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LAWRENCE HARGRAVE 1850 - 1915

For many centuries man was captivated by the flight of birds and had dreamt that he too would, one day, join them in the sky. The development of hot air balloons only served to whet the appetite, and the real goal became powered flight.

This was achieved by the Wright brothers of the United States of America on the 17th December, 1903.

Wilbur Wright wrote: "six very remarkable men in the last decade of the nineteenth century raised studies relating to flying to a point never before attained.

Lilienthal, Chanute, Maxim, Ader and Hargrave formed by far the strongest group of workers in the field that the world has seen".

The American Octave Chanute said: "If any man deserves to fly, that man is Lawrence Hargrave of Sydney, New South Wales".

Working alone, Lawrence Hargrave developed fuselage construction, curved wing surfaces, propellers and engines. Only Australia's comparative isolation prevented him from beating his contemporaries.

He was born on the 29th January, 1850 at Greenwich, England and was educated at Queen Elizabeth Free Grammar School, Kirkby Lonsdale, Westmorland.

He arrived in Sydney in 1866 to join his father who was a prominent Judge and who wanted him to follow in his footsteps and become a lawyer. Lawrence, however, was more interested in Engineering and took a job with the Australasian Steam Navigation Company.

It was during this period that he developed his enthusiasm for exploration. He made several trips to North Queensland and, in 1872, set out to do some gold prospecting in New Guinea. Having survived a shipwreck, he sailed again in 1875 for the Gulf of Papua where he joined another expedition to explore the land beyond Port Moresby. In 1876 he met the Italian naturalist Luigi d'Albertis and together they sailed some 800 kilometres along the Fly River.

On his return to Sydney, he was elected a member of the Royal Society of New South Wales in June, 1877 after which he returned again to the Torres Strait.

He took an active interest in The Engineering Association of New South Wales which he joined in 1875. He became a member of the Council and was elected Librarian in 1888. It was recorded at the time that he exhibited models of his

flying machines and engines. A typical report in the Minutes of Proceedings of the Association was his description of a Flying Machine Motor.

DESCRIPTION OF A FLYING MACHINE MOTOR.

BY LAWRENCE HARGRAVE.

THE exhibit consisted of an engine and compressed air receiver for a screw-driven flying machine.

The receiver is made of tinned-iron plate $\cdot 013$ inches thick, with a breaking strength of 62,000lb. per square inch section of metal; the diameter of the receiver is 3 inches; content, $\cdot 18$ cubic feet; and weight, 29 ounces. The longitudinal seams are $5\text{-}16$ th inch lap, soft solder joints, which have more than 100 per cent strength; it has been tested to 250lb. per square inch with water; 150 lb. is to be the working pressure.

The engine has three single-acting cylinders, $\cdot 89$ inches diameter and $1\cdot 29$ inches stroke; the air is cut off at $\frac{3}{4}$ stroke. Two novel features are introduced, which are, that the crank-pin is fixed and the valve-face is the thrust-block. There are 43 metal pieces in the engine; 19 are all that are necessary; the rest are for convenience of manufacture. The weight of the engine is $7\frac{1}{2}$ ozs., and its I.H.P. is $\cdot 29$; the first one made of this type weighed 12 ozs.

A diagram was also exhibited which showed the thrust, time and revolutions; with 150lb. initial pressure in the receiver, the thrust is as high as $1\frac{1}{2}$ lb.; coupling this with what is already known, viz., that $\frac{1}{2}$ lb. thrust will drive a machine weighing 209lb. a distance of 90 yards, when supported by 2,130 square inches of surface, the author does not think he is over sanguine to expect this machine to have a range of 115 yards, after allowing for a slip of 20 per cent.

The blades of the screw are set at 20 degrees, giving a pitch 44 \cdot 4 inches; the diameter of the screw is $36\frac{1}{4}$ inches; the area of each blade is 32 \cdot 7 square inches; it acts on an annular column of air $6\cdot 1$ square feet cross section.

He eventually settled in Sydney and, on the 7th September, 1878, he married Margaret Preston Johnson. They set up house at Roslyn Gardens on the western side of Rushcutters Bay. They had a son and five daughters.

His interest in celestial navigation resulted in his appointment as Assistant Astronomical Observer at the Sydney Observatory in 1878.

It was during this time that he developed a close friendship with Brother Edmund Barton, destined to become Australia's first Prime Minister.

Hargrave resigned from the Observatory in 1883 to devote himself to the possibilities of human flight. He studied the movements of birds, fish and reptiles and the action of sea waves and air currents. He even made working models of earthworms in his research on natural movement. Many branded him as eccentric for his belief that earthworms could lead him to fly! He received the same reaction when he was seen apparently "walking on water" from Darling Point to Point Piper on what appeared to be inflated water wings!

