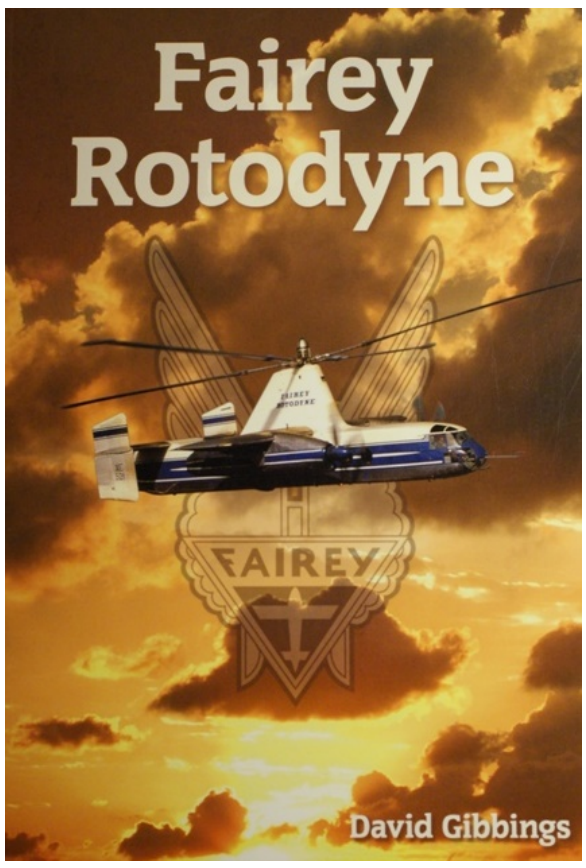
Book Review: Fairey Rotodyne by David Gibbings



Eileen Bjorkman

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From November 1957 until early 1962, a fanciful-sounding aircraft named the Rotodyne graced the skies over the United Kingdom. The aircraft could takeoff vertically like a helicopter, but cruise like an airplane, similar to the modern CV-22 but using a very different design. Instead of a tilt-rotor, the Rotodyne used a conventional combination engine and propeller on two stubby fixed wings, along with a tip-jet driven rotor that was depowered and declutched after takeoff to provide a rotating, lift-producing surface.

After a brief introduction, Gibbings provides a short history of concepts prior to the Rotodyne, dating back as early as an 1842 proposal to drive a rotor with steam engines on the tips. Later researchers found that small engines attached to rotor tips eliminated the need for a transmission and tail rotor, setting the stage for Rotodyne's most interesting feature, the rotor tip-jets. I had never heard of tip-jets until I saw a helicopter with them in Moscow's Russian Federation Air Force Museum. I thought they were a discarded, whimsical idea, until I read Gibbings' account and discovered the rich history of tip-jets.

Richard Fairey, who had been the chief engineer at Short Brothers, established the Fairey Aviation Company in 1915, at age 28. After World War II, Fairey experimented with two rotorcraft that demonstrated the feasibility of the technologies used on the Rotodyne. The Rotodyne design specification called for an aircraft capable of carrying 40 passengers and cruising at 165 mph. Although slower than airliners, the Rotodyne had the advantage of being able to take off and land vertically, thus travelling from one city center to another, eliminating the need for costly airport infrastructure, travel time, airspace and traffic congestion, etc. Gibbings spends many pages describing design details of the Rotodyne, and flight test engineers will especially enjoy his descriptions on test instrumentation and test facilities used for risk reduction, such as the outdoor Tip-Jet Test Facility at Middlesex and the Main Rotor Running Rig at Boscombe Down.

The Rotodyne progressed steadily through testing, working out bugs and acquiring customers along the way, including Okanogan Helicopters in Canada, Japan Airlines, and British European Airways (BEA). Interest from the RAF and NATO led to British government funding. Just as the Rotodyne reached maturity in the early 1960s, the British aircraft industry began a consolidation process similar to that of the U.S. aerospace industry in the 1990s. By the end of 1960, Fairey belonged to Westland Aircraft, Inc., which continued to believe in the Rotodyne. In 1961, however, Rolls-Royce, which had taken over manufacturing of the Napier Eland engine, discontinued support for the powerplant. While Westland scrambled to find a replacement engine and struggled to reduce the noise levels produced by the jet-tips, the RAF decided to buy the Andover as their medium transport aircraft. The British government withdrew funding, and the commercial customers cancelled their orders. The government claimed the Rotodyne as their property and destroyed the prototype, hardware, and all data, in what Gibbings describes as a "crime." Fortunately, the Fairey Rotodyne lives on through this marvelous book.

