One man's work in radar, television and stereo

Alan Blumlein: wartime radar pioneer

A Halifax bomber crashed 40 years ago, 10km from Ross-on-Wye in England, killing 11 people. One of them was Alan Blumlein, one of Britain's most prolific engineers, and who invented vital radar equipment used by the British during WWII.

by BARRY FOX

DO YOU KNOW who devised the first electronic television set? Or who invented stereo sound? Or even who made the crucial innovations that made radar work? It was the same man who made stereo sound on film tracks a reality and who designed the basic electronic circuits that much modern electronic equipment still uses today. His name? Alan Blumlein, a Briton, who was 38 when he died on June 7, 1942.

If you've never heard of Blumlein, you are in good company. For a host of curious reasons, varying from official secrecy to company policy, his name is familiar to relatively few people, mostly enthusiasts in the field of electronics. Details of his achievements are known to even fewer.

By the time he died, Blumlein had filed 128 patents, an average of one every six weeks of his working life. While most engineers specialise in one area, Blumlein contributed to virtually all areas of electronics. Marcus Scroggie, author of today's standard works on electronic circuits, describes him as "the greatest circuit designer and originator ever".

In his short life, Alan Blumlein devised circuits to prevent adjacent telephone lines interfering with each other, and electrical measurement circuits so accurate that they could sense the altitude of an aircraft by detecting the capacitance between it and the Earth. He designed innumerable filters and amplifiers that have become standard building blocks for the electronics industry.

He worked, under Isaac (later Sir Isaac) Schoenberg, to develop the world's first electronic TV system. The BBC used it for the transmissions from Alexandra Palace which began in November 1936. Modern TV still uses most of the same basic technology. Soon after Blumlein's death, Schoenberg told a colleague "there was not a single subject to which he turned his mind that he did not enrich extensively".

In the early 1930s, Blumlein developed and patented a stereo system on which the world finally standardised in 1958. All today's stereo relies on the same principles. His patent on stereo, BP 394 325, is a bible for audio engineers. Philip Vanderlyn, who worked under Blumlein at EMI's Central Research laboratories, in Hayes, and steered EMI into stereo 20 years later when the world caught up with his ideas, says of the patent: "It pre-empts all further useful reasoning on the subject".

English engineer Alan Blumlein (1903-1942).

After successfully cutting two channels into the single groove of a disc record in 1933 and 1934, Blumlein went on in 1935 to record two channels of sound in the optical track of a motion picture film. He did so more or less as a casual aside to developing 405-line television. Dolby Labs, the US electronics company known world-wide for its noise reduction systems, has recently revolutionised cinema sound by developing a stereo system based on optical sensors. This is so similar to Blumlein's original format that, Dolby engineers say, one of Blumlein's 35mm stereo optical films would play on the standard stereo optical film projector installed in many modern cinemas.

From television it was a logical step to radar. The work probably started well before the Second World War. Before he died, Blumlein had made seminal contributions first to "airborne interception" radar, and then to "plan position" radar, the airborne navigational aid that displays an image of the ground below. Sir Bernard Lovell, in charge of these projects later described Blumlein as "one of the best electronics engineers which Great Britain has ever produced". Sir Alan Hodgkin, who was also involved in the radar project for five years, has told how the use of Blumlein's radar inventions in the North Atlantic reduced the loss of shipping due to German submarines from 400,000 tonnes in March 1943 to less than 50,000 tonnes three months later.

When Blumlein died the Government postponed even a brief announcement

for three years, because it feared that the news of his death would give solace to Hitler – then seriously disturbed by the effect British radar was having on Germany's U-boat campaign.

There is no simple explanation for Blumlein's lack of recognition. There is just an unfortunate but fascinating set of circumstances which have conspired to deny the man the place in history which he deserves.

