

DARK HORSE RUNNING

Bell Martin-Bell's Cold War Orbital Glide Bombers, Part III

By Dave Stern

EVENTS 1955-1956

The BoMi engineering team was heavily revising MX-2276 BoMi in accordance with development requirements, System 118P's (Part II Hypersonic proposal) guidelines in late 1955, when the Lockheed empire again, cast a covetous eye upon Bell Aircraft. For the fifth year their management negotiated with Larry Bell to secure a merger with their company.¹ Larry Bell stated that he would talk merger so long as his company became a stronger organization; that declaration ended the talks, thus Bell remained an autonomous company.² Addressing his employees during the company's 20th anniversary celebration in 1955, Larry hinted that the firm was committed to conceiving and building vehicles flying between 7,000 to 14,000 mph up to 50 miles and higher, within the next two decades.³

During 1955, hypersonic research was underway at nationwide wind tunnel facilities, the NACA, universities and subcontractors, manufacturing especially engineered components for missiles and advanced aircraft. For example, executives at Glenn L. Martin Company's Middle River, Md., headquarters created a subsidiary research laboratory that would join with Bell to compete for the USAF's RS-620A Dyna Soar I project in March, 1958. It was the Research Institute for Advanced Study (RIAS), a design department headed by Welcome W. Bender.⁴ Their charter included "building-block"

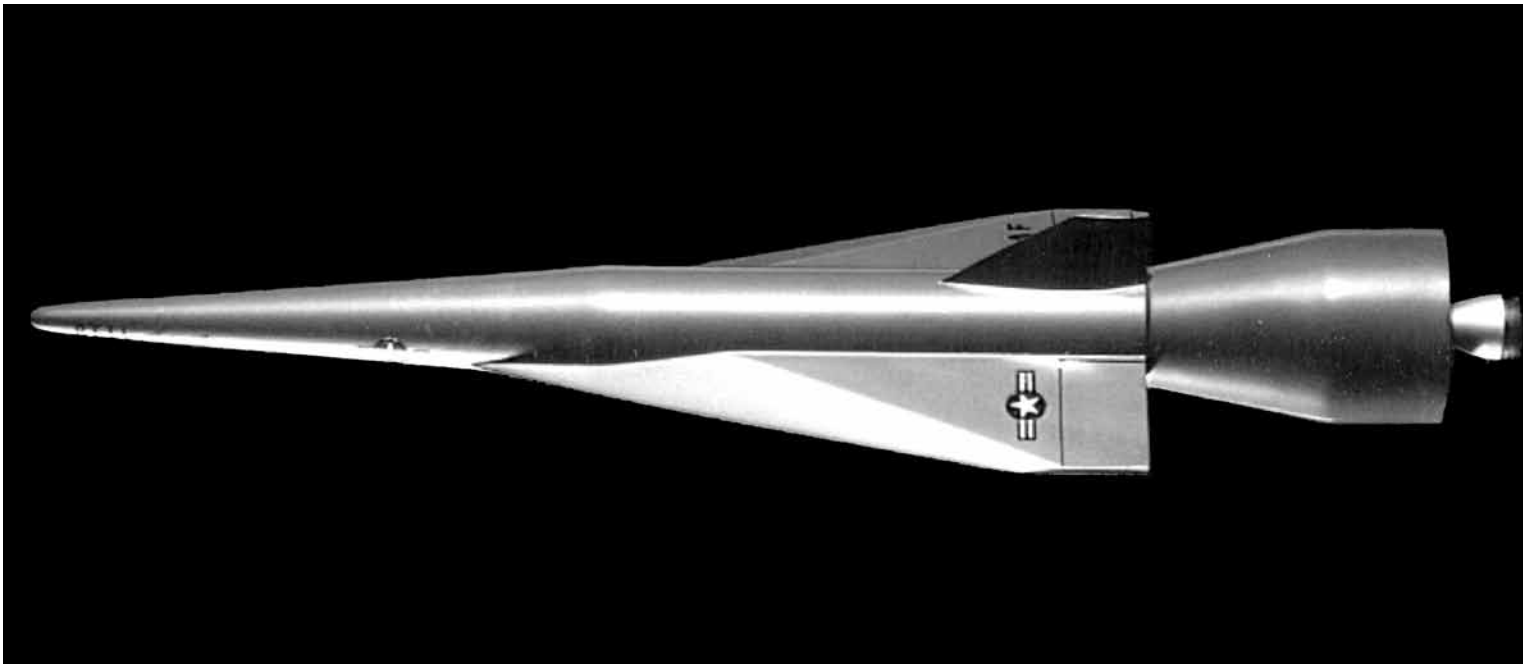
studies encompassing negative-gravity research, advanced design, warm structures (renamed hot-structures), high speed warhead delivery and hypersonic vehicle designs.⁵

RIAS departments investigated both theoretical and physical disciplines including electronics, physics and other fields, all focused upon advanced ideas and solutions. RIAS management modestly stated their desire to remove "the spaceship" from comic-book creations and transform it into a respectable future vehicle.⁶ RIAS was reportedly modeled on Princeton University's Institute for Advanced Studies (IAS), engaging in both theoretical and experimental science studies.⁷

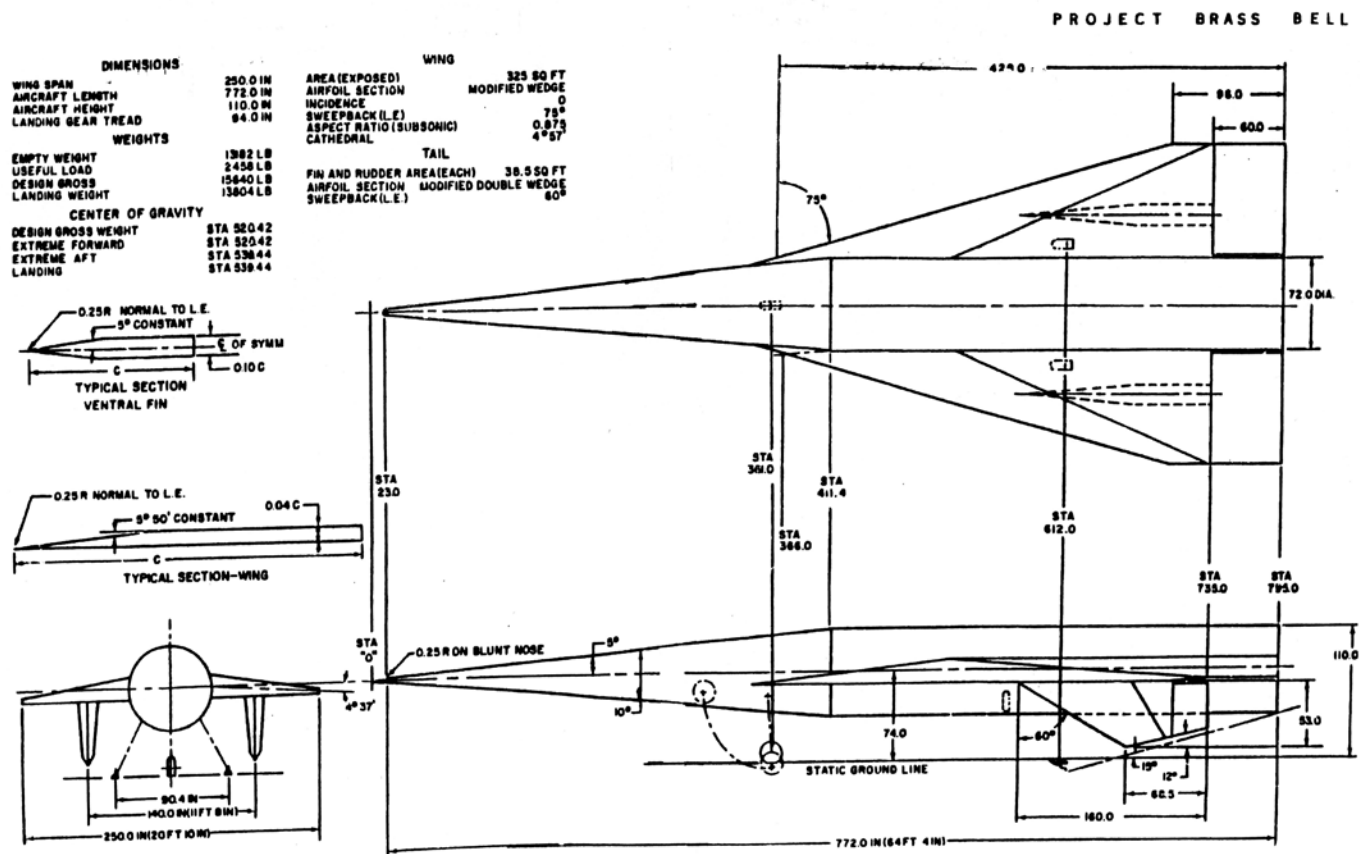
Simultaneously, NACA, Princeton, MIT, Cornell Aeronautical Laboratory (Curtiss Wright's research facility transferred to Cornell University),⁸ Battelle Memorial Institute and other facilities applied old research tools coupled with new gas dynamics tunnel technology to accumulate hypersonic aerodynamics data.⁹ During the mid-1950s a NACA faction emphasized constructing metal hypersonic wind tunnel models. They believed that accurate hypersonic research could only be accomplished by economical ground research, rather than actual prototype flight testing, via piloted or robotic flight.¹⁰ Concurrent with this work was an intense nationwide research program to develop survivable re-entry ICBM nose-cones, also applicable to hypersonic boost gliders; both ICBM and



