armament and several other aspects have all been carefully developed to ensure successful service with the Indian Air Force.

The HF-24 has highly swept wings, a needle nose and a graceful, area-ruled fuselage. It incorporates "many advanced aerodynamic concepts which make its flying safe and easy at low speeds as well as at supersonic speeds." Power is provided by a pair of Bristol Siddeley Orpheus 703 turbojets, manufactured under licence by Hindustan Aircraft Ltd.

HAL's Aero Engine Division were the first organization in Asia —outside the Communist countries—to manufacture an aircraft gas-turbine. The Orpheus licence was concluded in September 1956, when the Indian Government also procured a licence for the manufacture of the Folland Gnat Mk 1 fighter. The Gnat Mk 1 engine is the Orpheus 701, rated at 4,700lb thrust, and identical to the British-built unit. HAL's engine factory was completed early in 1959, the first Orpheus 701 came off the line on November 21, 1960, and type approval was granted by the Indian Defence Ministry nine months later. The 100th Orpheus 701 was accepted last September 30.

From the start of design the HF-24 has been matched to the Orpheus, but the level of total thrust required is greater than the 9,000lb aggregate of a pair of Gnat engines. At the start the optimum engine appeared to be the Orpheus 12, with dry and simplified-reheat ratings of 6,740lb and 8,170lb respectively. The Orpheus 12 was projected for the Taon and other aircraft which did not go into production, and so Bristol Siddeley ceased its development.

Discussions between Bristol Siddeley and the Indian Government were held in 1960 and 1961 with a view to completing development of the Orpheus 12, or of continuing development of the much later BS.75 turbofan as a possible HF-24 powerplant. These talks did not lead to a satisfactory conclusion, and in 1961 the Soviet Govern ment was approached to investigate the possibility of fitting the HF-24 with a Russian powerplant.

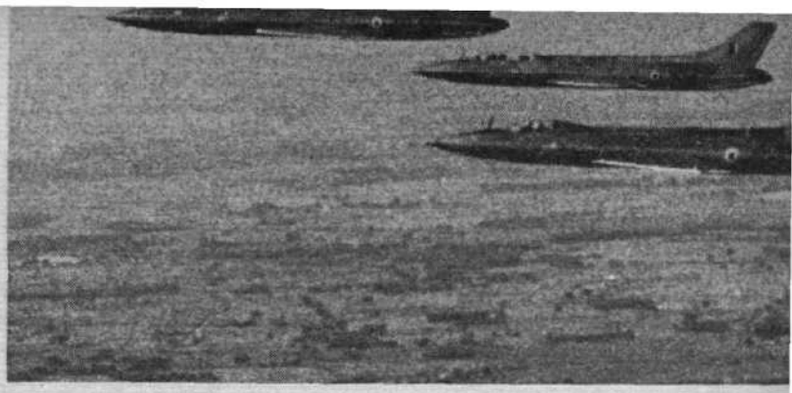
Six RD-9F turbojets were imported by the Indian Government in 1961 and bench-tested in that year and in 1962. Ultimately it was concluded that these engines would not be the best answer. One reason for the decision was the fact that the development potential of the RD-9F could not be extended beyond about Mach 1.5 without changes in materials and other specifications, whereas the HF-24 was regarded as potentially a Mach 2 aircraft. Another reason was that the Indians found it impossible to obtain from the Soviet Union the necessary level of detailed information on manufacturing the RD-9F without which they could not have produced it themselves.

By 1963 the decision had been taken to adhere to the Orpheus 703 engine as the basic powerplant of the Maruta Mk 1, but to do everything possible to increase its performance. Although closely related to the Orpheus 701, the 703 has a D-size fuel pump enabling it to be fully rated at all altitudes down to sea level, where static thrust is 4,850lb. Pairs of these engines were used in the first four HF-24s. In the fifth aircraft a major advance is incorporated: an Indian-developed reheat system. The Orpheus 703 reheat makes use of Bristol Siddeley techniques and advice, but is basically a product of HAL's Engine Division and reflects that organization's steadily growing self-sufficiency. The Orpheus 703 Reheat, as the engine is known, probably has a maximum rating in the 6,500 to 7,000lb class, and is the current powerplant of the HF-24 Mk 1.

As already noted, the HF-24 is far from being merely a fighter. From the outset everything possible has been done to ensure that it would have weapon-carrying ability and general versatility at least as good as that of the Hunter, and even the present Mk 1 aircraft can carry some 4,000lb of armament in a variety of locations. Basic ordnance comprises four 30mm Aden guns, mounted individually in the underside of the forward fuselage and each fed by a belt containing some 125 rounds. As an alternative it is possible to carry and fire 48 spin-stabilized rockets of any of several patterns, arranged in four vertical rows of 12 on a launcher extended from behind the nose-undercarriage bay. Under the wings are four stations each stressed for a 1,000lb load, and in the photograph at the heading of this article these are each occupied by six 3in rockets. Also in the picture are 1,000lb GP bombs, tanks for fuel or napalm, 60lb rockets and 19-tube spin-stabilized rocket launchers.

Aircraft 1 to 4 (BR462-3 and BR828-9) all differ in detail, notably in cockpit, dorsal spine and equipment. Many of the chief components were originally of British origin—Dowty is known to have a major interest—but as many as possible are now being made in India. In effect this means the creation of a completely new industry. Aircraft No 5 is the first with the 703 Reheat engines, and it also has modified supersonic intakes. Instead of having "transonic" performance the fifth machine is described as "highly supersonic," and the first production batch, now coming off the line at Bangalore, are similar. Operational development is now in hand by the embryonic IAF squadron to which the first aircraft have been assigned, and this unit is scheduled to be on active service early next year.

Meanwhile development continues on the HF-24 Maruta Mk 2. This project has never been able to crystallize properly, because—like the Mk 1—it has switched from one engine to another. The primary objective of the Mk 2 is to bring out all the potential of a modern weapon system inherent in the basic airframe. Mach 2 performance is considered possible of achievement, and discussions have also been held with a view to equipping the aircraft with all-weather radar and fire-control computer, and at least one type of guided weapon (presumably an air-to-air type). Powerplants which have lately been under consideration include: UK, Rolls-Royce RB.153 and a BS proposal: USSR, RD-9K (other designations have also been reported); USA, P&W J52 (JT-8) and General Electric J-1; and Egypt, Brandner turbojet. The latter, which is said to have dry and reheat ratings of 7,050 and 9,500lb, may well be flight-tested in an HF-24 in about eight months' time.



The first air-to-air picture of a group of Maruta aircraft: the pilots are those named in the text as participating in the display on May 10