s, it was clear that jet engines and nuclear armament were not enough: the wartime concept was itself obsolete. Visually aimed defensive guns were now largely useless, given the performance of fighter interceptors, and guided missiles made the escort fighter as vulnerable as the bomber. So, henceforth, viable bombing aircraft would have to have fighter-like performance over long ranges at altitudes far above—or below—the 8000-20000 ft common previously. At the operational heights and speeds now envisioned, it would be hard to navigate visually or drop even a nuclear weapon with sufficient accuracy. Radar navigation and bombing would be essential.

This raised a serious problem. While the principles of radar navigation and targeting had become familiar during the war and while satisfactory equipment was available, there was a severe dearth of navigational reference information for the most likely theater of operations, the Soviet arctic and hinterland. Maps of any kind for this region were scarce. While wartime German maps and reconnaissance photos showed the general appearance of a few of the areas of interest, these relics could tell a bombardier/navigator nothing about the appearance of the same region on a radar scope. For radar navigation and targeting to work, the attacker had to be able to compare radar imagery with accurate radar maps of the route and the objective. Radar reconnaissance thus became the obsession of post-war British and American strategic air forces. At the instigation of USAF Gen. Curtiss Lemay, Strategic Air Command RB-29s, RB-47s, and RB-36s mounted many dangerous, provocative, illegal forays into Soviet air space. Britain was more circumspect, but no less determined, having just committed huge resources to the production of no fewer than three new jet-propelled, radar-equipped strategic *V-bombers*—the Avro Vulcan, Handley-Page Victor, and Vickers Valiant:



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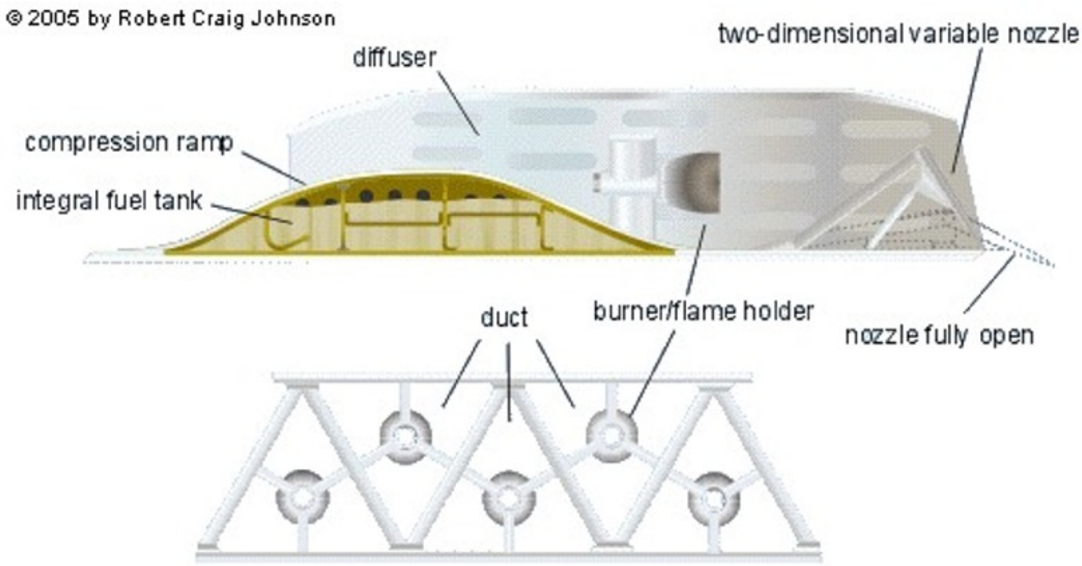
Accordingly, in 1954, the Air Ministry issued Specification R.156T for an all-weather, high-altitude, supersonic, radar-reconnaissance airplane capable of scouting the way for the V-force. The principle contenders for R.156T—the Avro 730, the Handley-Page HP.100, the Vickers 5.55, and our subject, the English-Electric P.10—were remarkably alike, given the dearth of experience with flight at the speeds and altitudes anticipated by the specification. All were short-span types with long fuselages—to house the required sensor, the over 50-ft long *Red Drover* sideways-looking radar array. All utilized a canard layout. All had either a stubby, trapezoidal or delta wing. All but the Vickers entry were fabricated from stainless steel rather than conventional aluminum alloy.