The book is generally quick and easy read. Some technical discussions may prove hard to follow, but Gibbings provides helpful definitions to help fixed-wing readers, clearly delineating between such terms as helicopter, gyroplane, and compound helicopter. He also repeats material from one section to another, which I found a bit distracting on my front-to-back read through the book, but the repetition will be helpful for those just interested in particular sections.

Flight Test News

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Spotlight on the Helicopter FTE

David Gibbings is many things, including an FTE, author, Fellow of the Society of Flight Test Engineers, and the 1993 winner of the Kelly Johnson Award for Outstanding Achievement in the field of Flight Test Engineering. Born and educated in Plymouth, England, Gibbings joined the Air Training Corps in 1945 and experienced his first flight. He joined the Royal Air Force (RAF) at Halton as an apprentice and became a navigator in 1952. Then he served at various RAF stations including a period at RCAF Winnipeg, flying Expeditors during a NATO training exercise. He left the RAF in 1953, briefly worked with DeHavilland, and then joined Fairey Aviation in 1954 as a Flight Observer, initially flying in Meteors on a Guided Weapons project. His career path led to White Waltham, where he worked closely with the Fairey Rotodyne, Scout, Wasp, and Gannet Mk3. After transferring to Westland Helicopters Yeovil Flight Test Dcpanmcnt in late 1964, he was instrumental in planning the Lynx Flight Test Program and flew on the first Lynx sortie.

As a holder of a Private Pilot's License, he first soloed a Tiger Moth in 1955 and has since piloted 17 different types of fixed wing aircraft. As a professional flight test engineer. he has flown in over 100 types of aircraft, including 35 helicopters. Several years ago, Dave shared this brief biography with the SFTE, in his own words.

DG: The role of Flight Test Aircrew has been an essential part of the duties of the Flight Test Engineer from the outset of helicopter development in the 1950s. In those early days they were known as 'Flight Test Observers'. The term Observer being the time honoured title for aircrew other than pilots, a tradition which had held from the beginning of aviation. However, as time progressed it was considered that the title implied that an 'Observer' simply sat and watched, and so with the onset of 'Political Correctness' we all became Flight Test Engineers.

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The Greatest Airplane of All Time

The NCAA college basketball tournament known as March Madness ™ strikes the USA in preparation for the championship in early April. Last year, an even greater phenomenon was born, the Greatest Airplane of All Time Tournament. **It's back!**

The tournament is open to all – share this with your friends, because the more the merrier. But this year there's something extra for SFTE individual members: **You can win an Amazon Gift Card for $100**. Which airplane do you think is the greatest airplane of all time? Which would you like to see in the tournament?

1. Nominate your favorite airplane here, or go to the link below. Nominations will be used to see which airplanes are included in the tournament and where they are seeded. Make as many nominations as you want, as many times as you want. Nominations are due by **Wednesday, March 9th**.
https://docs.google.com/a/multiplyleadership.com/forms/d/1FAYfPfysL0rnTtgx2M3QHKbIK456wTrkk0UVvIKdt_M/viewform)

Scoring: Fill out your bracket in its entirety—this entry is what you will be scored on, and it must be received before voting on the first round is over. After the tournament is over, the actual results of each round will be compared to your bracket.

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Spotlight on the Helicopter FTE (continued from page 1)

The Test Pilots Department had always remained a separate entity, retaining firm and undisputed control of all aspects of flight operations, including; Air Traffic Control, Airfield Management, Aircrew training, Safety equipment and Emergency services. Most organisations also had a separate department to control the engineering aspects of the flight programme, staffed by engineers, who by choice preferred some involvement with the finished product. Most Flight Test Departments provided the link between Flight operations and the Design office, charged with the collection and reduction of data and day-to-day management of the flight programme.

The Fairey company had never had the luxury of an airfield at their factory site. Throughout the pre-war years, their flight test airfield was on a site built by Fairey, situated a few miles from the factory at Harmondsworth and generally known as 'the Great West Aerodrome' This was requisitioned in 1944 to become part of Heathrow, and Fairey having been evicted, moved their flight operations twenty miles to the west to White Waltham near Maidenhead, well clear of London's air traffic. Structurally complete airframes would be transported from their Hayes factory by road, during the quiet hours of the night to avoid busy traffic times. The Flight Devlopment Department was housed in the offices that had been the headquarters of the Air Transport Auxiliary and included ample hangar space.

