Aviation Week & Space Technology

Two-Stage-to-Orbit 'Blackstar' System Shelved at Groom Lake?

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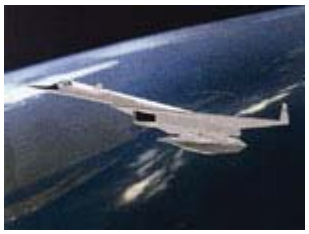
03/05/2006 04:07:33 PM



SPACEPLANE SHELVED?

For 16 years, Aviation Week & Space Technology has investigated myriad sightings of a two-stage-to-orbit system that could place a small military spaceplane in orbit. Considerable evidence supports the existence of such a highly classified system, and top Pentagon officials have hinted that it's "out there," but iron-clad confirmation that meets AW&ST standards has remained elusive. Now facing the possibility that this innovative "Blackstar" system may have been shelved, we elected to share what we've learned about it with our readers, rather than let an intriguing technological breakthrough vanish into "black world" history, known to only a few insiders. U.S. intelligence agencies may have quietly mothballed a highly classified two-stage-to-orbit spaceplane system designed in the 1980s for reconnaissance, satellite-insertion and, possibly, weapons delivery. It could be a victim of shrinking federal budgets strained by war costs, or it may not have met performance or operational goals.

This two-vehicle "Blackstar" carrier/orbiter system may have been declared operational during the 1990s.

A large "mothership," closely resembling the U.S. Air Force's historic XB-70 supersonic bomber, carries the orbital component conformally under its fuselage, accelerating to supersonic speeds at high altitude before dropping the spaceplane. The orbiter's engines fire and boost the vehicle into space. If mission requirements dictate, the spaceplane can either reach low Earth orbit or remain suborbital.

The manned orbiter's primary military advantage would be surprise overflight. There would be no forewarning of its presence, prior to the first orbit, allowing ground targets to be imaged before they could be hidden. In contrast, satellite orbits are predictable enough that activities having intelligence value can be scheduled to avoid overflights.

Exactly what missions the Blackstar system may have been designed for and built to accomplish are as yet unconfirmed, but U.S. Air Force Space Command (AFSPC) officers and contractors have been toying with similar spaceplane-operational concepts for years. Besides reconnaissance, they call for inserting small satellites into orbit, and either retrieving or servicing other spacecraft. Conceivably, such a vehicle could serve as an anti-satellite or space-to-ground weapons-delivery platform, as well.

Once a Blackstar orbiter reenters the atmosphere, it can land horizontally at almost any location having a sufficiently long runway. So far, observed spaceplane landings have been reported at Hurlburt AFB, Fla.; Kadena AB, Okinawa; and Holloman AFB, N.M.

The spaceplane is capable of carrying an advanced imaging suite that features 1-meter-aperture adaptive optics with an integral sodium-ion-sensing laser. By compensating in real-time for atmospheric turbulence-caused aberrations sensed by the laser, the system is capable of acquiring very detailed images of ground targets or in-space objects, according to industry officials familiar with the package.

THE SPACEPLANE'S SMALL CARGO or "Q-bay" also could be configured to deliver specialized microsatellites to low Earth orbit or, perhaps, be fitted with no-warhead hypervelocity weapons--what military visionaries have called "rods from god." Launched from the fringes of space, these high-Mach weapons could destroy deeply buried bunkers and weapons facilities.

While frequently the subject of advanced studies, such as the Air Force's "Spacecast 2020," actual development and employment of a transatmospheric spaceplane have not been confirmed officially (AW&ST Sept. 5, 1994, p. 101). However, many sightings of both an XB-70-like carrier and a spaceplane have been reported, primarily in the western U.S. Only once have they been seen together, though.

On Oct. 4, 1998, the carrier aircraft was spotted flying over Salt Lake City at about 2:35 p.m. local time. James Petty, the president of JP Rocket Engine Co., saw a small, highly swept-winged vehicle nestled under the belly of the XB-70-like aircraft. The vehicle appeared to be climbing slowly on a west-southwest heading. The sky was clear enough to see both vehicles' leading edges, which Petty described as a dark gray or black color.

For whatever reason, top military space commanders apparently have never been "briefed-in"--never told of the Blackstar system's existence--even though these are the "warfighters" who might need to employ a spaceplane in combat. Consequently, the most likely user is an intelligence agency. The National Reconnaissance Office may have played a role in the program, but former senior NRO officials have denied any knowledge of it.

One Pentagon official suggests that the Blackstar system was "owned" and operated by a team of aerospace contractors, ensuring government leaders' plausible deniability. When asked about the system, they could honestly say, "we don't have anything like that."

Aerospace industry contractors suggest that a top secret Blackstar system could explain why Pentagon leaders readily offered the Air Force's nascent unclassified spaceplane project, the briefly resurrected SR-71 program and the Army's anti-satellite program for elimination from budgets in the late 1990s. At the time, an industry official said, "if we're flying a spaceplane, it makes sense to kill these cover programs and stop wasting money on things we can already do."

