A Vulcan B.1 undergoing a minor inspection at Waddington. Most servicing operations are performed from beneath the aircraft.

Vulcans in Service . . .

the major effort. Even after the design was frozen in late 1949, the results of R.A.E. wind-tunnel tests were awaited and major changes to the wing were made.

The company has said that "this patience in the early days saved incalculable time and money later." If the first prototype had been tooled up for production in 1948, the cost of changes later would have amounted to that of the whole 707 programme and these changes would have caused delays at the present time. Similarly, the second prototype Vulcan was held up and brought fully into line with changes made to the first after flight experience, with the result that it represented a production aircraft and set in motion the production line.

The first production Vulcan was delivered for preliminary acceptance trials in March 1956; initial acceptance was in May; and the aircraft began service with the R.A.F. in August of that year. A leading part in the test programme leading to the initial acceptance was played by the company's Flight Research and Development Department, a self-contained unit whose effective and streamlined organization was introduced by Sir William Farren.

Production of the Vulcan is now approaching its peak rate. This means that the programme has been timed to permit the equipping of the remaining R.A.F. Vulcan squadrons at progressively shorter intervals. The company states that 50,000 special tools have been required to put the first Vulcan squadron into service, and that each aircraft consists of 167,063 separate parts (excluding engines, nuts, bolts, rivets, etc.).

Other statistics announced by the manufacturers include the following. A total of 39,500 drawings was required for the Vulcan project from the start of the 707 series to completion of the basic Vulcan. Total drawing-office man-hours on the project were 1,467,000. The Vulcan contains 410,300 nuts, bolts, washers, etc.; metal sheet sufficient to cover 1½ football pitches; 9,362ft of tubing; 14 miles of electric cable; and 2½ miles of rolled sections. In addition to the Avro production line, 17 sub-contractors are building airframe parts. A total of 39,600 bought-out items is involved, from more than 400 suppliers.

For two years, teams of Avro specialists ranging from test pilots and engineers to teachers, artists and writers have been engaged on the job of getting the Vulcan into R.A.F. service. This work has included that of the company's apprentices, who have put in 10,000 man-hours on the construction of working models of Vulcan internal systems for the instruction of R.A.F. pilots.

A special instructional school at Woodford has trained 300 Bomber Command technicians and over 30 from the R.A.E. and A. and A.E.E. during the past 18 months. Courses which required only two weeks to qualify servicemen on the Shackleton are, for the Vulcan, of 12 weeks' duration. The school's instructors are teaching airframe, electrical and instrument maintenance with technical data that took over a year to collect into more than 700 foolscap pages of notes. In addition they are training R.A.F. instructors, and pilots, engineer officers and other key men in Bomber Command.

The company's technical publications department is producing almost 1,000 5ft × 4ft hand-coloured instructional diagrams, incorporating 13,500 display panels hinged to show internal details. The department has also written and produced three volumes of lecture notes, a 1,200-sheet spares schedule, two volumes (1,000 pages) of descriptive and maintenance notes, and the pilots' notes.

A comprehensive ground-rig test programme was completed on the Vulcan, in addition to the normal prototype testing and the tests of the 707 aircraft. A complete airframe was built solely for ground-test purposes and was subjected to two years of thorough load-testing, and other rigs were constructed to test the hydraulic systems, pressurization and air conditioning, powered flying controls, fuel system and engine installation. Other items of research equipment installed by the company included a transonic and supersonic wind-tunnel, high-altitude and low-temperature pressure chamber, electronic flight simulator and a digital computer.

The head of the team responsible for the Vulcan is Sir Roy Dobson, managing director of A. V. Roe, who has made himself personally responsible for all major decisions covering the design, development and production of the aircraft. The technical director of the company in the early months of the conception of the design was the late Roy Chadwick, and his position was later taken over by Sir William Farren.

The chief designer of the Vulcan was S. D. Davies, whose right-hand men during the critical research and development phases were G. A. Whitehead, Vulcan project designer; and R. Connor, 707 series project designer. Today the Vulcan design team includes J. R. Ewans, chief designer; G. A. Whitehead, chief design engineer; P. L. Sutcliffe, chief aerodynamicist; and T. House, project designer. On the production side, under C. E. Fielding, works director, are A. Sewart, works manager; H. Dobson, works superintendent; and K. Beasley, aircraft controller. Co-ordinating, guiding and encouraging the teams working on all aspects of the Vulcan programme is J. A. R. Kay, general manager, while Roly Falk, superintendent of flying, has headed the delta flight-test programme since 1950.

Shown on the Wilmot Breeden stand at Farnborough was the Vulcan pilot's control installation, of which the pistol-grip—for an aircraft of this size—is a unique feature.