

GERMAN

V-2

WWII BALLISTIC MISSILE 'TOUCHSTONE TO THE STARS'

On September 8, 1944, a large, streamlined object hurtled from space towards Great Britain. At 6:43 P.M., traveling nearly 2,000 miles per hour, it struck the quiet London suburb of Chiswick-on-Thames with an earth-rocking explosion. A second object fell on London just sixteen seconds later. Launched only minutes earlier from a mobile unit in German occupied Netherlands, this was the world's first encounter with Hitler's V-2 rocket, the second of his Vergeltungswaffen, or Vengeance Weapons. Two V-2 missiles had been launched unsuccessfully against Paris two days earlier.

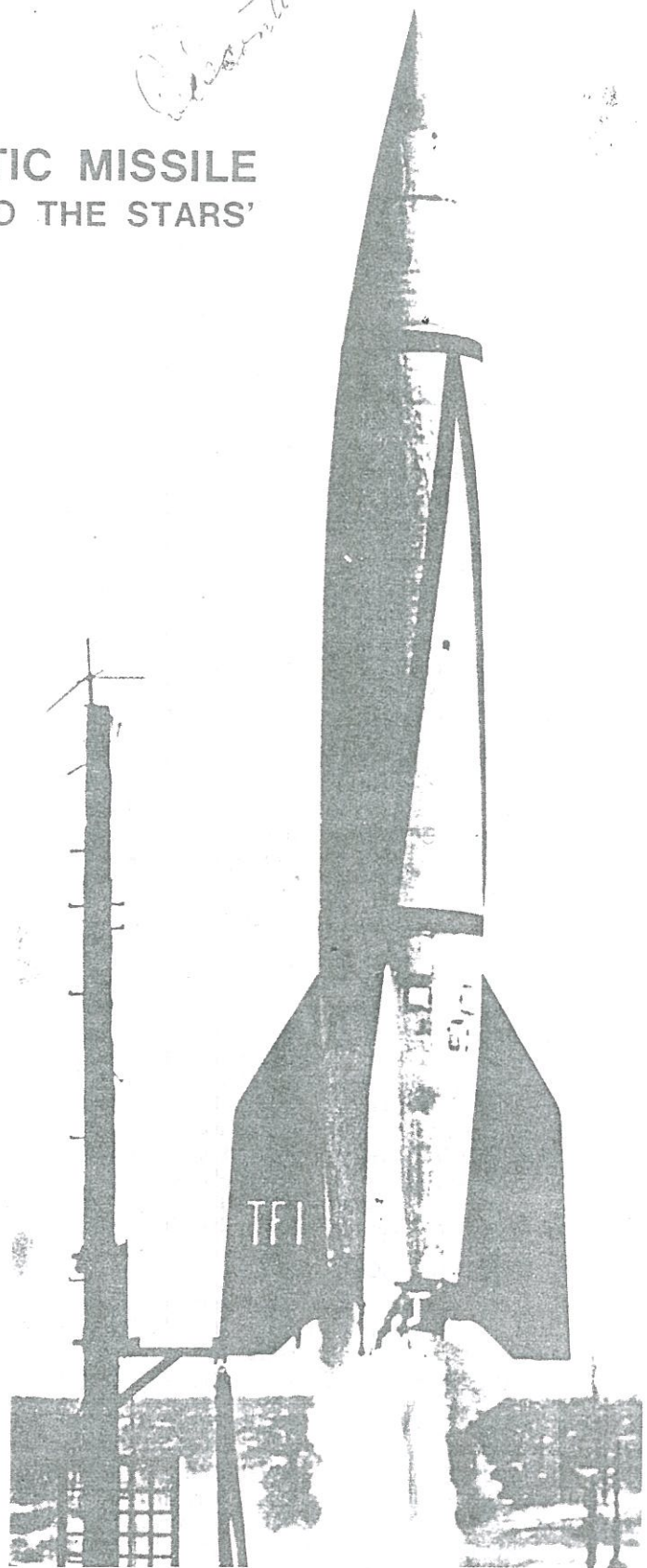
Although dwarfed by space boosters and missiles of today, it was a giant for its time. Standing 46 feet high with a diameter of 5-1/2 feet, the V-2 weighed just over 28,000 pounds. It could deliver a combined explosive payload and warhead weighing over one ton (2,200 pounds) to a target 200 miles away.

The guidance compartment was divided into four sections and contained radio equipment, steering gyros, batteries and compressed air cylinders. Four removable panels provided easy access for pre-launch adjustments. Two large, aluminum tanks containing the liquid fuel and oxidizer were located in the main body section. The tail section included the propulsion unit and its pumps as well as the stabilizing fins and attitude control vanes. Using turbopump-fed liquid oxygen and an alcohol-water mixture, the rocket engine produced an average sea-level thrust of 56,000 pounds. A generator which combined hydrogen peroxide and potassium permanganate provided steam to drive the turbopumps. Missile construction consisted of a 2-millimeter thick steel skin over a lightweight supporting framework.

