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Chapter 15

Project Dyna-Soar: The Roots of Shuttle—A Memoir*

William C. Walter†

The remembrances related here span a time period from 1951 through 1963, the pioneering days of winged, hypersonic, boost-glide vehicle system technology in the U.S.A. The roots of the United States Space Shuttle program which, like the legendary Phoenix, rose from the ashes of the ill-fated Dyna-Soar program some twenty years later, go back even further.

The contributions to this field made by the team of Eugen and Irene Sänger (formerly Irene Bredt) have been related many times. Perhaps too many times—enough to cloud the facts considerably. The Sängers were, in reality, more like Godparents to the manned, hypersonic boost-glide vehicle field, at least where American-direct efforts leading to the Space Shuttle program are concerned (Figures 1 and 2). The true father of the manned, hypersonic boost-glide technology and hardware development programs in this country was Dr. Walter Dornberger. Dornberger was the German General in charge of all rocket powered weapon system development programs (such as the V-2) before and during WW II. He was Wernher von Braun's boss (Figure 3). Dornberger gave a full accounting of these years in his book *V-2*.

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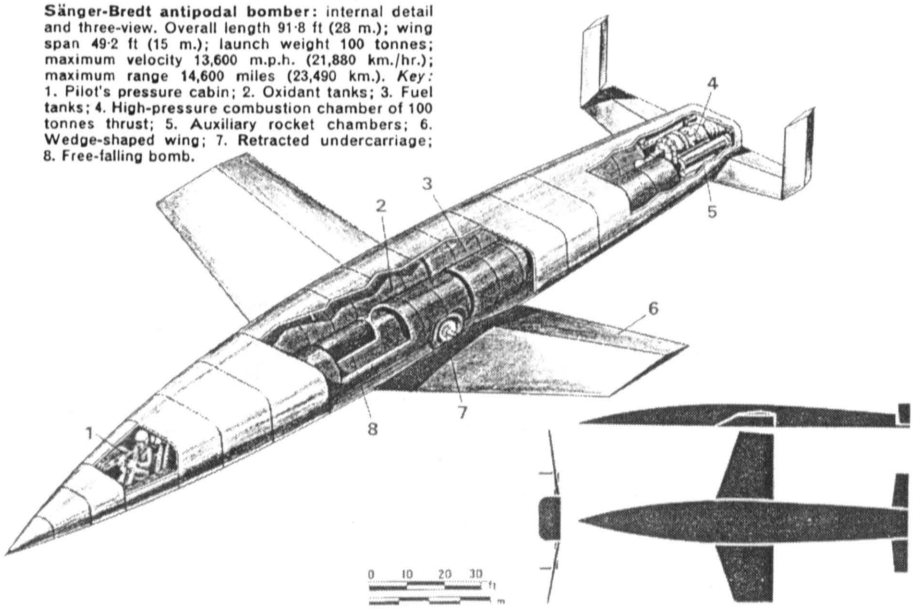

Figure 1 The Sänger-Bredt Antipodal Aircraft (1941).
Source: *Frontiers of Space.*

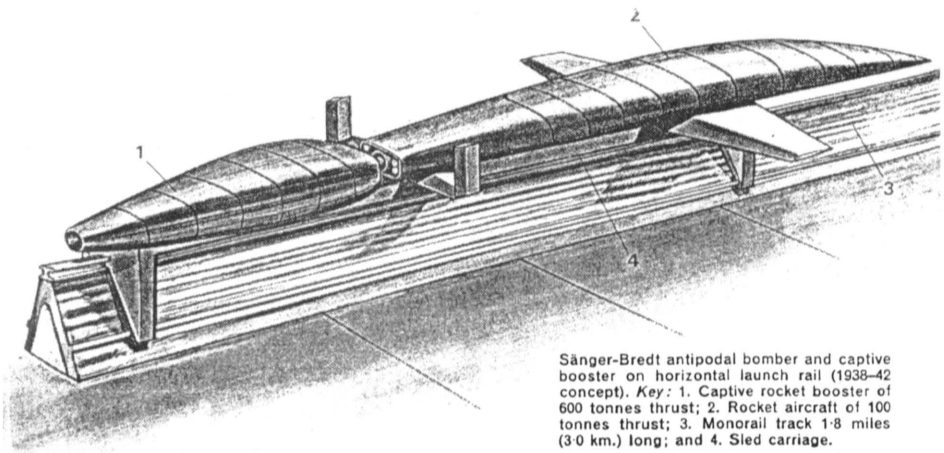

Figure 2 Sänger-Bredt Antipodal Vehicle in Launch Rail Configuration.
Source: *Frontiers of Space.*

The Sänger concept never reached the hardware stage; Dornberger's did, in Germany late in WW II. The A4-b was a winged modification of the dreaded V-2 missile (Figure 4). The winged boost-glide vehicle A-4b ("b" for bastard) was flown twice, once successfully, just before the end of WW II. It had a range

of 466 miles. How much longer the war would have had to continue before the more sophisticated A-9 /A-10 winged, hypersonic, boost-glide missile, with a range of 3,107 miles, would have been tried on New York City as the intended target, is anybody's guess (Figure 5). It is chilling to contemplate the impact on the history of the world, had the Germans had a nuclear warhead to put on it. They were working on that, too!

Figure 3 Dr. Walter Dornberger (1944). Source: *V-2*.

When von Braun and Dornberger were brought to the United States at the close of WW II under Project Paperclip, von Braun went with the U.S. Army, while Dornberger served with the USAF at Wright-Patterson Air Force Base (WPAFB) in Dayton, Ohio. Von Braun's name is now a household word. Dornberger's name is less well known, but he was no less a powerful influence on the U.S. Space program than was von Braun.

About the turn of the 1950's decade, Dornberger became an executive of Bell Aircraft Corp. (now Bell Aerospace), later becoming a vice president. Not long after joining Bell, he asked for a private meeting with "Old Man Bell" (Larry Bell, President) to discuss a special matter. Bell was amazed to see somebody from Dornberger's office dragging a foot-locker into his office with one hand, while struggling to keep from dropping three brief-cases, bulging with papers, with the other. He dropped the stuff in front of Bell's desk and left.

Dornberger then popped in and, grinning broadly, he said in his thick German accent, "I didn't show them everything."

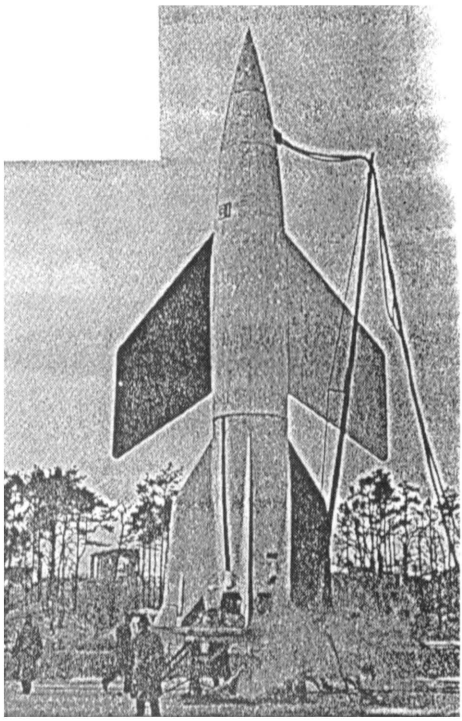

Figure 4 An A-4b Prior to Firing From Test Stand X, January 1945. Source: *V-2*.

He was referring to the vast amount of data and files the U.S. had encouraged the German rocket scientists to bring with them when they were brought to this country after the war. What he dragged into Bell's office that day, no American eyes had seen—until then. It was a fraction of what he had brought with him from Germany, covering every aspect of the A-4b and A-9/A-10 programs: tech reports, blueprints, engineering design data, test reports, photographs, and motion picture film.[1]

A gold mine of data was literally laid out at Bell's feet, and standing before Dornberger was probably the only person in the world who could turn it into a profitable business opportunity in the United States. Larry Bell was fascinated.

The rocket powered, hypersonic, boost-glide reentry vehicle program in this country had its start right then and there; the roots of Shuttle had been successfully transplanted from Germany to U.S. soil! A couple of years later, it would spread like a weed.