My personal experience working with helicopters began in 1960 when I moved to White Waltham as a propulsion test engineer, having spent the previous five years engaged on airborne guided weapons work, flying in Meteors. Fairey was, at the time, working to capacity on a wide range of projects including the following: Gannet anti-submarine aircraft and record-breaking Fairey Delta 2. On the helicopter side they were working on the little Ultra-light helicopter and the Rotodyne, both of which incorporated tip-jet drive.

White Waltham Fairey offices and Air Transport Auxiliary HQ during WW II

With so many projects running in parallel, there was a shortage of people to fly, and I, as a consequence, having clearly expressed my wish to be involved in flight operations, was asked to fly with the Rotodyne, in addition to my duties running Tests on the Rotodyne tip-jets in the test rig facility—multi-tasking was quite common within the Fairey organisation. Thus it was that the first helicopter I flew with was probably the most innovative, largest and potentially fastest of the many rotorcraft I subsequently became involved in.

My task on Rotodyne as flight crew involved the role of 'Flight Engineer,' monitoring the tip-jet drive system and the engines, and data management operating the various data recorders and the photographic auto-observer panel. These produced a vast quantity of photographic images all of which had to be laboriously analysed and identified. Analysis of the auto-observer panel involved working in a darkened room, reading some 10 or 15 flight instruments, frame-by-frame to provide tables of data for the Technical office.

The overall impression of flying in the Rotodyne was similar to that of flying in any medium-sized turboprop airliner. Much has been said concerning the noise generated by Rotodyne, and it is true that during initial start-up and while the aircraft was operating as a helicopter using the tip jets, noise levels were high. Having come from the military I could see no cause for concern, and certainly the internal noise level did not seem unduly excessive in cruise.

The 'Rationalisation' of the British Aircraft Industry took place in the early 1960s, so it was that I was in place at Hayes to become one of the assets acquired by Westland, when they took over Bristol (Helicopters), Fairey and Saunders-Roe to become Britain's sole helicopter company. For two years, while the Rotodyne programme was on line, I performed my dual role, primarily as a Propulsion Engineer running tests with the tip-jets in the static test chambers and spinning rig. All of which were situated in the far northwest corner of the airfield, well away from the offices, because we generated so much noise. During this time It was my privilege to work for Dipl Ing August Stepan, an Austrian who had worked with Doblhoff during World War 2, and when the world's first jet driven helicopter (WNF 342) flew for the first time in 1944, Stepan was the pilot.

My first impression upon joining the test site at White Waltham, was one of amazement at the dedication and extreme confidence with which the small team went about their business, in fact when I first arrived I seriously wondered whether I would be able to hold my own. The rest of the team were generous with their assistance, and I soon settled down to what I now look back upon as the most exciting period of my career. When called upon I was required to fly, which frequently clashed with my responsibility for a busy test schedule. Flying with the Rotodyne meant working closely with the two test pilots, Ron Gellatly and John Morton, who worked together as the most competent and dedicated team I ever have ever witnessed. And their approach to flight test procedures and airmanship set the way in which I have continued to operate for all my flying activities. When the Rotodyne was cancelled in 1962, Westland were in the process of transferring the development of the Scout and Wasp helicopters to Fairey at White Waltham, the result was that I was transferred to the flight development department to take part in this work which included the engine-out programme for the Scout (a sporting ride!) and carrier trials for the Wasp.

Westland closed White Waltham in 1964 and moved Flight Test staff to Yeovil, which was to become the Flight Test centre for all activities, including Sycamore, Belvedere and Skeeter. The turbine powered Whirlwind and the twin-engined Wessex were both in production at the Yeovil factory, and work was in hand to start production of the Sioux (Bell 47) under licence from the Italian firm Agusta, for the British Army. The main development activity was centred around the Wessex HAS Mk 3, one of the first helicopters to carry a fully integrated electronics system for sonar and automatic flight control system. Flight operations were carried out by a group consisting of, ten test pilots and fifteen flight test engineers, The test pilots were retained in an autonomous department, with total responsibility for all aspects of flying. The flight test engineers remained part of the Engineering organisation. This arrangement was typical of a system, which has remained unchanged to this day, except that there is now a Programme Management organisation within the system "to control the costs." One clear difference I immediately noticed when arriving at Yeovil was that most of the flight test engineers showed little interest in flying. This is not a criticism, we were after all engineers, but the company had no flying club, and offered no encouragement for their flight crew staff to gather this rudimentary skill and understanding. Indeed the Chief Test Pilot clearly did not want any flying out of Yeovil other than test operations and local traffic by visitors.

