Memorial Service for Professor Austyn Mair held in Downing College Chapel on 1 March 2008. Text of an address by Professor David Newland, former head of the Engineering Department. This followed an earlier address by the Master which covered Professor Mair's contribution to College affairs.

Professor William Austyn Mair CBE MA FREng FRAeS

24 February 1917 – 17 January 2008

Francis Mond Professor of Aeronautical Engineering 1952-83
Head of the Engineering Department 1973-83
Fellow of Downing College 1953-83
Honorary Fellow of Downing College 1983-2008

AN APPRECIATION

When the new Engineering Building was opened in 1952, the old pupils' association commissioned an oil painting by Terence Cuneo to mark the occasion. His large panorama has hung in our foyer ever since. It shows a youthful Duke of Edinburgh with assembled dignitaries in the Heat Laboratory. They are all peering at part of a polished steam engine. The Duke and Professor Baker are in full scarlet academical dress. As they lean over a railing to look down at the engine, a tall figure looks over Baker's shoulder. That figure is instantly recognisable. Austyn was one of those fortunate people whose bearing and dignity make them look old when they are young, and young when they are old.

He and Mary had arrived in Cambridge just a month earlier with their two young sons. They came in October 1952 for Austyn to take up the Francis Mond Chair of Aeronautics on the retirement of Bennett Melvill Jones. The major part of Austyn's life's work had begun. How did it all start?

The early years

Austyn was an undergraduate between the wars. He was born in London to Scottish parents in 1917. I'm told that he rather regretted not having been born in Scotland, not being a "proper Scotsman", as his brother had been. I never saw him wearing a kilt, and asked Mary about this. *"Oh, no."* she said, *"He was much too tall for a kilt."*

He came to Cambridge in 1936. In those days you couldn't read Engineering. It was Mechanical Sciences (Cambridge didn't have an Engineering Tripos until years later). He graduated in 1939 with 1st Class Honours, taking the Rex Moir Prize for the top student on the final class list. The Master mentioned that he became a fellow of Downing College in a coronation year. He had also been an undergraduate in a coronation year, that of the Queen's father in 1937. It was a time of great change and anxiety with the looming dangers of war growing ever nearer.

Austyn recalled afterwards that he was encouraged to take up aeronautics by his predecessor Melvill Jones, and, on graduating, he went as an engineering pupil to the Experimental Department at Rolls Royce, Derby. He remembered leaving the factory on a Friday in September 1939, on the weekend when war was declared. When he returned on Monday, the skylight windows were already blacked out and the Rolls-Royce cars had all been removed for safekeeping elsewhere.

War service

Austyn volunteered for the RAF and soon found himself at the Royal Aircraft Establishment, Farnborough, doing secret research into high-speed flight.

The focus was on making aircraft fly faster, a wartime goal of huge importance. This led to urgent work to build a high-speed wind tunnel to test model aircraft by blowing air past them. Design of RAE's tunnel had begun in 1938, but it was a big project and not completed until 1942. The tunnel was huge, about 140 feet long and 40 feet high. It needed a 4,000 hp motor to blow the air round and had to be artificially cooled to prevent overheating. Austyn arrived in time to help with the construction phase and he played a major role in setting up the necessary measuring instruments.

In addition to wind tunnel testing, test flights were also made to obtain experimental data. This was done by flying to as high an altitude as possible, usually in a Spitfire because this was the fastest plane, and then diving steeply for as long as possible to get up speed. It was hair-raising and dangerous work. They were testing at probably the highest speeds

that had ever been recorded in flight for any aircraft in the world. At these speeds, the handling characteristics of aircraft were unknown, and there was concern that violent buffeting would make the craft uncontrollable or even whether the pilot would be able to pull out from a high-speed dive.

A flurry of Reports and Memoranda from the Aeronautical Research Council, published between 1942 and 1951, document Austyn's contributions to this wartime research. Their subjects range from the design of guide vanes for the wind tunnel to measurements of pressure on the control surfaces of a Spitfire at high speed. At the time, these were secret, but most of them were eventually released after the war ended.

One RAE report records in 6 parts the results of wind tunnel tests on Meteor jet-propelled fighters.

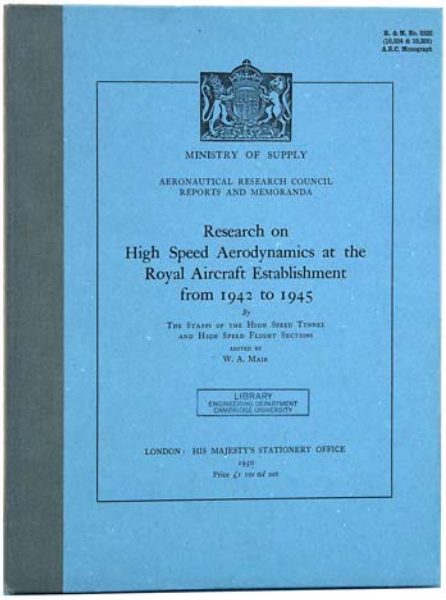
The first jet aircraft

The Meteor was the first operational jet fighter. It had two turbo-jet engines. For production aircraft, these engines were made by Rolls-Royce, which had taken over Whittle's original firm Powerjets Ltd. The Meteor's engines were based on Whittle's design. It was the design on which Will Hawthorne had worked. Later, at Cambridge, Austyn and Will became colleagues and they served successively as heads of the Engineering Department.

