

Air and Space this Week

Item of the Week

Animals and Flight Test

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This particular Item of the Week is motivated by the first supersonic ejection test involving an animal subject, 60 years ago on March 26.

The half-decade after the end of WWII was marked by a shift in military strategy due to both the US and the USSR having atomic, then hydrogen, weapons. Long-range land-based and submarine-based missile technology was in its infancy, and both countries were looking to long-range high-speed bombers as their primary nuclear deterrent.

LONG-RANGE BOMBERS AND THE B-58

The B-29 was a technological marvel during the latter stages of WWII, but Korea proved it was no match for jet fighters. The B-32 Dominator bomber was introduced at the end of the War, but it was essentially obsolete-on-arrival. It could carry the load, but it couldn't survive a deep-penetration mission. Jet engines were part of the solution, but not a panacea; the subsonic B-47 Stratojet was not good enough. A much faster aircraft, capable of flight at higher altitudes, was needed.

The Air Research and Development Command at Wright-Patterson issued a study on the topic in 1949. The result was the first modern military *weapons system* contract. The Air Force wanted a bomber that could carry a hydrogen bomb (very heavy at that time) and be capable of sustained flight at Mach 2 or above with an operational ceiling in excess of 70,000 feet. After a revision, the design competition boiled down to two concepts, one by Boeing and one by Convair. The latter was selected in August, 1952; Boeing would take a different path and produce the slower, but longer-ranged, B-52.

The Air Force issued a contract to Convair for what would become the B-58 Hustler. Convair was the prime contractor, and would be responsible for all program elements, including the aircraft itself. The Convair design was based on their experience with the F-102 Delta Dagger, a delta-wing fighter. The characteristics that the Air Force sought were most difficult to achieve with the prevailing or soon-to-be technology. The bomb and fuel requirements were extreme, leading to a number of innovations, including the use of bonded aluminum honeycomb panels for weight-reduction and novel frictional heat management tactics. Jet engines do not like to intake air at supersonic speeds, so the Hustler would have to have conical intake spikes that could move forward during flight to keep the intake air slow enough, a feature that would be

carried to the extreme in the A-12/Blackbird. The aircraft would prove to be a beast to fly, requiring a pilot, bombardier, and defensive systems operator within the fuselage, leaving no room for the bomb or adequate fuel; both would be carried in a large pod beneath the aircraft. And, of course, rapid advancements in fighter and anti-aircraft missile technology would render the Hustler obsolete soon after it was brought into service.

The B-58 never carried a combat bomb load, but was relegated to low-level, high-speed missions. It had dangerously-poor take off performance, and had to land at speeds so high that drogue parachutes were required to keep it from running off all but the longest runways (as did the B-47 and B-52). Its center of gravity moved around in flight, and its large centerline fuel tank was prone to fuel "stacking" instability (load shift).

The B-58 went operational on August 1, 1960. SAC pilots with experience in the delta-winged F-102 were sought to man it. For all its flaws, it was the fastest crewed thing in the sky on operational status. It could climb at 46,000 fpm and had no problem with sustained flight at Mach 2. Its cost, high accident rate, and eventual vulnerability to improved anti-aircraft missiles rendered it obsolete, and it was taken out of operational status on January 31, 1970.

A total of 116 B-58s were constructed, 30 training aircraft and 86 operational. Construction ceased in October, 1962. Since the B-58 was the only airplane that gave its pilots experience at long-distance supersonic flight, some of the younger B-58 pilots were recruited to fly the SR-71 Blackbird.

SUPERSONIC EJECTIONS

In the olden days of the Red Baron, a pilot in a crippled aircraft could simply climb over the side and parachute to safety. As aircraft speed increased, however, such a simple means of escape became more and more difficult. With the advent of jet aviation, some sort of ejection seat mechanism was necessary to separate the pilot from the aircraft. But even the best ejection seats of the day wouldn't save a pilot ejecting a Mach 2; the air blast would cause fatal injuries before the pilot could freeze to death or asphyxiate.

