TSR-2: cardinal points

★ *All-weather day and night reconnaissance*
★ *Conventional strike against point targets*
★ *Nuclear strike*
★ *STOL capability from "Dakota strips"*
★ *Long ferry range*
★ *Supersonic low down; Mach 2+ at altitude*
★ *Equipped to operate away from main base facilities*

"THE NEXT WAR," said Colonel-General Baron von Fritsch, a former Wehrmacht C.-in-C., cogitating in the months before World War II, "will be won by the military organisation with the most efficient photographic reconnaissance." He was right.

Times and techniques have changed since then but information produced by reconnaissance—a task neglected by many armchair defence "experts"—will always be required during any dispute, from "brush-fire" to nuclear.

That reconnaissance is vital was fully appreciated by the Air Staff when they drew up the operational requirement which resulted in the TSR-2. To carry out its recce. mission efficiently, the TSR-2 must be able to get to its target in any weather, day or night, and through whatever defences there may be—its navigation and survival needs are therefore the same as when on a strike sortie—and then collect information which is as accurate as possible and, if seconds count, be capable of instantaneously transmitting that information back to base.

Reconnaissance today therefore calls for a very sophisticated aircraft/equipment system; anything less may mean zero results—aircraft shot down on its way to the target, for example. The equipment used in the TSR-2, which can if required operate at any altitude, includes cameras, sideways-looking radar, and optical linescan.

The primary all-weather reconnaissance tool is the sideways-looking radar. This has the added facility of Moving Target Indication which reveals immediately any movement of surface transport systems, stationary objects being obliterated from the display. In common with the aircraft's other reconnaissance aids, the record produced by the radar incorporates information fed in by the highly accurate navigation system; each radar picture recorded thus has a corresponding navigational "fix", which makes for more rapid and accurate interpretation.

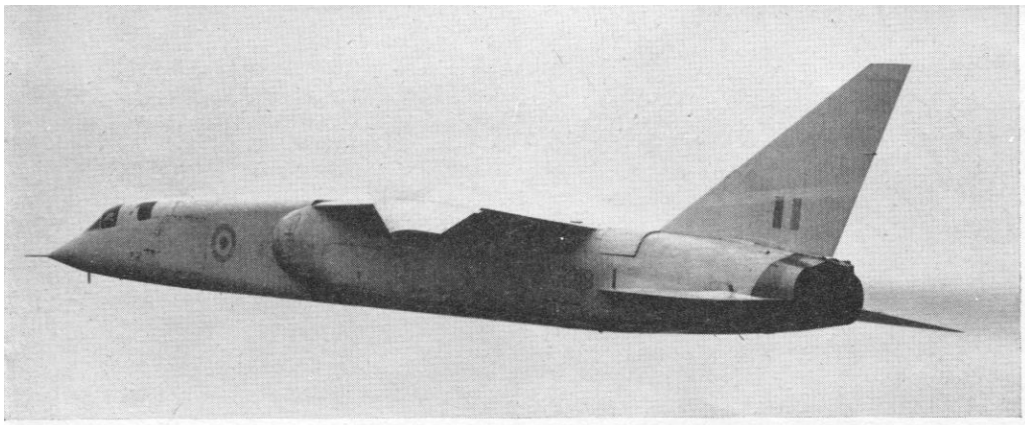
In average visibility cameras or optical linescan can be used. The linescan system —which, in effect, is an electronic "eye" scanning the ground below the aircraft— can be used by day or night and the pictures produced can be recorded in the aircraft or transmitted, instantaneously or at selected intervals, to a ground receiving station by a radio link. The TSR-2 has been designed from the start to take all the foregoing equipment, does not need any external pods or "Christmas-tree" additions, and in no way is its performance penalised.

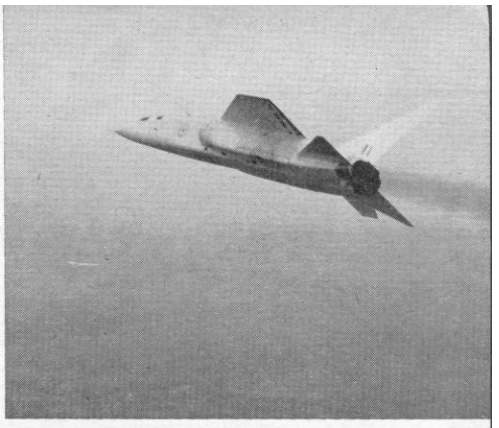
History is full of battles whose outcomes have been decided by a crumb of information which may have arrived incomplete, inaccurate or too late; and it needs little imagination to visualise the advantage given to, say, an Army commander who, seated in front of his TV set, can see what is actually happening at that moment at the particular spot he has asked the TSR-2 crew to investigate.

Nav/attack system

The need for ultra low level flight, if recce. or strike aircraft are to survive when penetrating enemy territory, has already been emphasised in previous issues of *Air Pictorial*. The relationship between penetration altitude and vulnerability has been studied thoroughly on both sides of the Atlantic, and it has been shown that, if the attack height is reduced below 500ft., the exposure time is less and the chance of successful defence is sharply and correspondingly reduced. This can be reduced still further if electronic countermeasures equipment is carried by the aircraft.