The Meteor flew first in March 1943, but it suffered from instability problems at high speed. Urgent research was carried out at Farnborough to understand and rectify these problems, which caused a number of early crashes.

High-speed buffeting was traced eventually to irregular airflow around the engine nacelles and Austyn's work led to the nacelles being lengthened. This resulted in much improved aircraft performance and his modifications were incorporated in all Meteor aircraft manufactured subsequently. In 1946, the Meteor broke the world air speed record, reaching over 600 mph, a consequence of increased thrust and because of its re-designed engine nacelles.

At the end of the war, Austyn edited the RAE's definitive monograph documenting all their wartime research. This very substantial volume has 150 closely printed pages with almost 200 diagrams and photographs. With the help of our librarians, I tracked down an original, unmarked copy in the Engineering Department. It is a beautifully bound book, obviously prepared meticulously, and explaining succinctly but in detail all that was done during those critical war years. It established Austyn's professional reputation.



Demobilisation

Austyn was demobbed with the rank of Squadron Leader. Although he had not been a pilot, he was very conscious that flight research always involves risk and he had often flown as an observer when tests were being made. When writing RAE's acknowledgements, in the final monograph, Austyn recorded his admiration for the work of RAE's three wartime test pilots *"on whose skill and courage the whole of the high-speed flight research depended"*. That experience made a big impression. Years later he was very distressed when, in 1966, the Cambridge University research aircraft crashed, killing the pilot and a member of Austyn's research team. Henry Gardner of the British Aircraft Corporation, speaking afterwards, remarked particularly on the *"deep effect this accident had made on him (Professor Mair) some months ago."*

Many good things came out of that period of concentrated research at Farnborough. Some led directly to improvements in aircraft design. Others led to improved testing methods and procedures.

But the most important personal benefit of the wartime period arose from a different quarter. During the blitz, a Red Cross detachment from Cornwall was posted to a hospital in Surrey where the London wounded were being treated. Austyn's father, who was a doctor, had come out of retirement to help there. One of those sent from Cornwall was a young nurse, Mary Crofts. In circumstances that remain a wartime secret, Mary met Austyn at a dinner party given by Austyn's parents. And a romance flourished.

This seems to have been love at first sight, and Mary and Austyn were married in a London church in 1944. It was the beginning of the long and happy partnership which we have all admired so much for so long. Christopher was born during wartime in St Thomas's Hospital shortly before a flying bomb exploded nearby, fortunately safely, in the Thames, and Robert was born in the immediate post-war years when the family had moved to Manchester.

Manchester University

The high-speed flight research at RAE attracted a great deal of attention when it became public knowledge after the war, and Manchester University wanted to enter the field of experimental high-speed fluid mechanics. In 1945, the University decided to establish a Fluid Motion Laboratory. This was to be in an empty hangar at Barton Airfield near Eccles. The intention was to keep noisy supersonic wind tunnel tests out of earshot of the university community. Austyn was invited to become the new Laboratory's first director, and he was appointed to a Readership in High-Speed Fluid Mechanics in 1946.

I asked Mary whether she had any qualms about moving to Manchester. *"Good heavens, no"*, she said. *"That was where the job was and so we went. The subject wasn't raised"*.

Years afterwards, Austyn recalled that, when he arrived at Barton Airfield, there were no facilities whatsoever, *"not even a table and chair, but there was an awful lot of good will"*. However, the separation of the airfield from Manchester University made life difficult and this experience made him determined not to accept a laboratory miles away from the main Engineering Department when he moved to Cambridge. This determination led to our Aeronautics Laboratory being in the South Wing of the Baker Building.

Austyn was just becoming established at Manchester when Sir Melvill Jones, Cambridge's first Professor of Aeronautics, retired. There were older and more experienced people interested, but the electors preferred youth to age and by now Austyn had a great deal of experience in setting up and running experimental facilities for aerodynamic research as well as a substantial reputation. He was elected to the Francis Mond chair at age only 35 and, in 1952, Mary and Austyn and their family came to Cambridge in time for the start of the Michaelmas Term; in time for Austyn to be present at the opening of the new Engineering building and to appear in Cuneo's picture.