Perhaps the most relevant factor is the Official Secrets Act. Because he died while working on military hardware the Act has hampered historical research. The people he was working for either kept inadequate records or have since destroyed or lost them. Many of his colleagues are now dead. So no one really knows what Blumlein was doing between 1937 and 1939. Although still on EMI's payroll when he died, Blumlein was working for the Telecommunications Research Establishment or TRE at Malvern. This is now the Royal Signals Radar Establishment. Although RSRE says most of the papers on Blumlein would now be unclassified (under the 30-years rule), wartime TRE personnel were notorious for not keeping records and there is no original TRE material on Blumlein. The problem is exacerbated because Blumlein was employed by EMI not TRE.

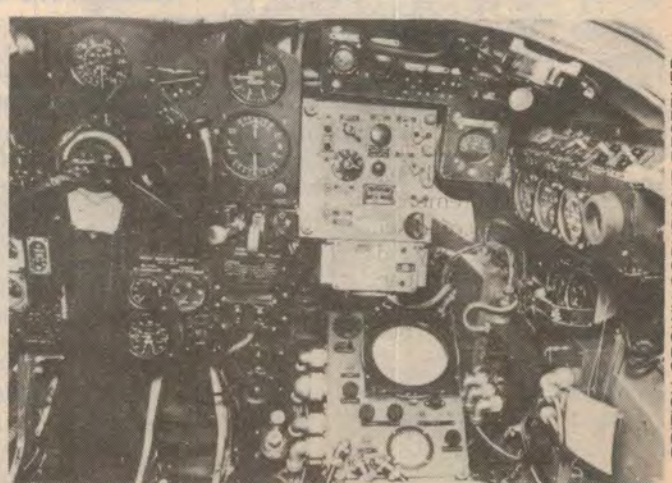
From an historical point of view Blumlein suffered a disadvantage by working for EMI, now Thorn-EMI. The company is known for keeping details of its own history to itself. Although it possesses one of the best collections of old equipment, and archives, the company has done little with them. It has files, which in historical value are priceless, of original notes made by Blumlein and his colleagues in the 1930s. These are jealously guarded, but EMI has never explained why. Original equipment, such as that used to record stereo sound on film and disc was thrown away years ago. The reason? "In the current economic climate, our first concern must be today's sales and tomorrow's products. Research into archival information cannot be given foremost priority," says Thorn-EMI's David Sowter.

Avro Lancaster bombers were among the first aircraft fitted with the PPI radar sets.

The stereo-optical sound films Blumlein made in 1935 are still on nitrate stock. This is not only dangerously explosive but also becomes sticky and loses its image with the passage of time. The National Film Archive, part of the British Film Institute, believes that even under ideal storage conditions, Blumlein's material dating back to 1935 must be on the point of irreversibly degrading. Although Thorn-EMI has been promising for five years to transfer the nitrate originals onto the safe, acetate stock, the company says merely that the work is "in hand". The problem, says Thorn-EMI, is that it is being undertaken by "an expert" who is busy with other things.

There is another reason why Blumlein's life and work remains a secret to the world at large. Whereas most pioneers are the subject of at least one biography, there is still no book on Blumlein, something of a mystery in itself. In 1967 Basil Benzimra, an engineer who decided to immortalise Blumlein, called for reminiscences about him to be sent to his son Simon Blumlein. A year later, at a seminar on Blumlein's life organised by the British Kinematography Sound and Television Society, Simon Blumlein spoke with affection about brief memories of his father, and said how he hoped with Benzimra, to write a biography.

Ill health forced Benzimra to abandon the project and it was taken over by Francis Paul Thomson, author of books on banking, the Giro money system and tapestry. In September 1973 the authoritative magazine, *Wireless World*, carried a letter from Rex Baldock, organiser of the BKSTS memorial meeting, suggesting that anyone with information on Alan Blumlein should send it to Thomson at his Watford address. At the unveiling of the Blumlein plaque in 1977, Thomson told how he had been "persuaded to write a biography".



The photograph above demonstrates the quality of the images received from even the early Plan Position Indicator radar. At right is a PPI installation in the cockpit of a Mosquito fighter of 1942.

