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Project Paperclip

It was an all-out race to seize the best German scientists and technologies. America won.

By Walter J. Boyne

Even as World War II ground toward its bloody climax, Germany continued to astound the world with amazing new technological marvels. Hitler's reich, in the war's last days, introduced rockets, jet fighters, V-1 unpiloted aircraft, lethal V-2 missiles, and a host of other military advances.

The nations on the verge of defeating Germany naturally wanted to exploit these developments and make the new war-making capabilities their own. Thus erupted a spontaneous international race to acquire equipment, documents, engineers, and scientists who produced the German weaponry advances.

The pressing need to secure the cream of enemy assets was obvious, and the Joint Chiefs of Staff on July 20, 1945 codified many different intelligence efforts into Project Overcast.

This provided the initial guidelines for seizing, holding, using, and returning enemy nationals. After the surrender of Japan, however, protests broke out over the use of former enemy personnel for national military purposes. This forced a name change, and, in March 1946, the effort to gather top-secret Nazi technology became known as Project Paperclip.

The term "Paperclip" stemmed from the fact that dossiers of the most highly valued scientists were flagged with paperclips.

The initial driving factors behind Overcast-Paperclip were complex. The armed services wanted to use German capabilities in the war against Japan. The State Department's primary concern was preventing a resurgence of German might, as had occurred after World War I. Underlying this was a pervasive desire to exploit the intellectual capital of the former enemy for the future.

The program was controversial; nearly all the sought-after scientists and engineers had connections to the Nazi party, the German war effort, or even, in some instances, to war crimes. Despite a universal reluctance to deal with anyone connected to the Nazi regime, necessity forced the military authorities to skirt the rules prohibiting their use.

The German intellectual capital

Army Maj. Gen. H.N. Toftoy (back left) with some key scientists brought from Germany. Left to right, they are: Ernst Stuhlinger, Hermann Oberth, Wernher von Braun, and Eberhard Rees.

was formidable and priceless. German achievements extended beyond mere advances in weapons. They included developments in wind tunnels, materials, and other disciplines necessary to build an advanced scientific infrastructure.

Other countries were less successful than was the United States, which clearly won this race despite the admonitions of Gen. Dwight D. Eisenhower that there were to be no dealings with any Nazi. Initially, the United States planned to permit only about 100 individuals to enter the country. Ultimately, however, Washington approved the entry of about 700, with family members.

There were many reasons for the United States' greater success in exploiting the accumulated information and potential contributions of its former foes.

The primary cause of success was the vision of Gen. H.H. "Hap" Arnold, Commanding General of the US Army Air Forces, whose strong penchant for research and development led to his work with Theodore von Karman, the Hungarian emigre who established the Scientific Advisory Group (later the Scientific Advisory Board) in 1944. (See "Von Karman's Way," January 2004, p. 74.) Arnold's backing and von Karman's connections in academia created the climate and top cover for Air Technical Intelligence personnel to scour the German countryside and gather the necessary data, equipment, and personnel.

Col. Donald L. Putt, backed by Gen. Carl A. "Tooey" Spaatz, led an aggregation of specialist teams in Operation Lusty. This was the most immediately successful of the competing operations racing across Germany, and it was the one that had the most direct effect on aeronautical research. (See "Operation Lusty," January 2005, p. 62.)

Exploiting enemy technology was commonplace in World War II. Examples ranged from the purely serendipitous (as when an FW-190 fighter inadvertently landed in Wales) to the carefully planned (as in the daring British commando raid on the German Freya radar site at Saint-Bruneval on the French coast).

Dirty Dozen

The Allied countries devised multiple schemes to gather up hardware, data, scientists, and engineers. Some had a reckless "Dirty Dozen" flavor—and most failed.

Large-scale efforts did not get under way until after the June 6, 1944 D-Day invasion of France. Then, teams were able to advance across the European countryside just behind the front lines. The AAF formally combined technical and post-hostilities intelligence objectives on April 22, 1945, using the code name Operation Lusty.

