

DARK HORSE RUNNING, The Bell and Martin-Bell Cold War Orbital Glide Bomber

By Dave Stern

TRAVELING OUTBOUND

It has long been the dream of earth-bound humanity to leave the safety and security of its nest and travel outbound through space to explore. The previous century offered two possible future parallel methods whereby this might be achieved. First, a brute force vertically launched multi-stage rockets placing a purpose-built craft into orbit or deep space, but powered by chemical fueled rocket engines. Still embryonic in the 1920s, its engineering and operating principles remained to be learned, thus providing a challenge and steep learning curve for inventors and engineers alike. Still, this unproven method was enthusiastically championed by such luminaries as Konstantin Tsiolkovskiy, Robert H. Goddard, Herman Oberth, the VLR (German Rocket Society), Werner von Braun and other supporters.¹

The second, a parallel earth-escape mechanism was a rather more elegant advanced hybrid winged aircraft escaping earth's gravity, and thrust aloft via multi-stage rocket boosters. Such aircraft were either non-powered or equipped with an onboard liquid fueled rocket engine (as were several winged expeditionary spacecraft proposed for Lunar and Mars missions during the 1950s). They would operate in low earth orbits (LEO) but execute a high-speed glide return to earth and accomplish a powerless landing (exactly as performed by the Space Shuttle decades later). However the requisite high speed aerodynamics and supersonic flight data was non-existent for engineers to design a survivable intra-atmospheric and exo-atmospheric aircraft.



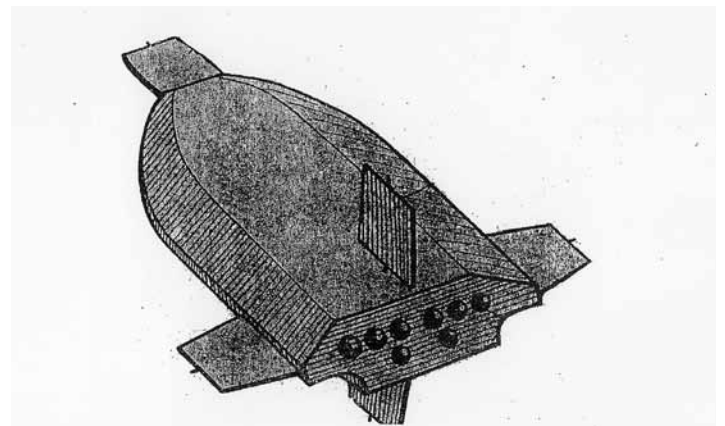
One of Valier's race cars rigged with rocket motors smack against the back of his seat. Had they exploded with any force Max could have been fatally wounded. This unidentified auto is but one of a few Max used in his rocket experiments. (Library of Congress photo)

ROCKET AIRPLANES

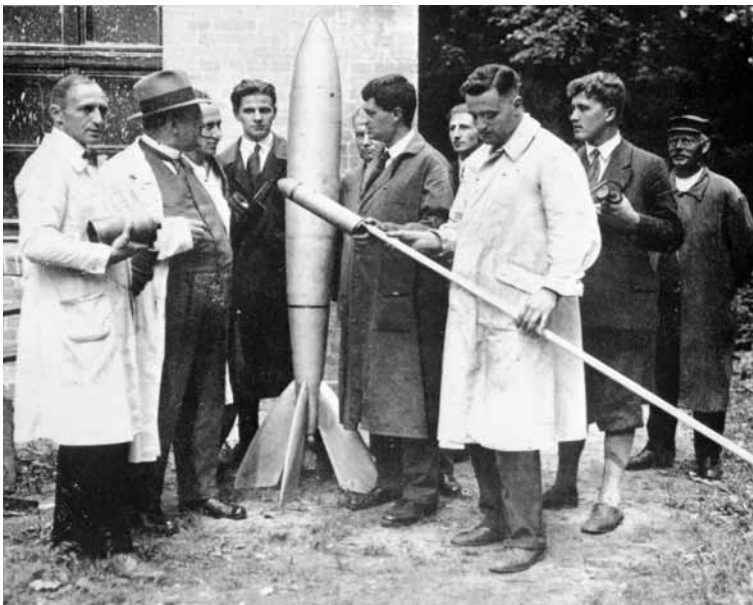
Early rocket designs were crude and dangerous solid and liquid fueled rocket engines that were constructed and jury-rigged in cars (Opal race cars), gliders and the (1928) two seat Mueller-Griesheim monoplane (only its liquid-powered rocket engine was ground tested).² Predictably, the airplane and rocket engine were eventually mated resulting in the Heinkel 176, flying on June 20, 1939; unfortunately the plane's low thrust rocket engine generated disappointing performance.³

