Lord Kings Norton of Wotton Underwood

Lord Kings Norton

A biographical sketch

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LORD Kings Norton grew up with aircraft: aircraft grew up with him. They matured partly through his work, which made flying safer and faster than anyone could remotely imagine when he was born into Edwardian England on 6th June 1902. Anyone who flies is, to some extent, in his debt: Cranfield is a major legatee, for he helped in its conception, attended its birth, and has been its father figure and champion ever since.

His 90 year-long journey began in Birmingham where, as Harold Roxbee Cox, he was taken by his father to see the flying machines which were capturing popular imagination in the 1900s as air shows and air races spread across Britain. At Edgbaston and Bournville he was able to see and, as he says, "actually touch" the aeroplanes which were piloted by the early giants of aviation, whose aerobatics he watched awestruck.

His recollections include Claude Grahame-White, lionised by the crowds that flocked to the aerial pageants through which he promoted British aviation: B C Hucks, the mechanic and self-taught pilot who was the first Englishman to loop the loop: and Gustav Hamel, winner of one of the annual United Kingdom Aerial Derbys: and he saw Hucks and his Blériot perform an early loop – a commonplace manoeuvre within a few years, but at that time a sensation.

Bitten like thousands of other boys with the flying bug, Harold Roxbee Cox left Kings Norton Grammar School

when he was 16 and headed straight for the Austin plant at Longbridge. The makers of motor vehicles and aircraft had, by 1919, switched from warplanes to light biplanes for pleasure flying, with names like Whippet and Kestrel. In the drawing office, guided by the chief designer, Roxbee Cox learnt on the job and designed the tail unit of the single-seat Whippet.

The post-war slump killed off Austin's aviation interests in 1920. Roxbee Cox, in a sense living backwards, went from the drawing office to the workshops, the toolroom and maintenance shop to work with the apprentices. While at Longbridge, however, he took an external London University BSc with first class honours, following in the footsteps of people as diverse as H G Wells and Barnes Wallis, who took the degree in the same way, "a wonderful system" as he recalls it.

The degree meant that it was a relatively short step from Austin to Imperial College in 1922, where he did research work for his PhD. His doctoral thesis was entitled: *A two dimensional solution of Laplace's equation with special reference to an aerofoil section.*

It was time to return to practice: while there was no doubt in which field it would lie, the young designer was to be presented with an unusually glittering prospect. By 1924 the government had decided to use airships to link the countries of the Empire across the world – a visionary

proposal for its time. There were two projects: the R100, privately inspired, and the R101, state financed. Dr Roxbee Cox joined the R101 team at Cardington.

He designed the outline shape of the airship, a mathematical closed curve. He worked with John Baker, later Lord Baker of Windrush, who was to become Professor of Mechanical Sciences and Head of the Engineering Department at Cambridge, and Alfred Pugsley, later Sir Alfred, who became Professor of Civil Engineering at Bristol. The fourth member of the team, who died relatively young, was Hilda Lyon. The four made major contributions in calculating the loading and stressing of the structure. During this work Dr Roxbee Cox was awarded the R38 Memorial Prize for a paper: *External forces on an airship structure.*

The young airship designer pressed hard to be a passenger on the R101's spectacular proving flight to India, but he was turned down. Instead, he lived. The R101 crashed a few hours out from Cardington at Beauvais, in France, killing 48 of its passengers and crew. After a brief spell at the Royal Aircraft Establishment, Farnborough, Dr Roxbee Cox became Chief Technical Officer at the Royal Airship Works. Work was planned on the R100, which had successfully flown the Atlantic and back. But the tragedy and national economic climate weighed more with the government than the success: the project was closed.

Dr Roxbee Cox was an airship man by conviction. He now went, as he says "somewhat reluctantly" back to Farnborough to deal with the development of aeroplanes – the ultimate victors in the competition between heavier and lighter than air craft. Reluctant or not, it was here that he was to make a significant contribution to air safety.