U.S. and European aerospace companies have pushed two-stage-to-orbit (TSTO) spaceplane concepts for decades. Most large U.S. airframe manufacturers designed spaceplane-type vehicles during the 1950s and '60s, and XB-70 program documents include a concept for carrying and launching a low-Earth orbiter. Two former test pilots and executives for North American Aviation (later, Rockwell) said the company had a technically viable plan for such a system in the 1950s (AW&ST Aug. 24, 1992, p. 25).

Boeing is believed to be one of several major aerospace companies involved in the Blackstar program. On Oct. 14, 1986, Boeing filed a U.S. patent application for an advanced two-stage space transportation system. Patent No. 4,802,639, awarded on Feb. 7, 1989, details how a small orbiter could be air-dropped from the belly of a large delta-winged carrier at Mach 3.3 and 103,800-ft. altitude. The spaceplane would be boosted into orbit by its own propulsion system, perform an intended mission, then glide back to a horizontal landing. Although drawings of aircraft planforms in the Boeing patent differ from those of the Blackstar vehicles spotted at several USAF bases, the concepts are strikingly similar.

One logical explanation given for why a Blackstar system is developed says that, after the shuttle Challenger disaster in January 1986, and a subsequent string of expendable-booster failures, Pentagon leaders were stunned to learn they no longer had "assured access to space." Suddenly, the U.S. needed a means to orbit satellites necessary to keep tabs on its Cold War adversaries.

A team of contractors apparently stepped forward, offering to build a quick-reaction TSTO system in record time. The system could ensure on-demand overflight reconnaissance/surveillance from low Earth orbit, and would require minimal development time. Tons of material--including long-lead structural items--for a third XB-70 Valkyrie had been stored in California warehouses years before, and a wealth of data from the X-20 DynaSoar military spaceplane program was readily available for application to a modern orbiter (see following articles).

DYNASOAR WAS TERMINATED shortly after President John F. Kennedy was assassinated in 1963, after $430 million had been spent on the spaceplane's development. Political opposition and the fatal crash of XB-70 No. 2 on June 8, 1966, contributed to the bomber program's being canceled before Air Vehicle No. 3 could be built. However, at one time, there had been plans to mate the two vehicles.

In XB-70 Valkyrie: The Ride to Valhalla, Jeannette Remak and Joe Ventolo, Jr., wrote: "One version of the B-70 could have been used as a recoverable booster system to launch things into low-Earth orbit. . . . The DynaSoar program, the first effort by the [U.S.] to use a manned boost-glider to fly in near-orbital space and return, was considered in this context in November 1959. The B-70 was to carry the 10,000-lb. DynaSoar glider and a 40,000-lb. liquid rocket booster to 70,000 ft. and release them while traveling at Mach 3. With this lofty start, the booster could then push the glider into its final 300-mi. orbit."

The two-stage U.S. spaceplane concept apparently has undergone several iterations since then, but the basic idea remained--launch a manned boost-glide vehicle from an XB-70-like platform (AW&ST Dec. 24, 1990, p. 48; Sept. 24, 1990, p. 28). An aerospace industry source said the Air Force once used the "Blackstar" moniker, but others suggested the intelligence community referred to this TSTO combination as the "SR-3/XOV" system. The SR-3 is the large, XB-70-like carrier aircraft, while the small orbital vehicles drop-launched at high speed are called XOV-1, XOV-2 and so forth. At one time, the XOV designator meant "experimental orbital vehicle."

Based on information gleaned from multiple industry sources, the SR-3 features:

*A roughly 200-ft.-long, clipped-delta-winged planform resembling that of the North American Aviation XB-70 trisonic bomber. The forward fuselage is believed to be more oval-shaped than was depicted in a 1992 artist's rendering (AW&ST Aug. 24, 1992, p. 23).

*Canards that extend from the forward fuselage. These lifting surfaces may sweep both fore and aft to compensate for large center-of-gravity changes after dropping the spaceplane, based on multiple sighting reports.

*Large, outward-canted vertical tail surfaces at the clipped-delta's wingtips.

*At least four engine exhaust ports, grouped as two well-separated banks on either side of the aircraft centerline.

*Very loud engines. One other classified military aircraft may have used the same type of powerplant.

*Operation at supersonic speeds and altitudes up to 90,000 ft.

During the system's development cycle, two types of spaceplane orbiters may have been flown. Both were a blended wing/fuselage lifting-body design, but differed in size. The smaller version was about 60-65 ft. long and may have been unmanned or carried a crew of two, some say. Industry engineers said this technology demonstrator was "a very successful program."