In Germany, during the 1930s-1940s, the Zeppelin-Werkes and Peenemunde high speed wind tunnels provided early supersonic data for the German Peenemunde rocket team to choose a body and fin design for their A-4 (V-2) project.⁴ Winged rocket-powered airplanes were still supported by advocates like Fritz von Opel, von Hoefft, Max Valier, von Braun, Sanger-Bredt and Alexander M. Lippisch, who created the Me-163 Komet rocket interceptor applied in defending the Fatherland's petroleum refineries.

Enthusiastic support of winged space airplanes was evinced by Franz Edler von Hoefft, a protagonist for the creation of the *Austrian Rocket Propelled Society for Altitude Exploration* in the 1920s. During the late 1920s von Hoefft, a chemistry



Vienna born Dr. Franz Oskar Leo Edler von Hoefft, with degrees in physical chemistry and philosophy, conceived several radical looking manned and rocket-powered winged boost-glide vehicles in the late 1920s. This is one design with eight rocket engines to achieve low-earth orbit; the vehicle would then execute a gliding re-entry to earth. Upon contacting several Vienna institutions they could find no records of him and furthermore, there are no records of his rocket research. However, he is written up in 1920s magazines and communicated with Dr. Eugen Sanger, who continued von Hoefft's research. (Photo from the Dave Stern collection)



A group of German rocket society members and a very young von Braun with an object in his hand, standing behind a man holding a solid fuel rocket. His deep interest in rocketry led him down a most unique life-path to fulfill his and others' dreams – sending men to the moon. (Library of Congress photo)

teacher, received little credit or recognition for his designs of rocket-powered winged aircraft that would operate in a space environment and glide-return to earth.⁵

He reportedly tested at least one model in the Vienna Aerodynamic Institute of the Technical College's wind tunnel, with positive and surprising results, but did not continue pursuing this research.⁶ However an enthusiastic "candidate technician" student named Eugen Sanger attending the Technical Institute communicated with von Hoefft about rocket power and its application to space aircraft.⁷ In 1928 Sanger was awarded a doctorate of technical sciences after his thesis entitled *Rocket Flight Technique (Investigations of energetics of high altitude flight with rocket planes)* was defended and

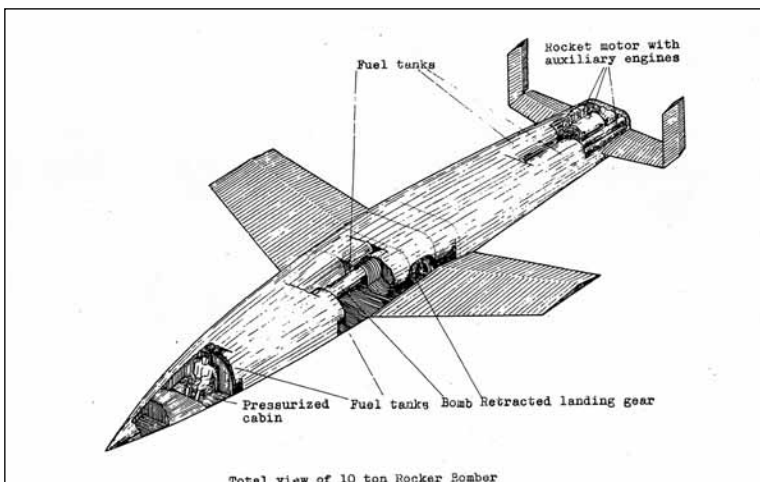
accepted.⁸ In 1933, Sanger designed an early winged rocket-powered *stratosphere plane* with a round projectile-shaped fuselage, thin straight low aspect ratio wing (the ratio of the wing span to its chord or width from leading to trailing edge) plus a conventional tail layout.