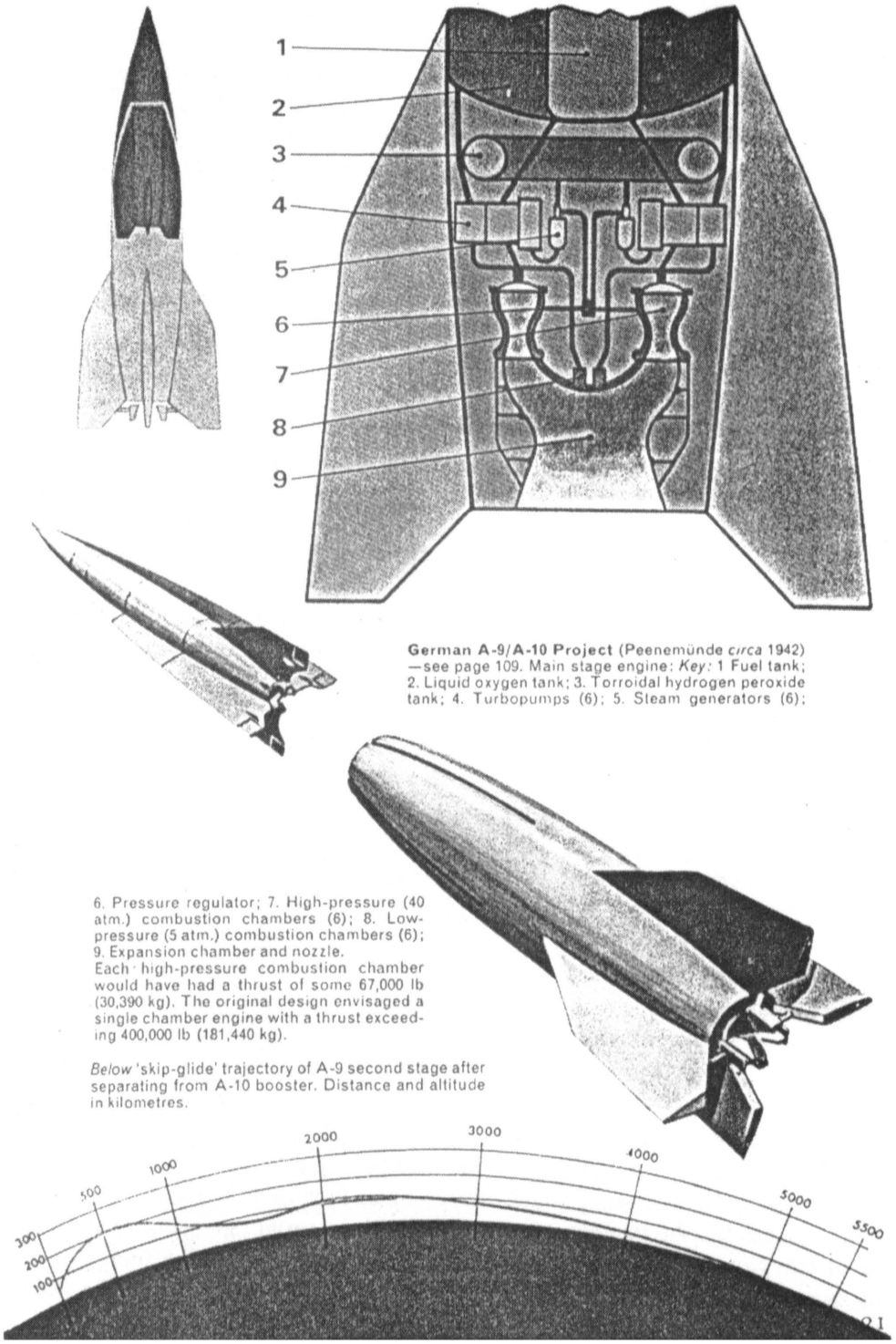

Figure 5 The German A-9/A-10 Concept. Source: *Missiles and Rockets*.

On Tuesday, May 4, 1954, I attended The Third Annual Symposium on Space Travel held at the Hayden Planetarium in New York City. I was amazed that a symposium on this subject had even been contemplated. At that time, the American public had no interest in manned space travel; they hadn't been fired up yet. It took Sputnik to do that several years later.

To the American public, including most people in the fields of science and technology, in government circles and especially in the military, manned space-flight belonged in the funny papers along with Buck Rogers. I remember, at the time, looking for the books von Braun and others had published on manned space exploration and finding them in the children's section of the book stores—all of them!

At that time, I was an Air Force Lieutenant earning a Masters Degree in Aeronautical Engineering at the USAF Institute of Technology (USAFIT), stationed at Wright-Patterson AFB (WPAFB), Dayton Ohio. I had taken a personal leave of absence to attend the symposium, and had hitch-hiked a ride on a MATS transport plane to New York City, so I was in uniform when I entered the Hayden Planetarium auditorium that day.

Several things about the people in that crowded room struck me as peculiar. First, I don't remember seeing any women present. Second, the room was filled with old guys (you know, at least forty years old and up). Third, there was only one other person in uniform in the room, and he was a one star USAF General officer sitting in the very first row—on the aisle. I barely sat down, when I was bodily hustled out of my chair and right out of the auditorium by one of those "old guys" who was wearing a dark business suit, white shirt and a very dull looking tie. Come to think of it, everybody else in there was dressed like that too, except the general and I, of course.

He turned out to be a full colonel in the USAF, and he was red-in-the-face mad at me. He demanded to know why the hell I was there in uniform, when the orders were to wear civilian business clothes. When I explained that I was a USAFIT student stationed in Ohio, and was attending this symposium out of personal interest, he relaxed. But, he didn't apologize. He had thought I was stationed in the Pentagon, Washington D.C., and was attending this meeting under orders. Still, he dragged me to the entrance door of the auditorium and told me to look at the audience. "What do you see," he asked.

"I see a bunch of old guys in civilian clothes," I said.

He ignored my wisecrack and said, "You're looking at most of the highest ranking officers in the Pentagon from all the military services—every God damn one of-em. Now we don't want the God damn press making a big thing out of this so we all came in civilian clothes except that one general sitting in the front row. He's a plant. The newspaper and magazine reporters will be let loose in

here shortly, and they're all going to rush right down to interview that general. He's going to tell the same story you told me, that he's just here out of personal interest. Then they're all going to rush back up here to interview you—you get the picture?

"Now, you listen up, son, and you listen good. When they get back up here, you tell 'em exactly the story you told me—no more and no less, or your career in the Air Force is over. Are you read'n me, boy?"

I said, "Yes, sir."

Well, it all happened just like he said it would, and I must have done my part okay, because when the reporters left, he leaned over to me and whispered, "Good boy!"

Eight panel speakers gave papers that day: Mr. George Sutton, North American Aviation; Mr. Joseph M. Chamberlain, General Manager and Chief Astronomer of the Planetarium; Arthur C. Clarke, well-known author and rocket authority; Dr. Walter R. Dornberger, Bell Aircraft Corporation (then a consultant, later a VP of Bell Aerospace Corp.); U.S. Navy Commander R. C. Truax, Bureau of Aeronautics, Guided Missiles Division; Dr. Harry Wexler, Chief, Scientific Services Division of the U.S. Weather Bureau; Dr. S. Fred Singer, Professor of Physics, University of Maryland; and Dr. Claud E. Shannon, noted mathematician and expert on Communication theory. Every one of these men went on to make history with their contributions to the American National Space Program as it unfolded as the years went by.

At this symposium Dr. Singer proposed the very first American hardware spacecraft development program: a "preliminary type of space ship" with the technical name, "Minimum Orbital Unmanned Satellite (Earth)" or "MOUSE." Dr. Singer, who is now at the Institute for Space Science and Technology, Gainsville, Florida, U.S.A., is scheduled to give a talk on the MOUSE in one of the sessions here at this World Space Congress (IAA-92-0200, "Origins of the MOUSE Proposal").*

Dornberger was a speaker at that symposium that day. He showed slides and film of many of the rocket vehicles and missiles Germany developed during the war, including the V-2. As he briefly covered the A-4b and A-9/A-10 projects, alluding to the possibilities for manned space exploration in the future, I heard snickers coming from various places in the auditorium.

How little they knew or understood! This is particularly surprising, since most of these attendees were there expressly to hear Dornberger's talk. Not so surprising, when you realize what they wanted to hear Dornberger talk about

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* See Chapter 13 in this volume.

was the V-2. *What the military of all the services was most vitally interested in at this point in time were long range liquid rocket missiles—not space flight!*

What none of them knew, except those in the USAF directly involved in the secret project, was that Bell Aircraft, under the personal direction of Dornberger, had an ongoing study contract with the USAF for hypersonic boost-glide vehicle systems. This work had begun as early as 1952.

I, for one, was fascinated by Dornberger's talk, especially the part about manned spaceflight with a winged spaceship that could reenter the Earth's atmosphere from orbit and glide safely to a landing like a conventional aircraft. But then what did I know? I was just a kid.

I bought all of von Braun's space travel books and everybody else's I could find in the children's section of the book store.

Way back in 1952, shortly after Dornberger revealed to Bell what he had brought with him from Germany, Larry Bell and Dornberger were traipsing the halls of the Pentagon trying to sell the Air Force on a new hypersonic, winged, boost-glide weapon system. It was a souped-up version of the A-9/A-10 system, except that it featured equilibrium glide (smooth, steady decent through the atmosphere) in place of the skip-glide (skipping in and out of the atmosphere during decent) approach. Aerodynamic heating of the skip-glide approach to reentry had been found to be excessive, if not prohibitive.

They eventually found an audience. Dornberger completed his briefing and sat down. The reaction of the DOD and Air Force audience that day was not only abusive, it was downright insulting. Dornberger took the abuse as long as he could stand it, and then he just had to say something. What he intended to say was something like, "You would have a lot more respect for rocket powered, winged, boost-glide technology if we had had more time to demonstrate it against your bombers in WW II."

That is not what he said!

He leaped out of his chair, red faced, startling everybody and shouted in a thick German accent, "I wish we had shot down more of your bombers in WW II." Then he sat down.

The silence was deafening.

It took a long time for Old Man Bell to mend the fences trampled down that day!

The big excitement in military circles in the early 1950's was the ballistic missile; short, medium, and long range missiles—intercontinental even. Any one talking seriously about manned space travel, even unmanned satellites, was considered some kind of kook—space was a dirty word in the military.

By 1953 and '54, Bell Aircraft was having better luck in promoting hypersonic, boost-glide concepts to the R&D arm of the USAF, particularly at

WPAFB. But, they didn't talk spaceflight—they talked hypersonic speeds, and circumnavigation of the Earth at extremely high altitude with cross range maneuverability.

Higher, faster and farther, the heart of the requirement inherent in aerial bombardment and reconnaissance—that's what they talked about. They hit a nerve. Bell's team was getting a sympathetic ear at long last. But the guy doing the talking was a brilliant, young, talented engineer named Casey Forrest, the lead project engineer for the boost-glide project at Bell. Dornberger still ran the show but, for some reason, he remained more in the background those days.