He studied the problem of flutter, which had caused accidents to some fighters and light commercial aircraft of the time. Flutter is the interaction between aerodynamic loads and the behaviour of the structure. At critical speeds an oscillating, twisting motion could occur which, in extreme cases, caused part of the structure, perhaps an aileron, wing or tailplane to fail in mid-air, sometimes with catastrophic results.

Theoretical work at the National Physical Laboratory suggested the idea of critical speeds. Roxbee Cox worked empirically from the other end of the problem, plotting the criteria for successful aeroplanes and aeroplanes which fluttered. There was a clear division between the two. Typical of the papers he wrote at this time: *A statistical method of investigating relations between elastic stiffnesses of aeroplane wings and wing-aileron flutter: Problems involving the stiffness of aeroplane wings: On the synthesis and analysis of simply-stiff frameworks.*

Dr Roxbee Cox's work was embodied in the design of new aircraft. So was his work on the stability and stiffness of

wing structures, which also became part of design practice, and which he did with Alfred Pugsley, who had transferred from Cardington. Between them, Roxbee Cox and Pugsley coined the term aeroelasticity.

From 1932-38 Dr Roxbee Cox was an external lecturer to postgraduate students in aircraft structures at Imperial College. In 1935-36 he was Principal Scientific Officer in the Aerodynamics Department at Farnborough and in 1936 he became head of the Air Defence Department. With his team, he devised the kite balloon barrage, which was ultimately responsible for bringing down many Vl missiles over southern England in the Second World War. Each balloon cable was fitted with two inertia links, which meant that when it was hit the shock wave caused the links to part and two parachutes to open, leaving the aircraft entangled with wire and parachutes. Roxbee Cox flew as an observer in aircraft which were piloted into cables of light wire to test the idea.

In 1938, in a change of tack rather than course, Dr Roxbee Cox became Chief Technical Officer to the Air Registration Board, to which he brought his (by now) extensive structural experience to bear on the airworthiness of light aircraft. He started the development of requirements which became the standards for manufacturers to meet. In 1939 war saw him back at Farnborough as Superintendent of Scientific Research – an administrative post.

In 1940, at the age of 38, he faced the most important challenge of his career – and a critical task for Britain and its aero engine industry. Under Dr (later Sir) David Pye, as Deputy Director of Scientific Research at the Ministry of Aircraft Production, he became mainly responsible for gliders – and Whittle. He had been admitted in 1939 to the secret of the jet engine – the aircraft gas turbine – which Frank Whittle had been pursuing, often in the face of official indifference, since 1935. Within months he became Director of Special Projects, which meant giving up gliders and concentrating solely on administration and co-ordination of Whittle's company, Power Jets, and the work of other engine manufacturers, who were entering, somewhat tentatively, the jet age.

The tortuous and acrimonious relationship between Whittle and one manufacturer, Rover, and his early struggle for official acceptance, is outlined in Sir Frank Whittle's *Jet – the story of a Pioneer (Muller 1953)*. But in an often bitter book Sir Frank emphasises more than once his feeling that Roxbee Cox was a true friend both at personal and project level. This was a challenging task for Dr Roxbee Cox. In 1941 he decided that all the engine manufacturers, including Power Jets, must exchange information about the state of the various jet engine projects which were initiated during the war. This was not always to Power Jets' advantage as research and design leaders, but the diaspora of knowledge which took place was clearly to the national advantage in running an effective programme.

The Gas Turbine Collaboration Committee, invented by Dr Roxbee Cox and chaired by him, met for the first time in Birmingham on 1st November 1941, and then met about five times every year throughout the war. The meetings rotated around the companies, so that all could freely see design work in progress and engines under test. Each manufacturer provided the others with data on design and performance of the engines for which they were responsible. Manufacturers represented included Rolls Royce, Metropolitan-Vickers, Halford-de Havilland, Armstrong-Siddeley, Bristol, Lucas and Ricardo – a formidable collection to co-ordinate. Proof of the GTCC's effectiveness is the fact that it survived the war and celebrated a 21st birthday at Leavesden, with its first chairman among the guests.