Cambridge 1952-62

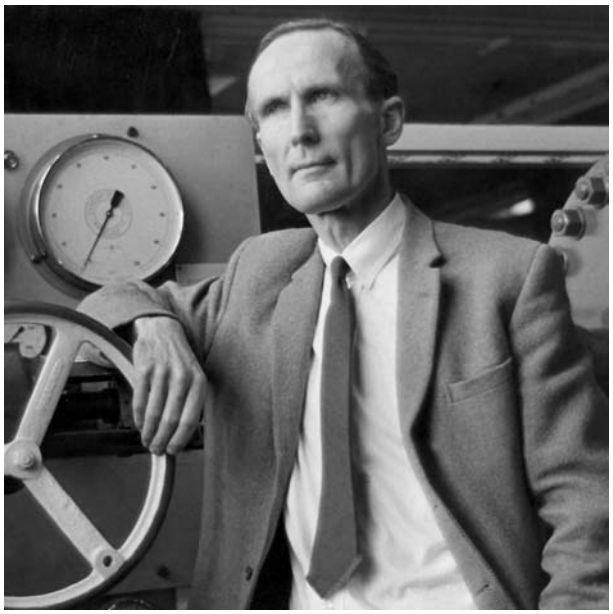
When he arrived here, Austyn took over the existing aeronautical facilities. These consisted of three small wind tunnels in a wooden hut. The hut had originally belonged to the University Air Squadron and, when it came to be removed, a detachment of Cambridge Scouts dismantled and took it away in a day. It became their scout hut. The old facilities urgently needed replacing with more modern equipment. Melvill Jones had concentrated on flight testing, which had been carried out at the RAF base at Duxford, but the emphasis was moving to precision experiments under carefully-controlled conditions. That meant that new wind tunnels were essential.

Austyn wanted improved versions of the tunnels he had set up in Manchester. Soon after he arrived, in February 1953, he submitted a report to the Faculty Board headed *"Notes on a Proposed New Fluid Mechanics Laboratory for Mechanical and Aeronautical Engineering"*. In addition to the new wind tunnels, this proposed that there should be new laboratory space for other fluid mechanics and heat transfer research to be carried out in collaboration with Professor Hawthorne. Will Hawthorne had arrived from MIT in 1951 and he also wanted new laboratory facilities.

Initially there was no money. The Faculty Board could do nothing except endorse Austyn's report, which it did. They submitted his report to the University's Secretary General *"for information"*. Initially a long wait looked in prospect.

But all at once, later the same year, everything changed. Winston Churchill was back for his second term in Downing Street and his government decided to give increased grants to university engineering departments. The upshot was that new money unexpectedly became available and the UGC agreed to pay for extending the new engineering building in Cambridge and for part of the cost of equipping it.

A large addition at the south end would accommodate new wind tunnels and laboratories, and another, smaller one, at the centre would provide a home for mechanics of machines and fatigue research which would be displaced from their then temporary building by the new south wing. Detailed drawings were completed in 1956. Construction took two years, but by September 1958 (6 years after Austyn had arrived) the new building was complete. It then took time to build and commission the wind tunnels but the new high-speed blow-down tunnel was completed in 1960 and the larger return-circuit low speed tunnel by late 1963. Both still exist at Trumpington Street and are still used.



The photo on the front of our Order of Service shows Austyn at the controls of what is now called our *No 1 Supersonic Tunnel*, the one completed in 1960.

During those early years, research was building up using what equipment was available and by flight testing with the help of RAE using their Vampire jet aircraft and with an Auster monoplane which had been modified to achieve high lift by controlling airflow over the wings by suction. This was kept at Marshall's Airport in Cambridge during a long period of collaboration with Sir Arthur Marshall. The supersonic tunnel was used for studies of three-dimensional shock wave interaction with structures and with fluid jets, but Austyn's own interest was turning towards high lift aircraft and hovercraft.

Cambridge 1963-72

For the next 10 years, with his laboratories completed, Austyn concentrated on teaching and research in all branches of flight and industrial aerodynamics. His research focus began to change. It had been about making aircraft go faster and be more manoeuvrable. But by now STOL (short-take-off and landing) aircraft, and soon VTOL (vertical take-off and landing) aircraft were being developed. There was much interest also in the aerodynamics of hovercraft.

Hovercraft had just been invented by Christopher Cockerell, an alumnus of the Department (Peterhouse, 1933-35), who made his first tests on the Norfolk Broads in 1952. Cockerell's people-carrying hovercraft's first "flight" was in 1959. In January 1964, Austyn delivered his paper *"The*

Physical Principles of Hovercraft" to a half-day symposium of the Royal Aeronautical Society and, in it he thanked Cockerell who had *"greatly assisted"*.