Meantime, now serving as an R&D officer, I found myself, in 1955, by sheer good fortune, the Engineering Manager of the USAF Hypersonic, Boost-Glide Study Program in Detachment 1, Hqs. ARDC (Air Force Research and Development Command) in the Bomber New Developments Office of the Bomber Division, WPAFB, Ohio.

My immediate boss was Major Bill Stephens. Bill was a propulsion system expert who earned his masters degree under a scholarship as an exchange student in England. I had earned mine at the USAF Institute of Technology (USAFIT) right there at WPAFB. We tended to treat the division of labor between us according to our respective training and personal interests. He took the propulsion oriented programs, I got the aerodynamically oriented stuff. That's how I got the manned, hypersonic, boost-glide study program.

The civilian head of the Bomber New Developments Office was Bill Lamar, later to become the civilian deputy Program Manager of The Dyna-Soar System Project Office. The Commanding Officer of The Bomber Division was Colonel Jules (Bill) Maxwell, who later became the head of this country's supersonic transport development program. It was a closed club. You had to be named Bill to get in.

By that time in 1955, Bell Aircraft had submitted a technical report to my office for a USAF study contract for what was now called BOMI (BOmber MIssile). Since the spacecraft had become manned, I felt the name BOMI to be a misnomer. Between 1955 and 1959, the whole program area grew like Topsy in terms of the enthusiastic interest it earned, the official government support it gained, the availability of vast sums of study money, and the number of contractors who wormed their way into the business. Everybody wanted to get into the act.

As Study Program Manager, I was at the forefront of all the action. It was a great job for a young, ambitious R&D officer to have. Wright-Patterson Air Force Base was a beehive of new system studies, advanced technology development, and vehicle system development activity.

Hqs. ARDC had only recently assigned the management of all USAF vehicle system program development activity to Detachment 1, Hqs. ARDC and stationed it at WPAFB. The offices were called WSPOS (Weapon System Project Offices), or SPOS for short.

New bomber WSPOS, such as the Nuclear Powered Bomber WSPO and the B-70 WSPO; the B-58 & B-52 WSPOS (well, they were new and exciting then) were each "doing their thing" in the basement of building 14 on Wright Field. Upstairs, the new fighter WSPO had the F-105, and research aircraft WSPO had the X-15. Still another had giant new transport aircraft under development.

Bomber New Developments? Well, I felt we had the best of all worlds. We had stuff that was the most exotic and far out. Would you believe a hardware development program to build and test what the newspapers loved to call a flying saucer. It was called THE AVROCAR, which was under development by AVRO Aircraft Ltd.—of all things a Canadian Company (Figure 6)! Bill Stephens chose to manage the Avrocar program; I took the manned, hypersonic, boost-glide. These were exciting and stimulating times to be in R&D in the Air Force. WPAFB was swarming with young, bright, well educated engineers holding down jobs with higher level responsibilities than many of them would encounter anytime later in their careers, in or out of the Air Force.

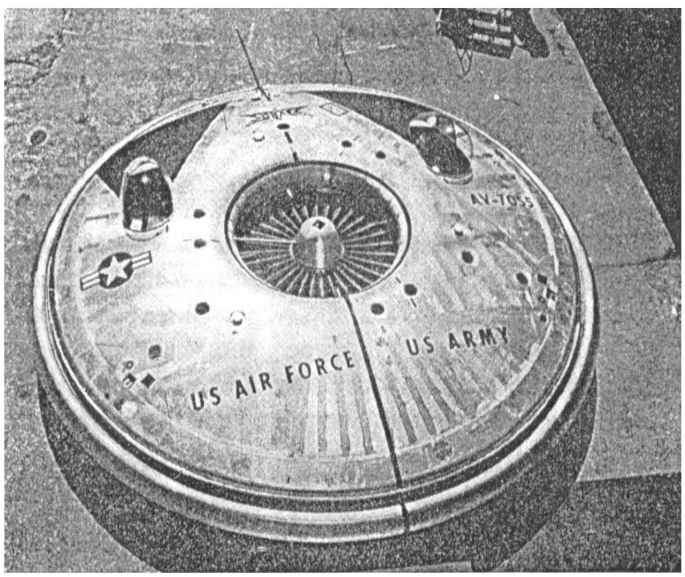


Figure 6 The AVROCAR. Source: AVRO.

Here we were, Lieutenants, Captains, Majors, and a few young Lt. Colonels, getting more technical and management experience in the several years we would serve at WPAFB, than others might get in their entire careers elsewhere. We were responsible for making decisions involving multi, multi million dollar expenditures—every day; decisions that would affect the ability of future generations of military aircraft to perform their missions, and perhaps affect even the fate of their crews—and doing a good job of it.

Why? Because many of the program office commanders were colonels who earned their "Chickens" (Eagle emblem of full colonel rank) as combat veterans of WW II. These were the guys who gained their outstanding management experience and honed their leadership skills the hard way, in the school of hard knocks.

But these were also the guys who were just starting their professional careers, or who had their college career interrupted, or who had never even got started with it, because of WW II. They helped stop Adolph Hitler, Mussolini, and Tojo, but now they could use some help with the technical side of managing the development of the next generation of new Air Force weapon systems. So, these Colonels were actually delighted to manage a cadre of sharp, young bucks, many only recently out of graduate school, who would eagerly tackle some of the most difficult and advanced technological R&D activities ever undertaken in the U.S.A., competently and confidently.

The combination of the experienced, qualified, management leadership of the colonels, coupled with the young, qualified engineering staff, performed exceedingly well as a team—they got the job done. Except for the obvious differences in ages, and the gulf in the rank showing on their collars, you couldn't tell boss from worker, just to watch them in action. It was an atmosphere of mutual respect, not asked for and not demanded. That's just how we all felt about each other.

The kids learned management skills, and the colonels gained the technical knowledge they needed, both by mutual osmosis. Many a young Air Force officer stationed at WPAFB in those days would, throughout his remaining career, find himself comparing his present working conditions and his current bosses to those he had at WPAFB, and find them (the current ones), sorely lacking.

By 1956, all the major aircraft companies in the country had gotten into the act under study project ROBO (ROcket BOmber). But things were approaching shake-out time when the Brass Bell (reconnaissance) and Hywards (research vehicle) programs came along. The technical competition was getting really tough. Once in a while something would happen which made it painfully

clear that this madhouse of technology advancement was getting some of us in over our heads.

I remember writing a technical summary of a contractor's proposal for an unmanned, winged, hypersonic, boost-glide vehicle. The contractor envisioned a winged reentry vehicle with a group of sensors located in the nose, behind a transparent, plastic nose-cone. The proposal skirted the problem that no known transparent plastic material yet existed that could withstand the severity of aerodynamic heating during reentry from space without melting away. Never dreaming that anybody might fail to see the humor in it, I wrote that this contractor obviously intended to employ *UNOBTAINIUM* as the nosecone material.

As a routine matter, a copy of this report went to Hqs. ARDC in Baltimore, Maryland, our immediate higher headquarters. A few days later, I received an urgent memo from an ARDC colonel wanting to have additional information about this wonderful material called unobtainium. I've often wondered if my reply was diplomatic enough.

On another occasion, the chief engineer of another big aircraft company tried to convince me of the novel idea that cooling the inside of the wing on his design for a manned, hypersonic, boost-glide reentry vehicle could be accomplished by having a free swinging water hose swish water back and forth inside the wing during reentry, "—just like your garden hose behaves under full pressure when you let go of the nozzle," he said.

I'm afraid the expression, "I threw him out of my office," comes very close to describing his sudden departure.

Not too long after that, he became president and general manager of a division of that company. And not too many years after that, I went directly to work for him as an executive of that company. For the longest time, every time I went into his office, he would look at me with a very peculiar expression on his face, like maybe he was trying to remember something. I had no doubt what would have happened had Harrison Storms of North American Aviation ever remembered just where and when he'd met me in the past.

But there were certain areas in this technology in those early days, where even the most knowledgeable among the experts in their field argued among themselves over the right answer to a problem.

Among the most baffling for all of us was the question of just what the overall aerodynamic configuration (shape) of one of these vehicles should really look like. Should it be flat-bottomed with the fuselage on top, or the other way around? Could it be mid-winged as Bell proposed in an early design (Figure 7)? Should the wings and nose of the fuselage be sharp, or should the nose and leading edges be bulbous?

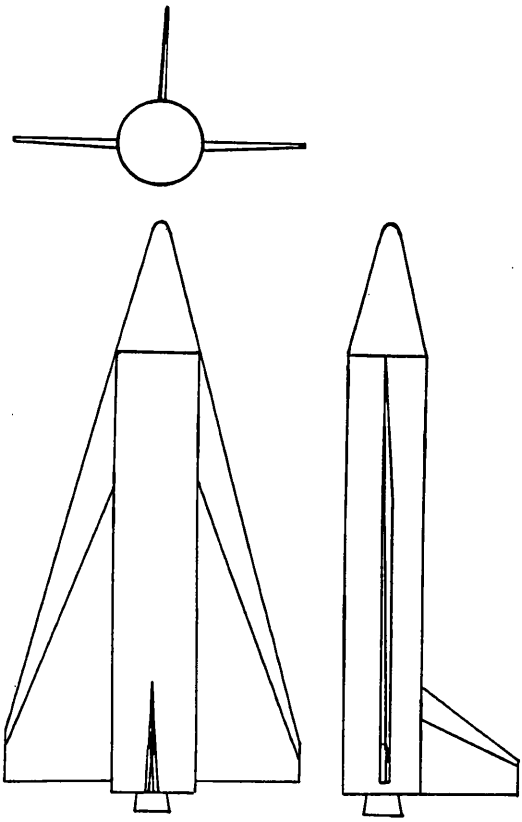


Figure 7 Early configuration of Bell Aircraft BOmber-MIssile (BOMI)-1955. Note mid-wing configuration. Major contributions by NACA and later NASA scientists to hypersonic winged reentry vehicle design led to more suitable flat bottom blunt nose configurations capable of withstanding severe aerodynamic heating loads upon reentry from orbit.