Some of the scepticism ceased when one of his flapper wing models flew for some 100 metres at about 20 kilometres per hour.

The results of these studies were contained in his paper "The Trochoided Plane", given to the Royal Society of New South Wales on the 6th August, 1884.

From that time until 1892, he experimented with the monoplane in models made from light wood and tissue paper, some propelled by flapping wings, others by a primitive airscrew. The motive power sometimes was clockwork, rubber bands in tension, or compressed air and steam.

In 1892 Lawrence moved the family to Stanwell Park, some 28 kilometres north of Wollongong, New South Wales.

There his work continued until, on the 12th November, 1894, four box-kites lifted him 5 metres from the beach in a 35 kilometres per hour wind. This led to his research into the superiority of curved wing surfaces. He would have delighted in the modern hang gliders being launched from Bald Hill, Stanwell Park where, in 1940 a memorial was erected to commemorate his achievements.

Meanwhile his work on engines continued with experimental fuels such as steam, carbonic acid, kerosene, petrol and gunpowder. Thirty-three different models were built and his three cylinder radial rotary air-screw engine, originally designed in 1889, became the prototype of the famous "Gnome", "Clerget" and Le Rhone" engines used during the first World War and into the 1920's. The engine weighed just 212 grams and operated on compressed air at 456 revolutions per minute.

He also discovered that two wings gave greater stability and soaring power than one. He corresponded regularly with Octave Chanute who built gliders and acted as a "clearing house" for the interchange of information between aviation enthusiasts. Hargrave read many papers before the Royal Society of New South Wales and, in 1898, returned to his native England to read a paper and exhibit his many models at a meeting of the Aeronautical Society of Great Britain.

On the wall at the dwelling at No. 58 Wunulla Road, Point Piper, was a plaque simply inscribed:

Lawrence Hargrave
A Pioneer of Aviation
Lived here 1902-1915

His house had no blinds or curtains in order not to obstruct his view of Rose Bay. Mrs Hargrave once remarked to the people next door that she envied their curtains and blinds keeping out the glare.

He discontinued full-time aeronautical work in 1906, however, he took the chair at the inaugural meeting of the Aerial League of Australia on the 28th April, 1909. The meeting was held in Sydney's Hotel Australia. Lawrence Hargrave was appointed Vice-President and George A. Taylor Honorary Secretary.

George Taylor was a man of extraordinary ability. He was an artist, editor, journalist, inventor, astronomer, town-planner and radio engineer. On the 5th December, 1909, assisted by Brother Edward Hallstrom and Charles Schultz, Taylor made the first heavier-than-air flight in Australia. It was over sand dunes near Narrabeen Heads.

Just prior to this, on the 11th September, 1909, the Australian Defence Department announced a prize of five thousand pounds for the best and most suitable aeroplane for military purposes. The offer was subsequently withdrawn as there were no entrants.

Brother Edward Hallstrom was initiated into Lodge Roseville No.344 United Grand Lodge of New South Wales on the 9th February, 1923.

Hargrave's work was largely unrecognised in Australia, and he sold his models to the Deutsches Museum in Munich in 1910, even though a belated offer was made by the New South Wales Government. The Museum was bombed during the Second World War by the very means he helped to create.

He continued to read papers before the Royal Society of New South Wales on such matters as deep-water berths in Sydney Harbour, a single wheeled gyroscopic car and the discovery of the East Coast of Australia by the Spaniard, Lope de Vega in 1595. When asked why he had not patented any of his inventions he said they would: "tend to bring peace and goodwill to all and will herald the downfall of all restrictions to the free intercourse of nations".

How bitterly disappointed he must have been at the outbreak of war in 1914 when he was branded as unpatriotic for selling his work to an enemy who had superior air power.

In 1915 his son and co-designer, Geoffrey was killed at Gallipoli. Lawrence, who survived him by just nine weeks, died on the 6th July, 1915.

On the 6th August, 1934, a Conversazione in honour of Lawrence Hargrave was held at the Union Hall, University of Sydney. The date was the 50th anniversary of his presentation to the Royal Society of New South Wales on his theory of flight. A number of learned societies and aviation bodies co-operated in the programme which gained the patronage of Their Excellencies, the Governor-General and Lady Isaacs. During the Second World War, the Royal Naval shore base, HMS Golden Hind was situated in the Warwick Farm area. After the war when housing was in short supply, the war-time buildings were used for an emergency settlement named Hargrave Park. A street named Lawrence Hargrave Road is a reminder of this temporary settlement. A number of other suburbs, including East Sydney, have a street which bears his name and, in 1952, a Lawrence Hargrave Chair of Aeronautical Engineering was established at the University of Sydney.

