obituary

Wernher von Braun

ONLY occasionally may it be claimed that a single individual has exerted a major influence on a global scale during his lifetime. For von Braun, who died in America on 16 June 1977, the claim may be justified since his work was of critical importance in war and peace throughout the turbulent years of the middle decades of this century. There was, too, a uniqueness about von Braun —that he exerted these influences in two nations divided for half of his life by two World Wars. For although his later triumphs belonged to America, who claimed his citizenship for the last 20 years of his life, he was a German by birth who created a devastating weapon of war in support of Hitler's regime.

Wernher von Braun was born in Wirsitz, Germany on 23 March 1912, the second of the three sons of Baron Magnus von Braun and Baroness Emmy von Braun (née von Quistorp). The ancestral family estates and his early environment might well have led Wernher to a traditional cultural life, but for the circumstance that his mother was an exceptional person. The Baroness was an amateur astronomer who presented Wernher with a telescope as his confirmation gift. We have von Braun's own authority for the statement that it was this event and his early reading of an article in an astronomical magazine describing an imaginary trip to the Moon which fired his determination to join the Verein für Raumschiffahrt (VfR–Society for Space Travel) in 1929. He was then a student at the Berlin Institute of Technology and the VfR, with Hermann Oberth as President, although founded only two years previously, was a thriving concern with over 500 members.

This VfR began the real German experimental work on rocket flight from the *Raketenflugplatz* at Reinickendorf on the outskirts of Berlin. Von Braun participated in the establishment of this 'rocket flying field' from which in 1931 the VfR claimed to have launched a hundred liquid-fuel rockets and made three hundred static firing tests. Altitudes of a mile were achieved but in spite of these successes the VfR almost immediately suffered from the economic depression in Germany. Their difficulties were enhanced by the increasing objections of the Berlin police to rocket flights within the city limits.

Imperial War Museum

Von Braun, arm fractured in a car accident, surrenders to the US Army in 1945. With him, L to R: Maj-Gen Walther Dornberger (Peenemünde Commander) and scientists Lt-Col Herbert Axter and Hans Lindenberg.

Ironically it was this rapid decay of the VfR which determined von Braun's future, for, in its desperation the group sought support from the German army. In the summer of 1932 a demonstration of a *Repulsor* (the liquid-fuel rocket of the successful 1931 tests) was given at the army proving grounds at Kummersdorf. This demonstration did not save the VfR—by 1933 it was bankrupt and was finally extinguished by Hitler and the Gestapo—but the army had been greatly impressed by von Braun and invited him to do the experimental work for his doctor's thesis (he graduated in 1932) on rocket combustion phenomena at Kummersdorf.

The army's rocket work was under Captain (later General) Walter Dornberger and his acquisition of von Braun was to prove an event of major significance. Two years later his rockets were reaching an altitude of 6,500 ft, and in 1937 the army rocket group of 80 personnel with von Braun as technical director moved to Peenemünde on the Baltic coast. There, under pressure from the army to develop a missile with a range of 150 to 200 miles and capable of carrying a one ton warhead, von Braun and his team created modern rocket technology. At last in October 1942 when a test rocket reached an altitude of 50 miles and travelled 120 miles, Hitler ordered top priority for the work.

The attacks against London with the V1 (the buzz bomb) began on 12 June 1944. On 9 September 1944, three days after the Chiefs of Staff reported that all the V1 launching sites had been captured, the world's first ballistic rocket, the V2, fell on London. These attacks continued until 27 March 1945 when all the launching sites had been captured. These V1 and V2 missiles of von Braun had killed 8,938 people and injured 24,504 mainly in the London region.