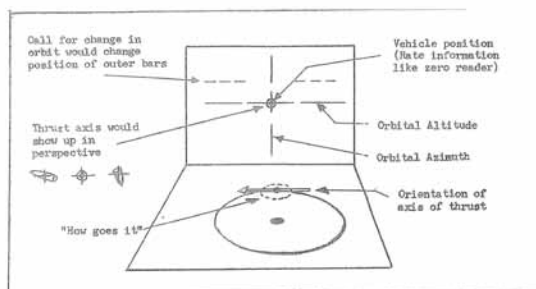
This is believed to be Bell Aircraft's answer to Part II of the Systems 118P requirement—a delta-wing four engine supersonic reconnaissance aircraft. The carrying case has a 3-digit cipher lock and apparently was an industry standard when taking project display models on commercial airline flights to Air Force presentation meetings. The Model number and details are unknown. (Photo: Tim Whetstone, L.D. Bell Museum)



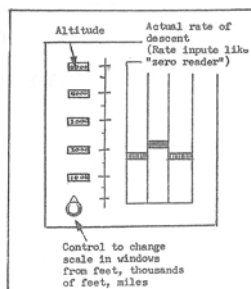
A presentation model of MX-2276 BoMi with upper-stage booster after analytical research methods were applied to the original BoMi concept. The result is a total re-design from the original BoMi configuration presented in Part II of this article. (Photo: Niagara Aerospace Museum)



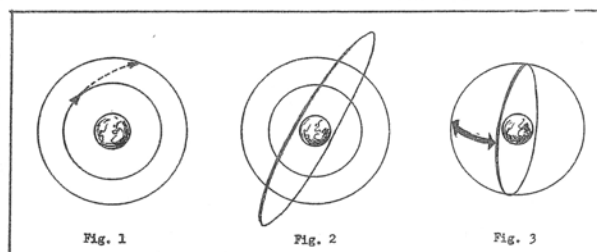
One of a few configurations of 459L unarmed reconnaissance gliders in the Brass Bell series. This tailless configuration is 64 feet long with the large 72 inch diameter fuselage and a very short 20 foot wingspan utilizing a modified wedge-airfoil. (Drawing: Bell-USAf)



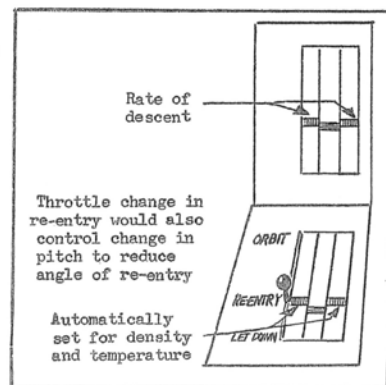
FLIGHTPATH PLOTTER has navigational table with altitude, steering and position data.



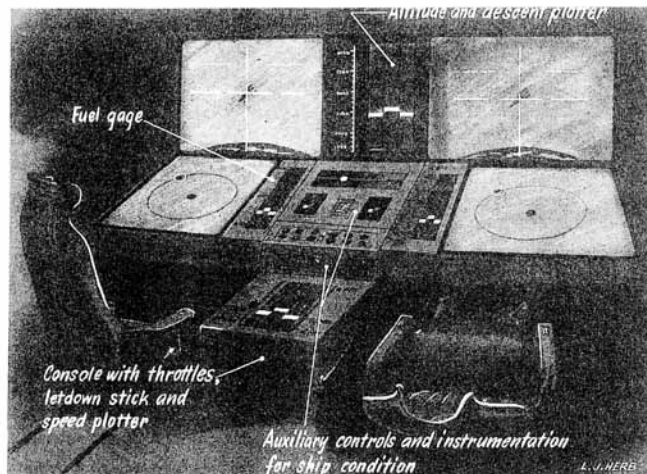
ALTITUDE PLOTTER



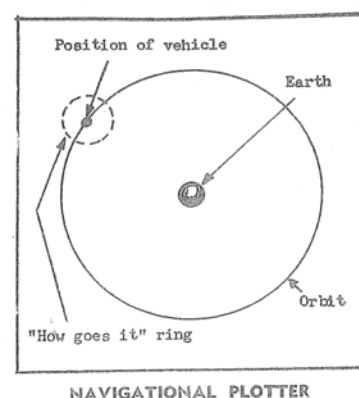
ORBIT CHANGES: Tangential thrust increases orbital diameter (Figure 1). Angular difference in elevation changes the orbital size and positions of apogee and perigee (Figure 2). Azimuthal change moves the orbit geographically (Figure 3).



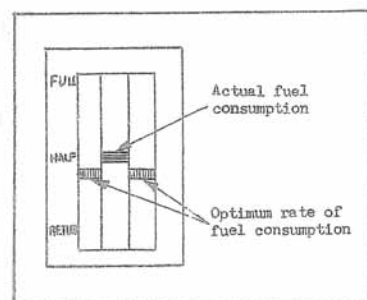
SPEED CONTROLS for spaceship depend on inputs matched to ideal indication.



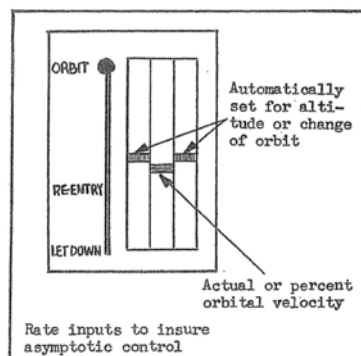
INTEGRATED instrumentation for spaceship is shown in this artist's conception.



NAVIGATIONAL PLOTTER

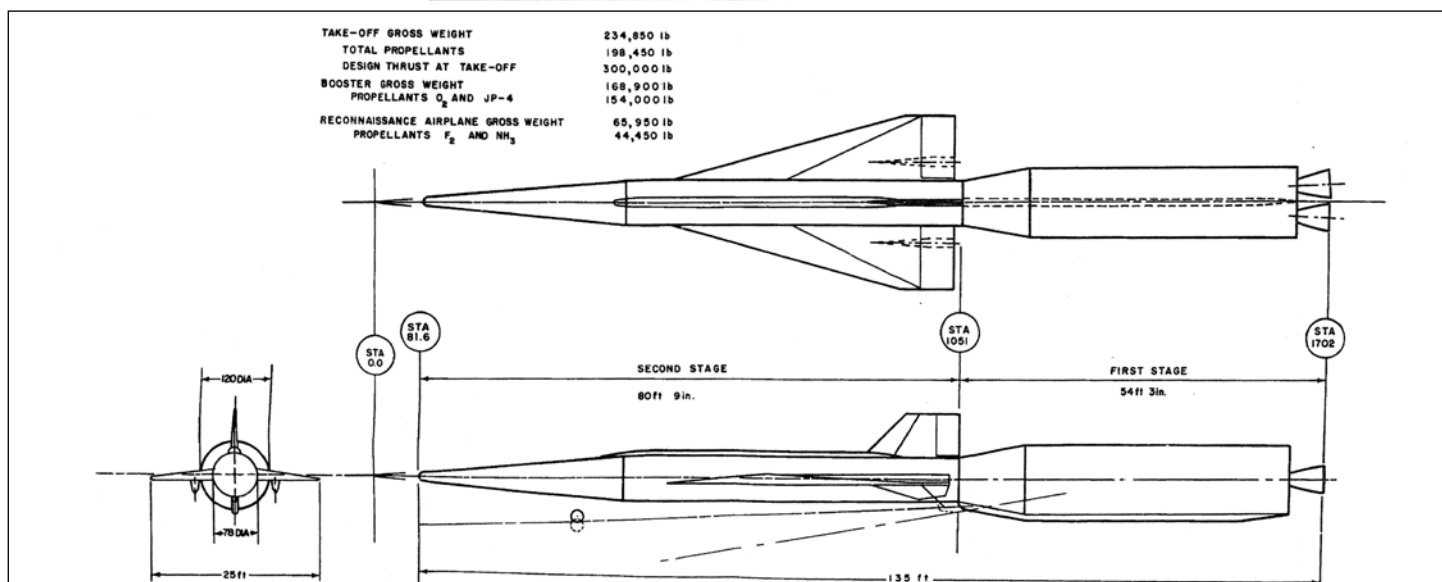


FUEL GAGE shows actual and ideal rates.



