Issue 33 Feb - Mar 2016

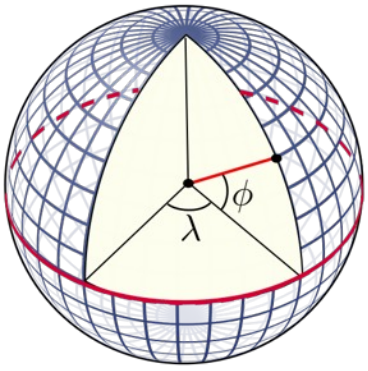
Contrails

Newsletter of the Christchurch Aviation Society

CAvSoc

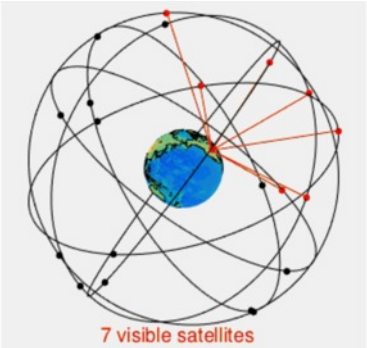
Modern Navigation Systems

Our first talk for 2016 in January was by Ernie Ball who trains potential airline pilots in the craft. He gave an outline of navigation through the ages from the days of the Vikings and their use of lodestone, a natural occurring magnetised magnetite ore, a piece of which suspended from a cord acted as an early compass. Awareness of the suns regularity led to the development of sextants to determine latitude (ϕ) vertical distance from the equator – but to fix ones location a horizontal distance,longitude (λ) from a known point is required, which can be obtained by using an accurate clock and the time difference between the mid-day sun in ones present position and mid-day at a known reference point. That known reference point is the Greenwich meridian and the distance from it is measured in degrees (1/360 of the earth's circumference), subdivided into minutes (1/60 of a degree) and seconds (1/60 of a minute) such that 10° 11' 12" is 10 degrees (600 n.m.) 11 minutes (11 n.m.) and 12 seconds.(1/5 n.m.). A nautical mile (1.151 larger than a statute mile) is a measurement on any meridian on the earth's surface equivalent to one minute of arc. Speed is measured in knots as the distance travelled in nautical miles per hour. So knowing ones distance covered and time taken gives a speed in knots. Whilst compasses, sun and dead reckoning worked for centuries it was not until the advent of radio that great strides in navigation could take place as shorter wavelengths (higher frequencies) gave more accuracy and consequently spawned a number of navigation aids – **RA**dio Direction **A**nd **R**anging which allowed ground mapping when above cloud, **A**utomatic **D**irection **F**inding (ADF) and **V**HF **O**mni **R**ange (VOR) enabled the pilot to track towards or away from the beacon, or to fix the aircraft's position by taking cross-cuts from any two of them. The higher frequency VORs overcame the multitude of problems associated with ADF. The advent of **D**istance **M**easuring **E**quipment (DME) utilised the time a signal took to travel from and back to the aircraft (divided by two) to give the range from the DME site. This is now using the speed of light as a known velocity to measure and thus determine distance. This principle of measuring the time of a signal with known velocity ultimately provides the basis on which the **G**lobal **P**ositioning **S**ystems (GPS) works which gives us our Sat Nav capability.



However, for military use the dependency on radio stations cannot be guaranteed, especially if one sets out to bomb the landlord of the radio station! A self contained system was required and the Massachusetts Institute of Technology (MIT) came up with the first inertial navigation system. With two accelerometers fixed at 90^0 to each other and orientated N/S and E/W the aircraft's present position from a start point may be determined by mathematical calculations. In civilian airliners the accuracy was such that after a transatlantic crossing the aircraft would be within plus or minus 8 miles of its destination which was more than enough to then home in on local beacons.

Finally the GPS depends on the measurement of signal times from satellites placed in earth orbit. By using synchronised atomic clocks, the length of time from several satellites can be used to triangulate the position of the user. A minimum of 3 satellite signals are needed and sophisticated equipment is used to work out errors created by natural phenomena. There are 3 main systems in use: Navstar (USA), Glonass (Russia) and Galileo (Europe) about 30 satellites each, in multiple orbits, to ensure that enough satellites are 'visible' to obtain bearings.



'Winkle' Brown

Aviation in Britain suffered a sad loss when Captain Eric Brown,CBE,DSC,AFC, HonFRAeS, RN passed away on 21st February 2016 aged 97. A legend in his own lifetime he flew 487 different types of aircraft. He was the first person to land a jet aircraft - a de Havilland Sea Vampire - onto an aircraft carrier on 3 December 1945. I met him when he was an after dinner speaker at the Royal Motor Yacht Club and he told me that this was before ejection seats were fitted to the aircraft.

His father had been an RFC pilot so Eric experienced flying at the early age of around 10 and later visited the 1936 Olympics in Berlin where he met Goering and Udet, both WW1 fighter pilots. Udet took him for a flight and said he should learn to fly and learn German which he did when he went to University. On the outbreak of war he was in Germany on a student exchange and arrested but released a few days later along with his MG Magnette to the Swiss border.

His knowledge of German and aviation made him a natural to evaluate captured aircraft at the RAE and his experience with carrier landings led him to amass a total of 2,271 landings.

Next Meeting - at Druitt Hall commencing 8pm

Wednesday 4th May 2016 - AGM then Charles Rolls and Bournemouth's International Aviation Meeting