There were numerous high speed aeronautics technology seminars and conferences held all across the country during the 1950's, sponsored by organizations like the National Advisory Committee for Aeronautics (NACA), professional societies, colleges and universities.

I remember one in particular, that I attended, where two famous scientists from NACA, named Eggers and Bogdanoff, were among the speakers. Both men were highly respected experts in their respective fields. Al Eggers strongly favored sharp leading edges and noses for high lift to drag (AD) ratios, while Bogdanoff argued strongly for bulbous noses to reduce aerodynamic heating (Figure 8).

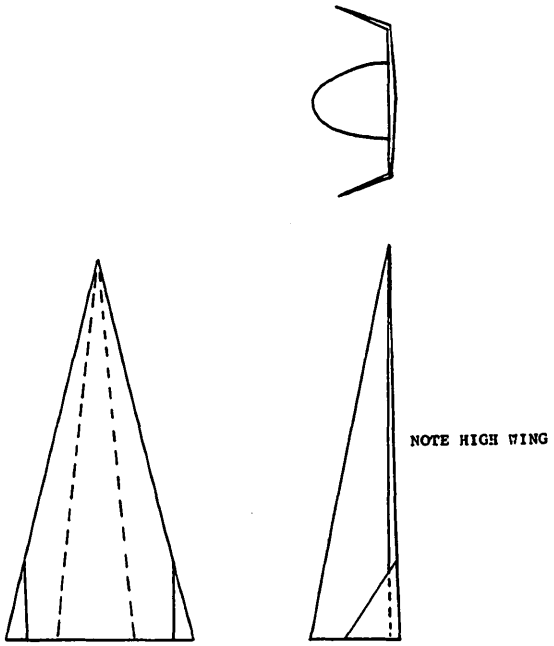


Figure 8 High L/D hypersonic boost glider configuration of the type proposed by Al Eggers of NACA in the mid-1950s. Later research revealed the advisability of employing a flat bottom and a blunt "Bogdanoff nose" configuration to reduce aerodynamic heating problems.

Now Eggers' face sports a rather sharp nose, while Bogdanoff has an unmistakably, shall we say prominent proboscis.

Well, these two were really having at it "on stage," shouting and waving their arms at each other, defending their respective positions, when suddenly they both stopped for a second or two to breathe. Just then, during the silence, someone in the audience said audibly, "It's easy to see which approach each of these guys favors, it's as plain as the nose on their face."

The whole place cracked up, especially Eggers and Bogdanoff. From then on, to anybody in the know, a bulbous nosed, winged reentry vehicle was laughingly referred to as having Bogdanoff's nose. The Space Shuttle has one.

The very real gulf between the latest technological state of the art in high speed flight in the upper atmosphere, and that of the manned, hypersonic, boost-glide reentry regime we were attempting to address, was brought home to me one day in a very personal way.

I had an appointment to brief Col. Maxwell on the Boost-Glide study program. I went to his office and wound up waiting over an hour outside his door.

Inside, there was some kind of a heated discussion going on. I couldn't make out much of what was being said.

Suddenly the door flew open, and about a dozen officers from the B-52 WSPO came tumbling out, white faced, and obviously shaken.

I went in. Maxwell was standing with his back to me, staring out the window. All I said was that I was there to brief him on the boost-glide—! He startled me by leaping away from the window, leaning across his desk and shouting in my face. I'd never seen him so red-faced mad.

"I'm not interested in hearing about any @#ø/0$ hypersonic reentry vehicle crap right now. How the @#%$ are we going to make that work when we can't even solve a simple problem like all the @#ø/O$ Marmon Clamps leaking fuel all over every @#ø/O$ B-52 in the @#ø/0$ fleet." (Marmon clamps are used to clamp and seal fuel line connections in many aircraft.)

The expression on my face must have been priceless, because he backed right off and calmed down immediately.

"Sorry, Bill," he said to me with a broad smile. "I didn't mean to take it out on you, but this thing is making me crazy! How about giving me a few days to sort this thing out, then we'll talk? Okay?" That's the one and only time I can remember in my whole career to date when any boss of mine ever apologized for shouting in my face, even when I didn't have it coming.

He solved that problem too, even before I had a chance to redeem my rain check. I liked and respected Bill Maxwell. He was one of those tough minded but fair managers I referred to earlier. So was Bill Lamar.

Lamar spoiled me rotten for every boss I've ever encountered since, and I've had a few. He is a manager's manager. I never met anybody who worked with him or for him who doesn't feel the same way about Bill. He possesses a remarkable grasp of technological theory in many diverse fields, as well as pragmatic knowledge of hardware and systems. Bill has the ability to quickly zero in on the heart of a problem, whether it has to do with design of a hypersonic shock tunnel or faulty landing gear on an "X" series research aircraft. For these qualities, Bill earned the respect and admiration of everyone who knew him. But his most endearing quality to those who worked with him and for him was his ever present fairness and humanness.

There is an amusing side to Bill that only those who are fortunate enough to share considerable time and particularly travel with him know about. I've never met anyone with quite as much nervous energy as Bill. It's reflected in his propensity for rapid-fire speech. There were never enough hours in a day for him to cram in all the things he wanted to get done. To Bill the job always came first.

But every once in a while, he'd bring himself up short and decide to "take the time to smell the flowers." I'll never forget one incident that happened in the summer of 1957, when Bill and I were scheduled to travel together from Washington D.C., to Newport News, Virginia. Bill suggested we make the trip overnight, on a quaint old excursion boat, rather than flying down there.

It was a delightful experience; "dinner in the diner," a balmy night, standing at the stern watching the Moon's reflections in the ripples of the boat's wake—a restful sleep in a private cabin—. In the morning I awoke and met Bill on the deck. I was amazed to see, trailing behind the boat as far as I could see, little white scraps of what looked like tissue paper, floating on the water.

It turned out that the night before Bill was being kept awake by the creaking of the hundreds of wood framed windows of the cabins surrounded by the deck. It was a chilly night on the river, so everyone had their windows closed. Bill wanted to be sure to be fresh and alert for a very important meeting we were going to the next day. So he got up and stuffed Kleenex into lord knows how many of those windows on the boat to silence the racket and went back to sleep in his cabin. When the passengers awoke the next morning, most of them, including me, opened their cabin windows to greet the glorious new day and, voila!

One day Lamar came to my desk dragging a flip chart page he'd torn from a briefing he'd just given to some visiting officials from Hqs. USAF. We didn't use overhead projectors (viewgraphs) in those days, There weren't any drypaper copiers to make the slides on then, anyway.

If we had to make a really fancy briefing, it was presented using 35 mm slides and a projector. But that was very expensive and time-consuming, because you had to have the graphics department do the art work and the photo lab to do the slides. That could take a week or more.

So, for everyday briefings, we drew our own charts on big pads of butcherpaper, which we'd hang on a big clumsy easel. We used grease pencils, because there weren't any big, fat felt pens then. For a pointer, we'd use a sawed off golf club, a yard stick or just point with a finger; larger pointers hadn't been invented yet.

Anyway, on the chart that Lamar brought me, there was a curve of Altitude vs. Speed. On it Bill had drawn the reentry flight path for a winged, hypersonic boost-glide vehicle. The plot showed a maximum altitude of 400,000 ft. and a maximum of circular orbital speed. During the briefing, Bill had been forced to admit that the part of the curve above about mach 5 and 100,000 ft. was pure conjecture. The factual data didn't yet exist.

He had tried to get a comprehensive picture of the aerodynamic lifting reentry flight corridor from both our Aerolab and our study contractors, to no avail. Nobody had it. We were all guessing.

To be fair, a large part of the reason for this deplorable state of affairs was that no approved standard atmospheric tables of very high altitude data yet existed which covered altitudes up to 400,000 ft. The U.S.A. had been sending sounding rockets into the far reaches of the high altitude regime and into free space for many years to get that data, but, as of early 1957, nothing had yet been published.

Bill placed the chart on my desk and asked me to develop the needed envelope curves. "Don't panic," he said, laughing at the expression on my face, "I'm really not asking you to perform some miracle." With that he dropped a fat three-ring binder onto my desk. I opened the cover.

Inside was an advance copy of the new ARDC Standard Atmospheric Tables. They covered our entire area of interest. It was still so freshly copied that it smelled of vinegar. I didn't know where or how he got it, and I didn't ask. Armed with this thing we could stop guessing, if I could get the job done, that is.

Business computers were a very new thing in those days; they filled whole buildings, like the latest IBM monster we had recently obtained at WPAFB. It wouldn't do me any good, though, unless the Aerolab had developed a program for calculation of that winged reentry corridor. They hadn't. Personal computers (PCs) didn't exist, either. I'd have to start from scratch and develop my own equations and crank it out on a calculator. We didn't even have electronic pocket calculators back then—one used a slide rule. What I needed was a desk calculator.

These we had. They were big, clumsy, Jules Verne-looking monsters, a little larger than an office typewriter. That thing would shake everything else off your desk as it cranked away interminably on a division problem. I couldn't get permission to take one home with me; I certainly couldn't be expected to do this job during the day!

One of the engineers in my department had a hand held Curta Calculator. It was an import from Liechtenstein. They were very expensive and very rare. This gadget looked like an innocent black pepper grinder, little turn crank on top and all. Yet it was just as accurate as a desk top calculator, to as many decimal places. I managed to borrow it.