They were searching for technology for use against Japan and to accelerate American development of advanced systems.

For example, weapons such as the Henschel Hs 293 guided missile promised to be useful if the war against Japan continued.

Air Technical Intelligence units were competing with more than 30 allied technical intelligence groups to gain information from captured equipment.

Under Putt's leadership, ATI teams swarmed over Germany as it collapsed. A special group led by Col. Harold E. Watson made the most immediate impression on AAF leaders by snapping up copies of the latest German aircraft, which were transported to Ohio for test and evaluation.

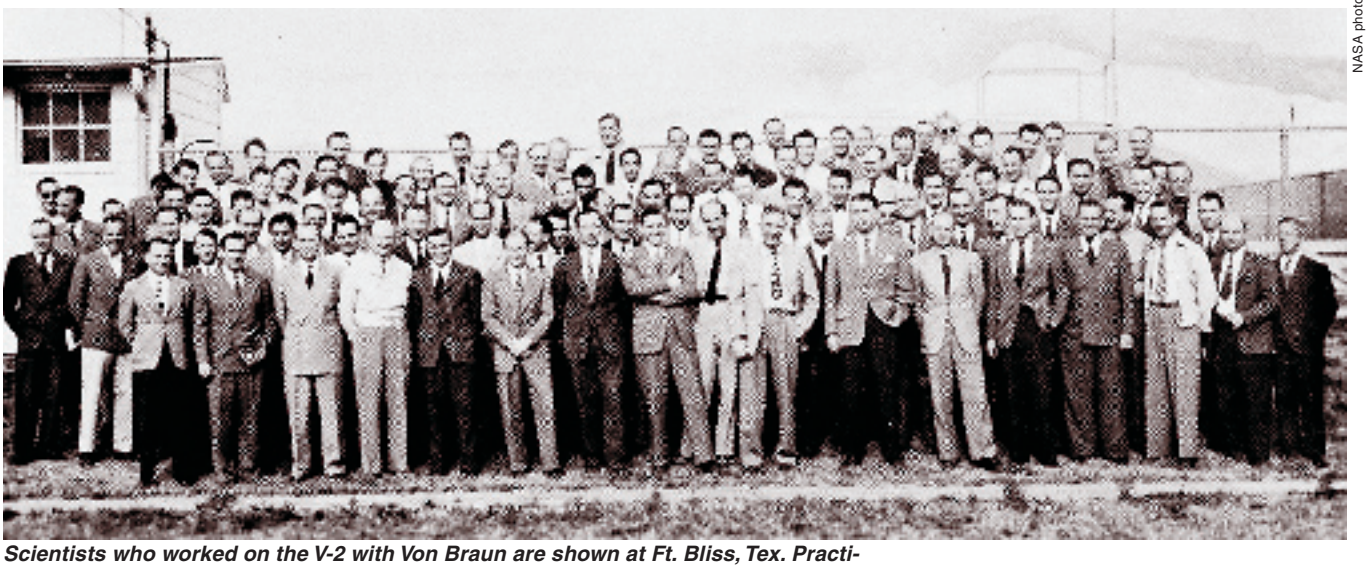
However, the most productive long-term discoveries were made by teams led by Putt and other members of the Scientific Advisory Group. These teams swept through the well-known German research centers in Stuttgart (the Graf Zeppelin Research Establishment), Goettingen (the Aerodynamics Research Institute), and von Karman's old stomping ground at Aachen. There they met their peers, leading academics, many of whom they knew personally and had worked with before the war.

Putt was astounded when, on April 13, 1945, he was led to a previously unknown German research site, the Hermann Goering Aeronautical Research Center at Voelkenrode.

Never detected by American intelligence, it was a well-camouflaged facility of Goeringesque proportions on the outskirts of Braunschweig. Almost 80 buildings, including seven wind tunnels, were hidden under a carpet of earth from which trees grew, blending the facility into the surrounding forest. (Some wind tunnel parts captured in Germany are still in use in the United States today.)

Putt immediately saw that a full exploitation of the information available required the presence of his old friend, von Karman, and his colleagues.