Rate inputs to insure asymptotic control

U.S. Navy Captain Hoover's personal research conceived a specialized instrument system applicable to Bell's boost-gliders and other spacecraft; this when the mere word spacecraft was still an "inappropriate term." His instruments are quite different from the standard mid-1950s aircraft instruments. The Bell BoMi presentation film displays a similar instrument panel while there is also a resemblance to the instrument display console seen in the movie, *When World's Collide*. (Drawing: Aviation Week)



Another two-stage 5,000 mile range 459L reconnaissance glider configuration with its booster. This version displays top and lower fin and two small ventral stabilizing fins close to the fuselage. The booster alone is roughly eight feet longer than a V-2 rocket in comparison. (Drawing: Bell Aircraft)

hypersonic glider data was accumulated by research rockets launched at the NACA Pilotless Aircraft Research Division (PARD), station at Wallops Island, Virginia.¹¹

Navy Cmdr. George W. Hoover (officially with ONI-Office of Naval Research) performed his own private research into spacecraft cockpit ergonomics, that is, pilot cockpit instrument interfacing.¹² He proposed advanced instruments for sidereal and orbital time clocks, an altitude and flight-path plotter, new forms of fuel, radiation and pressure gages; they were specifically designed for both boost-gliders and piloted spacecraft.¹³ Hoover's research was sound, in the ballpark, but early to mid-1950s electronics still utilized bulky and heavy chassis with vibration prone vacuum-tubes unsuited to missiles, spacecraft and Bell's boost-gliders.¹⁴

The early cruise missiles, Regulus, Matador, Snark and Navaho demanded lightweight, rugged and dependable electronics to survive heat, cold, vibration and high speeds. Aviation electronics slowly evolved into lighter, stronger and more compact quick-change black-boxes. After Sputnik I, military funding forced an electronics revolution yielding lighter micro-miniaturized printed circuits, printed wiring, lighter inertial guidance platforms and components for missiles, boost gliders and other satellites.¹⁵ An ongoing research project applicable to Bell's MX-2276 and R459L projects was Corning laboratory's updated canopy glass for Mach 2 plus flight.¹⁶

By 1960, Corning's laboratory produced glass windows briefly withstanding 2,000 degrees F,¹⁷ during sustained hypersonic high altitude flight, including atmospheric re-entry. Test articles were described as four laminated panes forming a trapezoid window, 21 inches high and 7.5 inches wide on one side and 11 inches on the other.¹⁸ The glass could be applied to the Bell glider's side porthole windows, pilot and navigator's periscope windows plus the lower rear fuselage camera windows that required distortion free optically flat glass.

BOMI MORPHS

In late 1955 Bell-ARDC teams gave several BoMi presentations to ranking ARDC and other USAF officials, who evinced skepticism, despite BoMi representing a major but future breakthrough in speed, altitude and weapons delivery.¹⁹ General Boyd was supportive and requested \$1,000,000 for Bell to initiate a test program developing a 5,000 to 10,000 mile global glide-bomber, plus an unarmed reconnaissance glider.²⁰ In early 1956, USAF split MX-2276 into two separate project offices; a strategic systems office and reconnaissance systems office.²¹ Both apparently remained within the purview of the USAF's "Bombardment Aircraft Division, Directorate of Systems Management, Air Research and Development Command, Det-1," at Wright Patterson AFB.²²

Bell paper lists in March 1956 a USAF letter contract for \$1,200,000 for the 459L Brass Bell reconnaissance Weapon System Study.²³ Additionally the March list includes \$300,000 of USAF funds to complete their System 118P study by April 15, 1956. The completed study was accompanied by a Bell proposal to construct 21 System-118P vehicles satisfying its specifications.²⁴

On May 27, 1955, General Langmead contacted Larry

Bell through a Mr. Tracy Voorhees (possibly CIA or State) interrupting Dornberger's boost-glider and Rascal missile work. He requested the loan of "Lt. Gen. Walter R. Dornberger" (using his actual German WWII rank).²⁵ Dornberger would join an intelligence team in West Germany to interrogate returning German rocket engineers and scientists colloquially tagged *dragon-returnees*, repatriated to West Germany by Soviet authorities.²⁶ This British Intelligence term meant those who possessed technical and scientific information. The interrogations would provide technical intel concerning Soviet rocket developments for the UK/USA intelligence community, Bell and U.S. firms constructing rockets, rocket engines and guided missiles.

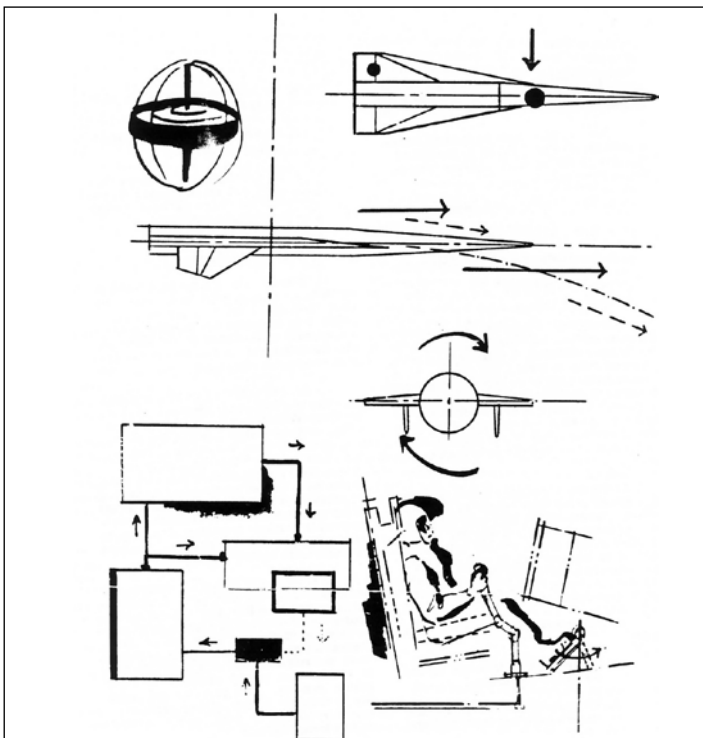
R459L

In 1956 the Bell engineering team received USAF contract AF 18(600)-1607 focusing upon an unarmed 459L Brass Bell Reconnaissance Weapon System. Its design features were derived from the MX-2276 BoMi bomber-reconnaissance glider, as presented in a Bell BoMi presentation film. One version, an unarmed reconnaissance glider housed a camera suite while the bomber version carried a re-entry missile. Initial 459L specifications were derived from the December 1955, revised BoMi proposed as a reconnaissance weapon system glider that satisfied System 118P requirements.²⁷