Flight data gathering was achieved by means of photographic trace recorders, but was also strongly clipboard and kneepad oriented. Vibration testing relied upon the Askania hand-held recorder, a heavy device that recorded onto waxed tape. The vibration measurements were taken in three planes (Vertical, Fore and aft and lateral) throughout the speed range. The procedure involved a considerable amount of movement and physical effort, and this often resulted in the onset of airsickness for the unfortunate FTE. FTEs now have to be able to operate complex telemetry stations and use the radio systems with confidence. Throughout the 1960s the space programme and development of guided weapons had accelerated the development of telemetry, and Flight Test organisations began to appreciate the potential of such equipment. The introduction of telemetry has made it possible for designers to become directly involved in the data gathering process, and also to make go and no-go decisions while a Flight was in progress, and this has established a whole new level of flight safety. The introduction of ground control to flight testing at Yeovil started with the Lynx programme, with the establishment of an air to ground radio link, operated from a control room with key design personnel present. This in itself was a cultural change offering a hitherto unknown hands-on involvement. One concern was that of Air Traffic Control, and it was recognised that the ATC controllers had to be able to intervene when necessary for operational procedures and flight safety.

From the outset, it was agreed that Flight Test Engineers would undertake the role of Telemetry Controller because they were already familiar with the flight environment, and radio procedures and worked with the pilots on a regular basis. This introduced a whole new approach to the job, the telemetry controller was now actively involved with the operation of the aircraft and the communications. It was decided that most FTEs should acquire Flight Radio Telephony Licences, which has become even more relevant with the increased complexity of avionics systems. Design staff, engineers and aircrew were quick to adapt to the new situation and by the time full telemetry was available things were running smoothly.

The scope of flight test work has also been affected by the growth of avionics systems that now account for more than half the total programme content, and call for specialisation on the part of flight crew. An example would be clearance of an anti-submarine or airborne early warning system, which demands some operational experience to ensure proper assessment. Military hardware and the aircraft systems are commonly integrated, and it is necessary for flight crews to

have an understanding of their operational function. The emergence of 'Information Technology' has accelerated the whole process and made it possible to work on the limits of the flight envelope with confidence.

As time has progressed the personal protection provided for Flight Test aircrew has developed, I recall that I was flying in comparatively fast jets, without the security of an ejection seat, using flying clothing similar to that used by wartime Spitfire pilots. In the late 1950s it was quite unusual for a Flight Test Engineer to have his own set of flying clothing. This at least has changed, as has the level of training to which civilian aircrew are now subjected, and since the early 1960s all flight test aircrew involved in military aircraft undergo a training course to ensure that there are familiar with safety equipment, procedures and survival. In the case of military projects helicopter crews also have to undergo regular sea survival and underwater escape training. Overseas climatic trials call for arctic and tropical survival instruction and an understanding of primary first aid.

Although my personal experience has centred on the aircrew function, it must be appreciated that the smooth day-to-day operation of any flight programme is very reliant upon instrumentation engineers and aircraft build controllers, who are Flight Test Engineers in their own right.

Since I first entered the Flight Test business, the job has evolved, embracing a wide range of disciplines and specialisations. There are moves afoot to introduce a more authoritive; QFTE qualification, working through the Test Pilot schools; this is bringing about heated debate between the industry, Flight Test schools and the civil/military test authorities. There is also some difference of opinion between the European and US authorities, as to whether a QFTE qualification should be simply desirable or mandatory. Additionally, the depth of knowledge and range of disciplines necessary to operate the aircraft now extends beyond the role of the pilot. Some of the more complex roles demand the attention of 'Specialists'. It follows that a well-balanced Flight Test Department now calls for a careful blend of specialists and all-rounders that can work together with mutual respect, cross training is essential. There is no place for the "one man band," the guy who makes a job his own to the exclusion of all others. The trouble is that when he stops playing, You don't get any music!

But being an FTE is still one of the best jobs in the world!

Greatest Airplane of All Time Tournament (continued)

Scoring (continued): You will receive 1 point for every correct entry in your bracket. For example, if one of the round 1 matchups is the 737 vs 727, and you indicate that the 737 wins. This will be compared to the final results – if the 737 won that matchup, you will receive 1 point for that part of the bracket. If all of your first round votes are wrong, then you will not receive any points for subsequent rounds.

Weekly Voting: You will receive a new bracket each week when the results from voting have been tabulated. Look at your new bracket, and examine each matchup to decide who goes on to the next round. You can print out the tournament bracket and write in your answer, or you can go to the link for the current round and fill in your answer electronically. The link for each round will be provided on Friday each week. The voting from all participants will determine which airplane proceeds to the next round.