Unfortunately for Putt, Voelkenrode was in the area designated for occupation by Britain, so he was forced to maximize his yield by doing some rapid "midnight requisitioning" of key documents and



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Scientists who worked on the V-2 with Von Braun are shown at Ft. Bliss, Tex. Practically under house arrest at first, they jump-started American ICBM efforts.

German Aerodynamics and the B-47

Project Paperclip is most famous for bringing top German rocket scientists and technologies to the US, but the seizure of war technology led to other important advances. Among them was validation of swept-wing aircraft designs.

Recovered in Germany were computations establishing the benefits of sweeping a wing. George Schairer was able to convince Boeing to modify its B-47 design to incorporate wings with a sweep back of 35 degrees. Schairer's information was distributed to the aircraft industry and similarly induced North American to accept a six-month delay to rework its P-86 from straight wings to a 35-degree sweep.

The following is a transcription of Schairer's handwritten May 10, 1945 letter from Germany. At the time, Schairer was Boeing's chief aerodynamicist. (Letter courtesy of John H. McMasters.)

G.S. Schairer
Voelkenrode
Germany
5/10/45

B. Cohn
Boeing Aircraft Co.
Seattle, Wash., USA

Dear Ben,

It is hard to believe that I am in Germany within a few miles of the front line. Everything is very quiet, and I am living very normally in the middle of a forest. We have excellent quarters, including lights, hot water, heat, electric razors, etc.

We are seeing much of German aerodynamics. They are ahead of us on a few items which I will mention.

The Germans have been doing extensive work on high speed aerodynamics. This has led to one very important discovery. Sweepback or sweepforward has a very large effect on critical Mach No. This is quite reasonable on second thought. The flow parallel to the wing cannot [affect] the critical Mach No., and the component normal to the airfoil is the one of importance. Thus the critical M is determined by the airfoil section normal to the wing and by the sweepback. ...

This is not complicated by adding a body at the center but is badly [affected] by most nacelles.

This effect can also be used in propellers by sweeping the tips backwards.

A certain amount of experimental proof exists for this sweepback effect. Only the Me-163 has used it so far as I can find out. Naturally many control and stability problems are to be encountered in using large amounts of sweep.

I do not know how soon this info will get around to other manufacturers, so will you write letters to Ozzie [W.B. Oswald, Douglas], C.L. Johnson ["Kelly" Johnson, Lockheed], R. Bayless [Ralph L. Bayless, Consolidated (Convair) Aircraft], E. Horky [Ed Horky, North American], E. Sheafer [E.V. Schaefer, Martin], & Darby [Bob Darby, Curtiss], quoting pages 2-5 for their information.

I am having a fine time. I even use my electric razor wherever I go. I have seen Kinnaman & Martin often. There is plenty to eat. Hope things are going well for you. My best to all the gang. They are sure tops in all comparisons.

Sincerely,
George

equipment and flying it out in war-weary B-17s and B-24s.

Putt's work annoyed the British but pleased his taskmaster boss, Maj. Gen. Hugh J. Knerr, who ordered him to Wright Field.

The ATI teams continued to gather up German experts wherever they could be found. When the European war ended on May 8, 1945, the United States had in custody almost every leading German aircraft engineer, including the young inventor of the German jet engine, Hans-Joachim Pabst von Ohain. (See "The Converging Paths of Whittle and von Ohain," January 2006, p. 70.) It was a stupendous haul and was infinitely more valuable for the work the scientists might do in the future than for the work they had done in the past.

Army intelligence teams were operating with the same diligence as their ATI counterparts, searching everywhere for equipment, data, and personnel that would be helpful in the future. Enormous publicity had been generated by the debut of the notorious V-1 and V-2, nicknamed "vengeance" weapons by Nazi propaganda minister Joseph Goebbels. This tended to cause the intelligence teams to focus more intently on German missile development.