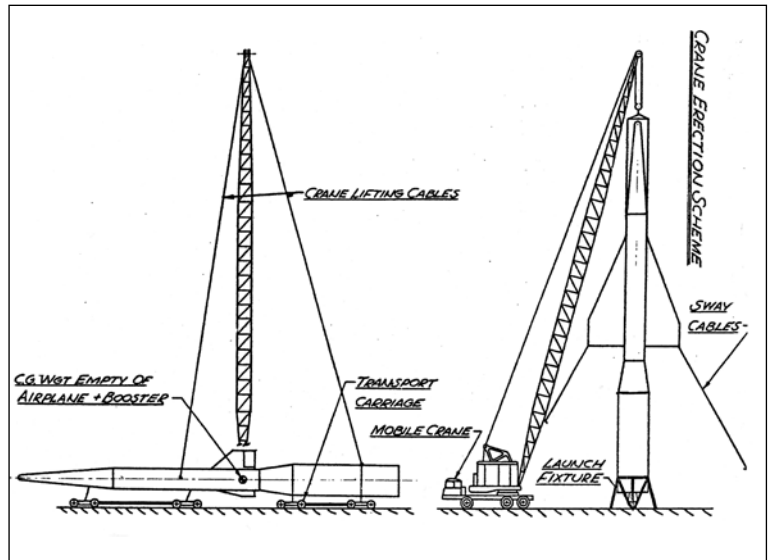
Bell engineers transferred the MX-2276 reconnaissance glider engineering design work into the 459L contract study but, with at least four variations according to range, speed and target requirements.²⁸ One 459L glider was 80 feet 9 inches long with a mere 25 foot modified wedge wing, a raised spine and vertical top and bottom fin. A second 459L glider was 63 feet 10 inches long, weighed 16,050 pounds with a 60 inch diameter fuselage. Another 459L glider was 64 feet 4 inches with a small 20 foot wingspan (shorter than the 23 foot 9 inch rotor-span of a compact Brantly B-2/B-2B helicopter), and weighing 13,182 pounds.

A pilot and navigator guided the hypersonic 5,500 mi range glider boosted aloft by a two stage liquid fueled booster hurling it to 170,000 feet and Mach 17. A third stage extended its glide-flight to continue a straight-line circuit around the earth. The mission ended with a high speed dead-stick or unpowered landing at Edwards AFB.²⁹ Emergency onboard problems during its Pacific Ocean transit required the pilot and navigator to divert in a cross-range glide to Eielson AFB, Alaska with its reinforced 13,000 foot runway for B-36 and B-52 bombers.³⁰ If unable to glide to Eielson, they would probably exit the glider while still over the Pacific Ocean.

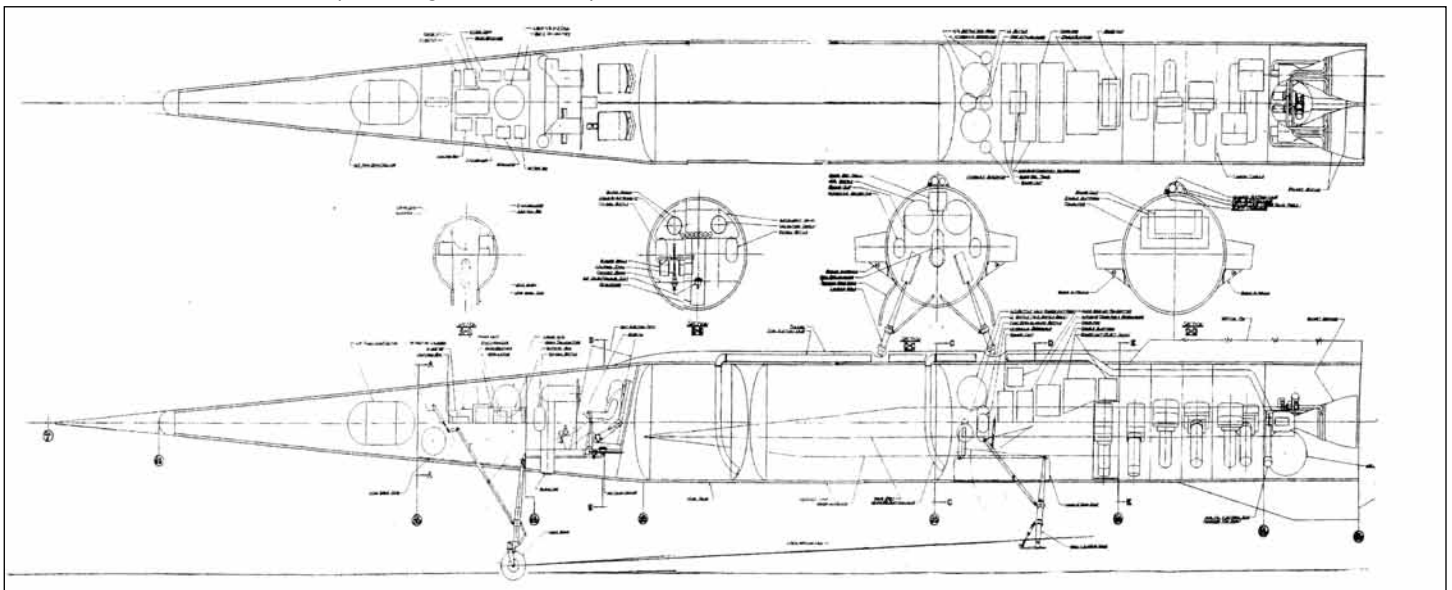
The MX-2276 Reconnaissance glider equipment transferred to the 459L glider studies included updated aerodynamics, a few planform variations, cooling-systems and equipment options. The basic glider configuration displayed a 5 degree half-cone angle cone-cylinder fuselage, 78 inches in diameter (another option was a tight 60 inch diameter fuselage), and 81 feet long. One displayed 25 foot span with bolt-on four spar wings with a modified double-wedge airfoil swept to 75 degrees and 4.3 degrees cathedral. The front was a slender, mildly blunted heat sustaining conical nose with a thermal resistant cap.³¹



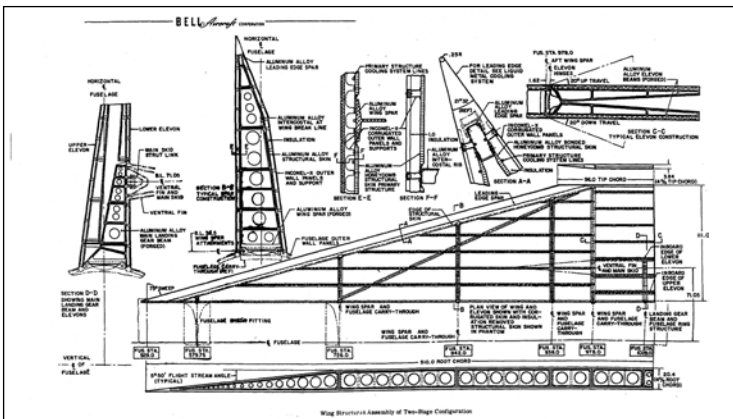
Bell's boost glider progress reports provided some rough in-house graphics such as this tailless Brass Bell configuration, one of a small number of variations proposed for the hypersonic reconnaissance role. (Drawing: Bell Aircraft)



A proposed method of erecting both the 5,000 mile range 459L reconnaissance glider with its booster attached. This method was created by the BoMi engineering team or by American Machine and Foundry Company (AMF) engineers. They teamed with Martin-Bell to form the East Coast competition for the 465L Dyna Soar Contract. (Drawing: Bell Aircraft)



Yet another variation of the 459L reconnaissance glider with side-by-side seating, a six-camera suite, twin Fluorine rocket engines and a forward fuselage escape capsule, designed for a hypersonic "once-around" mission. (Drawing: Bell Aircraft)



A phantom view of the endo-skeleton (the aluminum air-frame or inner structure), displaying a four-spar wing, elevons, and a side view of the modified wedge airfoil. It would then be covered by a thin layer of chosen heat resistant foil insulation, topped by the exo-skeleton thus performing the same exact thermal protection as did the tiles on the Space Shuttle. (Drawing: Bell Aircraft)

One model has cathedral wing-tips while another had ventral fins set near mid-span beneath the wings; still another design has a top fin-rudder and a stubby lower fin aiding directional stability, but jettisoned immediately prior to landing, ala the X-15. The USAF specifications include one or two on-board fluorine rocket engines, either Bell or Rocketdyne engines simultaneously under development but to be chosen through bids.³² The engines burning ammonia, dimethyl hydrazine or Hydrogen reportedly offered a specific impulse near 300 - a projected 25% (Bell estimates) increase in performance over Lox and JP-4.³³

Bell's Rocket-Nucleonics Division engineers solved the fuel pump problem (seals around the pump shaft) thus creating an engine achieving 15,000 pounds of thrust;³⁴ further development yielded an engine generating approximately 35,000 pounds of thrust and applicable to upper stage boosters too.³⁵ Glider variations reveal one carrying six cameras in an extended rear camera suite, while another carries just three cameras at the extreme rear end: its tri-camera layout was placed immediately ahead of the rear mounted liquid metal cooling system, where a rocket engine was normally situated.³⁶ This was indeed, strictly an unpowered boosted glider minus an onboard engine.³⁷

Wilfred Duke's structures team heavily investigated liquid sodium, water and lithium hydride plus a water-glycol coolant system for the exo-skeleton; this outer cooling-jacket was akin to an Armadillo's tough protective outer carapace.³⁸ This included cooling the blunt wing leading edges consisting of coated graphite where temperatures would hypothetically stabilize at 2,000 degrees: they even proposed a circulating Lithium metal coolant (lower weight), system or an interim Sodium system.

