

The Early Years of Avro

By DR. JOHN B. RAE

The story of Avro, one of the great names in the history of British aviation, began just sixty years ago when A. V. (for Alliott Verdon) Roe began to build his first airplane. It was a pusher biplane powered by a 9 hp aircooled motorcycle engine and had a single-lever control of Roe's own devising for elevator and rudder. His workshop was a shed loaned to him by his brother, a London doctor. His financing came from his own savings and through help from his family.

When the plane was finished, it was tested at the Royal Automobile Club's test track at Brooklands. The engine was far too weak for its job. The plane could fly in short hops when it was towed by friendly racing drivers, but even this had its problems because the drivers would get so enthusiastic that they would forget to release the tow when the plane began to swerve. Eventually, the purchase of an 8-cylinder, 24 hp French Antoinette engine gave Roe the power he needed, and on June 8, 1908, he made what appears to have been the first powered flight in Britain, about 150 feet. Unfortunately, no official observer was present, so that the credit which should have gone to Roe went instead to the American S. F. Cody for his 1,390 foot flight at Farnborough on October 16th of the same year.

There was no mistake, however, about Roe's second

effort, a triplane numbered Roe I. Since Roe had been temporarily evicted from Brooklands by an R.A.C. secretary who regarded these flying experiments as nonsense, this plane was built in a workshop housed under two arches of a railway viaduct outside London. It had a length of 23 feet, a wing span of 20 feet and an area of 285 square feet. The tailplane spanned 10 feet with an area of 35 square feet. The fuselage was covered with oiled paper. For an engine, Roe went back to his 9 hp J.A.P. (for J. A. Prestwich, the builder) because the Antoinette had been giving trouble in a mounting with a larger propeller (nine-foot, four blades) three feet above it and operated by a bicycle chain.

This combination worked. On July 23, 1909, Roe I flew for 500 feet, the first flight in Britain by an airplane entirely of British construction. An exhibition at Blackpool later in the same year proved to be a disappointment, because rain wrinkled the oiled paper and the plane's performance was below expectations. Roe I is now in the Science Museum in South Kensington.

The man who achieved this triumph, A. V. Roe, became interested in flight while he was working as a marine engineer and had some correspondence with the Wrights. He did, in fact, defend the Wrights in a letter to the London Times, refuting the widespread belief



A.V. Roe, founder of Avro, standing before his Roe III triplane during 1910. (Courtesy Hawker Siddeley Aviation, Ltd.)



The Avro Type D of 1911, the aircraft that immediately preceded the famous 500 series. (Paul Cullerne via Hawker Siddeley)

that the brothers had fabricated the whole story about having achieved powered flight. Roe's defense drew from the paper's engineering editor the comment: "It is not to be supposed that we can in any way adopt the writer's estimate, being of the opinion, indeed, that all attempts at artificial aviation on the basis he describes, are not only dangerous to human life, but foredoomed to failure from an engineering standpoint."

This sage observation was made in 1906.

Roe was for a short time secretary of the Royal Aero Club, appointed by C. S. Rolls, the co-founder of Rolls-Royce. He also worked briefly on a helicopter experiment promoted in Denver, Colorado by a wealthy enthusiast named Davidson. The machine as designed by Davidson was a heavy contraption with two 20 hp steam engines driving 30-foot "lifters" with 120 blades each. Roe's participation consisted largely of telling Davidson it wouldn't work--it didn't. At any rate, Roe had as much knowledge and skill in the field of aviation as any man of that day. But he needed money if his work was to progress beyond Roe I. This problem was solved by his brother, Humphrey Verdon Roe, who had a flourishing business as a manufacturer of webbing in Manchester. His best selling product was what Americans call suspenders, sold under the trade name of "Bullseye Braces." The brothers formed the firm of A. V. Roe & Co. in 1910, with A. V. in charge of design and production and H. V. as business manager. The company was established in a corner of the webbing factory. In fact, the bullseye was used for a while as the Avro emblem and humorists were able to say that, "The Avro is held up by Bullseye Braces."

With formation of the company, Roe continued his triplane series. All, like his first plane, were designed as pushers. Roe II had a 35 hp 4-cylinder, water-cooled engine; Roe III had a V-8, also rated at 35 hp, and it showed a major change in the airframe design by using ailerons and having a tail rather than a forward elevator. The triplanes were unlucky. Two of them, being shipped by train to a meet at Blackpool, were destroyed when sparks from the locomotive set fire to the tarpaulin covering them. Roe and his mechanics assembled a third from spare parts and managed to win a prize. This performance brought an order from the Harvard Aeronautical Society and an invitation to participate in an air show at Squantum, Massachusetts in September 1910. Again there was misfortune. Two triplanes were taken to Squantum, and Roe himself crashed both of

them. The Harvard order was filled by making a new plane out of what was salvaged from the wreckage, and the remaining spare parts were sold to the Burgess Company of Marblehead in order to pay the passage back to England for Roe's mechanics.

There was a Roe IV, but by 1911 Roe had abandoned the triplane and turned to other types. The firm built a successful enclosed cabin monoplane in 1911 (Avro type F). It had a 35 hp, French-built, 5-cylinder, radial engine and is claimed as the first all-enclosed airplane ever flown. However, a series of accidents to monoplanes in the next two years convinced British aeronautical opinion that the monoplane was inherently unsafe and further development was effectively suspended for twenty years. Another Roe "First", also in 1911, was a seaplane based on the Curtiss design. It operated for a summer on Lake Windermere but was eventually destroyed in a storm.

