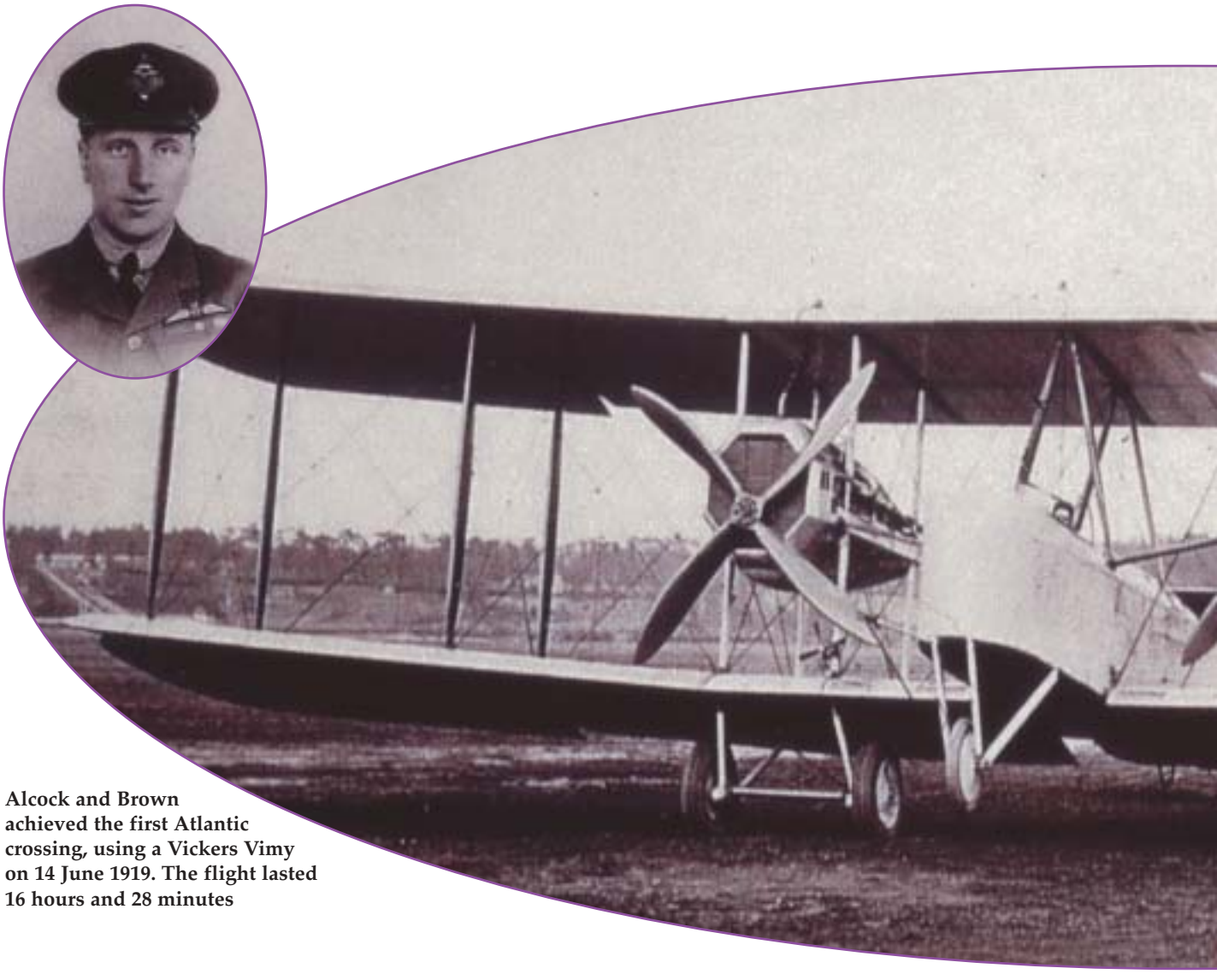
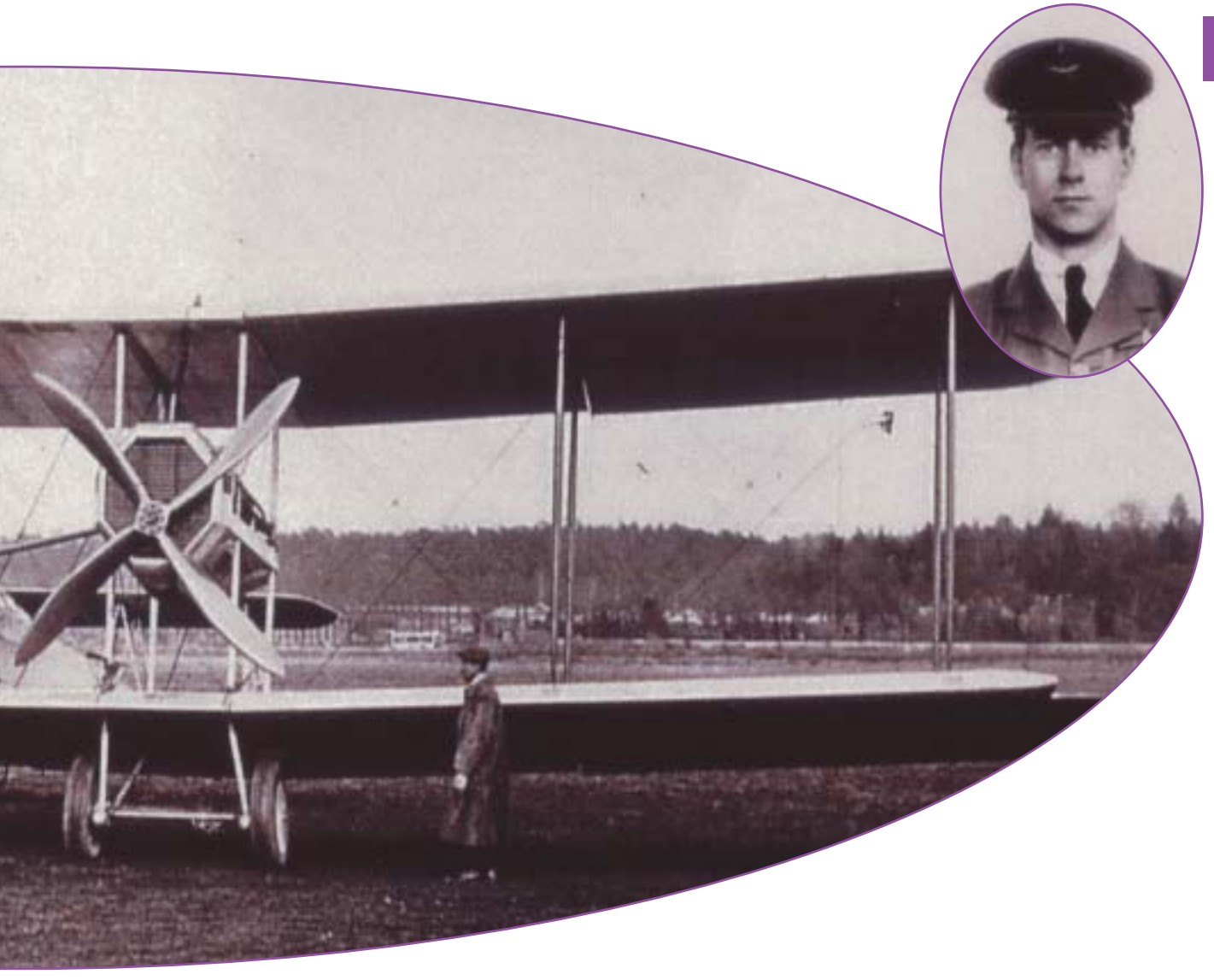


