

Executive Overview: Jane's All the World's Aircraft: Development & Production

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When, in 2009, All the World's Aircraft marked its centenary with a specially enlarged Foreword, readers were promised a shorter editorial essay upon the achievement of the hundredth edition four years thence. The discrepancy between years and editions, it was explained, was due to the exigencies of war - specifically the two major conflicts of the 20th century disrupting annual publication.

One of those exigencies, it subsequently transpired, was the unfortunate descent of a Luftwaffe incendiary bomb upon the premises of Jane's publishers during the London Blitz of 1940-41. The consequent loss of records, including the library of past editions, was to be acutely felt when the history of this annual was being written. Thus was permitted to be called into existence the '1911 edition', which, although claimed to be in the possession of some book collectors, has never been indisputably identified. The edition published in November 1910, it is now clear, was not followed until the Spring of 1912 - a delay for which Jane apologised to his readers. Unexpectedly postponed by a year, we now offer the following as the true 100th Foreword.

Proving a negative is always problematical. However, the fate of the mythical '1911 Jane's ' was sealed by references to contemporary literature that established beyond all reasonable doubt that our founder, Frederick Jane, did not submit a copy of any aviation annual for review by the weekly magazine Flight during the period in question - and, furthermore, that he religiously did so in all other years between 1909 and the start of the First World War.

What would previously have been a time-consuming chore of research in dusty archives was reduced to an hour of key-tapping in the comfort of the editorial office chair, thanks to the current publishers of Flight International , who have generously made the entire contents of that journal freely available online for word-search. In the past few years, many other newspapers, magazines and documents have been digitalised in this manner, vastly expanding the source material for diverse avenues of historical research. We shall return to this most welcome occurrence presently.

'Justice delayed is justice denied'

Meanwhile, how might the opportunity of a second anniversary Foreword be used to best advantage? Five editions ago, these pages reviewed a century (1909-2009) of powered aeroplane flight, making particular reference to how its most significant events were both predicted and interpreted by the Jane's editors of the day. For the present analytical exercise, a different approach is proposed. Namely: What misconceptions come to be accepted as fact when Jane's is not there to chronicle events?

Nine years before Fred Jane launched his aviation annual, the 20th century was dawning and it was clear that someone, somewhere, would demonstrate sustained, powered flight in a navigable aeroplane within the near future. Aviation pioneers in several countries were working on the problem, and history records that their goal was achieved on 17 December 1903 when the Wright Brothers' Flyer rose into the air at Kitty Hawk, North Carolina. Wilbur and Orville later and graciously acknowledged the contributions of many others who had nearly succeeded before them, but were less impressed with the supposed achievements of a fellow US resident (although never naturalised), the German immigrant, Gustave Whitehead (born Weisskopf).

Unafraid of 'getting his hands dirty', Whitehead (1874-1927) had amassed considerable knowledge of practical aircraft construction and was also gifted in design and production of the item then most prized by aspiring aviators: the light, yet powerful and reliable engine. He also knew a good propeller when he saw one, and was able to combine the best of these skills and features into a series of aeroplanes built for himself and others.

Even at this length of time, Whitehead still has his supporters, audaciously claiming that he flew a practical aeroplane at least two years before the Wrights. For a definitive opinion of this *lèse majesté*, we need go no farther than Orville Wright's comments on what he termed "The Whitehead Legend" when writing in the magazine *US Air Services* in August 1945: Only one local newspaper bothered to report the alleged flight, asserted Wright, and even that was on its back page, four days later. Orville cited these points as "evidence" that no one took the report seriously.

One who did - over a century later - was Australian aviation historian John Brown. In the best traditions of original research, Brown became involved in the controversy when looking for something else, and most kindly kept Jane's informed. Commissioned to produce a history of the roadable aircraft (or 'flying car', which is not quite the same thing), Brown found himself having to look farther back than he had imagined would have been necessary. Even beyond the time that Fred Jane had begun to record the particulars of the World's aircraft. Even beyond Kitty Hawk 1903.

Here, it is necessary to pause for a moment of lateral thinking. Most of the aviation pioneers appear to have given little consideration to the consequences of their succeeding in delivering an airworthy aeroplane into the world. For them, flight was an end in itself; for Whitehead, it was one step in the building of a business. He was among the few who realised that once the novelty of soaring above the ground had worn off, sustained - and profitable - sales of the aeroplane to the public could only be perpetuated if it were integrated into daily life.