One extended glider variant is powered by twin Fluorine engines, with twin XJ-85-GE-1 engines beneath the rockets, with an extended air intake.³⁹ To add to the variations in options, a similar glider design is devoid of the twin J-85 engines. The cockpit sports individual periscopes for the pilot (console to his left) and navigator (console to his right; both are side by side with drawings seemingly representing full pressure suits.⁴⁰ Another three-stage 459L variant offers tandem seating-pilot up front and navigator behind, including upward firing ejection seats through separate ingress-egress hatches.⁴¹

The MX-2276 reconnaissance glider's "search and detail" cameras" were transferred into 459L gliders including a support-stabilizing mount for all, thus allowing for the glider's pitch and roll.⁴² BoMi engineers offered to design any type of camera suite the USAF specified.⁴³ Quartz was also proposed for the camera windows rather than optically flat glass due to very high heat with camera lens so close to the window; quartz was understood to better withstand higher thermal temperatures, than currently developed glass.⁴⁴

Bell engineers designed their reconnaissance suite after thoroughly digesting high-altitude photography systems derived from the Moby Dick High, Viking Rocket programs, the USAF Aerial Reconnaissance Laboratory and Eastman Kodak's Research Laboratory work.⁴⁵ An alternate payload offered was a Ferret surveillance suite consisting of eight pairs

of radar receivers and antennae covering frequencies between 850 to 40,000 megacycles.⁴⁶ Another Brass Bell variant presents a raised spinal tunnel ala Boeing's IM-99 series Bomarc missile to house the fuel tank's suction line leading into the twin 35,000 pound thrust engines.⁴⁷

The glider's aluminum load-bearing airframe was enveloped in a thin insulation layer of microquartz or Fibrafax, a steel foil with aluminum silicate fibers withstanding up to 3,000 degrees, F. before failing.⁴⁸ The exo-skeleton covering the insulation layer consisted of thermal resistant Inconel X panels with expansion joints and internal liquid coolant lines circulating throughout the glider's outer shell.⁴⁹ The actual aluminum airframe's projected temperatures were estimated at 200-240 degrees F, allowing it to maintain its strength and rigidity independent of the outer exo-skin.

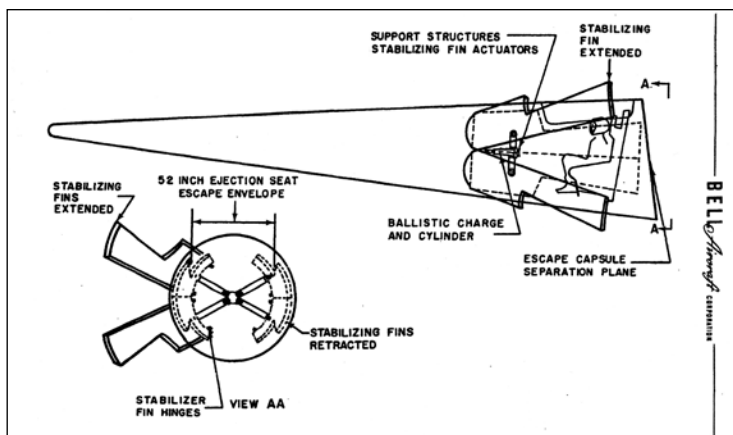
Senior citizens may remember when deluxe items besides whitewalls were catalog-ordered at the showroom while purchasing a new car. Well, Bell engineers also provided the 459L series with deluxe features such as a separable nose capsule with pop-out paddle-like stabilizing fins for emergency landings. The pilot's seat could elevate upwards through the released ingress-egress hatch to clearly view his flight path during landing approaches; it was also equipped with an electro-servo control stick to fly the glider from that position. The pilot's seat also tilted forward 20 degrees for the initial vertical liftoff but returned to normal position during flight.

The 459L glider accomplished three categories of "pioneer reconnaissance;" Terrain, Ferret, Aerial Photography, plus Side-Looking radar, or Infrared when developed.⁵⁰ Brass Bell is viewed as the most important and heavily USAF funded advanced reconnaissance glider from 1956, well in late 1958, despite official orders to absorb it into the Dyna Soar program in early-1957.⁵¹ The Air Force concluded that 459L glider's speed and altitude would successfully reconnoiter a target thus insuring minimum political risk, with the added benefit of being extremely difficult to intercept.⁵² As of 1956 the Bell engineering team applied the initial "BoMi" acronym, merely as a concept of flight by a rocket-boosted hypersonic glider.⁵³ In other words the term BoMi was now applied strictly as a generic acronym for SR-126 RoBo and 459L Brass Bell.⁵⁴

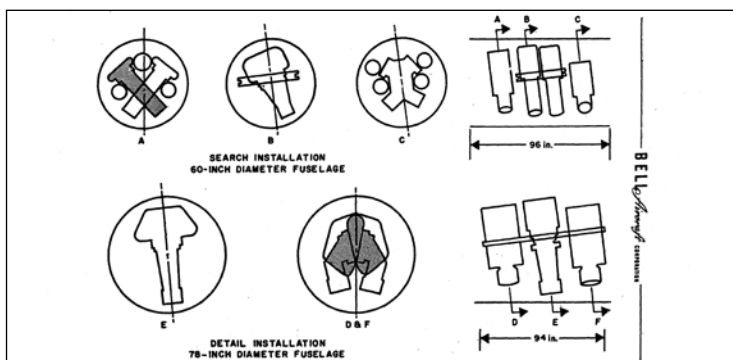
455L HYWARDS

The NACA, America's premier government aeronautics organization while performing hypersonic research proposed an in-house boost glider project, despite being committed to the X-15 project. The NACA in late 1956 teamed with the USAF to create the NACA-USAF Support System 455L HYWARDS or **Hypersonic Weapons Research & Development Support System**. NACA described it as a research vehicle succeeding the X-15 to verify and gain hypersonic flight knowledge concerning aerodynamics, hot-structures, human factors and component sub-systems.

The USAF however, approached 455L as a conceptual weapons test vehicle⁵⁵ that generated Air Material Command, SAC, Navy and Army interest.⁵⁶ Both Ames and Langley teams presented two similar 455L glider designs but with different weights, L/D ratios and minor dimensions. The glider was



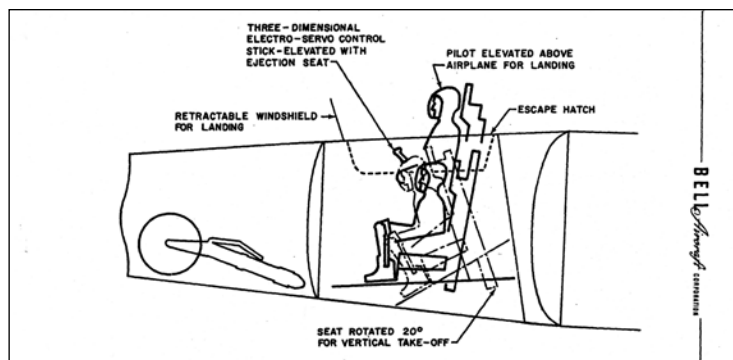
A proposed 459L glider escape capsule for the side-by-side pilot and navigator in pressure suits. Separation was achieved by either brute-force explosive bolts or Hi-Shear's explosive "separation nut," at a firewall breakaway point, immediately behind the pilot and navigator. The separation nut had a small measured charge thus, providing a safe separation without damaging the rear capsule wall. (Drawing: Bell Aircraft)