However, the design that really made Avro was the 500 series of tractor biplanes. There was a preliminary model, Type D (1911), with a span of 31 feet, length of 28 feet and wing area of 310 square feet. It had a 50 hp Gnome engine and had a speed of 40-50 mph. Six of these were built and were later converted to seaplanes. The 500 came in the same year of 1911. It was designed in response to War Office specifications for a two-seater airplane to carry 350 lbs, have an endurance of 4½ hours, an initial rate of climb of 200 feet per minute, speed of 35 mph and the ability to remain at 4,500 feet for an hour. It was slightly larger than the D, having a span of 36 feet and a wing area of 330 square feet. It also used the 50 hp Gnome. A. V. Roe regarded the 500 as his first really successful design and numbered all later Avro models from it. Its immediate successors, Avro 501-503, were seaplanes, slightly larger than the 500 and with 100 hp, 14-cylinder engines. Four of the 503 type were built; one of them was sold to the German Navy and had the distinction of being the first seaplane to fly from the German mainland to Heligoland, on September 3, 1931. Whether this was a feat the British should have encouraged is another matter.

The experience gained with these planes was incorporated into the 504 series, which would remain in production until 1931 and have more units built than any other British aircraft before the Second World War. The fundamental design was preserved, but modifications were introduced and identified by adding a letter to



The airplane that made Avro a leading manufacturer of British aircraft, the Model 504. This is a 504K manufactured by Hewlett & Blondeau during the First World War, one of 17 firms that turned out 504s besides A. V. Roe and Co. (Courtesy Hawker Siddeley Aviation, Ltd.)

the type number. By the end of the First World War the sequence had reached 504K, and 504S was reached before production ended.

The prototype 504 was built in 1913. It was bought by the Daily Mail and sent on exhibition tours because the newspaper's owner, Lord Northcliffe, wanted to sell aviation, especially military aviation, to the British public. Whether this pressure worked or not is uncertain, but at any rate the War Office ordered twelve and the Admiralty seven, characteristically with specifications for spars of different cross-section so that an identical model could not be put into production for both services. Nevertheless, these orders got Avro out of the experimental stage and the webbing factory and into its own plant and a large-scale operation for an airframe manufacturer of that period.

The original 504 and its successors through the 504H had a length of 29½ feet, a wing span of 36 feet, a tail span of 10 feet and a wing area of 360 square feet. It had a wheel-and-skid landing gear and the comma-shaped rudder that became a distinctive Avro feature for some years. The first power plant was the ordinary 80 hp Gnome which actually delivered about 62 hp. Later the 80 hp Gnome Monosoupape, a 7-cylinder rotary engine, was used in the hope of getting better performance, but this engine gave constant trouble. Subsequently, Le Rhone, Clerget and Rolls-Royce engines were installed in variations of the 504. The highest horsepower rating was the 110 Le Rhone on the 504J and K, which gave a maximum speed of 90 mph.

The 504 series was used chiefly for training purposes. Combat experience in the early part of the First World War indicated that the plane's endurance and service ceiling were not quite good enough for first-line duties, but because it was very stable and easy to handle, it was admirably suited for training and auxiliary purposes. Its value as a trainer, in fact, was what kept the 504 in production so long.

Nevertheless, the 504 had no mean service record. Its most spectacular performance occurred very early in the war but was a clear foreshadowing of what air power would mean in the future. On November 21, 1914, three 504s of the Royal Naval Air Service, numbered 873, 874 and 875, took off from Belfort, France to bomb the Zeppelin base at Friedrichshafen in Germany. (A fourth plane, no. 179, broke its tail skid and could not take off.) Each carried four 20-lb bombs in racks improvised by the Avro factory. One bomb struck a shed and

damaged a Zeppelin inside, and another destroyed a gas generating plant. One plane, 873, was shot down.

Some of the 504 series were allocated to home defense and, in fact, the 504C was an adaptation as a single-seat fighter with extra fuel capacity for anti-Zeppelin operations. Many were built as seaplanes, and one, the 504H, was the first plane to be launched by catapult from a British warship. This event occurred August 7, 1917 on H.M.S. Furious.

The total number of 504s to be built is unknown, partly because they appeared in so many variations and partly because, for war orders, they were turned out by at least 17 firms, including one in Australia and one in Canada, besides A. V. Roe and Co. The accepted figure for the First World War is about 8,340 produced, running through the 504K. Of these, 3,696 were built by Avro and the rest by other contractors. There were other Avro aircraft during this period, but none approached the popularity of this handy little biplane. It made Avro one of the major British airframe manufacturers, and it kept the company going through the depressed years of the 1920s—even in the desperate days right after the war when so many American and British firms folded up and Avro itself was making billiard tables to keep the factory going.

The Avro name has now disappeared. The company was one of the first to be merged into what is now Hawker-Siddeley, but in the great Hawker-Siddeley plant just outside Manchester there is a pervasive aura of Avro tradition. It was here that the Manchester and Lancaster bombers were built, the latter without question the best British bomber of the Second World War. The plant has now moved on to jets—a long, long way from A. V. Roe's primitive triplane with the nine-horsepower engine, and a long way, too, in technical progress, if not in physical distance, from H. V. Roe's factory where airplanes and "Bullseye Braces" could be manufactured side by side.

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