Alcock and Brown achieved the first Atlantic crossing, using a Vickers Vimy on 14 June 1919. The flight lasted 16 hours and 28 minutes

100 Years of Powered Flight
A Human Perspective



By Air Marshal 'Black' Robertson

The time will come when thou shalt lift thine eyes
To watch a long-drawn battle in the skies.
While aged peasants, too amazed for words,
Stare at the flying fleets of wondrous birds.

England, so long mistress of the sea,
Where winds and waves confess her sovereignty,
Her ancient triumphs yet on high shall bear
And reign the sovereign of the conquered air.

(Thomas Gray, 1716-1771)

Thomas Gray's words, written in 1737, were remarkably prescient. While England may not have reigned sovereign she has certainly seen some remarkable developments in the story of flight. This treatise picks out some of the key moments in British aviation in the last 100 years or so — from the well known to events that are much less familiar. In so doing it concentrates on just a few of the people who contributed to the inspiring story of flight and, in particular, it examines some of the qualities they exhibited. The history of

Paulhan was better able to cope with such weather and landed in Manchester in another Farman biplane in the early morning, earning £10,000 for his 186-mile journey

Louis Paulhan

powered flight is as much a human story as it is a technical one. Man's prodigious progress owes a great deal to the characteristics of enterprise, ingenuity, vision, tenacity and courage exhibited by the pioneers of aviation. Thus if there is a theme that runs through these paragraphs it is one that reflects the nobility of the human spirit.

The starting point is three contests with unique and specific rules, organised by the *London Daily Mail* in the early 1900s. The pioneers of British aviation owed much to the generosity of this newspaper's founder, Alfred, Lord Northcliffe. The first prize, of £10,000 for a flight from London to Manchester, was offered in November 1906. The journey had to be completed in 24 hours with no more than two stops *en route*. At the time the Daily Mail's money seemed safe — so much so that Punch, the satirical magazine, offered a similar sum for the first man to swim the Atlantic and for the first flight to Mars and back within a week!

Such was the pace of progress that by 1910 two competitors were ready to vie for what was in those days a substantial prize: Claude Grahame-White and a Frenchman, Louis Paulhan. The Englishman set off first on 23 April, having persuaded the London & North Western Railway to whitewash the sleepers for 100 yards or so north of every junction so that he could be sure of his route. But gusty winds in the Trent Valley forced him down just over 100 miles into his flight. Overnight these same winds overturned his Farman biplane in the field where it was left untethered and it had to be returned to London for repairs. Four days later Paulhan seized his chance and began his own journey from Hendon. When Grahame-White heard this he set off again in pursuit from Wormwood Scrubs in his restored machine late that same afternoon. However, failing light forced him to put down in a field when he was still some miles behind his rival. His only chance of catching Paulhan, who by dusk was still short of Birmingham, was to fly by night — which at the time was virtually unprecedented. Undeterred by the obvious dangers he set off again just before 3 am the next morning. The field was lit by lamps at either end and his friends set out to guide him using fast cars with powerful lights and huge flares at appropriate railway stations. By daybreak Grahame-White had almost overhauled the Frenchman. However, he ran into

Contestants had to fly British aircraft fitted with British engines. This was because at the time British aeroplane and engine constructors lagged behind their French counterparts

more bad luck in the shape of a faltering engine and strong winds that once again forced down his flimsy craft, effectively removing any chance of victory. The more experienced Paulhan was better able to cope with such weather and landed in Manchester in his own Farman biplane in the early morning, earning £10,000 for his 186-mile journey.