An historic milestone in the international development of the jet engine was the decision to share our knowledge with the USA, where the potential of the aircraft gas turbine had been all but completely overlooked. At 10.30 am on 22nd July 1941 (almost five months before America entered the war) two American officials met, in London, Air Marshal F J Linnell and Dr Roxbee Cox, who described the work of Power Jets and, three days later, took the Americans to meet Whittle and his fellow workers. Later still, they travelled on to the Gloster factory to see the two prototype E28/39 aircraft in which the Whittle engine first flew. Drawings and data were freely given to the Americans and an early Whittle engine was flown across to the USA, to be followed later by its

inventor. The USA entered the jet age via the small back rooms in Britain where the revolution was being forged.

An American view of Dr Roxbee Cox's efforts was given after the war, when he gave the ninth Wright Brothers Lecture in the USA. The subject was British gas turbines and in the subsequent discussions Col. Donald Keirn, who had been a US liaison officer on the programme, said: "The great progress made in the few years of war and the present excellence of several British gas turbines could not have been achieved but for the whole-hearted way in which various firms interchanged know-how through the medium of the collaboration committee . . . I know of no other man who has contributed so much toward the co-ordination of efforts in gas turbine development and who has done more to establish the delightful relations which have existed between the British and American workers in the field . . . "

For his services during the war in sharing information with the USA he was awarded the Medal of Freedom with Silver Palm by the Americans.

In 1944 he gave enthusiastic support to the idea of an educational institution which would provide high grade engineering, technical and scientific training in aeronautics to young men and women who would enter the aircraft industry after the war was over. Sir Stafford Cripps, Minister of Aircraft Production, had set up a committee chaired by Sir Roy Fedden, who was the driving force

behind the idea, and Roxbee Cox gave his support in the form of evidence to the committee. The Fedden Committee gave birth to Cranfield College of Aeronautics, with Dr Roxbee Cox on the board of governors from the outset.

It was also in 1944 that Roxbee Cox was to make another contribution to what he regards as his most important war service, becoming chairman and managing director of Power Jets. "I was Whittle's entrepreneur," as he recalls it. At this time he also became a member of the Aeronautical Research Council, and when the jet propulsion work of Power Jets and the Royal Aircraft Establishment were merged he became Director of the new body – the National Gas Turbine Establishment at Pyestock.

Dr Roxbee Cox's last service to Sir Frank Whittle was a remarkable letter written in his support to the Royal Commission on Awards to Inventors. Part of it reads: "Whittle's contribution was the association of jet propulsion and the gas turbine. Before him the gas turbine had been regarded, like other turbines, as a machine for supplying shaft power. Whittle recognised it as the ideal means of providing jet propulsion for aircraft . . . It is one thing to have an idea. It is another to have the technical and executive ability to give it flesh. It is still another to have the tenacity of purpose to drive through to success unshaken in confidence, in the face of discouraging opposition. Whittle, whose name in the annals of engineering comes after those

of Watt, Stephenson and Parsons only for reasons of chronology or alphabetical order, had these things . . . It may be said that without Whittle the jet propulsion engine and the other applications of the turbine would have come just the same. They would. But they would have come much later. Whittle's work gave this country a technical lead of at least two years . . . So far the gas turbine has been generally regarded as a means of propulsion of fighting aircraft. I think posterity will see it rather as a great commercial asset – presuming that we today do our duty in exploiting it. They will see too that the initiative in its development came from aeronautical technologists, and at the head of them they will see Whittle."

This prophetic endorsement helped the committee to decide that Whittle's award should be £100,000 – the highest payment made to any inventor of the war years.