The V-1 (officially the Fiesler Fi 103) flying bomb was essentially an updated version of the 1917 Kettering "Bug" concept—a cruise missile. It was powered by a pulse-jet engine and equipped with a primitive guidance system. The characteristic noise of the pulse-jet lent the nickname "buzz bomb" to the weapon, also called "Doodlebug" by battle-hardened Londoners.

The V-1 entered combat on June 13, 1944 when 10 were fired against London. Two days later, almost 300 were launched, and the "Flying Bomb Blitz" began. Ultimately some 29,000 V-1s were built. Of these, 8,000 were fired against London, with 2,419 hitting their target, killing almost 6,000 Britons.

A much larger number of V-1s struck liberated Antwerp. The majority were launched from ground stations, with about 1,200 being air launched in the manner of a modern ALCM.

The V-1 was copied in the United States as the JB-2 Loon. About 1,000 were built, but were not used in combat.

In the meantime, other Army teams were after the German engineers who had created the V-2 ballistic missile, considered by many to be the most advanced weapon of the war other than the atom bomb.

Enter von Braun

The Army teams were impressed by the advanced technology of the V-2, especially compared to previous American efforts which lacked the size or payload of the V-2. More importantly, unlike the V-1, the V-2 was essentially impossible to intercept.

Led by the charismatic young Wernher von Braun, the members of the Society for Spaceflight traded their technical expertise for German Army funds beginning in 1934. While their scientist eyes may have remained fixed on the stars, their lethal products were designed to hit London and, ultimately, New York.

Weighing almost 30,000 pounds, the V-2 was perhaps Hitler's last remaining hope to force Britain from the war. More than 10,000 were manufactured, largely by slave labor working under hideous conditions. Some 1,400 were launched against Britain, with about 500 hitting London, killing about 2,600 people. As the Allies gained ground after the invasion, Antwerp became the principal target.

In retrospect, the V-2 was a wasteful project for Germany. It consumed scarce resources that might have been better used elsewhere, and its total delivered tonnage was less than that being delivered by the RAF or AAF in a single raid.

Nonetheless, more than any other German weapon, the V-2 pointed the

way to the future, and the Army was determined to learn its secrets and moved swiftly to round up German scientists and equipment.

Von Braun had earlier forged documents that permitted him, 500 personnel, and extensive documentation to leave their experimental station to escape the oncoming Soviet forces. Despite this tremendous drain on V-2 brainpower, production continued at the notorious Mittelwerk facility at Nordhausen until April 10, 1945.

Knowing that Nordhausen was slated to come under Soviet occupation, the US forces worked swiftly to take as much from the Mittlewerk plant as possible. The first trainload of V-2s, parts, machinery, and equipment departed on May 22, 1945. Within nine days, more than three trainloads were sent to Antwerp, carrying enough material to manufacture 100 V-2s. Von Braun, his Nazi supervisor, and 126 principal engineers were captured on May 2, 1945.

Von Braun and the top seven members of his team arrived at New Castle AAF, Del., on Sept. 20, 1945. They were soon sent to a long-term assignment at Ft. Bliss, Tex.

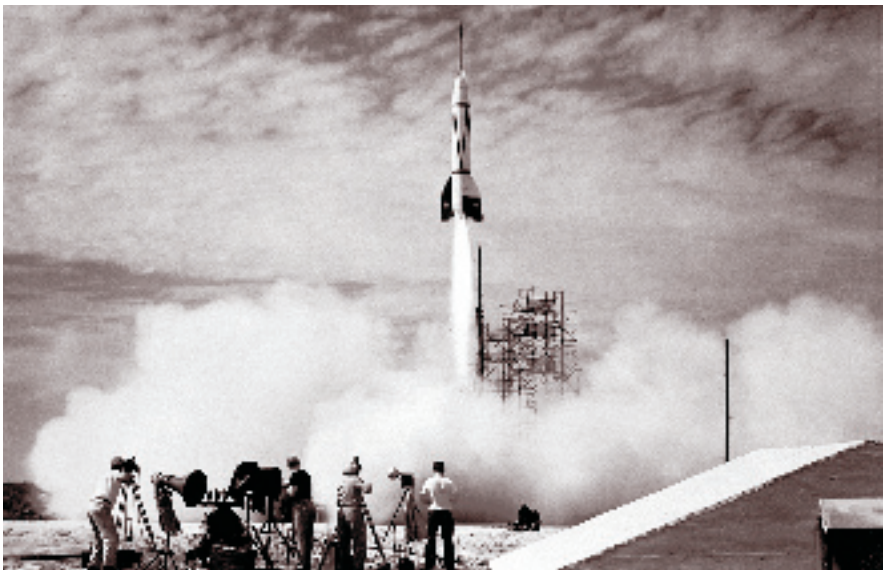
Their first task was to prepare V-2s for launch at the White Sands Proving Ground in New Mexico. The repatriated German scientists were generally well-treated, but were unable to leave the station without military escort.