Lamar was anxious to get that curve, but in all the weeks it took me to get the job done, he never once bugged me about it. He'd drop by my office occasionally and ask how it was coming, and I'd say I'm getting there. That was all. Yet, I knew that, if I'd given the slightest hint that I might be having trouble

with it, he would have jumped in immediately—*to help, not to complain or criticize me*. Late in February 1957, the job was completed.

Until it was officially published as a WPAFB Tech Report (TR), we could not distribute copies to our study contractors for competitive reasons. But Bill delighted in giving them a sneak look at the thing and then watching 'em squirm, trying to think of some way to talk him out of a copy. He never failed to give me credit for the work.

In March the report was finally published:
AD116610—"Characteristics & Aerodynamic Limitations of Efficient High Altitude Sustained Flight Within The Atmosphere.", March, 1957.

In August 1959, I published a technical article based on that report in *Aero/Space Engineering*, which is the magazine of the Institute of the Aeronautical Sciences. As a direct result of that article I was honored, years later, to be invited to author the Aerodynamics and Aerostatics sections of *The McGraw Hill Encyclopedia of Science and Technology*, where it has been included, unchanged, in all the issues since then (Figure 9).

Thanks to Bill Lamar.

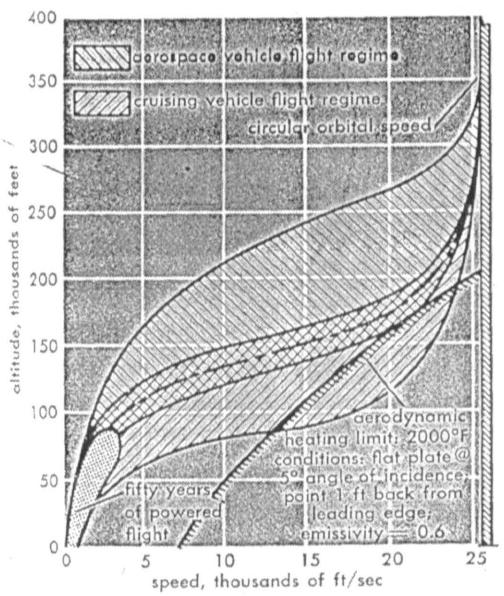


Fig. 1. The practical limits of aerodynamic flight within the atmosphere. (*Aero/Space Engineering*)

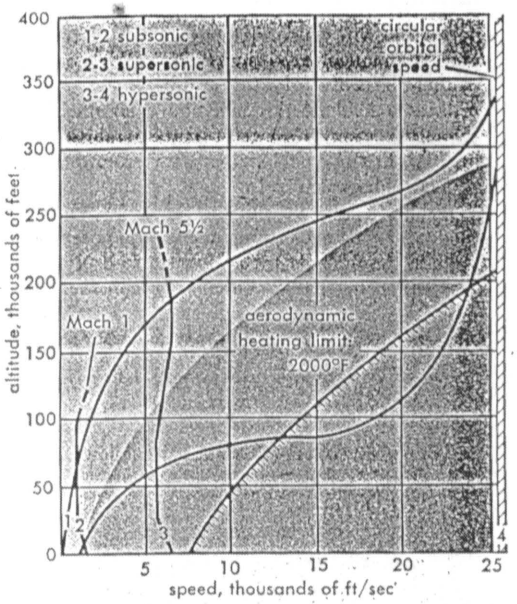


Fig. 2. The subsonic, supersonic, and hypersonic flight regimes.

Figure 9 Limits of Aerospace Flight Regimes. Source: *McGraw-Hill Encyclopedia of Science and Technology.*

By 1957, ROBO, BRASS BELL and HYWARDS, the three manned boost-glide vehicle system programs competing with one another for hardware development consideration, all had one very serious problem in common. None of them had a booster to call their own. Ballistic missiles were under development—boosters weren't.

We determined that the Atlas wouldn't be any use to us, but the Titan might be. The trouble was, everything was so very hush-hush ("tippi-top" secret), we didn't have any design data. We knew who had it though, General Bernie Schriever's ballistic missile WSPO; The Western Development Division (WDD), as it was then called—in sunny Southern California.

It took some doing, but we got the required "tippi-top" secret security clearances, declared our need to know, and a group of us from the WSPO and labs set out for the west coast. We got as far as the lobby in WDD, and there we sat—for several hours. Suddenly an inner door opened, and out leaped a very officious looking USAF officer in civilian clothes. He turned out to be a Major. He strode to the center of the room with a decided air of self importance, whereupon he delivered a short speech while he proceeded to pace in little circles.

"We wouldn't give you a wooden nickle for your damn winged, boost-glide bomber concept," he said. "The Intercontinental Ballistic Missile is the ultimate weapon! All you guys are doing is whistling Dixie and wasting the taxpayers' hard earned money! We aren't about to jeopardize the security of our program by giving you guys any data on the Titan. You can wait till Hell freezes over!" With that, he stepped back through the inner door and we were again alone. We went home empty handed—AND ANGRY!

I remember thinking, "Who the Hell do these guys in WDD think they are? Aren't we all American citizens. Aren't we all in the same Air Force? Are we not all on the same team? Apparently not! So they think the ballistic missile is the ultimate weapon, huh? Bull! Something else will eventually come along some day and sweep them away just like the dinosaurs. For millions of years the dinosaur was king on this planet, but today he's extinct."

I believed the manned, winged, hypersonic, boost-glide weapon system would some day dominate the Earth too; it would have its day, of that I was certain. When something more powerful comes along and replaces it—so be it, I was willing to accept that.

Maybe the thing that will come along to sweep away WDD's pea brained ultimate weapon will be the era of boost-glide vehicles, gobbling up the ballistic missile era like some giant dinosaur. I must have tucked that analogy between the boost-glide era and the dinosaur away in my head somewhere, because it popped out again some time later.

By mid 1957, it had become apparent to all concerned that it was time to hardware orient the boost-glide program—to build and fly a full scale vehicle system.

I got to thinking what it was going to take to get approval for a development program from higher headquarters, especially from the Department of Defense (DOD). Everybody I talked to was thinking prototype. That bothered me.

There are only two DOD budget line items covering vehicle system development in the Air Force: prototype ("Y" category) and research vehicle ("X" category). The big money and future is in the prototype, that's where promotions for a lot of people come from. The Air Force types know that and so do the contractors. That's why everybody was thinking prototype. A person could make a career out of working a single program from prototype through operational status. That's exactly what a lot of them both inside and outside the Air Force had in mind.

Research vehicle development programs tend to be one-of-a-kind and are continually suffering for lack of adequate funding—they're dead ended. That's why there are so few aircraft companies even willing to take on a research aircraft development program. Even as we were putting together our development plan proposal, the X-15 SPO on the floor above us was struggling with a threat to cut their funds.

For a prototype to be approved, the Secretary of Defense has to have already approved the Weapon System for entry into the weapon inventory at some specific time. The routine operational concept would have to have been established, and the total program costs would have to be earmarked in the federal budget. To deviate from this process, there would have to be a lot of changes in laws and regulations.

No matter which mission we claimed for the boost-glide system (bombardment, reconnaissance, etc.), we couldn't guarantee that the operational weapon system would even remotely resemble the prototype. How many of the weapon system versions would be required? What is the operational concept (how would the system be employed to get a military mission done routinely)? How about launch and recovery facilities? Launch vehicles? And the total cost? Multi-billions!

I didn't think we stood a ghost of a chance of getting approval for a prototype development program. We could waste a lot of time and effort, not to mention money, before we hit that brick wall, too!

That left research vehicle—the "X" category.

Too restrictive! Not because it was dead ended, or even that the money wasn't as good, but because we couldn't get the job done.

A critically important lesson for the whole National Space Program emerges here.

Why does any nation undertake to EXPLORE a foreign and hostile physical environment like the depths of the sea or the hypersonic flight regime at the fringes of space—or space itself? Just because it's there? Baloney! They do it because they intend, someday, to conquer that environment, and to put it to some useful purpose; to get some job done routinely and efficiently in or from that environment—to EXPLOIT that environment. To exploit an operating environment, you have to have the capability to operate within it and from it routinely: to go there and back as often as you like, whenever you like, to stay for as long as you like, and to do whatever it is that you need or want to do there. You don't gain this exploitation capability merely upon completing the Exploration phase in some new, unfamiliar, unknown and hostile environment like space. NOT EVER!

We humans have been routinely exploiting (in the good sense of the word) the Earth's environment and its resources for millions of years; it's an environment about which we know a lot.

But space, the boost-glide flight reentry corridor included, is a place! A place and an operating environment about which we know very little. A hostile, foreign environment which, in order to be conquered, calls for extraordinary steps that go beyond those required to advance the state of the art in the Earth bound environment.

It seemed to me, in early 1957, (and I still believe) that to conquer space (and the manned, hypersonic boost-glide flight regime) requires three distinct steps:

1. EXPLORATION MISSION: To find out what's there, measure it and record it.
2. EXPANSION MISSION (the transition from a capability to Explore to a capability to Exploit):
   a. To determine affects and effects of that environment.
   b. To learn how to live and work routinely in that environment.
3. EXPLOITATION MISSION: To do a job routinely in or from that environment.

The problem for the boost-glide program then, and the problem we, in America, continue to refuse to face up to in our national space program even today, is:

WE ABSOLUTELY REFUSE TO TAKE THE TIME AND SPEND THE MONEY TO FORMALLY ACCOMPLISH THE SECOND STEP: LEARNING HOW TO OPERATE ROUTINELY WITH MAN IN THE SPACE ENVIRONMENT. WE, FOR SOME INEXPLICABLE REASON, INSIST ON THINK-

ING WE CAN SKIP IT AND GET AWAY WITH IT! *NOT IN THE SPACE ENVIRONMENT YOU CAN'T!*

I have actually been told by some of America's highest level decision-makers that to perform the Expansion Mission (as I define it) would be a step backwards in our space program. How little they know and understand!