The vexing problem of launching this large, heavy, hybrid stratosphere plane up to speed and altitude led Sanger to design a sliding rail launch mechanism, with rocket boosters, thrusting his rocket plane along a 1.8 mile straight-line lubricated mono-rail. This ingenious concept became a component of his refined 1938 design and one may observe a variation of this launching system in the excellent science-fiction movie, *When Worlds Collide*.⁹ Meanwhile, Sanger had written a technical book entitled, *Raketenflugtechnik* that became the accepted textbook on rocket and rocket-flight engineering concepts, but Sanger was forced to pay most of the printing costs just to get it published.¹⁰

AN AIRPLANE NAMED FLAT-IRON

In 1938, a 1:20 polished steel wind tunnel model was constructed (it still exists) of an advanced re-engineered plano-convex glide-aircraft without benefit of hypersonic aerodynamic input. Nevertheless it was handsome and elegant in design.¹¹ Several of its advanced design characteristics were correct. This early concept - a flat bottom fuselage (half-ogival) generated some positive pressure into lift and a wedge or slab shaped airfoil gave it a favorable glide ratio. Dr. Sanger secured a patent - German *Reichspatent* Number 411/42, under "gliding bodies."¹²

The handsome design was variously known as *Silverbird*, or "flat-iron," (his team's vernacular term), *Raketen Bomber* (*Rabo* for short)¹³ and *Amerika-Rakete*, basically adopted as a long-range WWII bomber to cross the Atlantic and



A partial cutaway and isometric view of the "Raketen-bomber" as illustrated in Sanger's secret military proposal report in WWII. (Photo from the Dave Stern collection)



The brilliant team of Drs. Eugen Sanger and his wife Irene Bredt who performed all of the mathematical calculations for the Sanger plane project. They married and with help from French Intelligence agents, secretly entered France to work for its government on rockets and ramjets. (Photo from the Dave Stern collection)

attack America's East Coast. Other names were *Anti-Podal Bomber* or Skip-Glide aircraft (a hypothetical method of range extension by means of undulating skip-flight into and out of the atmosphere).¹⁴ The bomb carrying proposal was submitted to the Luftwaffe.¹⁵ No metal was cut for a *Rabo* prototype although a partial mockup is mentioned by author Igor Witkowski.¹⁶ He writes that *Rabo* reportedly bore the project code name *Thor's Hammer* carrying a single weapon and not conventional bombs.

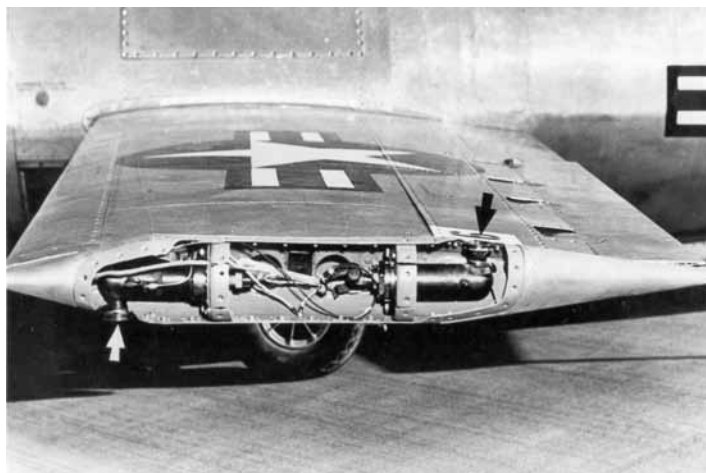
This is not to denigrate the elegant Sanger-Bredt Skip Glide aircraft but inherent design flaws required considerable research and design changes to become a flyable aircraft. The delicate twin tail (a popular German industry design theme) would demand a heavily modified structure to avoid failure during re-entry into the sensible atmosphere due to friction-heating, buffeting and aerodynamic pressures. The sharp nose was a problem; an oblate spheroid or blunt nose with ablative coating was more survivable and could absorb heat. The single wedge wing's sharp leading edges generated an incorrect shock wave to decrease hot wing leading edge temperatures during *Rabo's* repeated undulations into and out of the atmosphere.

Thermal heating problems demanded innovative solutions for the small plate windshield (X-15 suffered starboard window thermal fractures during a Mach 6 flight).¹⁷ *Rabo's* cabin seals were critical in preventing cabin pressure failures, while the requisite high temperature structural metals were just birthing and simply not available. Also, there existed no method whereby the pilot could maintain stable attitude control during *Rabo's* glide flight at approximately 100 miles in space. Ten miles was the generally accepted upper boundary of the troposphere where a pressurized cabin and pilot pressure suit were required. Thus, attitude control during *Rabo's* skip-glide flight was a critical function that affected its range. The Sanger bomber proposal report does not describe how the pilot guided it in a controlled stable attitude outside the sensible atmosphere.