When Japan surrendered, ending the war, US use of former Nazi scientists provoked strong domestic political protests. The view was that, with hostilities over, there was no continuing need. The knowledge already flowing from the captured scientists ruled out any major change in course, however.

On April 16, 1946, the first V-2 was launched in the United States. This would be followed by 63 more rockets, all carrying a wide variety of instruments and all intended as scientific experiments.

This mass transfer of personnel and equipment accelerated the US development of ballistic missiles. The V-2 itself became the baseline from which many later rockets were derived. The first of these was a complex, sophisticated family of rockets under the project umbrella name Hermes. With a contract awarded to General Electric in 1944, Hermes came to include the V-2 test program itself as well as other derivatives from the V-2.

The success of the American V-2 experiments also provided confidence to other firms developing rocket designs that did not use V-2 technology per se, as in the case of the Convair Atlas or the Douglas Thor. This influence extended for decades. In 1955, the Air Force launched the Titan program as a backup to the Atlas.



NASA photo

An improved V-2, called "Bumper," blasts off from Cape Canaveral, Fla.

Author William Harwood quotes Martin executive William G. Purdy as saying that the connections made with German engineers at Ft. Bliss continued on into the Titan era. Titan missiles carried the highest-megaton warhead of all USAF missiles and served as Gemini and later Air Force and NASA satellite launch vehicles.

Von Braun and his team were transferred to the Redstone Arsenal at Huntsville, Ala., in April 1950. Still nurturing his long-held dream of spaceflight, von Braun led the efforts resulting in the Redstone, which was longer and heavier than the V-2 and equipped with an inertial guidance system. The Redstone had a range of 250 miles and led directly to the larger Jupiter, an intermediate range ballistic missile with a 2,000-mile range.

In 1955, Defense Secretary Charles E. Wilson gave USAF responsibility for developing the ICBM. For intermediate range missiles, the Air Force was to develop the Thor, while the Navy adopted the solid fuel Polaris. These sudden shifts meant that the Air Force had inherited the legacy of the von Braun team and was destined to assert its dominance in space.

Von Braun and his team moved closer to their original dreams as the Redstone and Jupiter became important factors in the space race. America's long series of embarrassing, televised space-launch failures ended with the use of a Jupiter C on Jan. 31, 1958. It was used to launch America's first satellite, Explorer 1.

The influence of the Paperclip scientists did not end yet. NASA came into existence on Oct. 1, 1958. In 1960, NASA opened the Marshall Space Flight Center in Huntsville, with von Braun as the center's first director. In 1961, Mercury Redstones safely launched Alan B. Shepard Jr. and Virgil I. "Gus" Grissom on suborbital spaceflights.

Von Braun led the Marshall center until February 1970, where he and his team accelerated work on the Saturn series of launch vehicles that they had begun developing under Army auspices in the late 1950s. The original Saturn I was little more than a group of Jupiter rockets strapped together, but the later Saturn V was a massive and supremely reliable system.

The Saturn represented the peak of von Braun's contributions to NASA, but he and many of his colleagues went on to serve the United States and the free world in many capacities. Their influence on the world of aeronautics and astronautics is felt to this day. ■

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