The second *Daily Mail* £10,000 prize, for a 'Circuit of Britain' flight, was offered a month later, in May 1910. The rules this time meant covering roughly 1,000 miles in a week, stopping at 11 fixed control points including Edinburgh, Glasgow, Bristol and Exeter; London was the start/finish point. Such was the rapid progress in aviation that 30 competitors registered to enter. The race itself began on 22 July the following year. After the first 20-mile stage — essentially a spectator event from Brooklands to Hendon — there were only 17 competitors left. In these early days reliability was something of a problem of course! Engine difficulties and a variety of other breakdowns soon further reduced the original competitors to two — both Frenchmen. Victory finally went to a naval officer, Lieutenant Jean Conneau, in a time of 22 hours and 28 minutes — an average of about 45 mph. His success was attributed largely to his naval training and map reading. His rival, Jules Védrines, apparently lost his way two or three times over what was to him unfamiliar terrain.

The third historic flight, this time for a 'Water-plane Flight Round Great Britain' attracted a £5,000 prize. The rules specified a counter-clockwise route from Cowes on the Isle of Wight, along the south and east coasts to Aberdeen and Cromarty, thence through the Caledonian Canal to Oban, on to Dublin, Falmouth and, finally, along the south coast again to Southampton Water. There were two other important conditions: contestants had to fly British aircraft fitted with British engines. This was because at the time British aeroplane and engine constructors lagged behind their French counterparts. In this context it would be hard to over-emphasise the significance and, indeed, the impact of Blériot's 37-minute trip from Calais to Dover on 25 July 1909 — a flight that earned him another £1,000 prize from the *Daily Mail*.

This third competition brought together two famous names in British aviation: Tommy Sopwith, the aircraft designer, and the man he chose as his pilot, Harry Hawker (an Australian). Hawker's first attempt, on 16 August 1913, ended in failure when he was affected by sunstroke at Yarmouth, having already completed 240 miles in 4 hours. There he was replaced by another Australian, Sydney Pickles. This was within the rules because the contest was a test of British engineering, not British pilots. However, Pickles'

In the time-honoured British tradition of rewarding glorious failure, and recognising the enthusiasm for flying — the Daily Mail *generously presented Hawker with a consolation prize of £1,000*

This is not to belittle Védrines' achievements. He was one of the most successful air race pilots of the period and the first to exceed the 100 mph barrier, setting a record of 104 mph in 1912. There are interesting footnotes to Conneau's achievement too. He is credited with developing what became known as the 'dead reckoning' method of airborne navigation. The records also show that he invariably competed as André Beaumont. This fooled no one but was necessary because at the time the French Navy considered sport flying 'an unduly frivolous activity'.

own attempt was aborted when he had to beach his seaplane in rough water at Gorleston. So Hawker restarted from Cowes at 5 o'clock on the morning of Monday 25 August 1913, carrying his mechanic as a passenger. He had to contend with haze, strong winds (particularly along the Caledonian Canal), an overheating engine, valve problems and a waterlogged float. But such was the enthusiasm generated for the new science of aviation that some 40,000 people gathered to watch Hawker arrive in Aberdeen. Two days after starting, behind schedule and no doubt tired by

As World War I progressed, Britain began to match the skill and courage of its pilots with world class aircraft like the Sopwith Camel and the SE5A

Sopwith Camel

AHB (RAF)

his exertions, about 15 miles north of Dublin Hawker's rubber-soled boot slipped off the rudder bar and, from a height of about 50 feet, his aircraft fell out of control into Lough Shinny. It was completely wrecked but, miraculously, he emerged unhurt; his mechanic was less fortunate and broke an arm and was badly cut. But in the time-honoured British tradition of rewarding glorious failure, and recognising the enthusiasm for flying that Hawker's exploits had generated — not to mention the extra newspaper sales — the *Daily Mail* generously presented Hawker with a consolation prize of £1,000.

There is more to be said about the importance of competition in aviation later. But first it is worth drawing an early conclusion about those human qualities referred to earlier. The pre-World War I days of aviation in Britain were marked not only by the ingenuity of engineers and the courage of their pilots; they were notable too for the vision and enterprise of those prominent in public life. Lord Northcliffe not only helped aviation to prosper, he also led the public at large to recognise that aircraft were a matter of national importance. Without its founder's encouragement, and without the *Daily Mail's* public-spirited sponsorship, which effectively extended the perceived boundaries of aviation, progress would undoubtedly have been considerably slower.

The lead-up to the First World War saw further evidence of the early technical lead the French had established in Europe. By way of illustration, in 1911 the French could muster over 200 aircraft during army manoeuvres, whereas between them the British Army and Navy could manage only 12, together with 3 airships. French influence was also evident in early British aircraft design and nomenclature: hence the BE (Blériot Experimental), the FE (Farman Experimental, after the brothers Henri and Maurice Farman), the SE (Santos Experimental, after the Brazilian, Santos-Dumont, who was the first man to fly in Europe — in France in the autumn of 1906) and the RE (Reconnaissance Experimental). However, with

establishment of the Royal Flying Corps on 13 April 1912 and similar recognition of the Royal Aircraft Factory at Farnborough, which capitalised on the nation's inherent technical expertise and industrial strength, Britain at last began to catch up with her continental rivals. Moreover, as World War I progressed Britain began to match the skill and courage of its pilots with world class aircraft like the Sopwith Camel and the SE5A. A contemporary writer on aviation was moved to observe that: *'A very striking feature of the* [Royal Flying] *Corps is the extreme youth of the members, many of the most daring fighters in the air being mere boys of 20. The Corps has the very pick of the youth and daring and enterprise of the country.'*