When Maj. Charles Yeager took Bell's X-1A¹⁸ to heights where control surfaces were ineffective (the area once called the aeropause), it tumbled as did the X-2 during a record altitude flight. Attitude controls were critical during the March 1966 Gemini VIII orbital mission. One reaction control motor stuck open, thus Gemini's roll rate continued accelerating before Armstrong and Scott manipulated that system to re-stabilize it.¹⁹

Rabo too, would have uncontrollably tumbled about the pitch, yaw and roll axis, during its exo-atmospheric gliding flight. It needed to be equipped with miniature reaction control motors, situated in the nose, rear fuselage and wings (as in the X-15), or catastrophic airframe failure would result. Attitude control motors with different thrust levels according to their placement provide attitude control in the pitch (nose up, nose down), yaw (side to side) and roll about the aircraft's axis. Bell engineers designed, constructed and tested the first known attitude control system in the Bell X-1B rocket research plane, thus gaining early expertise in miniature rocket motors.

They were installed on the X-15, Mercury, Gemini and Apollo capsules plus the Space Shuttles and mission oriented reconnaissance satellites. This critical component is absent in a detailed Sanger-Bredt *Rabo* proposal submitted to the



Two of Bell Aircraft's reaction control motors installed in the port wing of the Bell X-1A are believed to be the work of Heinz Mueller who joined Bell in 1950. His creations called "thrust chambers," are miniature rocket engines of various low thrust ratings for attitude control of aircraft and spacecraft operating above the aeropause. (Bell Aircraft photo)

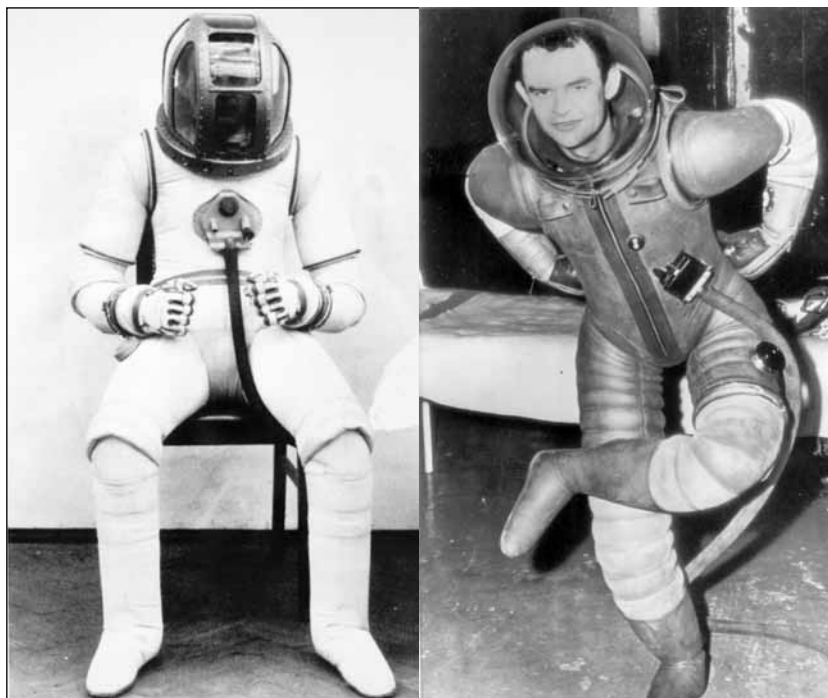
Luftwaffe.²⁰ Nevertheless *Rabo* was the most exotic and advanced winged aircraft concept designed in Germany during WWII that is publicly known. Reborn at Bell Aircraft during the 1950s, winged aircraft, rocket boosted to hypersonic speeds, were identified in post WWII years as a boost glide vehicle or simply boost-glider.²¹ Nevertheless, had *Rabo* been constructed and successfully achieved its designed hypersonic performance, there was absolutely nothing in the world capable of intercepting it during flight - except during its approach to and while landing.

SURVIVABILITY RESEARCH

WWII German technology included aero-medical research that remains secret many decades later,²² and it appears that Germans evinced a deep interest in constructing piloted rocket aircraft flying far higher and faster than contemporary aircraft of the day. Thus Erasmus Darwin's 1933 pressure chamber, plus Berlin and Hamburg based Aero-Medical Research Institutes, evolved since the mid 1930s protection equipment for pilots flying at the edge of and beyond the sensible atmosphere,. Only fragments of this research have been released over the decades, so it is an incomplete history.²³

However, their research yielded special high altitude garments called soft and hard-shell pressure suits simultaneously developed secretly in the USA²⁴ and Germany during WWII.²⁵ The piloted Sanger *Rabo*, Peenemunde's piloted A4b rocket-ramjet bomber and A9 rocket glider had pressurized cockpits, but flying into a vacuum still necessitated a working pressure suit should a catastrophic cabin failure occur.