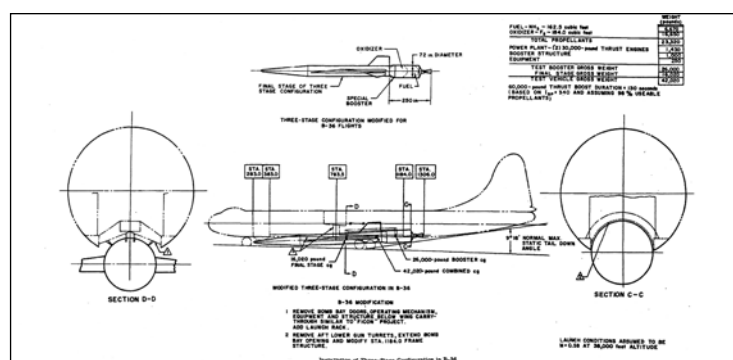
This drawing presents a cross section of the camera suite for the 60 diameter 459L glider and the increased wriggle-room 78 inch fuselage glider variant. The cameras are arranged to cover a large swath of ground. Chicago Aerial Industries (CAI) listed in Bell Brass Bell Progress Reports either providing the pilot-navigator's periscopes, and perhaps the classified cameras, although a paper history is lacking (Drawing: Bell Aircraft)



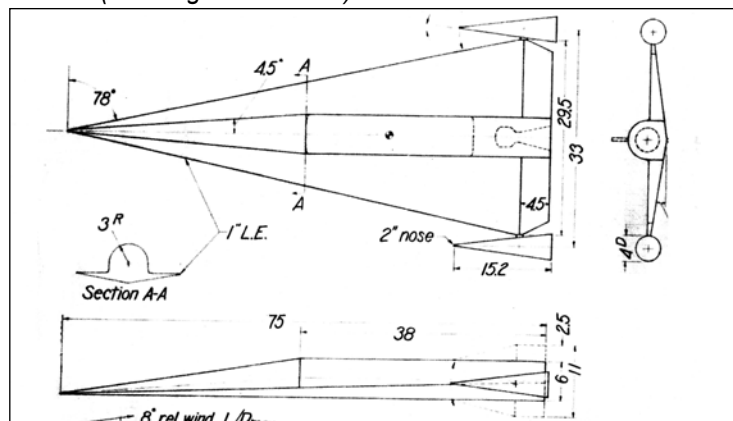
A large Fluorine rocket engine with an entirely different chamber from standard bell-style designs fires up in a Bell rocket engine test facility in Wheatfield, N.Y. Bell's 21 test chambers worked day and night perfecting the twin motors for Shrike, the three chamber Rascal motors, Nike-Ajax engines, the B-58 Hustler's "Hustler" engine for its weapons pod, later modified into the successful start-stop Agena rocket engine, and the Fluorine engine. (Photo: Tim Whetstone, L.D. Bell Aviation Museum)



Bell engineers provided emergency landing equipment for either one version or all the 459L glider variations. The pilot's seat elevated into the airstream through the top egress-egress hatch, but with a servo-operated control stick. An ejection seat was provided when a situation deteriorated, thus dictating an immediate exit from the glider. (Drawing: Bell Aircraft)



A special modified B-36 Mom-Ship rigged to air-drop (initial glide tests) or launch a three-stage 459L reconnaissance glider with boosters on operational missions. Two 3,000 pound thrust Fluorine rocket engines for the booster mentioned. The B-36's air-launch speed is Mach 0.58 at roughly 38,000 feet, thus giving the glider a somewhat slow head start on its flight. Flight tests across the Pacific Missile Range might have been contemplated for this combination or launches near the target nation. (Drawing: Bell Aircraft)



A three-view plan of the joint NACA-USAF 455L hypersonic glide rocket research system with the acronym HYWARDS-Hypersonic Weapons Research & Development Supporting System. It was intended to test hypersonic aerodynamics and cooling systems thus, contributing to the slowly increasing U.S. hypersonic database. No funds were issued to pursue development of 455L due to a committed X-15 research program. (Drawing: NASA)

approximately 75 feet long, with a 33 foot delta wing severely swept to 78 degrees and adjustable wing-tip mounted “body-wing cones providing stability and control of the glider.”⁵⁷

HYWARDS also required two onboard Bell 15,000 pound thrust Fluorine rocket engines successfully and repeatedly fired up at Bell’s Wheatfield rocket testing facility.⁵⁸ The booster engines were two North American Aviation 60,000 pound thrust liquid oxygen & JP-4 sustainer engines from WS-107A (Convair SM-65 Atlas), but no booster designs were detailed.⁵⁹ The NACA-USAF team was unable to sustain both HYWARDS and X-15 simultaneously due to a lack of funds, so only basic HYWARDS research was accomplished.

SR-126 Robo

The third newcomer forming a Bell boost-glider triad was the May 1956 feasibility Request for Proposal (RFO) issued to aviation firms as SR-126 (Strategic Requirement 126) for SR-126 RoBo (**R**ocket **B**omber). Bell engineers saved time and perhaps money by wisely transposing their 459L Brass Bell engineering work in creating several SR-126 RoBo designs that Casey Forrest’s BoMi team presented to the Air Force.

Bell’s contract is specifically identified as SR-126 RoBo, USAF Contract AF 18(600)-1623, ARDC Task number 89774 for the Strategic Directorate of Systems Plans, ARDC USAF Study Contract.⁶⁰ Bell financed its RoBo study because it was receiving substantial funds for ongoing 459L engineering and research work: 459L was advanced and credible enough for Bell to request a contract to construct a 459L air-drop prototype. USAF 459L funds allotted between May 1956 and August 1957 amounted to \$1,736,000, but actually continued into late 1958; however, further lists of funds awarded to Bell are unavailable.

The above money excludes separate annually funded USAF contracts for Bell to continue researching, constructing and testing hot structure specimens in Bell’s custom built facilities, and at NACA. Bell engineers worked closely with the USAF Aeronautical Systems Command’s Flight Dynamics Laboratory with its array of hot-structures torture devices to heat test Bell’s hand-crafted specimens.⁶¹ This work applied not only to 459L Brass Bell, but also to their SR-126 RoBo designs.

Because SAC would operate both the 459L reconnaissance glider and SR-126 Rocket Bomber, its strategic offensive attributes were defended as being recallable, possessing global range, pilot recovered but not requiring exact target locations to deliver its weapon.⁶² Bell offered a tailless Robo glider configuration to the Air Force approximately 60 feet long, 6.5 feet in diameter with 75 degree swept delta wings, but spanning a mere 21 feet with cathedral wingtips.⁶³ The slender fuselage was described as a slender 5 degree half-angle cone-cylinder that landed on 459L’s adopted landing gear. This 23,000 pound piloted glider-bomber (operational 1965-1970), carried a 2,800 pound warhead inside a re-entry missile totaling 11,000 pounds.⁶⁴

The unmanned expendable (dive into the target) glider’s range was approximately 5,500 N.M. at 18,000 fps (maximum) at 160,000 feet or a piloted recoverable range of 11,000 N.M.⁶⁵ Bell SR-126 reports describe the expendable RoBo glider

delivering a missile weighing between 1,530 to 25,000 pounds at a combat altitude of 100,000 feet minimum but at maximum hypersonic speed.⁶⁶

One bomb displays a blunt nose and flared tail, while another bomb with a sharper reentry nose is cocooned within a protective exo-skeleton.⁶⁷ Bell reports mention using the initial Titan ICBM modified into a short-range glider booster.⁶⁸ RoBo would be equipped with inertial guidance while the weapon navigated by map matching, performing self-corrections to the target.⁶⁹ The piloted RoBo would be thrust aloft by a three stage booster, burning fluorine-ammonia in all stages,⁷⁰ to attain a maximum speed of 25,600 fps at 260,000 feet. The RoBo report states that its flight path approached the target from the rear, thus heading away from the target after bomb release at 18,000 fps-roughly 80 minutes after takeoff.