For von Braun it was an immense achievement—8,000 V1's had been launched against London alone, 1,115 V2's fell on southern England and the Germans claimed another 2,000 had been launched against targets on the continent. The V2 as a ballistic missile was far in advance of anything conceivable elsewhere in the world. Weighing 12 tons at take-off the device was 40 ft long, 5.5 ft in diameter and could carry a one ton warhead 180 to 200 miles. The engine, using a turbo-pump-fed liquid oxygen and alcohol mixture and generating a sea-level thrust of 56,000 pounds worked for a minute after which the trajectory was entirely ballistic. The V2 had an inertial guidance system with two free gyroscopes, levelling pendulums and an integrating gyro-accelerometer. The rocket climbed 60–70 miles and five minutes after lift-off dropped on the target with a speed of 3,500 miles per hour.

Familiarity with contemporary rockets should not be allowed to obscure the monumental nature of von Braun's technological achievement in the development of the V2. It was a weapon which many experts in the Allied countries believed to be impossible to achieve and against which there was no defence. The effect of the V2 on the outcome of the War could well have been decisive if Hitler had not diverted priorities from Peenemünde to the Luftwaffe which curtailed von Braun's

efforts in the period from 1940 until the end of 1942. There were also internal disputes when Himmler attempted to take control of the project—an event which led to von Braun's arrest by the Gestapo and his imprisonment early in 1944 from which he was released after two weeks only by the personal intervention of Hitler.

The second phase of von Braun's career in America culminating in the development of the Saturn rockets which launched men to the moon has received great publicity and is far better documented than the remarkable episodes in 1945 surrounding his escape from Peenemünde and his surrender to the American army. In January 1945 when it was clear to him that Hitler's Reich was about to collapse, he met secretly with his top staff members to decide whether to obey the directive to stand firm at Peenemünde and fall into the hands of the advancing Russians or escape to the south and surrender to the Western Allies. The almost unanimous decision to escape was assisted by an enormous bluff. 5,000 employees and their families together with vast amounts of literature and equipment set out from Peenemünde in February 1945 in railway trains, trucks and cars blazing prominent signs indicating a purely mythical "Project for special disposition." Carrying one of several contradictory orders implying that rocket research was to continue in the Harz mountains, the von Braun convoy forced its way through road blocks, the SS and Gestapo and eventually reached Bleicherode in the Harz mountains. 12,000 tons of equipment shipped from Peenemünde and earmarked to follow von Braun to the Harz mountains was eventually captured by the Russians in Lubeck.

At Bleicherode von Braun found himself faced with the SS General Kammler who had earlier tried to take over Peenemünde, but Kammler thought he could bargain better with the approaching Allies if he used von Braun and his team as hostages and he placed them in a prison camp at Oberammergau. Eventually von Braun managed to disperse his group into the surrounding mountains and it was from that region of the Bavarian Alps that he surrendered to the Americans early in May 1945. They had acquired one of the great technical prizes in history for, apart from the Peenemünde team, the huge underground V2 assembly plant at Niedersachswerfen was captured intact.

When he arrived at Bleicherode, von Braun hid 14 tons of documents about the Peenemünde developments in a tunnel near Dörten at the northern edge of the Harz mountains. These and large amounts of the V2 material (enough for about 100 rockets) were removed from the region only days before the Russian army moved in. Sixteen Liberty ships transported the cargo from Antwerp to New Orleans and within a year the Americans were gaining invaluable experience and commencing their upper atmosphere researches by launching the reassembled rockets from White Sands, New Mexico.

These complex and urgent movements were under the command of the US General Holger N. Toftoy, Chief of the Ordnance Technical Intelligence team in Paris. It was Toftoy who recommended that von Braun and his technical staff should be brought to the United States. On 23 July he was ordered to arrange the move but only for 100 of the staff and in early August 1945 he met von Braun at Witzenhausen to offer him a one year contract in the US under Ordnance Corps custody. Before finally leaving for the US von Braun spent two weeks in England for meetings with Sir Alwyn Crow and other members of the Ministry of Supply who had been involved in the attempts to develop British rockets during the war.