The U.S.S.R. invested almost 20 years learning what routine operations in Earth orbit with manned satellites is all about; developing operational building blocks. I am absolutely convinced that the Russians understand this principle, which is why they have an operational space station in orbit today *and America doesn't!*

We needed to *learn how to operate routinely* in the manned, Boost-Glide flight environment too, but the existing budget line items, "X" and "Y," did not recognize what I referred to above as THE EXPANSION MISSION.

Therein lay the problem that was bothering me. Where America's National Space Program is concerned, it still bothers me.

We weren't ready yet to EXPLOIT the boost-glide flight regime, so a prototype ("Y") was out. A research vehicle program would allow only the gathering of data on the effects of the reentry environment on man and machine—a logical follow on to the X-15 program. But that capability would not be enough to take us clear through the EXPANSION MISSION, as I refer to it.

We needed to use the vehicle we intended to fly to experiment with man and machines to develop routine operating techniques for use in designing future operational weapon systems; any and all promising military missions we could dream up.

An extremely important part of the mission, then, had to be the development of routine operational building blocks, or the program would indeed be a waste of time and money. A conventional research vehicle ("X") program just wouldn't do the job! Besides, I wondered how far we'd get, when the top-level decision makers realized we'd also have to develop a booster for it at the same time.

We just weren't going to get there from here!

Well, I remember thinking, if neither the "X" nor "Y" filled the bill, just what would?

We needed a flying laboratory that could operate in the entire boost-glide reentry flight regime from circular orbital speed and about 400,000 ft. down to the Earth's surface. It should not have any military mission and should not be a prototype of anything! Nor should it be a research vehicle!

It should be capable of gathering information on the effects of the environment on man and machine, *PLUS developing routine operational building*

blocks for military missions to be conducted in or from that environment—all in the same vehicle!

What did we need? We needed a hybrid—an "X/Y" class machine. Some of what we needed to do is normally the function of a research type system and some was prototype in nature. But because of the way the budget classifications were written, it was impossible to define accurately what we wanted.

Not that the powers that be couldn't work their way around this problem, but in the confusion that was bound to result, there was a very real danger that there would be those decision makers in the loop who would, through lack of understanding, make a mess of it!

It also occurred to me, in the early 1960s, that this simple fact (refusing to recognize EXPANSION as a formal mission) was going to be a serious stumbling block to conquering space, should this, the U.S.A., ever get a manned space program going. It was—and I'm convinced that attempts by the top level decision-makers today, in refusing to recognize, address and resolve this budget problem, continue to "work their way around this issue." In so doing, there are numerous hardware development programs, today, suffering severe delays, confused decisions and lack of funding. Not the least of these is the NATIONAL AEROSPACE PLANE Program (NASP). I judge that The National Space Station Program is no better off!

I concluded, therefore, in early 1957, that we would be making a fatal mistake to go after either the "X" or "Y" programs. We would have to campaign hard for an "X/Y" system or go down to defeat! Lamar and Maxwell would have to be advised of this problem at my first opportunity!

Before the opportunity to talk to them came up, something else did.

What came up was a phone call to me from Col. C. G. ("Stretch") Strathy, Director of System Plans, Hqs. ARDC, which had the ROBO, BRASS BELL, and HYWARDS program offices. We had never met.

He wanted to know if I would be available to come to Baltimore to assist their consolidation of all three programs into a single one in preparation for a hardware development program. I was on the next plane.

Hqs. ARDC was then housed in the old *Baltimore Sun* building, which was an ancient, dilapidated wreck. The floor creaked and groaned at my every step, as I searched through the poorly lighted halls for the right office. The place was full of high ranking officers; mostly their office accommodations were atrocious. Not only were the offices cramped, but the furniture looked like it was left over from the Civil War. Perhaps it was. Strathy's office was among the few relatively comfortable ones.

Colonel Strathy didn't waste any time getting to the point. He handed me a typewritten page with the names, office locations and telephone numbers of

the three officers in charge of the three boost-glide programs. As I recall, they were two colonels and a major.

"Get them to agree on a single program they can all live with, and work with them to prepare an Abbreviated Development Plan," he said.

I was dismissed, having been in his office no more than five minutes. The next day I interviewed the three officers on his list. I went back to Strathy's office later that same day.

"Colonel, there's just no way these guys are going to agree on consolidating anything. They each demand that the new abbreviated development program plan reflect their mission, period! I'm going to have to write this thing myself." I wasn't expecting him to be particularly pleased with me, but those were just the facts, so there you are.

Instead, he treated me to a friendly grin and said, "What took you so long?"

We spent about an hour talking over what we were trying to accomplish, and about the prevailing situation. I explained my intention to define an "X/Y" type development program and my reasons for wanting to approach this thing in such an admittedly extraordinary manner. He listened intently, asking a few searching and pertinent questions. Finally he said, "Bill, I couldn't agree with you more. You go ahead and write this thing just the way you see it. You've only got two weeks to get this job done—give 'em hell." We became fast friends before I left Baltimore.

I settled into an office whose occupant was on extended leave. For the next two weeks, including the weekend in between, I was glued to a cantankerous old wire recorder (there were no tape recorders then), dictating the entire abbreviated development plan. I developed my own tables, graphs, charts and illustrations and sent them to the graphics department for final preparation.

Though he dropped by my office occasionally, and we met socially several times in the evening during those two weeks, Col. Strathy never once pressured me. "How's it coming?" he'd say. "I'm gettin' there," I'd say. He would wink and move on. I knew he would offer his help in a minute if I gave the slightest hint that I was having trouble—another Lamar. We met several times during those two weeks for a progress review. He never suggested any changes in my work, other than to offer an improvement in the structure of a chart or to suggest a useful illustration about some point I was trying to make.

One of the hardest things for me was resisting the temptation to write an orbital, and even multiple orbital, requirement into that plan. Space was still a dirty word in the Air Force, so I knew I didn't dare try that. I did write the plan to describe a new kind of vehicle system to perform the Expansion Mission—an

"X/Y" machine called a Conceptual Test Vehicle (CTV). Somehow I managed to meet the deadline.

On my last day, Strathy had me give a stand-up briefing on the Abbreviated Development Plan in his office. The other three officers from the program offices were there. When I had finished, Stretch stood up and said, "Bill, you've put us all to shame. I'm going to submit your development plan to Hqs. USAF just as you wrote it—with no changes.

"Now we've got to give a name to this thing—some suitable acronym. I think you have earned first crack at that if you've given it any thought, Bill," he said turning in my direction. I said as a matter of fact I did have an idea for a name, I'd like to suggest DYNA-SOAR!

Now, I had already thought about using that name for this program, but I swear I hadn't talked about that name to anybody before, including Strathy—it just popped out when he gave me that shot at it.

There was a stunned silence. Everybody looked at everybody else and then back at me like I had suddenly taken leave of my senses. I hastily gave them a thumbnail sketch of the sorry experience we'd had with WDD and their belief in having the ultimate weapon. Then I told them about my envisioning a dinosaur (boost-glide era) having its day; sweeping away the intercontinental ballistic missile era.

They all had a good laugh and discussed the idea for a few minutes. Then Col. Strathy said, "I like it!" He looked around the room, and everybody nodded agreement. Giving me a big grin and a wink he said, "Then Dyna-Soar it is."

I believe it was Strathy who saw the significance of dynamic soaring in that acronym; I can't take credit for that.

I took the draft and quickly made reference to the name, Dyna-Soar, in the appropriate places in the document, gave it back to Strathy, and said my goodbyes. I returned home to Dayton in mid-September.

On October 4, 1957, the Russians launched SPUTNIK-1!

Suddenly, SPACE was no longer a dirty word in the Air Force—or anywhere else for that matter. Let the nuttiness begin!

By the time the Dyna-Soar Abbreviated Development Plan cleared Hqs. ARDC approval channels, got printed as an official document and distributed, it bore this title:

ABBREVIATED SYSTEM DEVELOPMENT PLAN
SYSTEM 464L
HYPERSONIC STRATEGIC WEAPON SYSTEM
C7-115361
10 OCTOBER 1957

It was officially approved by Hqs. USAF on November 15, 1957. The USAF immediately set out to accelerate the development program schedule and

seek much more funding than was then currently allocated. It looked like Dyna-Soar was going to have its day. I was, to say the very least, very pleased. Thus it came to pass that DYNA-SOAR became this nation's very first approved space hardware program, manned or otherwise.

But, alas, starting almost immediately, the powers that be started mucking around with the objectives of the program, no doubt caused by the panic which followed the orbiting of SPUTNIK. It seemed like everybody and his brother-in-law followed Sputnik into orbit during those panic filled days.

There followed a series of amendments to that plan, and a series of new development plans, that continued right up to the time the program was finally canceled in 1963. It wasn't long before all officialdom had completely lost sight of the mission. They did accomplish one thing though—they made Dyna-Soar multi-orbital which, of course, in my mind made the need for the Expansion Mission even more imperative!

So much for official recognition of the EXPANSION MISSION in the Roots of Shuttle or, for that matter, in the U.S. National Space Program which soon followed. The issue was never officially raised again!

I still feel that the price we Americans paid for the failure to appreciate the significance of the Expansion Mission in America's plans for conquering space is floating over our heads in orbit this very minute. It's the Russian Orbital Complex called MIR!