Bomb detonation would occur after the glider was approximately 275 miles away. Engineers estimated the CEP (Circular Error Probability at 1,000 feet or a tolerable 1,500 feet. Two hours later Robo would approach its designated landing site at a speed of 4,000 fps, and execute a powerless, dead-stick landing.⁷¹

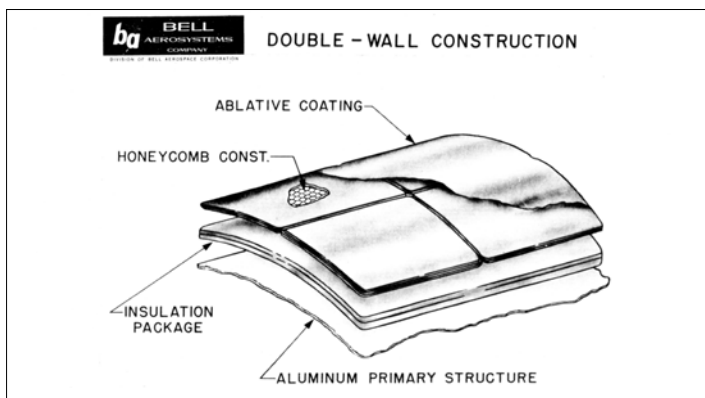
The Bell RoBO study includes a proposal to construct hardened underground launch complexes in a caisson 40 feet in diameter, 190 feet deep where the booster and glider would be serviced, fueled, elevated and fired above ground.⁷² RoBo’s exo-skeleton circulated a water-glycol cooling mixture around the endo-skeleton (internal aluminum airframe) to maintain a stable 250 degrees F. Late 1950s aluminums were strong enough to sustain this temperature without causing significant thermal damage that could result in airframe failure.⁷³ The wing leading edges and slender snoot were cooled either by a liquid metal convective coolant or a heat-sustaining material such as silicon carbide.⁷⁴

The Air Force requested industry-wide RoBo proposals, but without financing all of them. Bell, Martin, Republic and Lockheed received no SR-126 RoBo P-600 funds but the Convair, Douglas and North American studies were USAF financed. Boeing spent company funds to research and create 15 plus Model 728 RoBo designs including several quite unusual configurations.⁷⁵ Between 1955 and 1957 the USAF expended \$3,015,000 for RoBo studies while industry invested \$4,000,000 of its own funds.⁷⁶

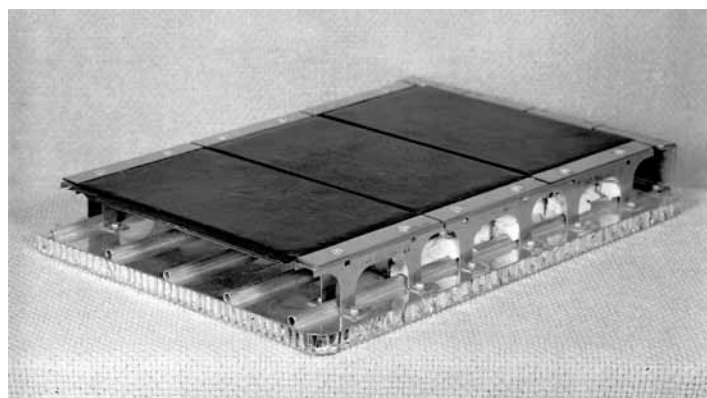
The Bell structures team having received separate ongoing ARDC funding continued its intense research into refining its cooling and insulation test panels and test specimens, even negotiating with the NACA Langley Research Center to modify a wind tunnel for special tests.⁷⁷

THE CAT ESCAPES

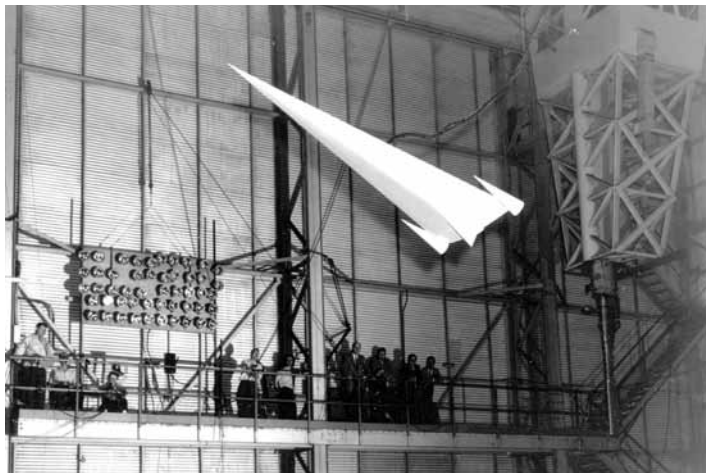
Nearly four years after Kenneth Gatland’s “Dornberger Project” article was printed, the cat finally stuck its head out of the secret boost-glider bag. The initial hints concerning Bell’s hypersonic glider projects (minus the term BoMi), were revealed in early 1957; oh, to have been the proverbial fly-on-the-wall at Bell. It would have been great to hear the snickers and comments of the BoMi engineering team when they saw the *Aviation Week* boost-glider article and its weird glider



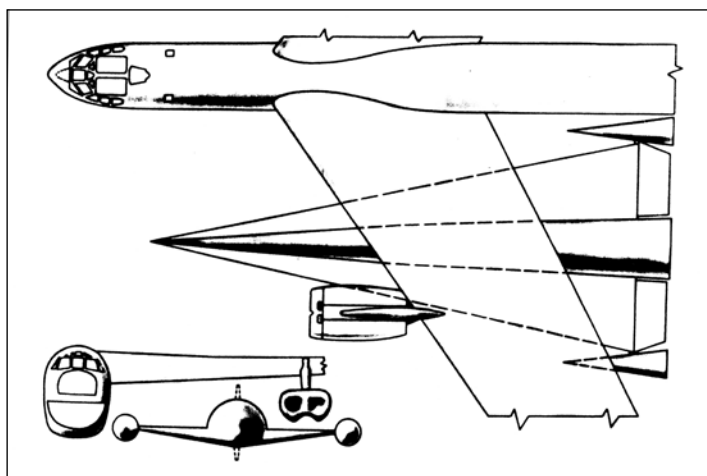
The drawing presents a curved fuselage "double-wall" specimen cutaway, created by and patented by Bell Aircraft. (Drawing: Bell Aircraft)



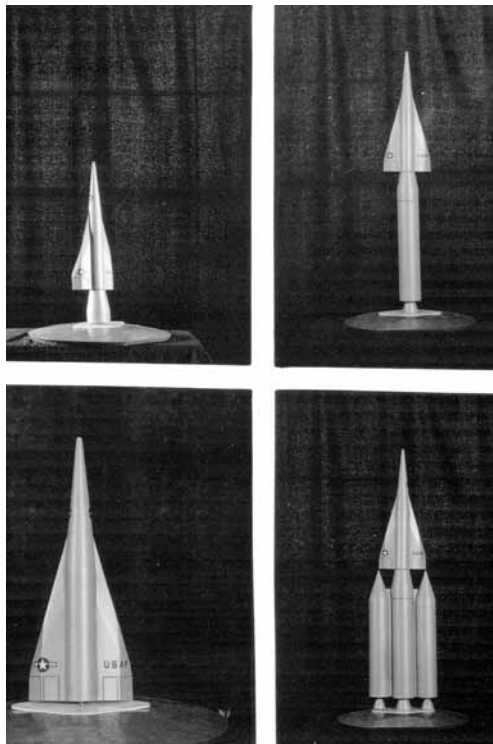
Test specimen of an actual "double-wall" exo-skeleton test panel displaying the outer panel segments with expansion joints and the inner frame with its fasteners. Cooling liquids flow through the five small metal lines seen at the bottom of the panel, circulating throughout the exo-skeleton. Bell's structures engineers estimated that the aluminum endo-skeleton would endure temperatures up to roughly 240 degrees F, when applying newer higher temperature sustaining aluminums developed in the mid to late 1950s. (Photo: Tim Whetstone, L.D. Bell Aviation Museum)



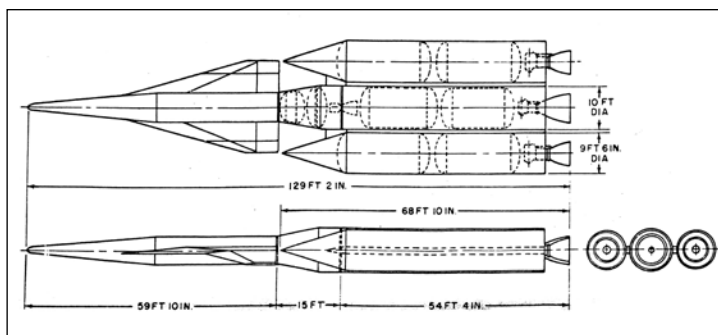
NASA-Langley free flight tunnel while a group of NACA employees along the upper catwalk, watch this strange vehicle. This model appears to be the Langley version, with a slightly increased wingspan against the NACA-Ames short span glider. 455L was controlled by an umbilical cable that appears to originate at the control booth in the upper right corner of the photo. (Photo: NASA)