Low level penetration demands a very refined automatic navigation and terrain-following system, and an accurate means of weapon delivery. The TSR-2's navigation system consists basically of a mixed doppler radar and inertia platform system





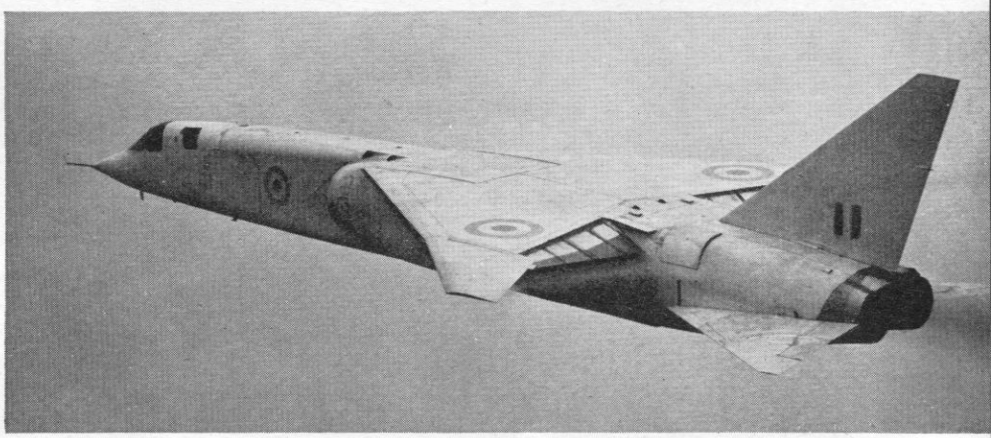
with separate radar for fix-monitoring.

Platform gyroscopes provide the direction sensing, while the radar measures the distance gone, and also provides correcting signals for platform tilt. To prevent an accumulation of errors which would seriously reduce the probability of finding the target, an azimuth fixing system is incorporated. To meet the requirement for all-weather operation, the principal fixing aid is sideways-looking radar. This radar is operated by the navigator and has a photographic display to ensure the highest quality pictures. Altitude information is obtained from air data and a radar altimeter.

To provide the terrain-following* capability inherent in the low level mode of operation, the forward-looking radar is used to guide the aircraft in the pitch plane.

The bomb—or, more accurately, weapon delivery system—can only be generally discussed for security reasons. The storage system and weapon-aiming computer system can accommodate any of the tactical weapons already existing or envisaged. It is obvious that high accuracy of strike is important when a target is being engaged with high explosive. The serious difficulties of taking out certain bridges and airfields in World War II and later the Yalu bridges in Korea will be recalled.

* "Terrain-following" equipment flies the TSR-2 automatically up and down over ground obstructions. "Terrain-avoidance" equipment, as in the F-111 (TFX), merely warns the low-flying pilot that there is an obstruction and that he ought to do something to avoid it.



TSR-2's armoury of free-falling bombs (which themselves can be delivered to a much higher accuracy than the best achieved in World War II) is supplemented by guided devices. These will have a very high order of accuracy indeed and will not involve the aircraft comprising its low vulnerability. The H.E. weapon delivery system is based on a "one sortie one strike" philosophy from the points of view of survival, accuracy of hit, and lethality. TSR-2 can also deliver tactical and high-yield nuclear weapons—again to high order of accuracy.

Crew efficiency during long-range penetration at low altitude can be sharply reduced by gust effects, as those who have flown on low level sorties in aircraft not designed for the purpose will testify. TSR-2 will be many times better in this respect than any other aircraft now flying. The gust response of the airframe has been minimised by basic design and the emphasis on crew comfort and automatic flight will reduce fatigue still further. Facilities for automatic flight are available to the pilot at all operating altitudes, and the aircraft can be flown "hands off" at tree-top height.

Mobility and dispersal

There is an obvious premium on world mobility and therefore ferry range. The ferry range of TSR-2 is exceptionally long. It is also fitted for in-flight refuelling.

There is an equally obvious requirement for dispersed operation which means STOL, the ability to operate from rudimentary strips, and the other requirements associated with rapid reaction. The TSR-2 has been designed to operate from Dakota-type strips, of which over 1,000 exist in the NATO area alone. A high degree of readiness can be maintained with the minimum of fly-in support, equipment being provided in the TSR-2 to enable it to "live" away from any main base facilities for considerable periods.

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On its fourteenth flight, on 22nd February, the prototype TSR-2, XR219, went supersonic for the first time, over the Irish Sea on its way to Warton, where future testing will be carried out. After the flight the pilot, Mr. Roland Beamont, commented: "It handles like a fighter at supersonic speeds and in turbulence is as steady as a rock. It is a fascinating aircraft to fly and in some ways the finest I have ever flown."