(William J Claxton, *The Mastery of the Air*)

The Royal Air Force itself was formed on 1 April 1918. However, its size could not be sustained in the aftermath of World War I. To highlight the nature of this problem, in November 1918 there were 27,500 officers, 264,000 other ranks and 25,000 members of the Woman's Royal Air Force. There were also more than 22,500 aircraft and about 100 airships. It was Winston Churchill, appointed Secretary State for War and Air in January 1919, who was largely responsible for the salvation of the new Service. He achieved this by inviting Hugh Trenchard back to his old position as Chief of the Air Staff. Then, in a far-sighted move, in April 1920 Trenchard opened the Royal Air Force College at Cranwell in Lincolnshire — a

They had been in the air for 16 hours and 28 minutes and had made history. When they reached London they were honoured by a reception at the Royal Aero Club and were immediately knighted. The flight of these two pioneers represents a triumph of engineering and an inspiring example of out and out courage

The Royal Aero Club borrowed heavily from existing sports, including horse racing, for its early regulations. This explains why the first air racing rules contained the injunction that 'No rider shall interfere with another rider on the course'

measure, and a training environment, that was to underpin the RAF's future. Lord Trenchard, as he later became, was to all intents and purposes the father of the Royal Air Force. He exemplified the vision that was fundamental to the development of military aviation in general and the Royal Air Force in particular.

To pick up the thread of our story again we need to go back the morning of 28 April 1910. Among the thousands who watched Paulhan land in Manchester was an 18 year-old apprentice engineer, John Alcock. By 1913 he had qualified as a pilot and had even won a race at Hendon Aerodrome. While this was just a weekend activity for Alcock at the time, later that same year his imagination was fired by a new challenge. Lord Northcliffe's newspaper was offering another £10,000 prize, this time for a flight across the Atlantic. The original rules allowed refuelling and repair *en route* and obviously favoured flying boats. But before anyone could rise to the Daily Mail's latest challenge, World War I intervened. Alcock joined the Royal Naval Air Service where he was shot down towards the end of the War while bombing the Turks. By coincidence, the man with whom he was to earn lasting fame as the first crew to complete a non-stop crossing of the Atlantic, was another prisoner of war, this time of the Germans: Arthur Whitten 'Teddy' Brown.

With the end of the War, by 1919 the prize for a transatlantic flight had grown to £13,000 through additional donations, both private and commercial. However, the rules had changed. The flight was now to be non-stop — a tremendous challenge given that the shortest distance across the Atlantic, between Newfoundland and Ireland, is some 1880 miles. The contest spawned a number of entrants and resulted in a several abortive attempts. Alcock and Brown were amongst the last to start. Their aircraft, a modified Vickers Vimy powered by Rolls-Royce Eagle engines, finally arrived in Canada in 13 wooden crates on 26 May — 16 days after Harry Hawker and his navigator had been rescued after ditching. The intrepid Australian continued his run of consolation prizes and received another £5,000 from the *Daily Mail* in recognition of his efforts. It was on 14 June that Alcock and Brown finally began their momentous journey.

To say that their flight was hazardous would be an understatement. Brown, who was partially disabled (he limped) after being shot down, was regularly forced to climb out of the cockpit to clear icing. For his part, Alcock had to cope with engine shutdowns, loss of control and the resulting near fatal loss of altitude. When they eventually reached the Irish coast Alcock saw radio masts at Clifden, a military installation, and decided to land on what looked like a smooth green field nearby. It was actually a huge bog. Men on the ground tried to wave the aircraft away but the crew merely waved back. As the aircraft touched down, its wheels dug in and it nosed over. This was partially Alcock's fault. To reduce drag he had decided against adding a nosewheel — the very feature designed to prevent the aircraft from ploughing into the ground on landing. Fortunately, both men scrambled out largely unhurt. They had been in the air for 16 hours and 28 minutes and created history. When they reached London they were honoured by a reception at the Royal Aero Club and immediately knighted. The flight of these two pioneers represented not only a triumph of engineering, it proved an inspiring example of out and out courage.

It would be hard to overstate the influence of the Royal Aero Club in the early years of the last century. In March 1910 the Club (or the RAC as it was popularly known) became responsible for the control of all private and sporting flying in the UK, as well as records and competitions (having started with the Daily Mail events), and continues to fulfil this function to this day. It borrowed heavily from existing sports, including horse racing, for its early regulations. This explains why the first air racing rules contained the injunction that: '*No rider shall interfere with another rider on the course*'. Club

The schneider Trophy was won three times consecutively by a Supermarine aircraft designed by Reginald Mitchell

AHB (RAF)

Thus it was a spirit of enterprise that contributed directly to Britain's third consecutive win in September of 1931, when Flight Lieutenant J N Boothman, flying an S6B, brought home the trophy permanently

members also included many of the most famous names in British aviation, amongst them Geoffrey de Havilland, Alex Henshaw and Alan Cobham.

