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Alec Reeves Lectures 2006

David Robertson and Tony Sale

Date	15 Nov 2006
Time	14.30 to 18.30
Venue	Lecture Theatre 408, Electrical Engineering Building, South Kensington Campus
Audience	Open to all
Category	Lectures and seminars
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Contact	Jane Horrell ✉
Website	Alec Reeves Lectures

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The Department of Electrical & Electronic Engineering hosts an annual lecture event directed to topics of wide interest and importance to engineers and the community. The new lecture series commemorates Alec Reeves, an alumnus of Imperial College London.

Reeves is widely regarded as 'the father of the digital age' in that he was the inventor of Pulse Code Modulation, one of the platforms which underpins today's pervasive digital technology, and also undertook important work on radar and radio navigation in wartime Britain. Read more about Alec Reeves below.

The 2006 Alec Reeves Lectures, will be given by David Robertson and Tony Sale. David, a well known communicator on science and technology, will be talking about the life and work of Reeves himself. Tony has long been associated with the historical and technical aspects of the vital wartime code-breaking activities, mainly undertaken at Bletchley Park, and will be talking about the events leading up to the re-build of the Colossus computer.

14.30 **Alec Reeves: designer of the digital age** - David Robertson - Room 408 - from 15.30 Strategic Advisory Group - Poster Presentations will be held in Room 509
17.30 **The Lorenz cipher - Fish, Tunny and Colossus** - Tony Sale - Room 408.

Alec Reeves: The Reeves Lectures celebrate the life and work of an Imperial College graduate who was one of the world's greatest - but least conventional - scientists and

engineers. Born a year after the death of Queen Victoria, he devised the technology on which our 'information age' depends. A committed pacifist, he developed a navigation system that altered the course - and perhaps the outcome - of WWII. A prolific and practical inventor, he routinely experimented with the paranormal.

Alec Harley Reeves was born on 2nd March 1902 at Redhill, Surrey. He went to Reigate Grammar School and in 1918 won a Governors' Scholarship to the City and Guilds Engineering College - later part of Imperial College. He received its ACGI (equivalent to a BSc) in 1921 and then came to Imperial to do postgraduate research. As well as important theoretical work on radio, he invented a cathode ray tube radio direction finder.

In 1923, Reeves joined the communications firm International Western Electric. Working initially at New Southgate, North London, with the distinguished French engineer Maurice Deloraine, he helped create the first high-frequency radio telephone link across the Atlantic.

When in 1925 IWE was taken over by International Telephone and Telegraph, Reeves moved to its Paris laboratory where, in 1937, he made his greatest contribution to engineering history. Pulse Code Modulation made possible the digital transmission of speech and our modern multimedia age. Though PCM was not used commercially until the later invention of the transistor, Bell Labs applied it for the complex and cumbersome radio system on which Churchill and Roosevelt talked in total secrecy for much of WWII.

The Germans invaded France in 1940 and Alec Reeves escaped to Spain - reaching England on a coal boat without his possessions. Initially reluctant to do war work, he saw the moral necessity of defeating Hitler and joined the Royal Aircraft Establishment at Farnborough. Under the powerful Head of Scientific Intelligence, R V Jones, he played a key role in the 'battle of the beams' - helping detect and destroy the radio navigation systems with which the Nazis inflicted deadly damage on cities like London and Coventry.

Britain's counter-attack was initially hampered by poor navigation and Reeves now joined the Telecommunications Research Establishment (TRE) to help our bombers find and hit their target. His solution was Oboe - the most accurate navigational device until the age of the satellite.

After WWII, Reeves returned to ITT's UK laboratory STL where he sought ways to increase the capacity and reliability of communications systems, helped develop early electronic switching systems and was a pioneer of semiconductor devices - including the 'positive gap' germanium diode. He was also among the first to appreciate the potential of light as a carrier, inspiring the STL team under Charles Kao and George Hockham that invented optical fibres.

Reeves spent his final years as a freelance 'boffin' - spotting trends or proposing avenues of research for younger engineers to investigate. He was also a 'father figure' in communications and electronics - predicting universal mobile telephony, portable phone numbers, satellite navigation and the Internet. And he saw how communications

could change lifestyles, noting that 'the transport of intelligence and information is ... much more sensible than the much slower and more expensive moving about of human bodies'.

Alec Reeves died of bowel cancer on 13 October 1971. He had received most - if perhaps not all - of the honours he could have expected as a major scientist and inventor: an OBE and a CBE; the top medal from America's Franklin Institute; awards from professional bodies like the IEE; honorary degrees - and a stamp in recognition of PCM.

If Alec Reeves is less well known than contemporaries of similar stature such as Claude Shannon and Alan Turing, this may reflect his unconventional methods. Many creative people believe ideas are 'out there', waiting to be grasped. Reeves took the phrase literally, sharing with his father - the distinguished geographer Edward Reeves - a lifelong interest in the paranormal. Like Thomas Edison, Oliver Lodge and John Logie Baird, he thought he could communicate with the dead. He even claimed his work was 'guided' by the great 19th century experimentalist Michael Faraday.

Alec Reeves: designer of the digital age, David Robertson

Abstract : In 1937, a British electrical engineer solved a problem - and laid the foundations for the modern world. The engineer was Alec Reeves who was working at the Paris laboratories of the American multinational ITT. The 'problem' was how to reduce noise on long-distance radio telephone circuits. Since Alexander Graham Bell had invented the telephone in 1876 , speech and music were sent by what he called a 'voice shaped current' - one that varied continuously in line with the original sound. It worked well but had a key weakness. Radio and cable systems - especially long ones - needed amplifiers to boost the signal at intermediate points. But when you amplified the signal, you automatically boosted the snap crackle and pop.

Reeves' answer was as simple as it was radical. Instead of sending an 'analogue' or copy of the original sound, he proposed it be sampled at regular intervals. The values of the samples would be turned into numbers and these numbers transmitted as streams of unequivocal on-off pulses. His technique, was called Pulse Code Modulation. It eliminated unwanted noise and is the basis of all modern telecoms networks. But there is much more to Reeves' legacy, for without PCM we'd have no CDs, DVDs or CD-ROMS; no digital radio and television; no digital landline or mobile telephony; no broadband networks; no email, e-commerce or World Wide Web.

In World War 2, Reeves faced another challenge: how to ensure pilots could find their targets, especially at night and in poor weather. His answer? A 'blind bombing' system called Oboe so accurate that a bomb dropped from 30,000 feet could land within 50 yards of its target.

Later Reeves inspired the invention of that other key ingredient of our 'information age' - optical fibres that transmit huge volumes of information over tiny threads of glass. Alec Reeves is virtually unknown to the public at large. One reason may be the way he

got his ideas. He was passionately involved with spiritualism and believed he was inspired by daily 'dialogue' with great scientists from the past such as Michael Faraday.

These and other aspects of the life of a rare and controversial genius will be explored by David Robertson in 'Alec Reeves: Designer of the digital age'