Pardonably, not having deduced that invention of the practical aeroplane would be followed in short order by 'invention' of the aerodrome and hangar, Whitehead was one of the first to provide it with the autonomy that he believed would be demanded by the private owner. That meant an aeroplane which could be kept in the garage of a town house, then make its own way - with a power drive to the landing wheels and with wings folded or dismantled - along the highway to a convenient meadow or park for take-off. Were this to be a businessman making a call, he would undertake a similar road journey on arriving by air at a suitable field in the vicinity of his customer.

Whitehead equipped his aircraft No. 21, known as the Condor, with two acetylene-fuelled engines of his own design: 10 hp for the road wheels and 20 hp as the main source of forward flight. 'Main' because at an appropriate moment during take-off, the flick of a lever would

transfer the road engine's output to augment the motor driving the twin propellers. He was by no means the only aviator to incorporate powered wheels into his designs, but by the time Jane began compiling his annuals, the practice was in decline and soon became lost in the mists of history, to be reborn in different form later.

In the early hours of 14 August 1901, the Condor propelled itself along the darkened streets of Bridgeport, Connecticut, with Whitehead, his staff and an invited guest in attendance. In the still air of dawn, the Condor's wings were unfolded and it took off from open land at Fairfield, 15 miles from the city, and performed two demonstration sorties. The second was estimated as having covered 1½ miles at a height of 50 feet, during which slight turns in both directions were demonstrated.

This, it must be stressed, was more than two years before the Wrights manhandled their Flyer from its shed and flew a couple of hundred feet in a straight line after lifting off from an adjacent wooden rail hammered into the ground. And, obviously, because of his demonstrated expertise in manoeuvring, Whitehead had flown missions like this before, suggesting his lead was even greater. (Two months earlier, his No. 20 was reported to have flown from the same field, albeit weighted with sandbags in lieu of an occupant.)

Could this have been a hoax, as Orville Wright was later to imply? How can it be inferred with such certainty that Whitehead had flown similarly before? The answers to both questions are simple and identical: His invited guest was the Chief Editor of the Bridgeport Herald.

Because of the cost of reproducing photographs in journals of the day, the weekly Herald used the editor's picture of the Condor in flight as the basis of a lithograph that illustrated a full-page feature article in its next edition, published on 18 August. Such substitution was common newspaper practice - and, indeed, producing exactly this type of engraved image was Fred Jane's first known employment. There is written evidence that the original photograph (blurred because of the poor dawn light) was shown at indoor exhibitions of early aviation imagery and artifacts in both 1904 and 1906. Its current whereabouts are shrouded in mystery.

Whitehead's No. 22, the next machine, this time powered by a 40 hp diesel engine, was similarly reported in flight on 17 January 1902 and confirmed as having executed a circular course over the shallows between Charles Island and Bridgeport, demonstrating its navigability and practicality. That manoeuvre was made possible by the roll control technique of wing-warping - the fact confirmed by a technical article in *Aeronautical World* for December 1902, well ahead of the Wrights patenting the method as their own. Affidavits and statements by 17 people, some of them recorded on tape and film or video, bear witness to the many powered flights made by Whitehead between August 1901 and January 1902.

The original Bridgeport Herald report is the article dismissed by Orville Wright. It was easily relocated by John Brown during his researches but, thanks to the recent drive to digitalise newspaper archives, only a few hours of online research were needed to locate 85 (eighty-five) more press reports of Whitehead's flights on several occasions during 1901 and 1902, many of them making front-page news. The search concerned only free-use archives; clearly, there are many more articles available in subscription services.

Syndicated reports of Whitehead's exploits contemporaneously appeared around the globe, from Australia to Austria. One, mentioned here not entirely at random, appeared on page 3 of the Portsmouth Evening News of 21 August 1901. At the time, this was the local newspaper of Southsea resident, Fred Jane. As a man keenly interested in technology (and author of four

published science fiction novels) it is difficult to imagine Jane not reading the report with utmost interest. However, it would be stretching credibility beyond its limits to suggest that this was the Genesis of the annual now achieving its hundredth volume.

There is further danger in reading between lines - especially when the lines do not exist. All that can be said for certain is that the first Foreword to what is now *All the World's Aircraft* is notable in that it does not pay homage to the Wright Brothers for initiating the age of aeroplane flight. Perhaps more from a position of knowledge than ignorance, Jane appears to have considered them to be no more than equal to many others in their contribution. Wright is, simply, one of the companies whose more recent aircraft are described in the first edition; Whitehead (for reasons shortly to be given) is not.

