History of Aeronautical Engineering at the University of Sydney

by Dr K. Srinivas

These pages were compiled by K Srinivas. Thanks to Prof. G P Steven, Dr D J Auld and Mr Alan Fien for providing valuable information about the department.

The year 2014 marks the 75 birthday of the Teaching and Research in Aeronautics at the University of Sydney. Let us not forget that an individual weakens as he ages while an institution strengthens as it ages. This is true of us although we operate under a new umbrella today, namely, School of Aerospace, Mechanical and Mechatronic Engineering. In that period there have been very many graduates, undergraduate and postgraduate. Some of these have gone on to make important contributions in aviation and space technology as well as in the military and commercial arenas. The following pages endeavour to capture some of the important milestones and people in this long period and help set the scene for the 75th celebrations. Not just an Australian institution, it is truly an international one.

In 1989 at the 50th anniversary celebrations for the founding of the Department at a gala dinner the guest of honour was the Governor of NSW Sir James Rowland, sadly no longer with us. In a rousing address he noted the fact that out of the shadow of World War 2 in 1939 the Department of Aeronautical Engineering had maintained the highest of academic standard while at the same time turning out graduates who could underpin the business of aviation in Australia.

By the time the 75th anniversary the Aerospace group, to give it the more up-to–date title, will have produced about 2000 graduates with about 40% gaining honours degrees. The list of graduates names since Alan Bolton, the first, reads like a Who's Who of Australian aviation and many have gone on to significant international careers.

Sections :

DRAFT -- review in progress

The Beginning

The department of Aeronautical Engineering at the University of Sydney was started in 1939 following the recommendation of Mr H. E. Wimperis, the Director of Scientific Research in the British Air Ministry and an outstanding scientist and administrator, whose services had been made available to the Commonwealth Government.

During those days, aircraft industry in Australia employed the British and American designs. Needless to say there were problems. To find the answers Australia did not have experimental or theoretical resources as had been clearly foreseen by the Secondary Industries Testing and Research Committee in 1937. The committee, however, made no concrete recommendations as the visit by Wimperis was impending. He was quick to react and accepted that Australia must find answers to its problems locally and should not depend on Farnborough or Teddington however qualified and ready they were. Interestingly, Wimperis made three specific recommendations –

- **a)** That an aeronautical research laboratory (costing £140,000), whose main features he outlined, should be established;
- **b)** That a chair of aeronautics should be created in one of the Australian universities; and
- **c)** That an aeronautical research committee should be formed.

The government accepted the recommendations and decided that C.S.I.R. be directed to establish an aeronautical research laboratory as per (a). Thus began in 1941 the Aeronautical and Engine Testing Research Laboratory at Fishermen's Bend, in close proximity to the Commonwealth Aircraft Corporation's plant in Melbourne. The laboratory became the headquarters of the Division of Aeronautics under the directorship of Mr Coombes. Assistance to RAAF and to undertake research on long range issues in aeronautics became its objectives. The organisation had four main sections: aerodynamics, structure and materials, engines and fuels and instruments. A wind tunnel was one of the first items of equipment to be installed in the new laboratory. It was designed by Dr G.N. Patterson, who came out from the Royal Aircraft Establishment, Farnborough, for this purpose. Today the laboratory stands as the Aeronautical and Maritime Research Laboratory governed by the Department of Science and Technology.

It is not clear whether the government accepted recommendation (c).

In response to recommendation (b) the government instigated the University of Sydney to establish a chair for Aeronautical Engineering and provided funds for it. Thus, emerged the Department of Aeronautical Engineering, which was incorporated into the Peter Nicol Russel School of Engineering. The newly established chair was named after Lawrence Hargrave, one of the pioneers in Australian aviation. The primary responsibility was to supply aeronautical engineering graduates to various government departments and the RAAF, airlines and the aircraft industry of Australia. A V Stephen was appointed the first Lawrence Hargave professor in 1940.

In these early days the research of the Department was done in close liaison with the Department of Supply’s Aeronautical Research laboratories (ARL) at Fishermen’s Bend in Victoria and the Weapons Research Establishment in Salisbury, SA. At that time, it was the only non-defence research laboratory the Department was able to also devote research to the fundamentals of aeronautics.