In 1966, Austyn was back at the Royal Aeronautical Society to deliver their 9th Lanchester Memorial Lecture on the subject *"STOL – Some Possibilities and Limitations"*. This was especially appropriate because in 1963 he had been appointed Chairman of the Powered Lift Committee of the Aeronautical Research Council. This gave him a very good, up-to-date view of national developments in the field. By then the prototype Hawker Siddeley Harrier aircraft was being developed (its first flight was in 1960), and there was huge interest in developing S/VTOL aircraft for both military and civil applications.

Research, much of it experimental from the results of wind-tunnel and aircraft testing, on these and other topics of industrial aerodynamics continued in conjunction with colleagues in the Department. Even some studies of the aerodynamics of cricket balls were included. In 1969, Austyn was awarded the *CBE* for his services to the aeronautical profession, and he was twice honoured by the Royal Aeronautical Society by their *Orville Wright Prize* in 1953 and their *Silver Medal* in 1975.

Cambridge 1973-83

Austyn became Head of the Engineering Department in 1973, succeeding Will Hawthorne, and he served for two full 5-year terms until close to retirement in 1983.

He appointed Donald Green as Deputy Head of Department with responsibility for teaching. Donald had been in the Department for a long time and had served as Senior Tutor of Sidney. The two made a formidable team. It was a time when much departmental business was done in the 2nd floor Tea Room, because almost everyone worked at Trumpington Street. The combination of Austyn's gentle persuasion with Donald's precise drafting and eye for detail saw through a root and branch review of the Engineering Tripos.

A new *Production Engineering Tripos* was also introduced and, just as the dust had settled on that, the government produced its *Finniston Report* of 1979 which recommended that all engineering courses should last for 4 years and all students should receive MEng degrees.

This brought renewed pressure on the newly-revised 3-year Engineering Tripos. Discussions were resumed about extending the undergraduate course to 4 years for everybody. That went on after Austyn had retired in 1983, but the groundwork was started during his period in office. His

endorsement of the 4-year principle coupled with his support for the broadened syllabus bringing together engineering science with policy and management was very influential in enabling the major developments in teaching that occurred during and after his time.

Changing times

Austyn's engineering career has spanned a time of great change in technology. In 1952, in aeronautics, speed and power were everything. Now energy conservation and silence rule. They killed off Concorde and spelt the end of tracked hovercraft. And VTOL has disappeared except for military applications. Instead, aeronautics is now about economy and keeping quiet. And there has been a sea change in what and how engineering is taught. In 1952, engineering science was king. We taught analytical principles, always based on hard science. Design was regarded with suspicion because no-one could articulate what its principles were. And engineering policy and planning had not been recognised as academically respectable topics. Now design and the creative parts of engineering have much greater recognition. All these were maturing during Austyn's time in Cambridge.

Reminiscences

My abiding memory of Austyn is his interest in all new developments and his tolerance for new ideas and new theories, even those he did not agree with. And I remember his period as Head of Department as a happy time without rancour or ill-will. Even as he bore illness with patience and fortitude, he maintained a continuing interest in his Department and all its activities. Robert told me several times how much his father enjoyed seeing the Department's weekly news sheet. His interest in all our activities was matched by the respect and admiration of his colleagues. His upright bearing reflected his upright intellectual stature. He was a man of integrity who planted seeds and allowed them to flourish naturally. We appreciated his unassuming manner and his gentle humour. We respected his straightforward approach and natural kindness. And that comment applies also to Mary. All of us here will have received Austyn and Mary's friendship and hospitality in one way or another and for that we give thanks.

The Master has mentioned how meticuluous and organized Austyn was. He usually cycled home from the Department at 1pm to have lunch with Mary and then cycled back to the Department to arrive at 2pm. Someone once remarked that you could set your watch by his departure and arrival times. And here's another example. Tom Kimura, a distinguished geotechnical engineer at the Tokyo Institute of Technology, who spent the snowy winter of 1977-78 in Cambridge, claims that you could tell

whether snow was expected by observing the front gates at 74 Barton Road. If snow was expected, Austyn left them open. If the gates were closed, you could be confident of good weather.

So sadly that tall figure in Cuneo's painting has completed his life's work. We remember his courteous, gentlemanly stature. We recall his achievements in war and peace; his contribution to this University, to this College, and to the Engineering Department, his contribution to aeronautical engineering, and his contribution as husband, father and grandfather as someone who deeply loved and enjoyed his family.

On learning that Austyn had died, Tom Kimura emailed from Tokyo about what had happened to him the previous day, before he had heard the news. *"Very strange (strange might not be a suitable word), Robert. We had a very heavy snowfall yesterday, more than 15 cm, which is very rare in Tokyo. I had to remove snow from a small gate of my house. While I was doing this, the scene of the opened gate of your parents' house came back to me many, many times. Is it a mere coincidence? I don't think so."*

For so many of us, his family, his colleagues, his friends, his students - he has left us better than he found us. All of us. We remember that, and we rejoice for that.