Brother Lawrence Hargrave's masonic career is rather complex. He was initiated on the 3rd April, 1877 in The United Service Lodge of New South Wales No. 937 English Constitution. He was raised to the third degree on the 6th June, 1877 and his master mason's certificate which bears No.2581 and is dated 2nd July, 1877, is held together with his other masonic documents, at the Powerhouse Museum, Sydney.

64
5/11
1877
2/7

This lodge was formerly the Volunteer Artillery Lodge No.1239 English Constitution, becoming No.937 when the United Grand Lodge of England re-numbered its lodges in 1863. The name was changed to The United Service Lodge in 1876 and it became No. 24 on the register of the United Grand Lodge of New South Wales at the inauguration in 1888. The lodge consolidated with Lodge Unanimity No.227. Following other consolidations, it is now incorporated in The Lodge of Australia No. 3.

Brother Hargrave resigned from this lodge on the 5th November, 1878. His clearance certificate was issued by the Volunteer Artillery Lodge No.937. It appears that the lodge did not change its clearance certificates when it changed its name.

He affiliated with Empress of India Lodge No.1761 English Constitution on the 17th April, 1878, where he served as Junior Deacon in 1879 and Senior Deacon the following year. He presented to the lodge a handsome brass derrick with a perfect ashlar suspended by a lewis. He called off on the 4th January, 1883. This lodge became No. 57 United Grand Lodge of New South Wales and surrendered its charter on the 30th November, 1984.

Brother Hargrave affiliated with Prince of Wales Lodge No.1653 English Constitution. The date is not known. This lodge became No.49 United Grand Lodge of New South Wales and, after consolidation with Lodge United Service and Unanimity also became incorporated in The Lodge of Australia No. 3. He called off on the 22nd August, 1893 and his clearance certificate, dated 24th October, 1893, shows him as Senior Deacon. He rejoined the lodge on the 24th July, 1900 and called off again on the 5th February, 1904. His clearance certificate for this resignation shows him as Senior Warden.

He also rejoined The Empress of India Lodge No. 57 on the 20th August, 1903 and remained a member until his death. He delivered an occasional lecture in this lodge, generally on moral teachings such as the working tools. Upon his death, although there is no record of a masonic funeral, the lodge observed a month of mourning.

Brother Lawrence Hargrave was made a Life Governor of The Freemasons' Benevolent Institution on the 21st August, 1914.

He was exalted to the Royal Arch Chapter No.548 (later 390) attached to The Zetland Lodge of Australia No.390 English Constitution on the 5th September, 1878. Certificate No. 1845 was issued to him. This Chapter became No. 1 of the Constituent Chapters of the Supreme Grand Chapter of Royal Arch Masons of New South Wales at the inauguration on the 25th June, 1889.

In 1880 and again the following year, Companion Hargrave was invested as a Steward. He held no further office until 1889 when he served as Standard Bearer. He filled other offices such as Sojourner when needed. He called off on the 21st January, 1890 and, in a letter to him dated the following day, 5 shillings was returned to him as his dues were in advance.

Zetland Chapter became Zetland Renown as a result of an amalgamation on the 9th April, 1976, and, at the Union of the various orders of Capitular Masonry on the 17th October, 1980, became absorbed in St. Ives Chapter No. 9 of the United Supreme Grand Chapter of Mark and Royal Arch Masons of New South Wales and the Australian Capital Territory.

His portrait, aged 40, and a sketch of his seaplane design, the fourth full-size machine built in 1902 appear on a 5 pence Australian stamp issued on the 4th August, 1965, to commemorate the 50th anniversary of his death on the 6th July, 1915. This machine did not lift off the ground due to inadequate engine power.

The stamp was the second Australian issue to be printed on helicon paper and has no watermark. It was issued in sheets of 48, perforated $13\frac{1}{4} \times 13\frac{1}{2}$ and was designed by George Hamori. A total of 37,324,320 were printed by photogravure. The colours are brown, yellow-brown, purple and black.

His portrait, from a photograph taken in 1911, together with illustrations of some of his models also appears on Australia's \$20 banknote issued in February, 1966. On the reverse of this note is another of Australia's aviation pioneers, Bro. Sir Charles Kingsford Smith.

A few remaining models are on display at the Sydney Powerhouse Museum and they clearly show how close Brother Lawrence Hargrave came to the honour of being the first man to achieve powered flight.

The inscription on the monument at Bald Hill reads:

LAWRENCE HARGRAVE

1850 - 1915

whose pioneering research in aeronautics,
with engines, monoplanes and box-kites

much of which was carried out at
Stanwell Park, played a vital part
in the development of the aeroplane

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