The English-Electric P.10 differed significantly in a number of respects, however. It was the smallest of the contenders, being sized for a crew of two, and it offered the highest performance, being designed to cruise at Mach 3 at above 70,000 ft (21,539 m). To achieve this ambitious combination of size and performance, its designers adopted the most novel propulsion system of any of the contenders: multiple Napier-designed ramjets integrated into the structure of the main lifting surfaces. The P.10 was effectively a biplane, with flat, low-aspect-ratio, upper and lower surfaces joined by shallow, spanwise, Warren-truss bracing. This provided the low drag essential for long-range, supersonic cruise with the structural depth to support heavy aerodynamic loads at high temperatures.



The many straight parts and standard shapes that resulted were also well adapted to fabrication in temperature-resistant stainless steel, an intractable material that could not easily be shaped into more complex curved forms. The struts of the Warren girders were insulated and lined with sheet metal to form straight-through ducts of triangular section. An integral fuel tank at the front end of the ducts was shaped to form the fixed, multishock compression ramp of a ramjet. Behind the ramp, simple, streamlined struts centered burners, fuel injectors, and flame holders in the duct. At the rear edge of the duct, a simple, two-dimensional flap did dual duty as a variable nozzle for the engine and an aerodynamic control surface for the aircraft as a whole. A pair of developed versions of the Rolls-Royce RB.123 turbojet were mounted in the wing roots, to provide power for takeoff and acceleration until the ramjet system would be capable of accelerating the aircraft to cruise speed and altitude.

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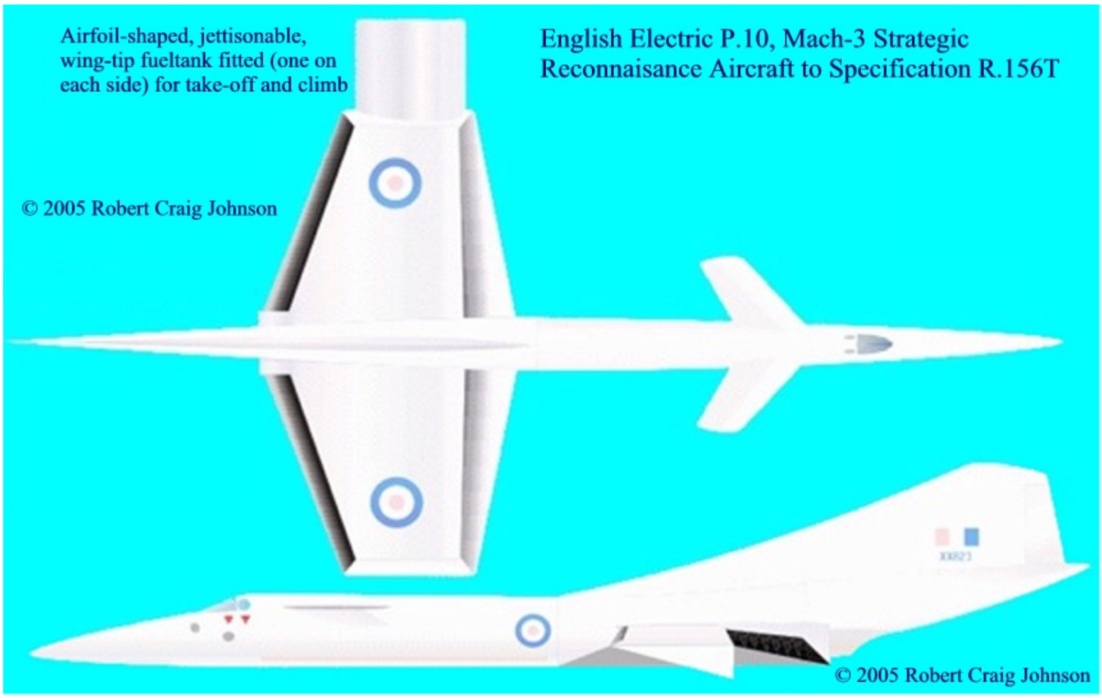