Alan Blumlein: wartime radio pioneer

The all-black Mosquito night-fighter prototype, W4052. The radar antenna was an arrow-head design mounted in the nose between machine guns.

According to Thomson, in a letter to Huddersfield Polytechnic, he has accumulated about 80kg of material about Blumlein and his inventions and researched the inventor's ancestry back to the early 15th century. The 1982 edition of *Who's Who* contains an entry in Thomson's name referring to a book on Blumlein called "Engineer Extraordinary" published in 1977. But the Science Reference division of the British Library can find no trace of any biography of Blumlein. Thomson has declined to say when he will publish his biography, or list any articles on Alan Blumlein that he has published since he started to collect biographical material nearly 10 years ago.

But what sort of man was Blumlein and what do we know about him? He was born in Hampstead, North London, on June 29, 1903. He won a scholarship to Highgate School, where he studied science. From Highgate the young Blumlein went on to win a further scholarship to City and Guilds where at the age of 20 he got a first class honours degree in heavy electrical engineering. He stayed on at City and Guilds as a demonstrator where he helped to develop a method of measuring electrical resistance using high frequency signals. Blumlein, still only 21, described it in a paper to the Institution of Electrical Engineers.

In September 1924 Blumlein joined International Western Electric, a foreign subsidiary of Bell Laboratories, later to become Standard Telephones and Cables. His job was to improve long distance telephone lines. He worked obsessively hard, inventing a solution to every problem that he encountered. In 1929 Blumlein, looking for work outside the telephone field, joined the Columbia Graphophone Company and worked under Isaac Schoenberg. His brief was simple: find a way round some patents owned by Bell and Western Electric on the then-new system of recording sound electrically. This used a microphone, an amplifier and an electric cutter head rather than an acoustic horn and diaphragm driving a stylus. All the companies who were recording electrically had to take out a licence on the US patents.

"One of Blumlein's many contributions was the video waveform".

Coming straight from the folds of Western Electric, Blumlein was obviously in the ideal position to seek a way round the patents. He did so by designing a completely new system, with a moving-coil (electromagnetic) microphone, a novel amplifier and a moving-coil cutter head. It is interesting to note that in recent years the hi-fi world has suddenly discovered the virtues of moving coil cartridges.

In 1931, Columbia merged with another firm, called The Gramophone Company, which was famous for the "His Master's Voice" record label. The result of the merger was Electrical and Musical Industries, later to be called just EMI, and ultimately (in December 1979) to be merged with Thorn. In the 1930s, EMI was famous for its research laboratories at Hayes. It was there that Blumlein worked. He continued to improve his disc recording system, extending the frequency range to around 10kHz and then turned his attention to stereo.

If there were any justice in this world, Blumlein, or at least his employers, EMI, would have benefited from the original master patent on stereo, BP 394 325. But Blumlein, like the Bell Lab engineers who were working and patenting along similar lines in the US at the same time, was too far ahead of his time. The files of the British Patent Office tell a fascinating story. BP 394 325 was kept in force by EMI for the whole of its legal life of 16 years, despite there being no commercial demand for what it protected. In 1947 the patent expired, but at the same time EMI applied to have its life extended.

The British Patent Office, taking into account commercial losses due to the war years, extended the patent for five years. So BP 394 325 did not finally expire until December 13, 1952. But it was still too early. The first discs came onto the market in 1958. But by then the patent, on which EMI could have claimed royalties on the system, was dead and could no longer be extended.

The television system that EMI developed in the 1930s was a remarkable achievement. Equipment installed for the first transmissions in 1936, were still in use in 1950. The 405-line standard is still being used for some transmissions in Britain.

But the inspiration for the 405-line standard came from a considerably less ambitious proposal. In 1934, a government committee under Lord Selsdon recommended that Britain should have a television service, based on 240-line pictures using John Logie Baird's mechanical scanning system. Isaac Schoenberg decided to knock the Baird mechanical system on the head once and for all. He committed Blumlein, and his fellow engineers, to developing the 405-line standard. Although this looks poor alongside today's 625-line pictures it was a remarkably tough target in the mid-1930s.