On behalf of the International Aeronautical Federation the RAC also organised those Schneider Trophy Races that took place in Britain. (The Trophy rules dictated that the previous winner hosted the next race.) This competition, one of the most important international events in aviation history, was conceived by a French Government official, Jacques Schneider, in 1911; the original prize was £1,000. The rules were somewhat bizarre. Aircraft had to float for 6 hours and further prove their seaworthiness by travelling some 500 meters on water. They also had to land on water twice during the race. The actual words were *'come in contact with'*, which in 1919 led Howard Pixton to invent a bouncing manoeuvre. This effectively increased average speeds, not least by reducing the tendency for floats to take on water — a penalty in terms of all up weight. The rules also dictated that after three consecutive wins the Trophy became the permanent property of the country concerned. Britain first won the event in 1914, then again in 1922 when a Supermarine Sea Lion II flying boat designed by Reginald Mitchell set a new speed record of 145.7 mph. By 1925 the Americans had earned a second consecutive win (the 1924 contest being declared void) due largely to the flying skill of Lieutenant Jimmy Doolittle, who went on to earn lasting fame during World War II with his audacious Tokyo raid. This second American win led to strenuous efforts on the part of the Italians and the British to deny them a third, and in 1926 the Italians duly took the Trophy with a Macchi 39. It was then won three times in succession by a series of Reginald Mitchell-designed Supermarine aircraft. The S5 won in 1927 at an average speed of 281.6 mph in

Venice. The race then became a biennial event and in 1929 the S6 won at 328.6 mph. However, as the time for the next race approached it became clear that not only had the British Government discontinued its support, the aviation industry seemed similarly disinterested. Fortunately Lady Lucy Houston came to the rescue. Variously described as an extreme patriot and an eccentric millionairess, she donated £100,000 to finance a new entry. Thus it was a spirit of enterprise that contributed directly to Britain's third consecutive win in September of 1931. Flight Lieutenant J N Boothman, flying an S6B — a modified version of Mitchell's previous winning design produced in barely 6 months — brought home the trophy permanently at an average speed of 340.1 mph. By way of a postscript, later that same month an S6B flown by Flight Lieutenant George Stainforth set an absolute speed record of 407.5 mph.

The significance of the Schneider Trophy competition is that it compressed 20 years of aircraft research into a mere six. It also led Mitchell to spend his final years (he died of cancer in 1937 at the age of only 42) pressing the British Government to use what was learned in these races to develop his design into one of the most important fighter aircraft of World War II: the Spitfire. This reinforces the thesis that progress in aviation has stemmed *inter alia* from a combination of pilot skill and engineering inspiration — underwritten invariably by bravery and an entrepreneurial spirit.

'Mutt' Summers took off from Southampton in the prototype Spitfire on 5 March 1936, paving the way for the first production aircraft which followed rapidly in June 1938. When Britain went to war on 3 September 1939 more than 2,000 Spitfires were already on order. The marriage of Mitchell's beautiful design with the formidable Rolls-Royce Merlin engine produced a world beating and, in every sense of the words, a battle-winning aircraft. More than 20,000 Spitfires in over 40 different variants were built. Although the last aircraft rolled off the production line in 1947, a number are

The marriage of Mitchell's beautiful design with the formidable Rolls-Royce Merlin engine produced a world beating — and in every sense of the words — a battle-winning aircraft

Mitchell's most successful design, the Spitfire

AHB (RAF)

AHB (RAF)

The first flight of a jet aircraft, the Heinkel He 178, took place at Marienehe on 27 August 1939

still lovingly maintained and flown by the RAF's Battle of Britain Memorial Flight.

The success enjoyed by the outnumbered RAF in the Battle of Britain owed as much to the daring of Spitfire and Hurricane pilots as it did to the quality of their aircraft. But in terms of courage — and here it is important to distinguish between spontaneous acts of bravery and courage of a sustained nature - there is little to compare with that exhibited by the crews of the RAF's Bomber Command. Their teamwork would represent a fascinating case study for human psychologists. Within Bomber Command itself no one exemplified courage more than Wing Commander Guy Gibson VC. His name will forever be linked with that of Barnes Wallis through their combined efforts to destroy three important German dams in the spring of 1943. Ordinary bombs could not damage these dams in the industrial Ruhr valley. However, Barnes Wallis came up with a unique solution. He designed an immense bomb, weighing nearly 9,500 lb, which rotated backwards at 500 rpm on release. This allowed it to sink down the face of the dam before a hydrostatic fuse triggered its detonation at a depth of 40 ft. The bomb's destructive power would then be magnified by the hammer effect of shock waves moving through an incompressible fluid. But to function correctly the bomb had to be delivered with extreme accuracy at 220 mph from a height of only 60 ft some distance from the dam; it would then skip across the water's surface, evading torpedo nets. The Lancaster crews used an ingenious system of converging light beams to achieve the correct release height. In a daring night raid Gibson and his handpicked crews destroyed the Möhne and the Eder dams and damaged the Sorpe. But of the 19 crews from 617 Squadron who took off on the 'Dambusters' raid, three failed to reach the target and eight were lost; 53 of 133 aircrew perished. While it did not produce the hoped for material effect, it did a great deal for a beleaguered nation's morale. Moreover the story of this raid reinforces the point that progress in aviation owes much to individual ingenuity, inventiveness and courage.

The next milestone in this journey through the past 100 years also occurred during World War II; however, its origins were much earlier. They go back to Trenchard's Royal Air Force College. Cranwell produced one of the true pioneers of British aviation — a man who can genuinely claim to be a world figure: Frank Whittle.