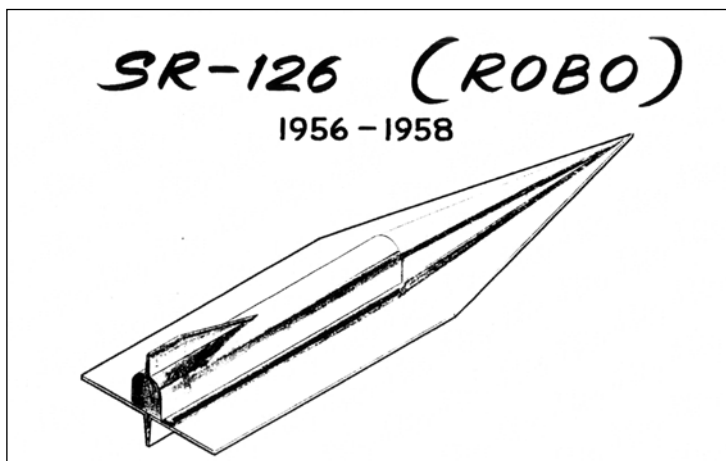
The 455L glider would be air-dropped for glide tests from a B-52 Mom Ship. The mounting scheme is extremely tight beneath the port wing, with its wings under the twin J-57 engine pod. It implies an uncomfortable situation with the glider's wings beneath the engine pods, plus extremely tight clearances with the glider's belly nearly contacting the tarmac; however, it's merely a projection of the glider attached to a B-52. (Drawing: NASA)



A four-view montage of the Bell SR-126 RoBo or rocket bomber vehicle presentation model. Authors have misidentified this glider as a BoMi design-it is not. It is SR-126 RoBo - a separate glider configuration, where the BoMi engineering team, again, transferred 459L's aerodynamics and cooling systems to the SR-126 glider and weapon configurations. (Photo: Bell Aircraft)



A three-view drawing of the Bell SR-126 RoBo long-range "once around" glider with its pre-Titan III booster. Extremely poor drawings preclude their inclusion concerning this particular tailless RoBo design, with cathedral wingtips. (Drawing: Bell Aircraft)



A well crafted model of a Boeing SR-126 Model series 728 with a booster and trailer. A Boeing "Space Activity" Report stated that there were neither powerplants nor materials available during the study's time-frame to construct a RoBo prototype, and the costs would be "prodigious." (Photo: Scott Lothar)

A rough drawing of a "Brand-X," SR-126 RoBo glider from Boeing Company. This style is one of over 15 different basic designs based upon Boeing's personal funded research. (Photo: Air Force)

illustrations.⁷⁸

Aviation Week's December 1957 issues finally revealed tantalizing bits concerning Bell's boost-glider projects to America's aeronautical community minus any illustrations.⁷⁹ Since no Bell glider drawings were approved for release *Aviation Week* artists made no attempt to conjure some illustrations. Bell gliders were described as an "orbital bomber," "boost-glide" aircraft and the strange revelation that the term "BoMi" had been changed to "New Horizons." Perhaps this name provided a cover for their classified ongoing 459L and SR-126 work.⁸⁰ The next issue stated that the USAF was examining the design proposals of five different firms for a hypersonic glide-bomber, but remained undecided.⁸¹ The last 1957 issue used sparse words (no drawings since Bell was patenting their work) to reveal Bell's double-wall system for their hypersonic gliders.⁸²

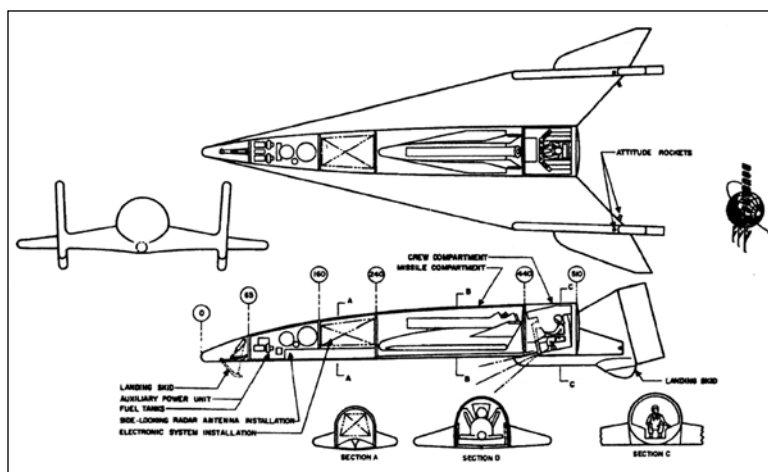
It was also revealed that Dr. Dornberger was now a technical assistant to the president of Bell Aircraft in Buffalo, New York.⁸³ Now that Sputnik I was orbiting earth the terms Boost-Glider, Space, globe-circling reconnaissance bomber⁸⁴ satellite killer and orbital bomber were now legitimate aerospace lexicons that the staff of the USAF Air University entered into its *Aerospace Glossary*. →

(concluded in Part IV).

Footnotes

- 1 "Lockheed-Bell Merger Talks," *Aviation Week*, June 20, 1955.
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- 4 "Martin Forms Research Laboratory," *Aviation Week*, September, 5, 1955.
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- 6 Clark, Evert. "Martin's Research Is Broad Varied," *Aviation Week*, June 3, 1957.
- 7 Ibid.
- 8 "Cornell Aeronautical Laboratory, *Aero Digest*, March, 1947.

- 9 Anderton, David A. "Hypersonic Quest Yields New Techniques," *Aviation Week*, July 2, 1956.
- 10 SP-4305. "Engineer In Charge, Hypersonic and the Transition to Space," <http://history.nasa.gov>.
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- 12 Hoover, George W. Cmdr, USN. Spaceship Instrument Study Needed Now, *Aviation Week*, May, 2, 1955.
- 13 Ibid.
- 14 Conversations with retired Aeronautical Engineer, Gerald Balzer concerning early problems with electronics and vacuum tube technology applied to early cruise missile projects.
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- 16 Industry Observer, *Aviation Week*, December 19, 1955.
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"Brand Y," the Douglas Model 1377 Robo glide-bomber. Model 1377. This bomber was 49 feet long, 72 inches in diameter, and guided by one pilot, seated in the extreme rear of the glider. The 17,000 pound glider's center fuselage housed a mini-glide missile with rocket engine. Douglas' RoBo engineering was aided by Southwest Research Institute and Battelle Memorial Institute. (Drawing: Air Force)

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- 20 "Director. Systems Management Weekly Activities Report," 24 November, 1955; *ASD Draft D-S Study & Chronology*, undated.
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- 25 Bell Aircraft Letter, (3 p.m.), Friday, May 27, 1955. A Letter Requesting the loan of Lt. General Walter R. Dornberger on a trip to West Germany.
- 26 Ibid.
- 27 Bell Aircraft MX-2276 Reconnaissance Aircraft Weapon System, Design, 1 December, 1955.
- 28 NX-2276 Reconnaissance Aircraft Weapon System, Summary Report, 01 December, 1955.
- 29 "USAF Space Programs 1945-1962," Volume I, *USAF Historical Division Liaison Office, Hqs, USAF.*
- 30 MX-2276 and R459L Brass Bell Progress reports show maps indicating Alaska as a possible takeoff-landing alternate, at Eielson AFB with the longest runway in the Territory at 13,000 plus feet.
- 31 R459L Brass Bell drawings.
- 32 USAF R&D Project Card, System 459L HI-Fi Recce (also Brass Bell), 31 December, 1956.
- 33 Ibid.
- 34 "Industry Observer," *Aviation Week*, January 13, 1958.
- 35 Yaffee, Michael. "Bell Readies Liquid Fluorine Engine Bid," *Aviation Week*, September 19, 1960.
- 36 Press Book, January-September, 1958, "Fluorine," *Bell Public Relations Department*.
- 37 R459L Brass Bell Cutaway drawings.
- 38 Ibid.
- 39 Cutaway side-views of R459L tandem seating glider, minus a rocket engine.
- 40 Side-view cutaway of the two-stage 459L glider.
- 41 Cutaway side-views of R459, side-by-side glider with a rocket engine.
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