In a typical mission, the P.10 would have taken off with a light fuel load and topped up from a tanker, in-flight. Once fueling was complete, the crew would light the ramjets and begin a subsonic climb, using the thrust from the turbojets augmented by the modest output of the still relatively inefficient ramjet unit. During this phase of the mission, the engines would draw fuel from a pair of large, external, airfoil-shaped aluminum fuel tanks mounted on the wingtips, where the lift generated would exactly offset the weight and drag of the installation. At 36,000 ft (11,077 m) and Mach 0.9, the aircraft would level off, jettison the wingtip fuel tanks, and accelerate through Mach 1. At Mach 1.2, ramjet efficiency would have increased to the point that the turbojets could be shut down. The airplane would then climb to operational altitude, 70,000 ft (21,539 m), and accelerate to cruising speed, Mach 3. During cruise, the ramjet installation could sustain the specified speed and altitude on extremely lean fuel/air mixtures, using only about one quarter of its maximum thrust. This assured long range and ample power reserves for emergencies. With full internal fuel—8,375 gal (38,080 ltr)—the P.10 was expected to have a range of at least 5000 nm (9265 km). When necessary, it could reach a service ceiling of 85,000 feet (25,908 m).

The wingspan of the completed aircraft would have been 70 ft (21 m) with the auxiliary tanks or 50 ft (15 m) to the tips of the wing/ramjet for a wing area 1310 sq-ft (122 m^2) with tanks, 1050 sq-ft (98 m^2) without. The fuselage would have been about 109 ft (33 m) long. Fully equipped, it would have weighed 123,000 lbs (55,800 kg).

English Electric estimated that, following an early decision by the Ministry, it could fly a prototype by 1961 and deliver production, service aircraft sometime in 1964. But it was not to be. While agreeing on the theoretical soundness of the P.10's propulsion concept, the government research laboratories, the National Gas Turbine Establishment (NGTE) and the Royal Aircraft Establishment (RAE), felt unable to recommend the approach for a production system, because it was so novel that nothing could be known about its real world behavior and practicality until extensive experiments had been carried out. This was unacceptable to an air force in a hurry—the RAF already viewed English Electric's aggressive 1965 delivery date as unacceptably remote. The radar specialists were also less than happy with the design, because English Electric had achieved compactness and modest operational weight by reducing the length of the enormous Red Drover arrays and by leaving no growth margin for additional radar-related equipment. Only the Avro submission, the Type 730, made provision for all of the reconnaissance equipment planned. This was much heavier, at 223,000 lb (101,000 kg), cruised at only Mach 2.5 and 60,000 ft (18,300 m), and had a range of 4500 nm (8339 km). But it seemed more of a known quantity, in spite of its radical canard configuration, a lack of suitable turbojet engines, and the airframe's cutting-edge, braised-steel honeycomb-sandwich construction.

As things turned out, of course, even the Avro proved too complex, too uncertain, and, above all, too expensive to emerge as actual hardware. By the early 1960s, reality was beginning to intrude on the heady, sandtable dreams of air staffs and generals everywhere. The likelihood and feasibility of fighting an all-out nuclear war and surviving—much less winning—seemed increasingly remote. Francis Gary Powers' unexpected encounter with a Soviet SA-2 surface-to-air missile had also shaken the West's faith in the defensive qualities of high aircraft speed and altitude. To a Mach-4 or -5 rocket with a large conventional or nuclear warhead, the difference between a U-2 flying at 450 mph at 60,000 ft and an SR-71, B-70, or Avro 730 flying at Mach 3 and 70,000 feet or more was arguably negligible. So Britain's defense planners lost interest and moved on to the next big thing: low-level, high-speed, under-the-radar bombers and ballistic missiles. R.156T faded away, surrendering the military/political lime light to TSR.2 and Polaris.

English Electric P.10, as it might have appeared in operational form, ca 1980

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