Britain did develop the first jet-powered passenger aircraft, the DH 106 Comet. When this airliner entered commercial service it created an immediate sensation — and considerable alarm on the other side of the Atlantic

It was Whittle who in 1928 spelt out in detail the technical requirements for the jet engine. He patented his design 2 years later but no one showed any interest, probably because the metals required had yet to be developed. In 1935 the patent lapsed, although Whittle later renewed it. It was not until 1936, when he obtained private backing, that he began to turn his designs into reality. Meanwhile, through the work of Hans von Ohain the Germans stole a march on Whittle and the first flight of a jet aircraft, the Heinkel He178, took place at Marienehe on 27 August 1939. Whittle's engine did not fly until nearly 2 years later, on 15 May 1941, in the experimental Gloster E28/39. However, thanks to his ingenuity, Whittle can justifiably claim to share with von Ohain the title of inventor of the jet engine.

Towards the end of World War II, in 1944, the Martin-Baker Company began their pioneering work in the field of aircrew ejection. The need for such a system was accentuated by the death of a pilot who used the standard over-the-side technique baling out when an emergency occurred while he was testing an early version of the Gloster Meteor. He lost consciousness and did not even attempt to open his parachute.

Martin-Baker is now the world leader in terms of ejection seats and escape mechanisms, having saved more than 7,000 aircrew lives, nearly half of them American. But if Martin-Baker is a household name, Bernard Lynch certainly is not. Yet 'Benny' (as he was better known) Lynch deserves the military aviation industry's admiration and gratitude. On 24 January 1945 he subjected himself to the first static live ejection test, up a ramp in controlled conditions. Eighteen months later to the day, on 24 July 1946, he completed the first live ejection test from a modified Meteor aircraft, flying at 320 mph and 8,000 ft. He went on to carry out more than 30 live ejections — every one of them quite literally a leap into the unknown. In the context of this treatise it is Benny Lynch who stands for all the unsung heroes — men and women of tenacity and grit — who have helped advance the cause of aviation in Britain.

Probably the most controversial airliner of modern times, Concorde, until the moment it retired from service, more than 34 years after its first flight on 2 March 1969, remained an elegant and distinctive sight — a masterpiece of innovative design

The next landmark in our journey occurred in June 1948. This was when the Soviet Union closed all road and rail communications with West Berlin, denying access to the British, American and French sectors. Fortunately both the RAF and the USAF were ready to mount an airlift to keep their garrisons supplied. But the respective governments decided to go a step further and supply the needs of the entire civilian population of West Berlin (over two million people). In an operation of unprecedented scale, the two Air Forces aided by British civilian charter airlines, ferried between 4,000 and 5,000 short tons of supplies into Berlin every day. The success of Operations PLAINFARE and VITTLES finally led the Russians to lift their blockade on 12 May 1949 after it had been running for over 10 months. This Operation demonstrated to the world the use of air power as a force for good in the humanitarian sense. It therefore represents an important milestone in the history of aviation.

Like the Schneider Trophy competition before it, the Second World War also telescoped decades of development in aviation into five or six years. But in the post-War world of commercial aviation to which we now turn Britain and the US adopted contrasting approaches. At the time it was said that the Americans listened to what the market was saying while the British kept building aircraft no one wanted. The US produced three sizeable propeller driven aircraft that met the newly created demand for long distance air travel: the DC3, the DC4 and the C12, better known as the Constellation. As a result, and in marked contrast with their British counterparts, American airliners were full. But in opting to take a different route Britain did develop the first jet-powered passenger aircraft, the DH 106 Comet. When this airliner entered commercial service it created an immediate sensation - and considerable alarm on the other side of the Atlantic. It was simply years ahead of its time. Unfortunately a poor accident record marred the aircraft's introduction. There were two early take-off accidents. No one was injured in the first, at Rome in October 1952. It was put down to pilot error and, as a result, higher air speeds were prescribed for take-off. The second accident resulted in the loss of all 11 people on board. It took place on a delivery flight from Karachi in March 1953 and was similarly attributed to an error of judgement on the part of the pilot. The solution this time was to modify the wing leading edge to increase lift at low speed and avoid the possibility of stalling on take-off. Then a third tragedy occurred, in January 1954, when the aircraft entered a violent thunderstorm just after take-off from Calcutta. It simply disintegrated in mid-air. At the time it was regarded as no more than a freak accident, on the grounds that turbulence within a severe thunderstorm could literally tear an aircraft apart. The Comet was nevertheless grounded for nearly two months while 50 modifications were carried out — despite the fact that the precise cause of this terrible accident remained unknown. It was not until a fourth accident, in

April 1954, when an aircraft departing from Rome again broke up in mid-air, resulting in the loss of all 43 people on board, that long, detailed and methodical investigations into the precise circumstances began.

This sad story is worth recounting in order to highlight the persistence, the skill and the ingenuity of those in the aviation industry who finally isolated the cause, which turned out to be metal fatigue. The inquiry itself involved the Royal Aeronautical Establishment at Farnborough and was chaired by its Director, Sir Arnold Hall. The sort of men and women who meticulously researched this accident — and hundreds of others like it over the years — have done much to advance the cause of flight safety in both civil and military flying.