The German *Dreagerwerke* firm (longtime manufacturer of diving suits) received secret contracts to design and construct breathing systems, breathing masks, advanced soft and hard pressure suits for pilots flying jet, rocket and other unspecified secret projects. Their work included specialized suits for the Horton jet-powered flying wings, Bachemwerke's Project 349B



LEFT: A rare photo of a German Draegerwerke's high altitude pressure suit—presumably a hard type with its segmented helmet. Americans and Germans simultaneously undertook secret development of high altitude pressure suits. Placed in the context of WWII they are exotic advancements despite there being no existing U.S. or German aerodyne with near orbital capability, requiring pressure suits. Viewed from the side, this Draeger suit's segmented helmet is massive. However, its interior space allows the wearer's head complete freedom of movement. (USAF photo) RIGHT: The secret WWII B.F. Goodrich "tomato worm" pressure suit worn by Capt. Waring L. "Pete" Dawbarn. He is demonstrating limited flexibility and movement, while the suit is pressurized to nearly 3 psi. Most of these suits were quite restrictive when pressurized, but a pilot could perform simple tasks while in flight, although the wearer would quickly fatigue. (USAF photo)

Natter rocket interceptor, and a special prone position suit for pilots preparing to fly DFS high altitude rocket reconnaissance gliders.²⁶

Their suits would be worn by *Rabo* and A9 pilots²⁷ because of *Draegerwerke's* successful and advanced engineering approach. Their suits were developed in parallel with secret WWII U.S. Rubber, Goodyear and B.F. Goodrich suits including research utilizing General Electric's utterly strange "copper man," a.k.a., *Sleepy Joe*, but it neither wore a cape nor a distinctive C on its chest!²⁸ Goodrich has produced a small run of their Model XH-5 *tomato-worm* pressure suits under USAAF Aero Medical Laboratory development since 1941.

Strange to say, no aircraft or design proposal of that period demanded the automatic use of either soft or hard suits although, they were suitable for low-earth orbit or space operations had such vehicles existed. The German and American suit research strongly hints that somebody was thinking of extremely high

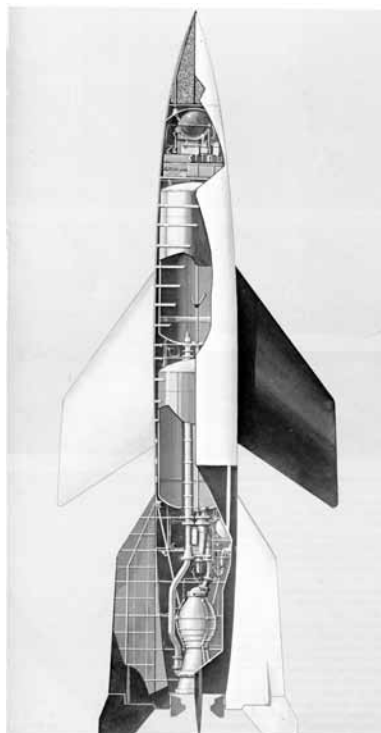
altitude flight if not orbital flight during the late 1930s and into WWII.²⁹

The *Draegerwerke's* late designs were advanced enough to protect a pilot or crew thus fulfilling their intended use, albeit under very uncomfortable, confining and fatiguing long-duration flights. The physiological problem of claustrophobia however, would automatically eliminate a pilot from the above mentioned projects encased within such a restrictive garment.³⁰ Despite the pressurized *Rabo* cockpit the pilot would be encased in a *Draegerwerke's* full pressure type suit. The anti-podal bomber's operating altitude was approximately 100 miles or higher, thus a cabin pressurization failure without a full pressure suit would have been fatal. The German firm engineered and constructed an unknown series of partial, full soft and hard pressure suits throughout WWII, but their fully detailed history remains to be told.