Today, it seems impossible that a vast cache of documentary evidence, such as those newspaper reports, can be overlooked by the world at large. True, there are small museums to Whitehead in both his homeland and adopted homeland (and gratitude is expressed to *Flughistorische Forschungsgemeinschaft Gustav Weisskopf* at Leutershausen for copyright photographs used here) but it is too easy to dismiss them as municipal monuments to a local boy. The reasons for the vanished recognition are several. The first is that critical examination of the Wrights' legacy is deflected by a non-sequitur of elephantine proportions: That because they were the most successful of the early aeroplane pioneers, they must have been 'the first to fly'.

Secondly, as was only disclosed much later, under sanction of a Freedom of Information request by Senator Lowell Weicker Jr, the Smithsonian Institute in Washington - undisputed repository of American aviation history - secured possession of the precious Wright Flyer No. 1 from surviving brother Orville only after agreeing in a legally-binding document that "the Smithsonian shall [not state] any aircraft...earlier than the Wright aeroplane of 1903...was capable of carrying a man under its own power in controlled flight". History is normally written by researchers who have dispassionately analysed all relevant data and not, as here, by the lawyers of interested parties. (Strictly, the document is also nonsense, since the wording contrives to prohibit the Smithsonian from mentioning numerous prior dirigible airships - which are 'aircraft' too.)

Thirdly, when selecting a partner to commercialise his invention, Whitehead exhibited catastrophic misjudgement...three times over. After two false starts, his third investor proved to be the serial convicted criminal (and, subsequently, lunatic asylum patient) Herman Linde who, early in 1902, attempted to appropriate the venture and had Whitehead locked out of the factory containing his production line of between four and six aeroplanes. To recover solvency, Whitehead turned all attentions to his other great skill: the manufacture of light and powerful engines, which became much in demand by a growing number of aspiring aviators. It is as such that he has been remembered.

The fourth and final reason is hypothetical, in that it was overtaken by events described above. However, it would have proved critical had Whitehead's business progressed for a few more years. Inspired by Otto Lilienthal, for whom he had worked before leaving Germany, Whitehead designed his aircraft with a bird-shaped wing structure of a single, stretched surface with stiffening ribs, which would now be described as similar to the Rogallo employed by hang-gliders and trikes. It worked - and still does, as proved by two latter-day replicas - but it is not a structure on which commercial and military aviation can be built. At some stage, Whitehead would have been forced into radical redesign to retain the initiative, which the Wrights already had.

While it is often the case that 'the second mouse gets the cheese', history is capricious in its decision to record the first or the second inventor's (or discoverer's) name. To take but one example, John Logie Baird is still lauded as the 'inventor of television', but his electromechanical system was a technological dead-end that was rapidly overtaken by an entirely different and more practical method, omitting a mechanical scan. Whitehead was in Baird's category, except that his recognition has been, largely, withheld. The Wrights, with their more tractable wing design, were 'the second mouse' and, perhaps, one of the things they learned from Whitehead's misfortune was the need for rigorous protection of their patents and wide avoidance of offers of business partnerships from characters of unproven honesty.

If this were to be the 110th Foreword, instead of the 100th, Fred Jane would have recorded Whitehead's flying machines and their achievements in his early editions, probably securing for this underrated pioneer a full paragraph in the annals of aviation history, rather than his present, dismissive footnote. Having occurred before Jane's first edition, the matter cannot be regarded as unfinished business for Fred Jane or his successors but, most certainly, we are convinced he would have approved of any efforts made to get the facts right, whatever the delay. Thanks to the meticulous researches of John Brown - to whose website www.gustave-whitehead.com we earnestly recommend readers seeking greater detail - an injustice is rectified with only slight bruising to Wilbur and Orville's reputation. The Wrights were right; but Whitehead was ahead.

Tubes with people in

Even commentators unschooled in the technicalities of combat aircraft design appreciate the requirement for such machines to be in the forefront of technology; in their aerodynamics, avionics and propulsion system. For the same reason, it is accepted that aiming just that little bit higher than that which is possible will bring delay and redesign, accompanied by unplanned, additional expenditure of taxpayers' money. And although unwelcome, these close relations of success must be accommodated as the price to be paid for aspiration.