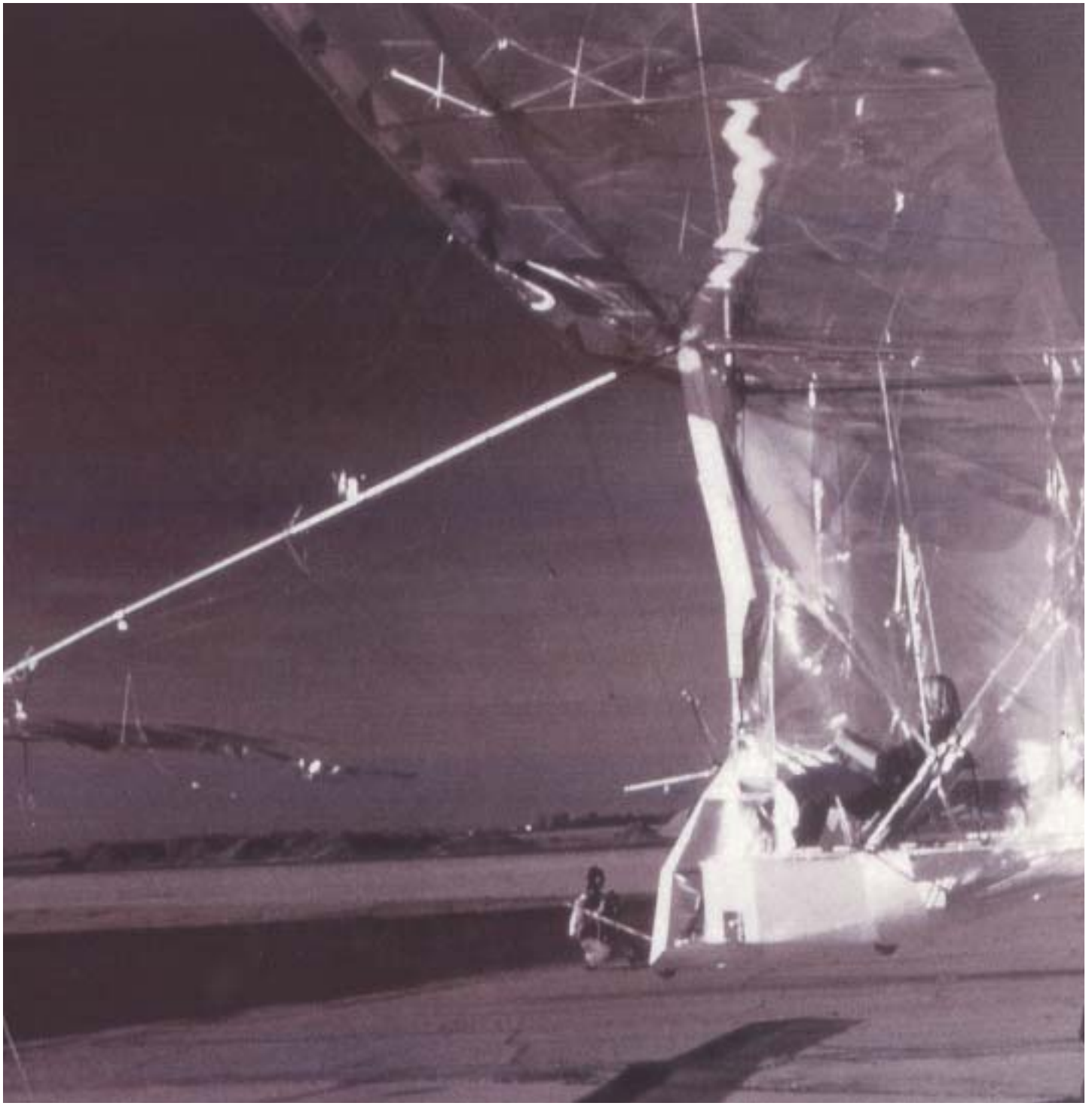
It is perhaps ironic, given earlier references to Anglo-French rivalry, that one of the finest technological achievements in airliner history, and probably the most controversial airliner of modern times, Concorde, should have resulted from co-operation between Britain and France. Until the moment it was retired from service, more than 34 years after its first flight on 2 March 1969, it remained an elegant and distinctive sight — a masterpiece of innovative design. Concorde's future though was always beset by doubts. The reasons for this included high operating costs, what were considered to be high noise and smoke emissions and, most recently, safety concerns that emerged after the Paris crash of July 2000 in which 113 people died. The temporary grounding that resulted was effectively compounded by the longer-term impact on premium air travel of the New York terrorist attacks on 11 September 2001, and undoubtedly contributed to the aircraft's ultimate demise.

Concorde effectively spanned the latter half of the century of aviation. Developed in the 1950s, it was not until 26 January 1976, 14 years after Britain and France finally agreed to build the aircraft, that Concorde entered commercial service. Unfortunately it failed to sell and routes soon had to be consolidated. Then, in September 1979, the British and French Governments halted production after building only 16 aircraft. The total cost of the programme has been put at £3 billion. It was the most expensive and in some ways the most disappointing airliner the world has seen. Until its final withdrawal from service with British Airways in October 2003 (Air France grounded their aircraft 5 months earlier) it remained a shining example of the aviation industry's technical capabilities. Moreover, in bringing together key elements of the European aerospace industry in a hitherto unprecedented manner the project effectively presaged the commercial success subsequently enjoyed by Airbus.

Returning to the military field, no discussion of British aviation would be complete without mention of the Harrier. The origins of this novel aircraft lie in the mid-1950s. The British Government's first venture into the vertical/short take-off and landing (V/STOL) arena was Shorts' delta wing, fixed undercarriage SC1. It required four RB108 lift engines for vertical flight, together with a single RB108 for conventional, wingborne flight. However, practical application of this concept proved difficult. The second prototype SC1 crashed in 1963, killing the pilot. While all this was going on Hawkers were pursuing their own ideas in the V/STOL field — ideas that led eventually to the Harrier, via the Rolls-Royce 'flying bedstead' and the P1127 prototype.