V-2 FLIGHT PROFILE

Launched vertically, the missile climbed slowly from its stand. Four seconds after lift-off, a programmed one-degree-per-second tilt began until an angle of 47 degrees from the vertical was attained. At 25 seconds and an altitude of 2 miles, the rocket reached sonic speed, or Mach-1. (Figures given are approximate since target distances and trajectories varied.) Maximum dynamic pressure was reached at 42 seconds while traveling 1,476 mph (Mach-2) at an altitude of 6.2 miles. An engine cut-off signal was given at about 63 seconds. Following shut-down at an altitude of 15.5 miles, the missile reached a max. speed of 3,355 mph (Mach-4.5) and had traveled 13 miles from the launch site. During the powered phase, steering vanes controlled the V-2's flight path. After coasting unguided to a peak altitude of 50 miles, it began a downward arc towards the target. Upon re-entering the denser atmosphere (altitude - 18.6 miles), exterior skin temperatures often reached 1,000°F. Early missiles often broke apart due to the high speed and severe aerodynamic stresses. Slowing to a velocity of 1,800 mph at impact, the V-2 reached its target just 5-1/2 minutes after launch.

Normally used against large targets, average range was 190 miles. V-2's using beam-rider guidance achieved an impact accuracy of \pm 1-mile. The long, cylindrical shape and dark green paint job earned it the nickname "Cucumber". Unlike the smaller aircraft-type V-1 robot bomb, there was literally no defense against the V-2 once it had been launched. As the world's first operational intermediate-range missile, it represented a turning point in modern warfare.



COURTESY US ARMY - WHITE SANDS MISSILE RANGE



A SUBSIDIARY OF DAMON

V-2 DEVELOPMENT

Early in 1930 the German Army began looking for a superior weapon system which was not prohibited to them by the Treaty of Versailles. A group of four men began a small scale effort at Kummersdorf near Berlin to find out what could be done with solid and liquid-fueled rockets. In March of 1936, decisions were made which began to shape the V-2. At that time the missile was known as the A-4, or Aggregate-4, meaning "assembly number four".

Obviously, a permanent, fixed launching base would be vulnerable to enemy aircraft. It was decided that the rocket should be mobile, small enough to be shipped on normal roads, even through small villages, or on a single railroad car through all European railroad tunnels. Research reached its peak in 1943 at the Peenemunde test facility located in Northern Germany along the Baltic coast. One area was used by the Air Force for testing of the V-1 glide bombs, jets, jet aircraft, and various guided missiles. An even larger Army Experimental Station employed almost 17,000 engineers and workers. It was commanded by General Walter Dornberger and his technical chief, Wernher von Braun. Both Dr. Dornberger and Dr. von Braun were part of the early research group formed in 1930.

The first successful A-4 launching took place on October 3rd, 1942. Following three earlier unsuccessful attempts, test vehicle number V-4 made a perfect, textbook flight. It broke all previous rocket records for speed, altitude, endurance and distance.

An enormous underground factory in the Harz Mountains eventually produced up to 30 missiles per day. It was commonly referred to as Mittelwerk meaning "Center Plant" so as not to reveal the location. Had Hitler supported efforts at Peenemunde prior to 1943, improved V-2 rockets plus operational Wasserfall anti-aircraft missiles would have made Allied air supremacy over Germany more difficult. Altogether, 3,745 V-2's were launched between September 6, 1944 and March 27, 1945. Approximately 1,115 fell on England, 2,050 on Allied targets in Europe and 580 rockets were used for research and launch crew training.

PROJECT BUMPER

Following World War II, captured V-2 rockets were brought to the United States. They served as experimental vehicles at the nation's first missile testing center at White Sands Missile Range, New Mexico. From a five-year experimental program conducted at WSMR emerged the first of America's large missiles. By 1951, a total of 67 modified V-2's had been sent aloft over the New Mexico Desert. Between 1948 and 1950, the Bumper Project fired eight spectacular two-stage rockets. The V-2 nose was modified to accommodate a 16 foot long WAC Corporal rocket. Bumper-WAC No. 5 sent its upper stage to an altitude of 250 miles and a speed of 5,510 miles per hour -- the world's record at that time.

DOORWAY TO OUTER SPACE

Although the wartime V-2 suffered from many operational problems, it was a missile of many "firsts". The forerunner of today's intercontinental missiles, it proved to be the cornerstone of man's research into outer space. Following the first successful A-4 flight, Dornberger remarked, "We have invaded space with our rocket and for the first time --- have used space as a bridge between two points on the earth; we have proven rocket propulsion practicable for space travel. To land, sea and air may now be added infinite empty space as an area of future intercontinental traffic... This... is the first of a new era in transportation, that of space travel..." Under the circumstances, these words were indeed interesting for a military officer. But it did show that the rocket scientists were not thinking strictly in terms of weaponry. Continuing the pioneering efforts of Robert Goddard and Hermann Oberth, they knew that Peenemunde would someday be recognized as the birthplace of spaceflight.

V-2 MISSILE CUTAWAY