His American life began on 29 September 1945 when, with seven other members of the team, he was met at Fort Banks in Boston harbour by Col. James P. Hamill who was to be his C.O. for many years. Soon, von Braun was at Fort Bliss in El Paso, Texas. Gradually his team arrived and by February 1946 they were complete and at work on assembly and testing of the converted V2's. The first launching from White Sands, New Mexico was on 16 April 1946 and the launchings of the captured V2 rockets continued for six years during which time the U.S. Army continued to move forward from the V2 technology under von Braun's guidance.

In 1947 von Braun was given permission to return to Bavaria to marry his 18 year old second cousin Maria Louise von Quistorp, and there are two daughters and a son of the marriage.

In October 1949 the Secretary of the Army gave formal approval for the transfer of the rocket group to the Redstone Arsenal in Huntsville, Alabama. The move in 1950 involved 500 military personnel, several hundred U.S. civilians and the technical core of von Braun and 130 members of his original Peenemünde staff. Hamill was in charge, with von Braun as director of the Guided Missile Development Division.

These were critical years for the US missile developments—spurred by the needs of the Korean War the Redstone missile was developed. First fired from Cape Canaveral in August 1953 it was the first missile to be in operational use in the US Army and was soon to play an unforeseen and dramatic part in the space research.

At that time intelligence sources found evidence that the USSR was in an advanced stage of development of an intercontinental ballistic missile (ICBM). All three US armed services were thereby spurred to vigorous development of an ICBM. The creation of the Army Ballistic Missile Agency in Huntsville under General Medaris was centered around von Braun as technical director. The Redstone rocket was upgraded and two upper stages were added to form the vehicle known as Jupiter C. The first stage

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3 February 1958. Holding a model of the successful Explorer satellite launch vehicle, L to R: William Pickering, Director of the Jet Propulsion Laboratory; James Van Allen; von Braun.

was a Redstone missile lengthened to hold more propellant and the engine was modified to burn a new fuel—hydyne, a mixture of unsymmetrical dimethylhydrazine and diethylene triamine. The second stage was a cluster of eleven solid-propellant rockets and the third stage fitting inside the ring of the second stage comprised three solid fuel rockets. Von Braun stabilised the system by spinning it rapidly during flight and on its first flight from Cape Canaveral in September 1956 this remarkable vehicle reached an altitude of 682 miles and travelled 3,400 miles.

Ironically and almost immediately the Army was ordered to concentrate on short range missiles while the control of the ICBM programme passed to the Air Force. External events, however, once more determined a different destiny for von Braun.

In 1954 he showed that it would be possible to launch an earth satellite using the Redstone rocket assemblies as in the Jupiter missile. His scheme, under the code name Project Orbitor, was considered by an advisory group under Assistant Secretary of Defence Donald A. Quarles who outvoted the idea by 7 to 2 at a meeting on 9 September 1955, in favour of Project Vanguard, an alternative proposal from the Naval Research Laboratory. The official record states that the decision was based on technical recommendations of the advisory group. More probably the phrase covers the persuasion of President Eisenhower that the military association and the constraints of the secrecy classification on the Jupiter C rocket would be harmful to the peaceful intent of the satellite project. In the event Vanguard, based on sounding rocket technology and aside from the main stream development of the U.S. military ballistic rocket, inadequately financed and with no appropriate priority, was an almost total disaster.

In the turmoil created by the success of Sputnik One on 4 October 1957 von Braun again pressed his case from Huntsville that he should be allowed to use the army's Jupiter missile to launch a satellite. Three weeks after the launching of Sputnik he was given three and a half million dollars with a target date of 30 January 1958. Once more he triumphed—on 31 January the Jupiter rocket placed Explorer 1, the first American satellite in Earth orbit which within a few days discovered the zones of trapped particles around the Earth (the van Allen zones). The decade of intense technological rivalry between the US and USSR following these events would have borne a radically different aspect if von Braun's advice had been followed in 1955.