The P1127 first flew in October 1960 and employed a different approach - vectored thrust and a jet reaction control system. But it should be acknowledged that it was a French engineer, Michel Wibault, who first proposed the concept of directing, or vectoring, the thrust of a jet engine. As a further aside, it is interesting to note that a similar design battle between the lift engine concept and vectored thrust was played out in the competition between Boeing and Lockheed Martin for the lucrative Joint Strike Fighter contract, won by the latter company in 2001. Back in the 1960s several countries were drafting requirements for V/STOL combat aircraft. This led to an agreement early in 1963 between Britain, the Federal German Republic and the USA to purchase nine developed P1127's. These aircraft were to be used in a tripartite evaluation programme with the objective

Dr Paul McReady, claimed the second Kremer prize of $100,000 for the first man-powered flight across the English Channel, this time with his Gossamer Albatross



Eurofighter Typhoon

It will take the Royal Air Force, and the Air Forces of the European partner nations, into a new era in terms of performance and capability

of establishing the ground-rules for V/STOL fighter operations. The aircraft was designated the Kestrel in November 1964 and was seen initially as the precursor of the soon to be cancelled TSR2. It was only with the February 1965 cancellation as well of the P1154 (the supersonic V/STOL strike fighter the RAF adopted after loss of the TSR2) that the RAF took the Kestrel into front line service. The aircraft adopted the Harrier name selected for the ill-fated P1154 but was itself fortunate to escape cancellation by Dennis Healey in his 1966 Defence Review. The Cabinet at the time simply could not face another politically damaging cancellation. Though Healey stuck to his guns he faced opposition from the Ministry of Technology and rising costs elsewhere (in particular the RAF Phantom programme). The result was that by December 1966 the way was clear for negotiations on an initial production order of 60 aircraft. The rest, as they say, is history.

By way of a postscript on this remarkable aircraft, in May 1969, 50 years almost to the day after Alcock and Brown conquered the Atlantic, the Daily Mail sponsored a repeat race, this time between London and New York. As before the rules were complex, involving fixed start and finish points in the heart of each city. The east-west leg was won by an RAF pilot, thanks to the versatility of the Harrier. Squadron Leader Tom Lecky-Thompson completed the journey in six hours 11 minutes and 57 seconds, using a rail yard for take-off and a motorbike as transport through town — yet another example of both human and engineering ingenuity.

At this stage it is important to emphasise that the spirit of enterprise and competition, so evident in the past, is still with us. In 1959 a British industrialist, the late Henry Kremer, offered a cash prize of £5,000 for the first human-powered aircraft that could fly a figure of eight around two markers 800 meters apart — the same performance level as the early Wright Flyers. However, it was some 20 years before this prize was finally claimed, by which time it had grown to £50,000. On 23 August 1977 it went to an American, Dr Paul McReady, with his Gossamer Condor design. Two years later he claimed the second Kremer prize of £100,000 for the first man-powered flight across the English Channel, this time with his Gossamer Albatross. While there may not be a commercial future in this field, it is worth recording that, by courtesy of Kremer's generosity, the Royal Aeronautical Society currently has on offer over £100,000 in prizes for three new sporting competitions, all designed to further the cause of human-powered flight.

A treatise such as this would be incomplete without mention of Eurofighter Typhoon. It will take the Royal Air Force, and the Air Forces of the European partner nations, into a new era in terms of performance and capability. The aircraft is a product of collaboration between Germany, Italy, Spain and the UK — collaboration at Government, industry and Air Force levels. In the eyes of independent experts, its cockpit - designed by pilots for pilots — is the best in the world, thanks not least to the use of DVI (direct voice input). The aircraft structure itself utilises carbon fibre composites, lightweight alloys, titanium and glass reinforced plastics. Unstable by design, it relies on a computerised control system that provides outstanding manoeuvrability, particularly at supersonic speeds. With a Mach 2 and +9/-3G capability, and an outstanding weapons system based *inter alia* on the ASRAAM and Meteor missiles, it is quite simply a world-beating swing-role aircraft. Sadly, it is likely to be the last fighter aircraft designed and produced in the UK. But those disturbed by this prospect can take at least a crumb of comfort from the fact that the same was said in 1957 of the TRS2 — and by the Deputy Chief of Air Staff at that.

But where is the human link here? It lies in the vision and persistence of those within British industry involved with Typhoon's precursor. Decades ago, after withdrawal of the Germans and Italians, these individuals worked diligently to turn their aspirations first into the Experimental Aircraft Programme (EAP) and ultimately into the reality of Typhoon. There can be little doubt that by keeping the EAP alive British Aerospace (*sic*) ensured that the Ministry of Defence specification for an agile fighter was eventually resurrected. In this context we must acknowledge too the skill of the designers and engineers who helped create this remarkable aircraft.

So what of the future? In aircraft terms, and largely because of costs, the UK's aviation future is likely to be a collaborative one: with the US and others on the Joint Strike Fighter/Future Joint Combat Aircraft project and with Europe in the Airbus consortium. The years ahead are also likely to see greater concentration on unmanned vehicles, systems development and systems integration – all in concert with increased emphasis on network enabled capability.

Aviation has come a long way since 17 December 1903. We have inherited a legacy of enterprise, innovation, ingenuity, tenacity and courage. There can be little doubt that these very same qualities — human qualities — will be needed in the next 100 years, no matter where future of aviation may lead.