Lawrence Hargrave

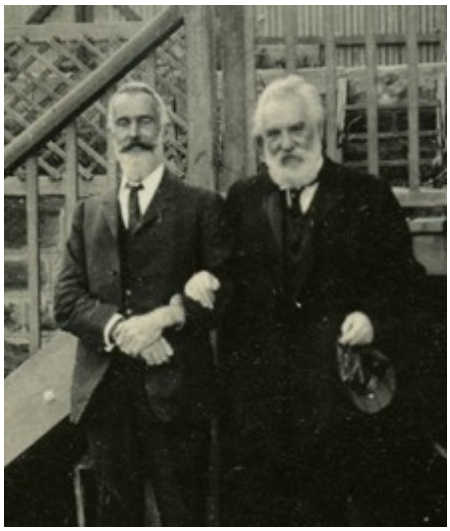
The chair of Aeronautical Engineering is named after Lawrence Hargrave who was a pioneer in aviation, an engineer and an inventor. He was born in 1850 in Greenwich, England. After he had his schooling he migrated to Australia with his parents in 1865. He took up an apprenticeship at the Australasian shipping company in Sydney. After undertaking expeditions to Papua, New Guinea and other places, he worked at the Sydney Observatory. He retired in 1893 and devoted the rest of his life to research in aeronautical engineering, being one of his passions.

Hargrave chose to carry out his research into *Flying Machines* at the Stanwell Park near Sydney where the winds were favourable to gliding and paragliding. Some of the important topics he studied are –

- Curved aerofoils with thick leading edges
- Box Kites which gave a good L/D ratio for gliders.
- Rotary Engines.

He communicated his work to the Royal Society of New South Wales. Some of his papers and models have been exhibited in the foyer of the aeronautical wing of AMME School.

In an experiment with a train of four of his box kites, Hargrave was successful in lifting himself to a height of 16 feet. Use of box kites became wide spread as a consequence.



Graham Bell of the telephone fame also experimented with kites and is said to have been influenced by Hargrave's work. The two met at the former's residence in Woolhara in Sydney in 1910.

Hargrave died in 1915, but his legacy remains to date. Though Wright Brothers are credited with the first human flight, Hargrave had accomplished much single handedly towards that goal. Well deservedly, the chair in the department has been named after him. His picture also appeared on the Australian $20 note from 1966 to 1994. Qantas has named its fifth airbus A380 after him.

Lawence Hargrave Professors.

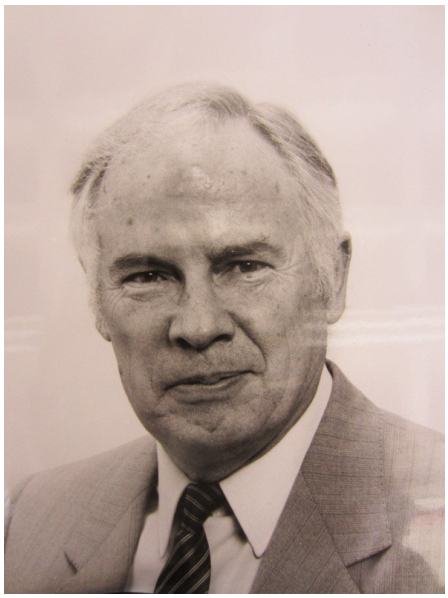
A. V. Stephens (1940—1956)

A. V. Stephens, M.A.(Cambridge), FRAeS, previously held joint appointments as Senior Scientific Officer at the British Royal Aeronautical Establishment at Farnborough and as a Fellow of St John's College, Cambridge he brought the needed balance in theoretical and experimental research, and in aircraft design. It was noted with pride at the time that Prof Stephens obtained interesting and valuable results with modest apparatus and equipment. Professor Stephens vacated the chair when he accepted the Chair in Aeronautics at Queens University, Belfast in 1956.

William Henry Wittrick MA (Cantab), PhD (Sydney), FAA, FRAeS, MIAS (1956 – 1964)

Wittrick (1922 – 1986) came to the Department in 1945 at the invitation of Professor Stephens who wanted to broaden the department to include aircraft structures. He sought the advice of John Baker who was head of the Engineering Department at Cambridge. Baker recommended Wittrick, a young Cambridge graduate who was then at the Royal Aircraft Establishment, Farnborough. In 1945 Wittrick became, at the age of twenty-three years, one of the youngest men to be appointed as a senior lecturer at Sydney University. In the 11 years before his appointment to the Lawrence Hargrave chair he established an international reputation for himself as a resourceful and original researcher in the theory of aircraft structures. He also became the first Engineer to gain a PhD in his Faculty at the University of Sydney. He received his at 10am on Saturday 28 April 1951 and it was presented by the Faculty of Engineering's Dean, Professor A.V. Stephens. His thesis was called *Torsion and bending of swept and tapered wings with ribs parallel to the route*. Wittrick was successful in introducing research and teaching of aircraft structures in the department.