The larger orbiter is reportedly 97.5 ft. long, has a highly swept, blended wing/body planform and a short vertical fin. This bulky fin apparently doubles as a buried pylon for conformal carriage of the spaceplane beneath the large SR-3. The "Q-bay" for transporting an optics-system pallet or other payloads may be located aft of the cockpit, with payload doors on top of the fuselage.

Outboard sections of the spaceplane's wing/body cant slightly downward, possibly for shock-wave control and compression lift at high speeds while in the atmosphere, whether on ascent or reentry. The only visible control surfaces are flap- or drag-type panels on the wing's trailing edge, one section on each side of the stubby vertical fin. A relatively large, spade-shaped section forward of the cockpit--which gives the orbiter a "shark-nose" appearance--may provide some pitch stability, as well.

The orbiter's belly appears to be contoured with channels, riblets or "strakelets" that direct airflow to engine inlets and help dissipate aerodynamic heating. These

shallow channels may direct air to a complex system of internal, advanced composite-material ducts, according to an engineer who says he helped build one version of the orbiter in the early 1990s. Air is directed to what is believed to be aerospike engines similar to those once planned for use on the NASA/Lockheed Martin X-33.

A former Lockheed Skunk Works official once expressed confidence in the X-33 prototype orbiter's powerplants, noting that "they have history." Whether this implies the aerospikes had flown before, perhaps on an XOV, or simply referred to ground test-firings is unknown. The X-33 was a prototype of what was to be the single-stage-to-orbit Venture Star (AW&ST Nov. 10, 1997, p. 50).

Technicians who worked at a McDonnell Douglas plant in St. Louis in the late 1980s and early 1990s said much of the XOV's structure was made of advanced composite materials. Some wing skin panels measured 40 ft. long and 16 ft. wide, yet were only 3/8 in. to 1/2 in. thick.

"Two people could pick them up; they were very light," one said. These panels were stacked in a sandwich structure to obtain the required thickness, then machined to shape. Although much of the structure was honeycomb, it was "incredibly strong, and would handle very high temperatures," he noted. Inside skin surfaces "were ungodly complicated," though.

WORK ON THE ORBITER moved at a relatively slow pace until a "fuel breakthrough" was made, workers were told. Then, from 1990 through 1991, "we lived out there. It was a madhouse," a technician said. The new fuel was believed to be a boron-based gel having the consistency of toothpaste and high-energy characteristics, but occupying less volume than other fuels.

Regardless of where they land, spaceplane orbiters usually are retrieved by one or more "fat" C-5 Galaxy transports. Three of the oversized aircraft were modified with 8-ft.-wide "chipmunk cheek" extensions on each side of the cargo compartment aft of the nose hinge point; an extra six-wheel set of landing gear that partially retracts up against the aft fuselage, forward of the ramp; a shortened upper deck, and two internal harness/cradle supports. These alterations originally were made to enable carriage of dome-topped containers measuring 61.2 ft. long, 17.2 ft. wide (maximum) and 16.7 ft. tall at the highest point. The containers normally protected satellites during transit to launch sites.

In 1994, NASA sources confirmed that two of the C-5s (Tail Nos. 00503 and 00504) were listed on NASA's inventory--although the aircraft did not "officially" exist, according to the agency's public records. Both transports apparently were deployed only upon orders from the administrator's office. The third oversized C-5 once had a red "CL" on its tail, and supposedly was used by the Central Intelligence Agency. All three C-5s may have been retired in recent years, according to a NASA contractor.

CRITICS ARGUE that there was never enough money hidden in intelligence and military budgets to fund a small fleet of spaceplanes and carrier aircraft. However, those who worked on the system's development at several contractor sites say they charged time-and-materials costs to a number of well-funded programs. Lockheed was the lead contractor for Blackstar orbiters being fabricated at McDonnell Douglas in the early 1990s, and workers there typically logged their time against a specific Lockheed charge number associated with that project. But their time might also have been charged to the National Aero-Space Plane (NASP) and the Navy's A-12 fighter accounts, they say. Both multibillion-dollar programs were canceled with little but technology development gains to show for massive expenditures.

"At first, [supervisors] said we were working on NASP, but this thing never looked like anything the public was shown," a McDonnell Douglas technician who worked in the company's "black hole" facility said. "Later, we were just told, 'Clock it to NASP and don't ask questions.' We never did anything that was really NASP--and money was never a problem."

Whether the Blackstar system was ever declared operational or not is unknown, but several orbiters may have flown over the years. A former program manager at a major aerospace company once declared, "There's no question; Lockheed is flying a two-stage space vehicle."

Interestingly, after both Lockheed and Boeing pulled out of the NASP competition

(or were "eliminated") in the 1980s, they may have collaborated to develop the two-stage-to-orbit Blackstar system under a highly classified "fast-track" program. However, many other contractors' "deep-black" teams probably also were involved in order to bring the nation's best expertise to bear on what must have been daunting technical challenges.