In 1947-49 Dr Roxbee Cox was President of the Royal Aeronautical Society, but in 1948 there was a sharp change in the direction of his career when he became Chief Scientist at the Ministry of Fuel and Power. The idea behind this move was to improve the quality of the R & D work done by the ministry so that it became comparable in stature to aeronautical R & D. In Roxbee Cox's term of office a number of advanced projects began. Those he outlined in his 1951 Hawksley lecture

indicate the quality of the forward thinking which he was developing.

A knighthood came in 1953, but by 1954 Sir Harold Roxbee Cox realised that the highest civil service appointment – permanent secretary – was probably not open to him because of his technological background. He pointed out to the Committee on Scientific Manpower, of which he was a member, that out of 52 permanent secretaries only one was a scientist – a physicist – and he was at the Ministry of Pensions! He decided to leave the civil service and pursue an industrial career, which included a directorship at Wilmot-Breeden, another at Brush Electrical and consultancy with Rolls Royce. Later he became first a director and later chairman of the Metal Box company during a period of expansion both at home and abroad. He was also chairman of Berger Jenson and Nicholson from 1967-75. He served on the boards of Dowty Rotol, Ricardo & Co, British Printing Corporation and Hoechst UK.

Throughout his industrial career Lord Kings Norton – he became a Life Peer in 1965 – continued in public service. Between 1961-65 he was chairman of the Council for Scientific and Industrial Research – the controlling body of the Department of Scientific and Industrial Research, which financed research in universities, research establishments and research associations. He was able to exercise a

formative influence on public spending by the DSIR. He was President of the Royal Institution from 1969-76, improving its finances by marketing its research through a company called Applied Photophysics, of which he was chairman. From 1966-72 he chaired the Air Registration Board and he was chairman of the Council for National Academic Awards from 1964-71.

Lord Kings Norton served continuously on the board of the College of Aeronautics from 1946. He was deputy chairman and then chairman on the death of Sir Frederick Handley Page. After the 1957 Defence White Paper suggested that spending should focus more on missile development than aircraft, he put his weight behind the policy of diversification adopted by the College. He was a driving force behind the efforts to get a Royal Charter, although he gives full credit to the then Principal, Alfred Murphy, and Laurence Wilson, Secretary. When the Charter was granted in 1969, Lord Kings Norton became the first – and so far the only – Chancellor. Of the Institute today he says:

"Cranfield has the right philosophy. The more influence it has, the better we shall be."

Lord Kings Norton is a Fellow of Imperial College, and the flavour of his educational philosophy can be found in an address he gave in 1967: "I would like to feel that the young applied scientist consciously rejects the snobbery

which seems to suggest that it is more meritorious to discover new facts than to create new things. The material advance of civilisation depends on the creation of new things, and in the spectrum of applied scientific effort leading to the production of one of them, there should be no most favoured station."

Today, Lord Kings Norton is a regular House of Lords man. He has served on the Select Committee on European Communities, which monitors the work of the Commission, and as chairman of its sub-committee dealing with R & D in transport and energy. He has initiated a number of debates including one on the deterioration in the use of the English language. His private interests include balloons, ballooning and airships, and his house in Chipping Campden is lined with one of the finest collections of prints in the country on this branch of flying. His favourite authors are Wodehouse and Beerbohm, and he rates Wilde's The Importance of Being Earnest the best play in the language. He is a Freeman of the City of London and a Liveryman of the Guild of Air Pilots and Air Navigators. He is an Hon DSc of the University of Birmingham, of the Cranfield Institute of Technology and of the University of Warwick, an Hon LLD of the CNAA, an Hon DTech of Brunel University and Membre Correspondant, Faculté Polytechnique de Mons.

How to sum up a life lived at the centre of the most tumultuous century known to mankind? Maybe the best

judgement was his own, when giving the Handley Page Memorial Lecture at the College of Aeronautics on 6th June 1969. The lecture was called Looking Ahead Again. He concluded:

"When I look back on the great things I was privileged to take part in – the building of the R101, the creation of the jet engine – the scenes are illuminated with an heroic glow. I have always felt the romance of achievement and I think my contemporaries in aeronautics feel the same."