One of Blumlein's many contributions was the video waveform, in which the picture information and the synchronisation pulses were all interwoven into one signal on a single frequency. The Blumlein waveform – to which engineers later added a colour signal – has become a world standard which is still in use today. It took just 18 months

Alan Blumlein: wartime radio pioneer

to design, develop and install a working system ready for the BBC launch in November 1936. By May 1937 the EMI team had produced outside broadcast equipment which could transmit King George VI's coronation – the first ever television broadcast from outside a studio.

In January 1935, while the EMI team was starting work on the 405-line all-electronic TV system, Robert (later Sir) Watson-Watt was working on a committee, chaired by Henry Tizard, for the Scientific Survey of Air Defence. They were looking for a "death ray" to defend against air attack.

But in February 1935 Watson-Watt wrote his now famous memorandum saying that although it was impossible to destroy aircraft by radio waves, it should be possible to detect them by radio energy reflected from the aircraft's body. Using BBC's transmitter at Daventry, he proved that detection by reflection was possible. Immediately, in the early spring of 1935, the whole project was covered with a security blanket of high secrecy.

It is unclear exactly when Blumlein and the EMI team became involved in the development but he filed many patents on radar circuits in the late 1930s, even though (for security reasons) they were not printed until 1946 and 1947. And we do know that by 1940 Blumlein had designed the Air Interception (AI) radar system, which operated automatically.

By the spring of 1941 they had improved the accuracy of AI radar sufficiently for one aircraft to detect another in the air several kilometres away. But it is likely that from as early as 1937, Blumlein's real aim was to develop a "plan position indicator" an airborne radar, that could display a picture of the ground or sea below. Some people believe Blumlein succeeded in this as early as 1938.

Accuracy and clarity of the image depended on the frequency and power of the signals used. The higher the frequency, the smaller the wavelength, the smaller the aerial needed, and the higher the resolution of the system. The breakthrough came with the invention of the magnetron and the klystron; the former was a carefully sculptured chamber within which high frequency oscillatory signals of great power could be generated; the klystron was an electronic circuit that achieved the same result, but with less efficiency. By early 1942 the work on the plan position radar (code-named H_2S) by EMI at Hayes and TRE at Malvern was bearing fruit.

An original "Emitron" camera tube, as used for the first regular TV service, 1936.

On June 7, 1942 Halifax V9977 took off from Defford crammed with experimental H_2S gear. There were five crew members, half Sir Bernard Lovell's engineering team and three men from EMI, including Blumlein. There was no EMI gear on V9977. But there had been much debate over whether the H_2S test flights should use magnetrons or klystrons. Winston Churchill was worried in case the magnetron, which was virtually indestructible, might fall into enemy hands if there should be a crash.

The fated bomber, Halifax V9977, was fitted with a magnetron and the flight on June 7 was made solely so that the EMI team could see how the prototype H_2S magnetron equipment worked at high altitude.

The Halifax was flying at around 2500 feet when disaster struck. The starboard outer engine failed, because an inlet valve fractured due to metal fatigue. This engine was driving the generator which supplied power to the H_2S equipment. So instead of feathering the propeller, the crew tried to re-start its engine. But it caught fire. The crew then tried to put out the fire, but found the extinguishers had not been filled. The plane crashed at 4.20pm killing everyone on board. The only piece of equipment to survive the crash was the magnetron. But it did not fall into enemy hands.

Today, plan position radar, like AI radar, television, stereo sound and numerous electronic circuits designed by Blumlein are taken for granted. It would be fitting to end on the note that although Blumlein died young, his inventions live on. But sadly, although his name will doubtless be found on a few commemorative plaques, his memory is revered only by a handful of people who have taken the trouble to read what they can about his life and work. The real tragedy of Blumlein's life is that by the time we wake up to his genius it will be too late to document that genius for posterity.

This article first appeared in "New Scientist", 3rd June, 1982 and is reproduced here with permission from the publishers.