There were several rounds of contractor proposal efforts that year, and again in 1958; this time for Dyna-Soar. One day I got a call at about 9:00 am from some colonel I didn't know at Hqs. USAF. All he wanted was for me to give him a figure for the total program cost of the entire Dyna-Soar program.

I told him we didn't have a figure that accurately reflected the latest redirection that had taken place in the program. If he could wait a couple of more weeks though, the latest round of contractor proposals was supposed to contain that very information.

But he insisted he had to have a number today. "Just a rough estimate will do—it's not for official use or anything like that," he swore to me. He wanted a number by noon, my time. I told him the number I could give him off the top of my head now would be as good as anything I might dredge up by noon. He said shoot! So I did.

When the contractor's proposals came in two weeks later, they all quoted total program costs to be at least two to three times larger than the figure I had given that colonel, whoever he was.

Hqs. USAF is still looking for the SOB at WPAFB who gave them that number. Of course, my number had become gospel and was quoted throughout

Washington, including the Congress and the White House. I had inadvertently embarrassed the Air Force to tears. Sorry about that colonel, whoever you are.

Then there was the day, early in 1958, when I had occasion to visit Hqs. ARDC in Baltimore again. Aside from visiting Col. Strathy, I found myself summarily called to some other colonel's office. The building was bulging with new people. ARDC was staffing up to handle THE SPACE AGE.

How crowded were they? They were so crowded in there, that people were doubled up in offices already too small for one person. As soon as you entered the front door, you could hear the floor creaking all through the place.

I went into the colonel's office. He took one look at me and said, "You the Bill Walters (my name has no "s" on the end) who's doin' Dyna-Soar at WPAFB? I admitted I was.

"Well, we're goin' to cancel Dyna-Soar!"

I kept smiling until I realized this guy wasn't kidding. He was deadly serious!

"Why?" I managed to gasp.

He looked at me like I ought to know the answer to that question without being told.

"Because Dyna-Soar's got too many technical problems, that's why!" he answered.

He pointed to a stack of bound, color brochures sitting on the floor next to his desk. They stood at least two feet high.

"Them's unsolicited proposals from every aerospace (so, it's aerospace now is it?) contractor in the country. "They got designs for manned spacecraft in there that can get us anywhere in the solar system, in just a few years too.

"And they all tell us they don't have the technical problems you guys have in Dyna-Soar!"

I felt my face turn beet red with anger and frustration! We had just spent years and millions of dollars to define and solve the problems required to be successful in developing a manned, hypersonic, boost-glide vehicle system capable of operating in the space environment, and now our progress was actually being held against us. It was painfully obvious that the "aerospace" contractors had gone into orbit over SPUTNIK, along with our government officialdom.

I was glad for the sake of the future of my Air Force career that he was not standing in my office when he said that. I left before I got sick all over his desk.

Back at Wright Field, there were some people who became concerned about what the Russians might be up to in the Boost-Glide technology field. I was one of them. We had German rocket scientists. They had German rocket

scientists. We started Dyna-Soar as a direct result of their influence. Could it be—?

I wanted to find out. So, I went to the Foreign Technology Division (FTD) of WAFB and stated my case. Could they give me a technical assessment of the Soviet Union's capabilities in this area?

Why, sure!

I was visualizing a small army of James Bond 007 type spies being sent deep into Russia to do their thing.

A couple of weeks later, I received a "tippi-top" secret request for copies of all the proposal documents submitted by all the Boost-Glide contractors to date, including Dyna-Soar. They wouldn't tell me who it was for. Since the request was legitimate, I supplied the data. I didn't make the connection to the FTD at the time.

Six months later, FTD submitted their report on the status of the Russian Space Program to me. Eagerly, I tore open the envelope marked "tippi-top secret" and excitedly pulled out the contents.

When I examined the report I discovered, to my horror, I was looking at the ROBO, BRASS BELL, HYWARDS, ROBO and, yes Dyna-Soar configurations and technology, all credited to Russian capability about ten years in the future.

Being young and naive to real world politics, I was furious and raced right down to FTD and demanded an explanation!

There had been no small army of 007 spies. Nobody had gone deep inside Russia to get this information. In fact, nobody had left the FTD facility at all. All this work was done by internal technical analysis of the USAF Boost-Glide contractor's data I had supplied. So that's who got all that stuff!

They explained to me that they had assumed whatever the U.S.A. could do in terms of technology advancement and vehicle system development by a certain time period, the U.S.S.R. would be capable of producing about ten years later. Thus, the report! Mounting a full blown effort to answer my question would cost millions, and it didn't have a very high priority with headquarters officials in Washington—thus the method chosen to service my request. What could I do? I just walked away—we never used their report, and we certainly didn't allow it to be forwarded.

Looking back on it, I was being too critical of FTD after all. It is very interesting to note that our Space Shuttle flew for the first time in 1981. Theirs was launched roughly ten years after ours.

AND, THEY HAVE TWO VERSIONS: ONE LIKE OUR SHUTTLE; THE OTHER LIKE OUR DYNA-SOAR (Figure 10)!

I can't help but wonder what the Russians have learned that we haven't?

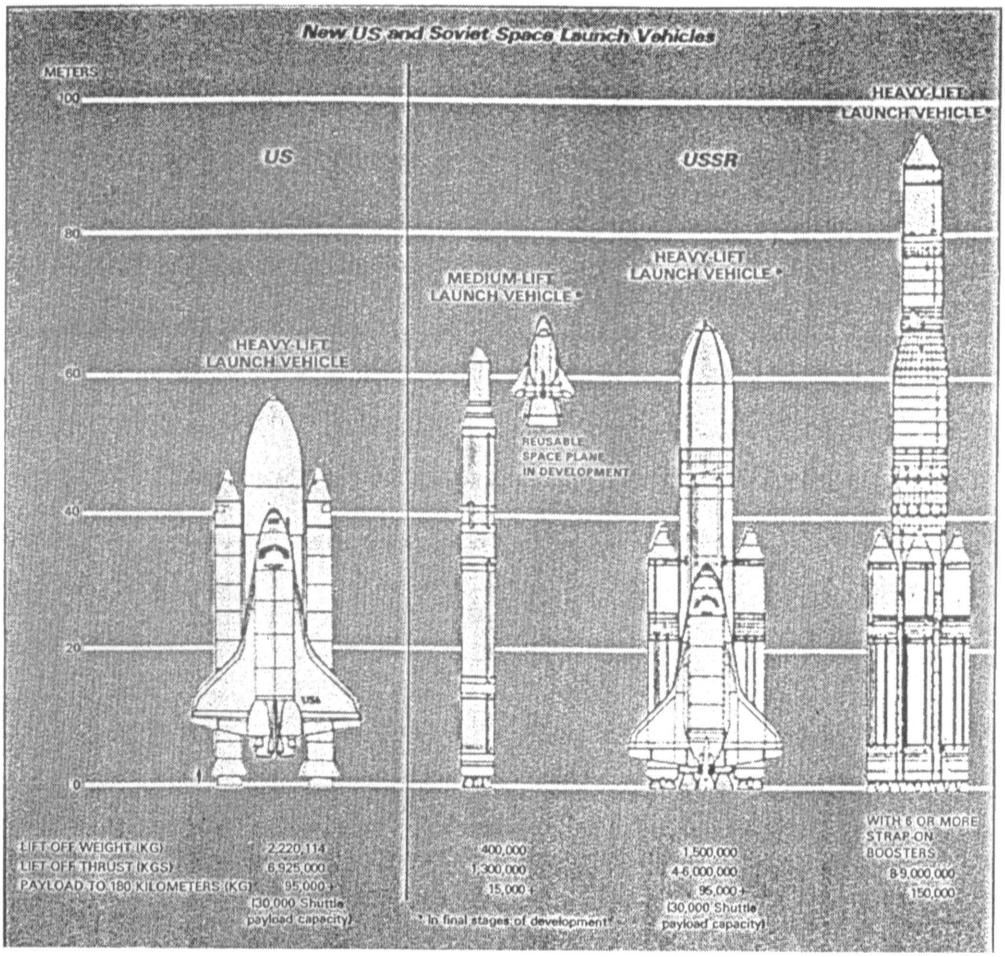


Figure 10 One of Our Planes is Missing.
Source: *The Encyclopedia of Soviet Spacecraft.*

Things were coming down to the wire in the competition between Bell and Boeing over which one was going to win the development contract for DS-1, now officially called the X-20.

General Curtis LeMay wanted very badly for Boeing to get the DYNA-SOAR development program contract, and he didn't make any effort to hide the fact. As the head of the USAF Strategic Air Command (SAC), he was a strong supporter of the DYNA-SOAR concept. Boeing was traditionally a major supplier of strategic bombers. Bell Aerospace was not.

Now that Boeing had lost the B-70 bomber development contract competition to North American-Rockwell, Boeing was available to take on the DYNA-SOAR program.

Quite naturally, LeMay preferred to work with a contractor management team with a track record he understood and worked well with in the past. He had a similar relationship with the Martin Management Co., because of their ICBM experience with SAC.

LeMay was well known for believing in conducting business on a "Win-Win" basis. The DYNA-SOAR program was apparently no exception.

Meantime, Bell Aerospace, as prime contractor, had teamed with The Martin Co., to develop the spacecraft, while Martin was to serve as subcontractor and provide the booster—by this time a TITAN IIIB (TITAN Liquid rocket booster stem with solid rocket booster "strap-ons").

Some people believe that it was through LeMay's influence that the USAF arranged to convince Bell Aerospace management that Bell would be wise to let Martin be the prime contractor with Bell sub to them. Since Martin was considered to have a stronger management capability, and was a more experienced hardware manufacturer, Bell was led to believe there would be a better balance in the upcoming DYNA-SOAR development-contract competition if they agreed to do that. Bell agreed, and the change was officially announced.