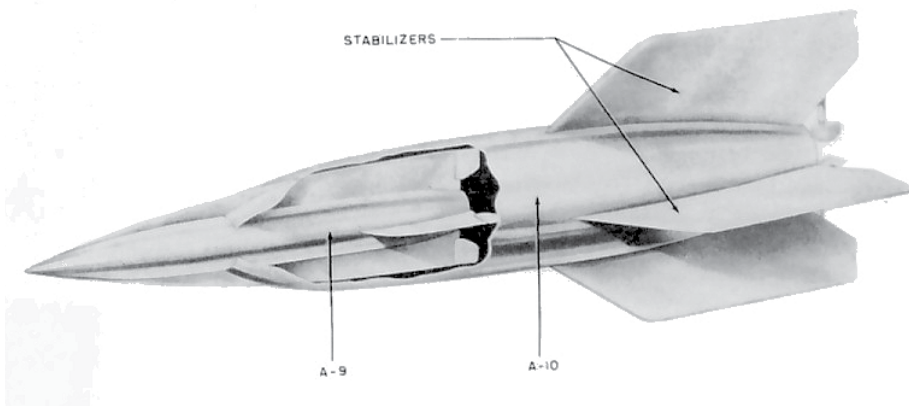
WINGED ROCKET GLIDERS

In a reverse of the Sanger-Bredt *Rabo* rocket powered airplane the Peenemunde rocket team commanded by Lt. Gen. Walter Robert Dornberger and Dr. Wernher von Braun's rocket team, planned to extend the range of their A-4 (V-2), while still under development. Their simple solution was to add wings thus turning the A-4 into a winged rocket glider in 1942. Piloted and winged rocket aircraft were included in von Braun's repertoire of ideas while at Peenemunde between 1939 and 1941. One of them was a piloted rocket-powered vertical-takeoff interceptor proposal sent to the Ministry of Aviation, but they evinced no interest.³¹

Dr. Adolph Busemann's research³² into swept wings for supersonic flight was included with other wing designs tested in wind tunnels. The Peenemunde rocket team decided to mount



This cutaway is still the basic V-2 (A-4) with a pair of wings swept 45 degrees to the fuselage. Comparing this drawing with the standard production V-2 there are a large set of "air-rudders." They move the rocket from vertical or near vertical flight into horizontal gliding flight after engine cutoff. (Photo: from the Dave Stern collection)



A rough and general sketch of the Peenemunde A9/A10 long range rocket project designed to reach the Eastern Seaboard of the U.S. and drop a single bomb on a selected target. (Photo from the Dave Stern collection)

a pair of swept wings of 45 degrees with a 145 square foot area to an A-4.

Also required were large air-rudders attached to the A-4s tail fins to aid the rocket during transition from ballistic to horizontal flight, thus extending its range. Two rockets reportedly code named *A9* but openly called A-4b were so modified.³³ Both A-4bs (the initial modified V-2 was called *the Bastard*, while rocket team members referred to both as “the glider”) were launched and failed due to the wings shearing off.³⁴ The A-4b launch on January 24, 1945 attained 3,960 feet per second and 48 miles vertically, where the air-rudders positioned the rocket into gliding flight before shedding a wing.³⁵ The pair of test A-4b rockets actually became prototypes for the piloted A9 long range variants.

Should the reader be confused about the correct descriptive term for a genuine rocket with wings attached, we defer to the wisdom of the USAF Air University’s Second Aerospace Glossary definition. *Rocket Glider* (also *Glide Rocket*); “a rocket carried to altitude by rocket power that assumes gliding flight by means of aerodynamic surfaces.”³⁶ This exactly describes the A-4b and another long range extension of the basic V-2 in a fascinating second stage piloted A9 rocket glider comprising the A9/A10 project. The combination of ballistic missile and a glide rocket bomb carrier was conceived as early as 1940,³⁷ while the actual A9/A10 drawings are dated as 1941.³⁸

