

consultancy has been awarded to Avions Marcel Dassault Breguet Aviation of France. The first flight of the LCA is scheduled for June 1996, and the LCA is not likely to enter service before 2005.

The ADA is also currently undertaking preliminary studies for a 120-seat medium transport aircraft.

ADE is a different organisation from ADA. Established in 1959, ADE is engaged in design and development programmes on all other aspects of combat aircraft such as aerodynamics, structures, flight controls, avionics, air armament and flight simulation.

### **AIRCRAFT AND SYSTEMS TESTING ESTABLISHMENT (ASTE)**

ASTE is a Bangalore-based unit of the Indian Air Force reporting directly to Air Headquarters. It carries out experimental test flying. It also undertakes tests on related equipment such as flight test instrumentation, flight test techniques, ground and flight simulators, airborne avionic systems, and night vision devices.

ASTE cooperates with the HAL Flight Test Centre in carrying out joint development trials for IAF projects. In this role it has contributed significantly to the development of indigenous designs and modifications. ASTE suffers from two limitations. In the first place, it does not carry out testing under simulated operational conditions. Secondly, it does not undertake flight testing of civil aircraft. Nevertheless, ASTE is the only organisation in Asia where experimental test flying is being carried out.

### **GAS TURBINE RESEARCH ESTABLISHMENT (GTRE)**

This establishment functions under the Defence Research and Development Organisation (DRDO), Ministry of Defence. With virtually no track record for engine development, GTRE has been engaged in the design and flight testing of a reheat version of the Orpheus jet engine. This engine will provide a base for the indigenous Kaveri GTX demonstration engine designed for a dry thrust of 4,500 kg and after burner thrust of 7,000 kgs. Developed as a precursor to the full development programme, this demonstrator incorporates various advanced techniques such as a transonic compressor annular combustor, a shrouded cooled turbine, and a fully variable nozzle, with an electro-hydraulic control system, using sophisticated materials. The bypass variant of the GTX-35 engine being developed for the LCA, will have a thrust of 6,500 kg (dry) and 8,600 kg (after burner).

### **BHARAT HEAVY ENGINEERING LIMITED (BHEL)**

BHEL Haridwar, a public sector company under the Ministry of Industry, is the latest participant in the aeronautics industry. The R&D Wing of the DGCA designed, developed and flight tested the first prototype of the SWATI (LT-1) light trainer aircraft on November 21, 1992. After detailed tests for performance evaluation, a technical certificate for the SWATI has been issued by Indian Institute of Technology, Kanpur and the aircraft has been type certificated. Further design and development work relating to the nose landing gear with metal wing and engine mount structure for fitment of O-235-N2C Lycoming engine has also been completed.

BHEL Haridwar has been issued a production licence to manufacture the SWATI (LT-1). BHEL reportedly received orders for 45 aircraft. However, a production run of 24 of these side-by-side seating aircraft should satisfy the requirements of the Aero Clubs for the next few years. As almost all aero clubs rely financially on the government for their aircraft, the SWATI will have a captive market. Other potential users are pilot training institutes, the Border Security Force and personal aircraft owners. The SWATI has an ideal cruising speed of 185 kmph at an altitude of 2,000 metres, a range of 550 kms and a take off weight of 750 kgs in normal operation.

The DGCA assisted BHEL in the fabrication of the first production model and four aircraft were delivered on March 31, 1993. Unfortunately one aircraft crashed on May 31 when a wing broke off. On June 5, BHEL issued an open tender for twenty-two 116 HP Lycoming engines and Hoffman propellers. However, any production will be halted until the DGCA completes its investigation of the crash.

### **BHARAT ELECTRONICS LIMITED (BEL)**

In 1991-92 the government divested 20% of BEL. In 1992-93, for the first time in its history, BEL's civilian sales (54%) accounted for more than its military sales (46%). Along with Tata Consultancy Services, BEL