Oxford Dictionary of National Biography

Hawthorne, Sir William Rede (1913–2011), *mechanical and aeronautical engineer*
by D.E. Newland
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Hawthorne, Sir William Rede (1913–2011), mechanical and aeronautical engineer, was born on 22 May 1913 at 11 The Grove, Longbenton, Newcastle upon Tyne, the first of three sons of William Hawthorne (1878–1957), civil and electrical engineer, and his wife, Elizabeth Curle, *née* Greenfield (1882–1952). His father was born in Northern Ireland and his mother in Edinburgh. They had come to Newcastle in order for his father to join the leading engineering firm of Merz and McLellan, who had made their reputation in Newcastle in the new field of electrical power generation and distribution.

Hawthorne was educated at the Dragon School, Oxford, and then Westminster School from where, in 1931, he won an exhibition to Trinity College, Cambridge. He read mathematics for a year and then mechanical sciences for two years. By now his family had moved to London and then to Esher, where Merz and McLellan established an office. After graduating from Cambridge, having won the university's Ricardo prize for thermodynamics and sharing the Rex Moir prize for best performance in the final examinations, he became a graduate apprentice at the boiler making firm of Babcock and Wilcox Ltd, near Renfrew.

With this grounding of practical experience, and an interest in boiler research, Hawthorne won a Commonwealth Fund fellowship to study chemical engineering at the Massachusetts Institute of Technology (MIT). There he completed a PhD on the dynamics of chemical combustion. His thesis, ‘The mixing of gas and air in flames’, studied burning jets of combustible gas. This work was to determine the direction of his future career and to prove invaluable later. While in America he met Barbara Runkle (*d*. 1992), a graduate of Radcliffe College and granddaughter of MIT's second president, John D. Runkle. They married in April 1939 at the Unitarian church in Harvard Square, and had a son and two daughters.

In 1937 Hawthorne had returned to Babcock and Wilcox, where he worked until the outbreak of the Second World War as a development engineer. In 1940 he was directed into a reserved occupation as a scientific officer in the Ministry of Aircraft Production. After a short time at the Aircraft Testing Establishment at Boscombe Down, he moved to the Royal Aircraft Establishment at Farnborough. There he joined the Engine Research Group. By now Frank Whittle's top-secret work on the development of his newly invented jet aero-engine was being held up because the engines could not be made to run smoothly. In great secrecy, and with Winston Churchill's personal support, prototype engines had been built at the old British Thomson-Houston works at Lutterworth, Leicestershire, but progress was stalled by the occurrence of combustion instabilities.

Hawthorne's PhD research had found that, in rapid combustion, flames might contain eddies of unburnt gaseous fuel along with free oxygen. Previously it had been thought that fuel would burn completely as long as there was enough oxygen available. This research had a direct bearing on the combustion problems that Whittle was experiencing, and Hawthorne was sent to help Whittle at Lutterworth. His theoretical knowledge of fluid dynamics proved crucial to designing a combustion chamber that would establish conditions for stable, fast combustion. With Hawthorne's help Whittle redesigned the prototype jet engine's combustion chambers to improve the dispersion of droplets of fuel within their fast-moving compressed air. This modified design allowed the prototype engine's

development to continue. The first successful flight of a Gloster E28/29 jet aircraft took place on 15 May 1941.

After returning to Farnborough in 1941 Hawthorne became involved in the formation of a new National Gas Turbine Establishment. He subsequently rejoined the Ministry of Aircraft Production. In 1944 he was sent to Washington to brief the Americans on gas turbine developments in Britain, afterwards working for the Ministry of Supply in Whitehall for two years. But the call of research was too strong and in 1946 he returned to MIT as an associate professor, being promoted to the Westinghouse chair of mechanical engineering in 1948.

By now John Baker was having success expanding the Cambridge University engineering department. New laboratories were being built at Trumpington Street, and Baker's recruitment of more staff led to engineering becoming the university's largest department. Baker had raised funds for a new chair of thermodynamics, and travelled to the USA to help persuade Hawthorne to return. His success led to Hawthorne's appointment as the first Hopkinson and ICI professor of applied thermodynamics in 1951, and a fellowship at Trinity College.

At Cambridge, Hawthorne prospered, with the help of two brilliant young staff, John Horlock and Arthur Shercliff, both of whom were later to become university professors at Cambridge. Working together, they developed a new undergraduate teaching course in thermodynamics based on ideas that Hawthorne had brought back with him from MIT. A new syllabus was introduced with smaller than usual classes. It brought a rigorous and disciplined approach to what had been a woolly subject in engineering courses. This intellectual rigour proved a wonderful training for analysing problems, and developments of this approach became widely taught in engineering departments around the country.

Hawthorne's engine research continued, concentrating on theoretical aspects of the thermodynamics of fluid flow in turbomachinery. He had identified an effect called secondary flow. At bends or turns, part of a primary fluid flow is diverted and flows in a different direction from the intended one. His observations and understanding led to improvements in the smooth flow of gases within turbomachinery, ultimately improving the efficiency of jet engines. With Horlock's help, the growth of engine research led to a need for more laboratory space, and a new turbomachinery laboratory was opened by Sir Frank Whittle in 1973. It was the first engineering building on a large, open site in west Cambridge, some way from the rest of the engineering department. Later this site became the focus of massive developments in technology over many years.