After these events the Eisenhower administration took immediate action to create a unified US space effort. Following the advice of a committee under James R. Killian steps were taken to create a strong civilian-orientated agency to direct the manned and unmanned exploration of space. The National Aeronautics and Space Act became law on 29 July 1958. Successively this National Aeronautics and Space Administration absorbed the 8,000-strong National Advisory Committee for Aeronautics, the Vanguard and NRL groups, the 2,800 staff of the Jet Propulsion Laboratory of CalTech and then in January 1960, President Eisenhower decreed that the vital army group, with 4,600 personnel under von Braun should be transferred from army to NASA control. On 1 July 1960 the transfer was effected when the President personally visited and dedicated the facility as the George C. Marshall Space Flight Center with von Braun as director.

Four years earlier von Braun had begun studies of rockets which would be far more powerful than the Redstone combinations. He knew that the rockets required for intercontinental missiles would never provide the thrust required to place man into space. In August 1958 he already had approval to develop a multiple Redstone/Jupiter combination with a thrust of 1.5 million pounds, and by the time of his absorption into NASA he had a priority rating for the development of vehicle known as Saturn 1. In October 1961 this 162 ft long carrier rocket weighing a million pounds had its flawless test launching from Cape Canaveral. By January 1964 a 3,700 pound test payload was placed in orbit. Thereafter von Braun progressed majestically and incredibly to the targets of the Apollo programme and to the fulfilment of his vision.

These early Saturn vehicles were mere stages towards the mammoth Saturn 5, the development of which was approved by NASA in January 1962. Standing 364 ft high, Saturn 5 weighed over six million pounds and could send 47 tons of payload to the Moon or place 140 tons in Earth orbit. The landing of Armstrong and Aldrin on the Moon in July 1969 was an operation of extraordinary complexity; an immense collaborative enterprise which von Braun and the Huntsville team made possible by designing this multi-million pound thrust rocket. From assembly to the count-down the monitoring system alone needed 10 miles of tape storing over 2.5 million words.

Von Braun witnessed the fulfilment of a youthful dream in his fifty-eighth year. No longer did it seem technical fiction that he wanted to proceed even further along this path. He had designs to get man even further into space. First he would have strapped on solid rocket motors to the first stage of Saturn 5, then to get the men to Mars he planned to replace the existing liquid hydrogen–oxygen third stage by a nuclear engine. But this remained a dream; NASA was forced to cut the space programme and within a few years of the climax of Apollo 11, von Braun had the chagrin of witnessing the dismantling of the facilities and the dispersal of the men who had made Saturn a reality.

In 1970 von Braun was made Deputy Associate Administrator for Plans in NASA, an office which he held until his retirement at the age of 60 two years later. He then joined Fairchild Industries as Vice President for Engineering and Development but became ill with cancer and retired finally a few months before his death.

Von Braun was an extraordinary symbol of the age. His vision was of a nature which the establishment looked upon as science fiction but by single-minded persistence he astonished the world by succeeding through the labyrinth of war and peace, first as a German and then as an American citizen. Although von Braun was granted American citizenship in 1955 and rescued the Americans from their despair in the face of the Soviet Sputnik, there were those who could not forget that he laboured for the Nazis. But for von Braun the transformation was complete. He built his rockets to get men away from the earth—his imprisonment during the Peenemünde era resulted from an unwise remark that the V2 would help towards space travel—and he succeeded.

Bernard Lovell

D. W. Holder

At the time of his death on 18 April 1977, Professor Holder had been Head of the Department of Engineering Science at Oxford for close on sixteen years. In that time the laboratory had expanded at both the undergraduate and postgraduate level and much of the planning for this growth stemmed from his own initiatives.

He was educated at Imperial College in the Department of Civil Engineering between 1941 and 1943 and subsequently in the Aeronautics Department under Sir Leonard Bairstow. After graduating he immediately joined the Ministry of Aircraft Production at the Aircraft and Armament Experimental Establishment at Boscombe Down but soon transferred to the Aero-