Graeme Bird (1964-1990)



The third Lawrence Hargrave Professor (1964-1990) was Graeme Bird who also started as a student in the department. He graduated with a first class honours degree in 1952 and worked as a scientific officer at the Department of Supply till 1959. Then he returned to the Department to lecture and undertake research leading to a PhD. He rose quickly through the academic ranks and was appointed Professor and Head in 1964. During his time as Professor he had periods as visiting scientist or Professor at the University of Manchester, Caltech, Imperial College, NASA Langley and the Max-Plank Institute for Stormungsforchung. He is a Fellow of the Australian Academy of Technological Sciences, the Institution of Engineers and the American Institute for Aeronautics and Astronautics and the American National Engineering Foundation. In 1990 he was awarded the NASA Distinguished Scientist Award, one of the few non-Americans to be so honoured. His research has been in the field of molecular gas dynamics, whereby the behaviour of gases at low and no so low densities are simulated by emulating them as individual molecules together with all their chemical and mechanical behaviour. He retired in 1990.

He has written the authoritative book - G. A. Bird, Molecular Gas Dynamics and the Direct Simulation of Gas Flows, Clarendon, Oxford (1994).

The direct simulation Monte Carlo (or DSMC) method is widely used for the modeling of gas flows through the computation of the motion and collisions of representative molecules. Computation at the molecular level is necessary for studies in rarefied gas dynamics (or RGD) because the transport terms in the Navier-Stokes equations are not valid in this flow regime. The essential characteristic of a "rarefied" flow is that the molecular mean free path is not negligible. This means that many applications involve normal and high density flows with very small physical dimensions.

G P Steven (1990-2000)

Grant Steven began his engineering career started at 14 years of age as an apprentice fitter and turner in John Brown's shipyard in Clydebank, Scotland. A trade certificate was gained in 1964 in conjunction with the undertaking of an engineering degree at Glasgow University. This led to a scholarship to undertake research at Oxford University leading to a DPhil award in 1970. For the final two years at the Department of Engineering Science at Oxford Grant held the position there of Junior Lecturer.

In 1970 Grant took up a position of lecturer at the Department. The he was promoted through the academic ranks and in 1990 was appointed Professor. He had been appointed Head in 1984. During his time at the Department there were several sabbatical breaks with visiting professorships at Glasgow, Swansea, Harvard, Oxford and Dalien Universities. He produced over 300 academic papers and several research books. Much of the research undertaken has been in the fields of numerical methods, especially the Finite Element Method (FEA) method for structural analysis, structural design and laboratory testing.

Recently the research has focused on new methods for achieving the optimum design of a structure for its many varied environments, This work has borrowed computational techniques from observations of evolutionary processes in nature. Grant Steven is a Fellow of the Australian Academy of Technological Science and Engineering and the Institution of Engineers. Since leaving the chair in 2000 he has been Professor of Engineering at the University of Durham and is currently a director of Strand7 which researches and develops the Strand7 Finite Element Analysis computer code which has over 4000 commercial users worldwide. He is also a professor emeritus in the School of Aerospace, Mechanical and Mechatronic Engineering.

Gregory Chamitoff

Greg Chamitoff (born 6 August 1962 in Montreal, Quebec, Canada) is a NASA astronaut. He flew to the International Space Station on STS-124, launching 31 May 2008 and was in space for 198 days, joining Expedition 18 after Expedition 17 left the station, and returned to Earth 30 November 2008 on STS-126. He served as a mission specialist on the STS-134mission, which was the last flight of Endeavour and delivered the Alpha Magnetic Spectrometer.

Greg has a B.S., Electrical Engineering from California Polytechnic State University, 1984, M.S., Aeronautical Engineering, California Institute of Technology, 1985, Ph.D., Aeronautics and Astronautics, Massachusetts Institute of Technology, 1992, M.S., Planetary Geology (Space Science), University of Houston–Clear Lake, 2002.

He has received many medals and honours including California Astronaut Hall of Fame, NASA Distinguished Service Medal and NASA Exceptional Service Medal.

Greg has been a frequent visitor to the school and was appointed the Lawrence Hargrave professor in 2012.