There will be two ways to submit your votes – scan your new bracket with your latest votes and send it in via email, or you can take advantage of the link sent out weekly, an electronic way to cast your votes similar to the google form used for making nominations.

Schedule Highlights

9 March – Submit your nominations for which airplanes will be in the tournament

11 March – Tournament Brackets will be published – fills yours in completely!

15 March – Submit your completed bracket for a chance to win the Tournament

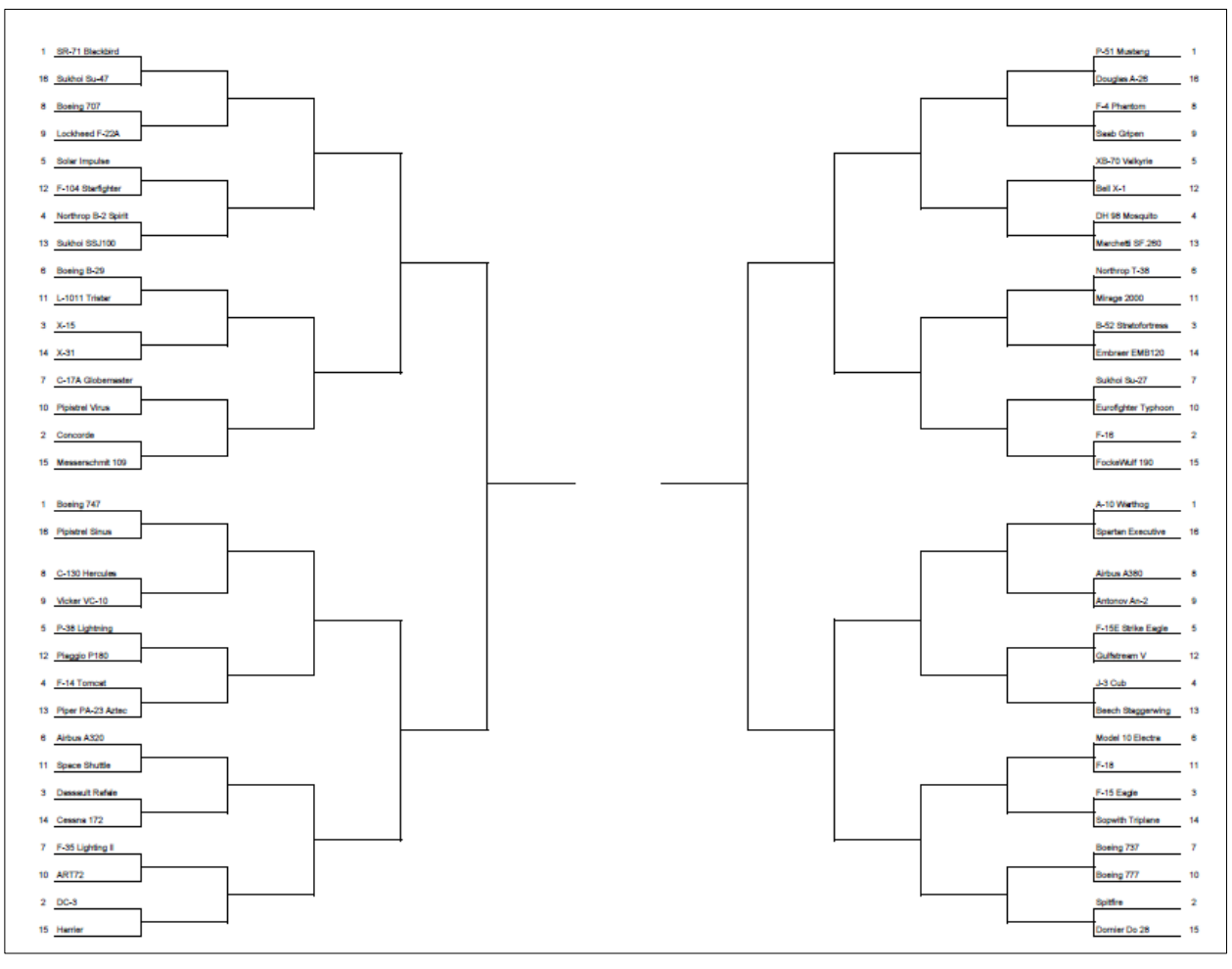
17 March – Round 1 results published

18 March – Round 2 Bracket published – begin vote on round 2

21 March – Round 2 voting complete

22 March – Round 2 results published

23 March – Round 3 Bracket published



Example Bracket (2015) Greatest Airplane of All Time Tournament