The solution: instead of a rocket-powered open seat, some sort of enclosed escape pod was required. Convair partnered with the Stanley Aviation Company to design and build a prototype. The pilot would sit in the open pod, which could close very quickly and blast away from the failing plane. Rube Goldberg would have been proud, as the pod's clamshell doors had to close very quickly, while automatically and quickly tightening restraining straps on the aircrewman and pull their legs under their seat to keep the pod closure from amputating their feet.

Tests of the escape pod concept were conducted using a high-speed rocket sled, without an occupant. John Stapp was an extremely brave man, but nobody wanted to risk a human on the successive tests, and flight-test dummy technology was too primitive to be of help.

The concept of an escape pod might be familiar to those of you who are fans of the XB-70 Valkyrie bomber made by North American Aviation/Rockwell. Only two were built; one is on display at the Museum of the U.S. Air Force in Dayton. The other was lost during a mid-air

collision photo op on June 8, 1966. The XB-70 was equipped with an escape pod derived from that of the B-58. Pilot Al White's pod successfully ejected (although his arm was crushed by the closing of the clamshell). Co-pilot Carl Cross' pod did not eject, possibly due to centrifugal forces when the XB-70 went into a flat spin.

Al White was North American's head test pilot, and was in charge of the Valkyrie test flight program. Carl Cross was a capable WWII pilot with Vietnam combat experience, in his first flight in the Valkyrie. The plane that collided with the XB-70 was an F-104 Starfighter piloted by Joe Walker, NASA's Chief Research Test Pilot, veteran of flights in the X-1 (24), D-558 (19), X-3 (20), X-4 (2), X-15 (78), and the X-15 (25, including two astronaut-level high altitude records (100+ km, not 50 miles!)). Walker also made the first test flight of the [Lunar Landing Research Vehicle](#), the one that [almost killed](#) Neil Armstrong. [Funny that the Armstrong Flight Research Center Fact Sheet linked to above mentions (barely) the crash but does not mention that Armstrong was flying and almost killed! See the YouTube link on another NASA fact sheet [here](#).]

For more on test flight and the loss of the Valkyrie, see [here](#).

YOGI (the OTHER) BEAR

When I was a little kid, I liked to watch cartoons. Huckleberry Hound was a favorite (hey, I wasn't even in kindergarten yet!). In 1958, Hanna-Barbera introduced a new feature on the HH Show, a goofy picnic basket-loving bear named "Yogi," a play on the ever-popular-even-then Yankee catcher and wordsmith "Yogi" Berra.

Apparently, the B-58 escape pod designers had kids my age. Their pod tests needed a test subject about the size and weight of a human; a bear would fit the bill. They acquired a female bear they named "Yogi" (why not "Cindy," Yogi's "girlfriend?"), and on **March 21, 1962**, strapped her in a pod in a B-58, ran it up to 45,000 feet at 870 MPH, and out she went. [I would think that the Air Force PR guys were a bit off their game on this one, naming a likely-to-be-hurt-or-worse flight test animal after a famous baseball star and popular cartoon character! And don't forget Smokey!] Eight minutes later, she was on the ground, relatively unscathed. Subsequent testing with other animals proved the concept, and most of the B-58s were retrofitted with Stanley escape pods.

Bears were used in eight tests of the Stanley capsule. They were easy to get into the seat; the handlers tempted them with apples and other treats. The first time. They may not have been "smarter than your average bear," but they were smart enough not to get fooled again. Sedated bears proved unsuitable for capsule tests. Contrary opinions exist. I suspect that the injuries to the test bears was (perhaps seriously) understated, but the tales of a bear massacre are pretty ridiculous. After all, the capsule did work.

Yes, I know there are moral issues relating to animal testing of anything, but the times and sensitivities were different, and the military needs of the Cold War were paramount, so that was the way it was. The same necessity was felt a few years later...

ANIMALS IN SPACE

The first Mercury astronauts took a lot of heat from their test pilot colleagues about the lack of piloting required to be “Spam in the Can;” some wanted no part in such things, preferring to be more of a “real” pilot (most of them are forgotten now). The use of chimpanzees in early rocket flights also was a source of not-so-good-natured teasing. But manned Space flight imposed much higher stresses and dangers than was faced in the B-58 – and there was no bailing out of a Mercury capsule!