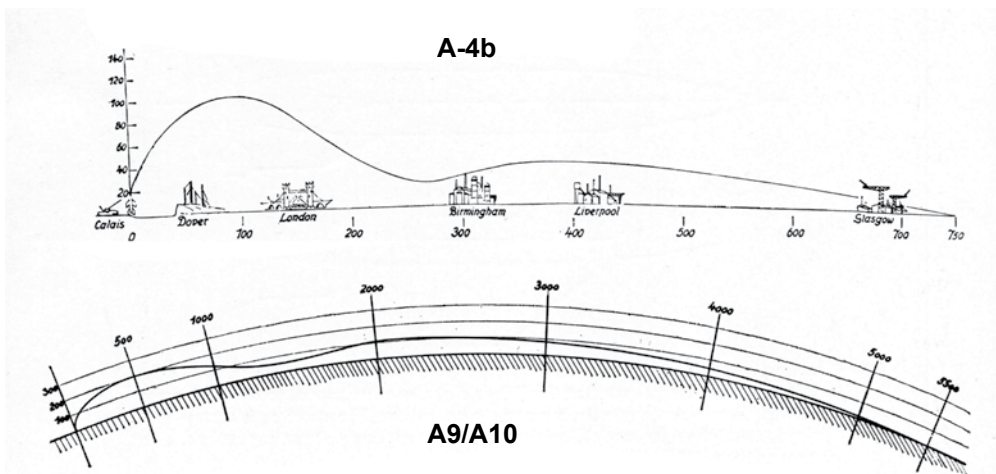
THE A9/A10

Various authors have projected the A9/A10’s inception date late in the war³⁹ citing an idle rocket team having no further work as V-2 production began under the Harz Mountains.

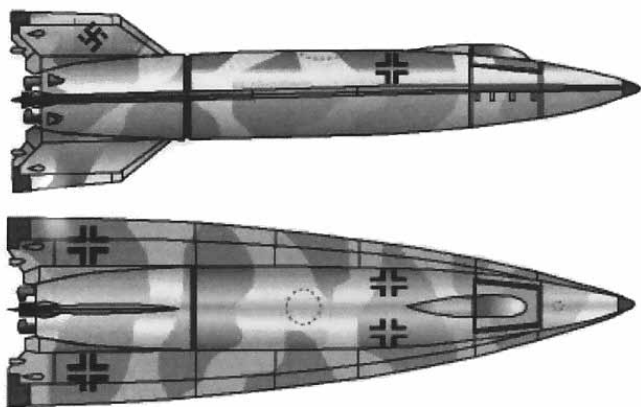
Historians postulate that because the U.S. entered WWII the Peenemunde rocket team thus received the impetus to modify a winged V-2, add a pilot and launch it atop a large booster rocket. The combination would allow the winged V-2, now identified as the A9, to achieve a transatlantic flight reaching America’s East Coast. The 87-ton A10 booster would generate 180 tons of thrust from a cluster of six V-2 engines burning 62 tons of alcohol-Lox for 55-60 seconds.⁴⁰ The A10 would thrust a piloted A9 top stage to 2,700 mph and approximately 200 miles, while the A9’s onboard rocket engine increased its speed to 6,300 mph.

The piloted A9 would commence a powerless 2,500 mile glide flight over the Arctic regions, and the North Atlantic to approach our eastern seaboard.⁴¹ There are two different published flight descriptions: one describes the pilot rigging the A9 to dive into the target and bailing out - thus early descriptions of his survival premise then become an extremely critical personal issue. Secondly, an A9 dropped a single one-ton nuclear weapon on a target while continuing to glide clear down into the South Atlantic to land in friendly Argentina. It is believed that the pilot would eject from the A9 and land by parachute, since no actual landing method is described.⁴² Post-WWII studies of the A9/A10 project indicate the projected range was far short by a factor of three.⁴³

The A9 featured a pressurized cockpit and canopy and two fuselage length strakes to presumably to stabilize the C.L. (Center of Lift) giving it a rakish look. Postwar design evaluations considered it an incorrect engineering approach since numerous wings tested in wind tunnels were applicable.⁴⁴ This and other highly advanced technology was captured by



The chart displays the flight paths of the winged A-4b rocket with its extended gliding range. The lower flight path is that of the A9/A10 long range rocket, in effect an ICBM, ala, WWII. Range and altitude are shown in kilometers, for the A-4b, roughly 750 km with a maximum altitude of 100 km while the A9/A10 is 5,500 km and 200 km, respectively. (Photo from the Dave Stern collection)



The piloted second stage glide-rocket designated A-9 showing the fuselage length strakes and modified tail fins. (Photo from the John Swartzwelder collection)

Allied intelligence teams composed of men experienced in aeronautical and related disciplines. They literally raced each other to acquire samples of the most advanced data and hardware samples, including the scientists and engineers. It literally set the future direction of U.S. aviation and rocket development during the Cold War era.