But how difficult can it be to build flying tubes for people to sit in? The public may be awed by the size of an airliner, yet the common view is that in all other aspects of their work, airliner designers have an easier ride than their colleagues in the military business. Military and space push the science; then hand down the fruits of their discoveries to a grateful civilian world. Had man not striven for the Moon, the human race would never have been bestowed with the unalloyed benefit of the non-stick frying pan.

Sad to report, however, the Apollo programme's oft-claimed legacy to the culinary arts is a fallacy. As is the belief that building airliners is an easy option for those not up to the task of designing a real man's combat aeroplane. Airliners - both regional and intercontinental - demand the deployment of talented design and generous investment in all facets of their construction. A half-hearted airliner design will be no more successful in the world marketplace than a poorly engineered warplane in the aerial battlefield. Recent events prompt us to ask if some in the aerospace business have forgotten this.

That truth has been around longer than many might realise. In 1934, a previous writer on these pages drew attention to the fact that commercial aircraft were becoming more advanced than their military counterparts, with specific regard to metal construction, flaps, variable pitch propellers and retractable landing gear. Subsequently, the Anglo-French Concorde airliner was by no means inferior to the military machines with which it shared the stratosphere.

Today, the talent that the military aeroplane displays through the media of noise, flame and high g, is paralleled in its peaceful counterparts by fuel-efficiency, low-noise, absolute reliability and safety. And while it is true that an expanding market usually contains opportunities for the purveyor of sub-prime goods, that has not happened in commercial aviation.

In the past two decades, the industry has witnessed the semi-voluntary departure of airliner manufacturers such as BAE Systems, Fokker and Saab and the marginalisation of Antonov, Ilyushin and Tupolev. Even the support of Boeing was unable to preserve the last of the McDonnell Douglas line. Replacing or augmenting them in the pages of this annual have come new companies such as COMAC, Irkut and Mitsubishi, while regional airliner manufacturers like Embraer and Bombardier have moved upwards into the lower echelons of the intercontinental market.

The pages that follow summarise the known details of the new crop of airliners these companies are producing and provide an indication of when they will enter service - remembering always that "enter service" in manufacturers' language is pronounced "start producing income". The in-service dates will be seen, in more than a few cases, to have receded into the future in a manner not unlike the majority of military aircraft programmes. This is not always the consequence of an unforeseen encounter with intractable technology.

China has two indigenous programmes for airliners, both run by COMAC: the 78 to 105-seat ARJ21 Xiangfeng and 130 to 190-seat C919. While the latter is still to fly, the ARJ21 first took to the air in November 2008 - six months late, although still planning an 18-month certification period. To abbreviate a long tale, in a frank interview at Airshow China in November 2012, the aircraft's chief designer revised Chinese certification (by CAAC) to the first half of 2013, adding that it might take another two years for the US authorities to confirm that approval. Further, he added that more than six months would elapse between Chinese certification and first delivery to a local airline, perhaps implying a relaxed attitude to turning on of the revenue tap.

Predictably, the 2012 Airshow brought the announcement of further orders for the C919, which is now to fly in 2014 and begin earning its living two years later. The West dismisses the potential of Chinese industry, and industriousness, at its peril, but those who argue that the 'traditional' airliner manufacturers have little to worry about from the awakening dragon have found a strange ally: Chinese aerospace itself.

The official message from Beijing is that China plans to be dominant in the airliner business - but not just yet, and not with the ARJ21 or, even, C919. Taking upon itself the curious role of managing Western expectations, China asks that its capabilities are not judged by the progress (or otherwise) of the present two airliner programmes. With this, we cannot disagree; for even with bought-in engines and avionics, the ARJ21 has recently found itself clear of the technical hurdles but tripping up on the molehills of certification paperwork.

This explains why the vital FAA certification will not be rubber-stamped on the same day as the Chinese equivalent is signed, as is often the case with foreign authorities which have enjoyed a longer working relationship with the US. In fact, the FAA is using the ARJ21 certification process to conduct its own audit of the CAAC's procedures, so the airliner cannot be approved until those who issue its certification are also approved by Washington. The nub of the matter can be no better summarised than in the words of the ARJ21's chief designer:

"There have been delays because we don't have experience in certification in terms of methods and infrastructure".