Both American and Russian rocket developers used a variety of animals, mostly monkeys, chimps, and dogs, for flight testing.

Four rhesus monkeys (Alberts I-IV) made test flights atop a V-2 rocket at White Sands in 1948 and 1949. I couldn't find out much about Albert I's flight, on June 11, 1948, but none of the other three had difficulties in-flight, but none survived their landings.

The next animal test (9/20/1951) involved an Aerobee missile, 11 mice, and a monkey with the awful name of “Yorick,” but unlike his predecessors, Yorick survived, so there was no scene of a doctor holding his skull and saying, “Ah, Yorick, we launched thee well.” Next up was another Aerobee flight, with monkeys Patricia and Mike, and mice Mildred and Albert, on May 22, 1962; all survived the high-g takeoff and free-fall conditions.

The Russians closely watched the US flight test program, and launched a number of animals of their own, most famously, the dog, Laika, on *Sputnik 2*, on November 11, 1957.

Now the US was really playing “catch-up,” because it was clear we were way behind in the launching-animals part of the Space Race. NASA came up with the MIA program (an unfortunate acronym, but it was for “Mouse In Able” a reference to the Thor-Able launch system being tested). The first MIA mouse did not survive its launch; the rocket had to be destroyed by the range safety officer. The second MIA mouse, Lasker, endured a 60-g launch and extended free-fall before expiring. Wilkie, the third and last MIA mouse, went MIA when its capsule was lost at sea, a fate shared by Gordo, a squirrel monkey, lost at sea after a test of the Jupiter missile on December 13, 1958.

A rhesus monkey named “Able” and a squirrel monkey named “Baker,” became the first primates to make it back alive (and unharmed) from a rocket test, another Jupiter launched on May 28, 1959. Able died during a medical procedure to remove electrodes implanted for the flight (and was stuffed and put on display at the National Air and Space Museum for years, the role model for the Space Monkey in *Night at the Museum 2!*), but Baker lived until 1984. Baker is buried at Huntsville, Alabama, and visitors will often leave bananas on her grave. After the movie was released, we had to make sure that museum Docents could handle telling little kids that the cute Space monkey they saw in the movie was in the display case in front of them.

Other animals followed, the most notable were Enos, HAM, SAM, and Miss SAM.

SAM, a rhesus monkey, was named for the U.S. Air Force **S**chool of **A**viation **M**edicine, was the first monkey launched in the Mercury program, on December 4, 1959. He was in a boilerplate

Mercury capsule atop a Little Joe rocket, for a test of the launch escape system. The test was a success, SAM was recovered, and lived until November, 1982.

Miss SAM, SAM's mate, was launched on a similar test on January 21, 1960. It, too, was successful, and she was also safely recovered.

HAM is perhaps the best-known animal test pilot. Named for the Holloman Aerospace Medicine facility, HAM was launched in a Mercury capsule atop a Redstone missile on a sub-orbital flight on January 31, 1961. It was a success, and Alan Shepard was green for go.

Enos is the last of the animal test pilots mentioned here. He was a rhesus monkey, launched in a Mercury capsule atop an Atlas missile, on November 29, 1961. Enos became the first chimp to orbit the Earth, although technical problems shortened his flight from three planned orbits to two. He was recovered successfully; now John Glenn was green to go.

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Long Range Bombers and the B-58

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YOGI (the Other) BEAR

Yogi's test flight: <http://airpigz.com/blog/2010/4/2/b-58-proves-supersonic-ejection-to-be-bear-able-in-1962.html>

Blog on Bear Testing: <https://medium.com/@shermikeholmes88/why-the-u-s-air-force-ejected-bears-out-of-supersonic-jets-24763d79be80>

Air Force video of Yogi's Flight and more: <https://www.youtube.com/watch?v=-KLnqorLgDM>

Animals in Space

By far the best summary for US/USSR animal tests for Space operations is: <https://history.nasa.gov/animals.html>

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