I'm sorry, but that move just tickled my funny-bone. I went to our graphic arts department and asked an artist to make up a special chart. Nothing fancy mind you, just a simple sketch of the most realistic looking, viscous tyrannosaurus he could dream up. I wanted a saddle on its back and reins attached to its snout. A little green man with bug eyes and two antenna sprouting from his head should be sitting in the saddle, holding the reins. Around the neck of this beast I wanted a large, brass cowbell hanging down.

Of course the message was: Martin is in the driver's seat, and Bell is along for the ride.

The artist, who was very familiar with the DS-1 program, and the latest events involving the change in primes, laughed so hard at what I described, that tears ran down his cheeks. He agreed to do my chart.

A few days later, he surprised me with a beautiful color painting of exactly what I'd described to him; it was suitable for framing—so I did just that. I hung it on the wall behind my desk, and I didn't think any more about it; not until the local Martin Company rep came to see me, that is. He took one look at that painting and flipped out! Nothing would do but that he had to borrow that thing (Figure 11)! I never saw the original painting again!

No more than a week went by before color prints of that damn painting flooded the whole aerospace contractor community. It was also circulated exten-

sively throughout Washington; Pentagon, halls of Congress, The White House and all.

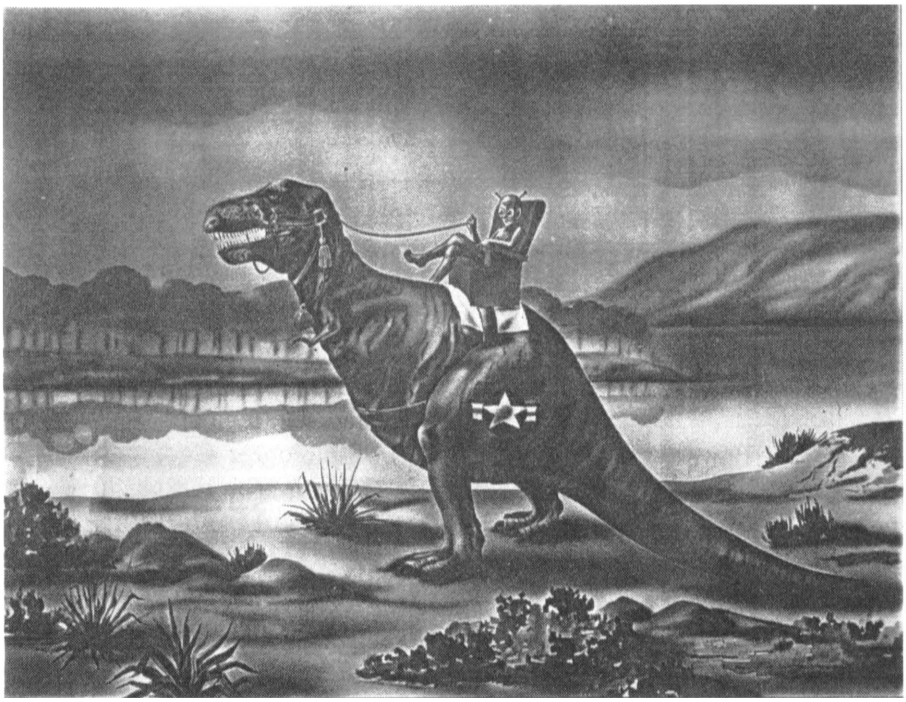


Figure 11 Martin is in The Driver's Seat.

Nice going Willie. You did it again!

Sorry about that Casey.

Casey Forrest, of Bell Aircraft, was another guy you just had to admire. I'll have to admit that I felt, right up to the end of the competition and the award of the DYNA-SOAR development contract to Boeing, that Bell's team was technologically way out in front of all their competition. That was Casey's doing. He worked that engineering team and himself harder than any design and proposal group I've ever seen, before or since.

But, that's not what was important or impressive about that team of guys.

What impressed me was, that these guys were dedicated to the cause. It wasn't just a job to any of them—they believed the world was ready for, and needed, a hypersonic, manned, boost-glide vehicle system—one with orbital capability. We would travel around the country together in those early days before any other contractors got into the act.

In the evening, after we'd done our thing at Langley, or Ames, or Hqs. USAF—wherever, we'd have dinner some place. Afterwards we'd go to one or the other of our rooms at our hotel and just talk.

Casey and his guys openly shared their fondest dreams with me. They wanted to get a manned Boost-Glide program going with the USAF, sure. That's where the money was. But they dared to dream, among other things, of a big, manned space station orbiting the Earth, resupplied by a whole fleet of BOMI type vehicles. And this brand of BOMI didn't carry bombs—it carried people. The station was on a peaceful mission. They all felt that way. They knew any major aerospace company could produce this beast, once the conduct of the Expansion Phase showed them how. But, they wanted it to be BELL.

On occasion, Bill Lamar would share an evening with us like that. That's when things really got going—Bill is a gifted dreamer, too. I miss those days, a lot.

For a short time there, an Air Force Captain was the first Dyna-Soar Program Manager: Me. I'm very proud of that. But it couldn't last. The rules call for a colonel to be the Chief of a WSPO. Two Colonels served in that job during the life of the Dyna-Soar program, both of whom, I'm pleased to say, are good friends of mine, though I haven't seen either one of them for many years now. We kept in touch back then. One was Colonel R. M. (Russ) Herrington, Jr. The other was Colonel W. L. (Mickey) Moore, Jr. They were believers, too.

The Dyna-Soar survived many ups and downs in the early 1960's, the details of which have been amply reported elsewhere.[2] Suffice it to say that there were agonizing changes in direction involving purpose, mission, vehicle design and performance specifications. The program was finally given the official designation X-20. The Boeing & Martin team was awarded the DYNA-SOAR hardware development contract (Figure 12).

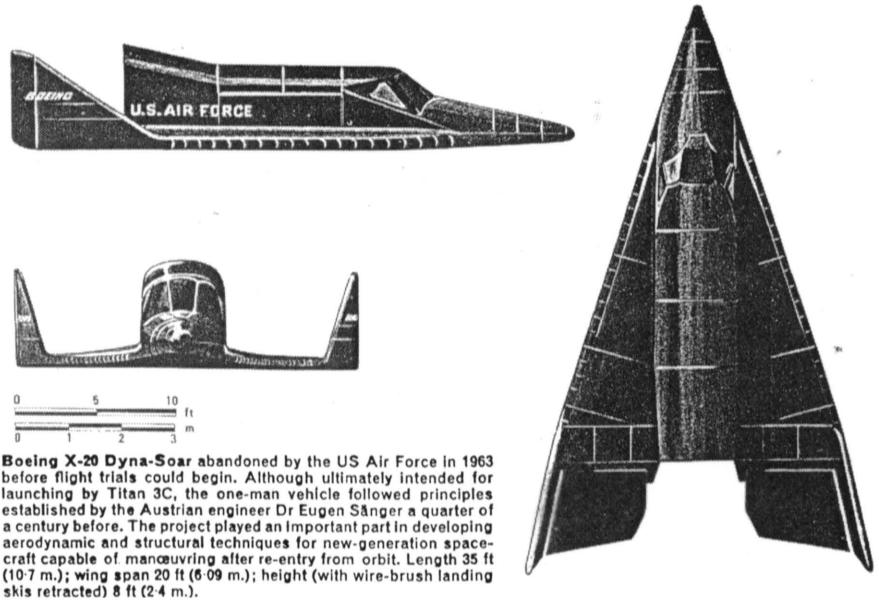
Though I was a Regular Officer, I resigned from the USAF in 1958, to pursue a civilian career. I kept visibility of the DYNA-SOAR program. It was not a pretty sight!

By 1962, Robert MacNamara, then Secretary of Defense, became convinced that the way to go in getting an operational, manned, military space system program going was to dump Dyna-Soar and develop a "small space station" module and "paint a Gemini vehicle blue" to resupply it. Thus was born the Manned Orbital Laboratory Program (MOL). MOL was later canceled, too!

A surprising number of cooler heads at all levels of the government, including NASA, suddenly surfaced in the eleventh hour and raised hell about the very idea of canceling Dyna-Soar. McNamara wasn't listening! So he did it!

It was a sad day for all of us who were part of The Roots of Shuttle from the early days with Bell onward, when the Dyna-Soar program was suddenly

canceled in December, 1963. Some part of each one of us died with it. For us it was a labor of love. That should never have happened!



Boeing X-20 Dyna-Soar abandoned by the US Air Force in 1963 before flight trials could begin. Although ultimately intended for launching by Titan 3C, the one-man vehicle followed principles established by the Austrian engineer Dr Eugen Sänger a quarter of a century before. The project played an important part in developing aerodynamic and structural techniques for new-generation spacecraft capable of manœuvring after re-entry from orbit. Length 35 ft (10·7 m.); wing span 20 ft (6·09 m.); height (with wire-brush landing skis retracted) 8 ft (2·4 m.).

Figure 12 The Boeing X-20 DYNA-SOAR.
Source: *Frontiers of Space.*

I'm convinced to this day that Dyna-Soar died, for reasons explained earlier, the day it was named X-20. It just took two more years to lie down. It died, not for all the official reasons given. No, Dyna-Soar died because the decision-makers at all levels in the chain of command had lost sight of its mission (i.e., EXPANSION).

I was afraid they might.

References

[1]Walter Dornberger, *V-2*, (New York, The Viking Press, 1954, p. xvi.).

[2]Richard P. Hallion, *The Hypersonic Revolution*, (Dayton, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio, 1987).