PLUNDER

The Germans kept meticulous records, plus their research and technological hardware generated the greatest episode of technological looting and plunder in human history. Under *Operation Paperclip* (search for German scientists and engineers) and *Operation Lusty* (immediate priority seizure of physical hardware), a plethora of records and hardware was located and seized.⁴⁵ One published figure states that 12,000 tons of “paper” were accumulated and shipped to the USA including an unknown quantity of Peenemunde records.⁴⁶

German scientists, engineers and others were quietly transported to Wright Field, were thoroughly interrogated, and put to work translating huge amounts of German documents into English. A side result included the creation of a special German-English dictionary - it was known as *Project Index*.⁴⁷ Included in the paperwork was Dr. Sanger’s Anti Podal bomber proposal to the Luftwaffe because two copies were reportedly sent to Peenemunde for evaluation. The search and seizure of V-2s, rockets and missiles including some of the surrendering Peenemunde rocket team has been repeated in numerous books and magazine articles and will not be repeated here.

However, a key figure missing from the surrendering Peenemunde was Lt. Gen. Walter R. Dornberger. He was captured for the second time by the British. Held two years in British CSDIC Camp 11, they apparently planned a “feel-good” war-crimes trial to accuse him of the rocket attacks upon England and probably swing him in the *Old Bailey*.

Orders from the commanding general of the AAF, Col. H.M. McCoy, Deputy Commander AAF Intelligence (T-2), placed Dornberger, Dr. Sanger and other high-priority German-Austrian scientists on a special wanted list.⁴⁸ Dr. Sanger and Dr. Irene Bredt evaded American intelligence teams and were hidden by French intelligence people. They especially evaded a desperate Soviet search team as well, and agreed to work for

the French government.

Dornberger’s importance was such that AAF Intelligence T-2 initiated *Project ABSTRACT* and contacted EUCOM (Europe Command) to broker his release from the British and transport him to Wright Field. At Wright Field, he was interrogated and (again, no details are known) worked on rockets as a “guided missile specialist,” or consultant.⁴⁹ It is not known exactly what Dr. Dornberger did at Wright Field, but it was related to rockets or guided missiles.

POST WAR

The post WWII U.S. media published numerous articles describing selected German technology, including the V-2 rocket, a space station with a giant “space mirror, and a rocket skipping along the upper atmosphere to bomb the N.Y. The sinister looking V-2 exuded the now reachable idea of space travel thus generating exciting illustrated articles about lunar bases plus trips to Mars. The V-2, aircraft and some missiles stored by Air Material Command at Freeman Field, Ind., were publicly displayed there, at Wright Field, and in Philadelphia, Pa., between late 1945 and early 1946. Meanwhile, the USAAF Air Material Command loaned specifically requested German technology to various aircraft companies engaged in postwar aircraft, rocket and missile projects.

THE BELL CONNECTION

In 1951 Dr. Dornberger left Wright Field to seek employment with Bell Aircraft Corporation. This highly unorthodox firm employing an excellent seasoned group of engineers was guided by Larry Bell’s intrinsic fascination in pushing aeronautics far beyond the norm. It won exotic contracts to build America’s first jet fighter, a line of rocket-powered research aircraft, a missile and developed a line of helicopters.

Larry Bell hired Dornberger as a “guided missile engineer and consultant” with a one year contract at a very comfortable salary of \$11,000 per annum with renewal, commencing on May 1, 1950 - that is, upon government approval.⁵⁰ In December, 1951 his salary was raised to princely sum of \$12,650.⁵¹ He presented Larry Bell with a radical plan - *Project Vulcan* - a true ballistic missile or failing that, a glide type rocket. The initial plan was to form an independent company strictly to design and construct ballistic missiles, with a select core of experienced engineers drawn from other aircraft firms.⁵² The USAF rejected both plans and so advised Bell Aircraft and Dr. Dornberger. They informed the company that Convair received a \$250,000 USAF feasibility study contract for a very high altitude missile but refused to elaborate on it.⁵³

Undeterred, Dornberger generated a secret concept that drew elements comprising the Sanger *Rabo* project and the A9/A10 - a piloted hypersonic long-range glide-rocket. It excited and appealed to Larry Bell’s intuitive sense for highly advanced and unconventional aircraft projects. The radical idea generated both excitement and a huge challenge among the “Niagara Frontier” staff briefed by Dornberger. Larry then approved Dornberger’s plan for a parallel recallable weapon complimenting the ballistic missile. The intra-company project study was baptized BoMi, short for **Bomber Missile**;

it was a piloted hypersonic weapons carrying rocket boosted intercontinental boost glider. ➔

(to be continued in the next issue)

Endnotes

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