Unfamiliarity with the US way of doing things is not an accusation that can be directed at Japan, which has six decades' experience of licensed manufacture of American military aircraft. Unfortunately, that does not seem to have assisted Mitsubishi in its bid to reverse the long-standing imbalance in Japanese airliner sales and purchases. This edition of Jane's records the announcement in April 2012 of a further year's delay in the 70/90-seat MRJ regional jet, which will now fly at the end of 2013 (two years late) and enter service at the end of 2015 or early 2016. The reason for this delay emerged a little later when it was revealed that "regulatory paperwork irregularities" between Mitsubishi's parent company and its aerospace division had forced the repetition of much of the earlier certification work.

This must be acutely embarrassing for Mitsubishi, in view of its strenuous efforts to assure the international market that it will be able to support MRJs with a global technical network - something the previously introspective Japanese aerospace industry has never required. That this is to be bought-in does not reflect adversely on the MRJ and its manufacturer, for even Sukhoi felt the need for sales and support guidance from Italy to position its Superjet in the market.

Another newcomer requesting a little more patience from us is the Bombardier CSeries, which recently announced a six-month delay, and is unlikely to enter service before the end of 2014. For an innovative airliner from a Western manufacturer of proven ability, the CSeries is significantly deficient in the order book area. Nevertheless, its effect on the market should not be dismissed: Its employment of the next generation of airliner power plant, the geared turbofan, has forced a chain-reaction in the industry as both Airbus and Boeing have announced re-engined versions of their smaller products (A320neo and 737-MAX) and Embraer is mulling the same change. Having stimulated the opposition, the CSeries' only remaining weapon is its earlier availability; more delay will weaken that advantage.

The past year has seen hints from Russia that it plans further penetration of the airliner market once the Irkut MS-21 is established in production. A successor to the slow-selling Ilyushin Il-96 widebody may be formally announced next year for a 2020 debut, while this edition of Jane's also carries first news of the newly announced RosAviaKonsortium Fregat Ekodzhel (Frigate Ecojet). A 300-400 seater, the Ecojet takes its 'widebody' description seriously enough to feature an oval fuselage cross-section to reduce airframe wetted area per passenger as one of its efficiency-increasing innovations.

Overall, the Ecojet is seeking efficiencies 35 per cent greater than the current generation of passenger jets, to which end it appears to be following in the path already trodden (but not yet graced with prototype funding) by Myasishchev and its innovative design team.

Communist-era economics (or the lack thereof) made a previous generation of Russian and Ukrainian airliners impossible to sell in profitable numbers, but the first wave of post-communist machines, including Tu-204/214, An-74-300 and An-148, appears to have been unable, up to now, to convince the world of a change of outlook. Bizarrely, a long-forgotten Tupolev Tu-334 prototype was present at an air show in Iran last December, for reasons which can only be guessed at.

The corner may have been turned with the Sukhoi Superjet, which is starting to pick up non-CIS customers, although to predict more would be premature. As Russia and Ukraine can

attest, and China and Japan are finding out, designing 'flying tubes with seats in' is a business unforgiving of the slightest inefficiency and no soft option.

Hawking Hawker

Sometimes, rules are there to be broken. In its printed edition, *All the World's Aircraft* includes only companies in being and those aircraft in (or preparing for) production, but the products of Hawker Beechcraft's Hawker business remain in their usual place - at least, for the moment. We justify the action on the Micawberish principle that it seems impossible to believe that nothing will turn up to keep the line in being. After the company filed for bankruptcy relief in May 2012, a Chinese buyer entered detailed negotiations, but was unable to press home the deal, recording a rare pause in the otherwise seemingly inexorable acquisition of US aerospace companies by China.

As this foreword is written, the plan is for the company to re-emerge from Chapter 11 protection in the name of Beechcraft, still manufacturing and expanding the product range that perpetuates the name of Walter Beech. Efforts will continue to find a buyer for the Hawker family (200, 400, 900/750 and 4000), which has already been reduced to a trickle or halted production altogether.

Recent signs of a slight rally in the light business jet sector, identified by an Embraer market study, present the best that can be managed by way of an argument for new investment in Hawker. Where two years ago, only the largest of the privately owned jets (the converted airliners) were showing any resistance to world economic depression, it has more recently become apparent that, at last, the medium market has been performing better in the showrooms. Small jets and turboprops still struggle to find customers and Embraer admits it finds the reasons elusive.

Despite many businesses and high-net-worth individuals having a good 2012, they are not spending on aviation as they did before. "We don't know what they are doing with the money," admitted an Embraer official, whose best guess was that they are "sitting on it". When even the rich are being careful with their money, the world of aerospace is advised to proceed with caution