The site chosen for the Whittle Turbomachinery Laboratory was across the road from the newly built Churchill College. In 1968 Hawthorne had been appointed to succeed Sir John Baker as head of the university's engineering department. A few months later he also became the second master of Churchill College, succeeding Sir John Cockcroft. The mastership of Churchill College is a crown appointment and there was initially some concern within the fellowship that the new master's duties as head of house might be restricted by his responsibilities as head of the engineering department. This concern proved to be unfounded, in part because Hawthorne had the ability to work continuously for long hours, taking only a few hours' sleep each night. He had a huge range of interests and regularly chaired late evening discussions in the college. His formula for these discussions was simple: have a good dinner with a dozen or more colleagues and guests, then hold a discussion. Although these events sometimes lasted into the small hours, Hawthorne never flagged during marathon discussions, especially on subjects that interested him.

One such subject was the supply of engineers to industry and their practical training. Hawthorne

wanted graduate training to be more organized and motivational than he had experienced at Babcock and Wilcox. His ideas and enthusiasm led to a new approach to practical training. Traditional hands-on experience was supplemented by guided projects, discussions, seminars, and talks. In the 1950s experimental courses held on his initiative led eventually to the Cambridge University advanced course in production methods and management. This developed into an MPhil course in the engineering department's Institute for Manufacturing.

When Hawthorne was elected to his Cambridge chair university professors did not supervise undergraduate students. He ignored this tradition, and regularly supervised the progress of final-year students. For students, initially this could be an unnerving experience. Instead of discussing examination questions they took part instead in testing discussions on engineering issues, which Hawthorne led with characteristic wit and sparkle. For several generations of students these discussions centred on Dracones, known irreverently as Hawthorne's NOBs (nylon oil barges). These were huge nylon sausages, enclosing oil floating on the surface of the ocean, several of which could be towed behind a tug. Hawthorne developed the idea in response to the Suez crisis of 1956, when British oil supplies through the Suez Canal were disrupted and tankers had to take the long-distance route around the Cape of Good Hope. For several years work on Dracones dominated research in Hawthorne's thermodynamics laboratory, and a team of graduate students was mobilized to carry out towing tests on the Ouse at Ely. In the event the Suez crisis passed before Dracones could be used for their original purpose, but they were used in the Falklands before, during, and after the 1982 conflict, for oil deliveries in other remote locations, and as containers for waste oil recovered from oil spillages at sea.

Hawthorne remained Hopkinson and ICI professor at Cambridge until 1980, and master of Churchill College until 1983. He continued links with MIT throughout his career, serving as a visiting professor there on several occasions. He was a member of the MIT Corporation from 1969 to 1974 and maintained that MIT and Cambridge working together offered advantages to both. His groundwork of collaboration encouraged the formation of the Cambridge–MIT Institute in 1998, which led to a regular programme of undergraduate exchanges and collaborative research between the two institutions. He served as a member of numerous government committees and advisory boards and continued as a consultant to industry long after he had retired from his academic appointments.

Hawthorne had been elected a fellow of the Royal Society in 1955, appointed CBE in 1959, and knighted in 1970. He was a founding fellow in 1976 of the Fellowship of Engineering (later the Royal Academy of Engineering), a fellow of the Institution of Mechanical Engineers, the Royal Aeronautical Society, and other professional bodies, and a foreign associate of the US National Academy of Engineering and the US National Academy of Sciences. He was twice vice-president of the Royal Society (in 1969–70 and 1979–81), and in 1982 received its gold medal. He held honorary degrees from the universities of Sheffield (1976), Salford (1980), Strathclyde and Bath (both 1981), Liverpool and Oxford (both 1982), and Sussex (1984). His hobbies included walking, skiing, sailing, cookery, the theatre, and conjuring. He was a member of the university's Pentacle Club from his undergraduate days onwards and for twenty years was its president. His skill as a magician entertained and enthralled his colleagues at Churchill College and MIT on several occasions.

Hawthorne died at his home in Pinehurst, Grange Road, Cambridge, on 16 September 2011, of bronchopneumonia following a stroke. He was buried next to his wife in the family plot in the Mayflower cemetery in Duxbury, Massachusetts. He was survived by his three children. Memorial events were held at MIT on 24 March 2012 and in Cambridge on 24 February 2012. The latter was followed by an entertainment organized by the Pentacle Club celebrating ‘our late member, former

President, and fellow magician Sir William Hawthorne'.

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Sources

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Archives

CAC Cam.

Likenesses

W. Bird, bromide print, 1965, NPG · photographs, 1974, Rex Features, London · C. Bennett, portrait, Churchill College, Cambridge · obituary photographs

Wealth at death

£1532: probate, 7 Aug 2012, *CGPLA Eng. & Wales*

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