

Air and Space this Week

Item of the Week

June 8, 2021: Anniversary Day in Flight Test

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Scott Crossfield Joe Walker Al White Carl Cross XB-70A Valkyrie

Several anniversaries of note occur this week on June 8: the 100th of the first successful flight of an aircraft with a pressurized cabin, the 62nd of the first test drop of the X-15, the 61st of a severe engine explosion in X-15 #3; and the 55th of the mid-air collision of the XB-70A AV-2 Valkyrie Mach 3 bomber and Joe Walker's F-104.

Harold R. Harris

Few today know of Harold Harris, a WWI flying veteran and famous test pilot, but in his day, he was an innovator in both piloting and aviation management. He held 26 different flying records, was the first to escape a damaged plane by using a free-fall parachute, and helped create the business of crop dusting.

Harold Ross Harris was born on December 20, 1895, in Chicago. Like many growing up during that time, he had a youthful interest in aviation that he kept through his entire life. At the time he graduated high school, no college was offering courses in aeronautics, so he pursued a B.S. in mechanical engineering at the precursor institution to Cal Tech, and received it in 1911.

The turmoil in Europe that foreshadowed WWI led to the establishment of several Citizen's Military Training Camps, and Harris joined the one in Monterey, California, because it had an aviation unit, one of the few, where he honed his aero-engineering skills. When the U.S. joined in the war "over there," Harris enlisted in the Army Signal Reserve corps, where he received ground school instruction in preparation for training to be a military pilot. He was then sent to Italy for flight training, and he earned his wings. He was as good a teacher as he was a student, and did a stint in Italy as the Chief Instructor for training, through July, 1918. He also helped the Navy establish an aerial ferry route over the Alps (Milan-Paris), and became the first U.S. pilot to fly over those mountains.

After the War, Harris was assigned to be a test pilot at Wilbur Wright Field in Dayton, Ohio. He was there almost two years, then the entire Engineering Division was moved to McCook Field, a now-defunct airbase in downtown Dayton. Harris had worked his way up, and by 1921 was the Chief of the Flight Test Branch of the Engineering Division of the US AAS.

The FTB was working on a number of interesting projects. One is of particular note here: on **June 8, 1921**, Harris was the first to fly an aircraft with a pressurized cabin. Two other attempts had been made by FTB test pilots, including the (soon to become) famous John A. Macready, who would become the only three-time winner of the prestigious Mackay Trophy, and was the pilot of the first non-stop transcontinental flight in May, 1923, as related in a previous [Item of the Week](#).

Planes were being developed that could fly higher than the pilots could tolerate. At altitudes greater than 12000 feet, oxygen deprivation can negatively-affect pilots, and the situation would get progressively-worse at higher altitudes, where the prevailing air pressure caused medical issues, oxygen or not. Pilots had experimented with taking whiffs of oxygen from a tank while aloft, and several primitive oxygen masks were used. These stop-gap measures worked after a fashion, but they were difficult to operate and less-than-desirably reliable, especially while piloting an aircraft near its operational ceiling, where the air was thin and cold. Nonetheless, a number of altitude records were set at McCook; Macready was the current record holder.

Harris' engineers figured that oxygen, pressure, and cold issues could be countered by sealing and pressurizing the pilot compartment. Two attempts had been made to test fly such a craft, but both were not successful. On **June 8, 1921**, Harris himself made the attempt, and conducted the first successful test flight with a pressurized cabin.

Commercial aviation was in its infancy, but with the development of the Junkers-52 and Ford Tri-Motor, passenger service was becoming more common. But it was a very uncomfortable experience, largely because the cabin was not pressurized. Planes had to fly through weather, not over it, and the kit of the first flight attendants included a fly-swatter (insects can invade an open cabin) and a wrench (the Tri-Motor vibrated so vigorously that the nuts holding the seats down would often back off their bolts in flight). A pressurized cabin would make the flying experience so much more pleasant, and the work in Harris' shop led directly to planes like the Lockheed XC-35 and the Boeing Stratoliner a decade later.

Harris was the first and one of the few pilots to fly the Barling Bomber, then the largest airplane in the world, and one of the first to fly the first helicopter prototypes, both in 1924. He left military service in 1926, and turned his energies to the business side of flying.

Harris and Macready, while still at McCook, worked on a design that would allow for the aerial application of pesticides from a highly-maneuverable low-flying airplane. In 1926, he formed the first crop-dusting company, and Macready made the first successful test flight of the aircraft and delivery system they had designed. Harris also consulted with the infant Pan American World Airways, who followed his recommendation and partnered with Grace Shipping to make an integrated commercial transport operation, Grace Airways. Harris served ten years as COO of Grace, stationed in Peru.

Harris was a stickler for flight safety, especially for passenger aviation. But perhaps his best idea at Grace was his insistence that Grace's passenger flights have an on-board bathroom....

During WWII, Harris resigned from Grace and accepted a commission as Colonel in the Air Transport Command, holding progressively-responsible positions for the Duration. He left service in 1945 as a Brigadier General, to serve as a VP at Pan Am, the President/CEO of Northwest Airlines, and president of a company dealing with aviation financing.

Over his career, Harris earned a variety of medals and awards from the U.S., and from both Italy and Peru. He passed away on July 28, 1988.

First Flight of the X-15

The X-15 rocket plane was an important bridge step between the earlier X-planes and the Space program. The X-1 was a simple, straight-wing design, but it could “break the sound barrier.” The X-2 utilized a swept-wing configuration, initially developed by German aeronautical engineers in WWII.

The needs of the military, and of NACA, required research to be conducted at hyper-velocities, several times the speed of sound. NACA put out a request for proposal (RFP) for a rocket-powered flight (carries both fuel and oxidizer and does not require outside air to operate) in late 1954. North American, builder of the WWII P-51 Mustang fighter won the contract to design and build the airframe, and an outfit called Reaction Motors got the contract to build the rocket engine. Three X-15s would be built.

The X-15 was as much a missile as it was an airplane. It would be carried aloft under the wing of a B-52 mother ship, just as the X-1 and other X-planes, and land on two skids and a twin-wheel on the dry lake bed at Edwards AFB. The X-15 would be dropped at 45,000 feet, ignite its rocket engine, and accelerate to Mach 6+ while climbing to over 100,000 feet. The powered part of the flight would last only two minutes or so, with the pilot trading altitude for speed to reach Edwards for a dead-stick landing.

The X-15 program comprised a total of 199 flights. The highest X-15 flight was over 350,000 feet, piloted by NASA pilot Joe Walker, on August 22, 1963. The fastest it went was Mach 6.7, on a flight by Air Force Captain Pete Knight, on October 3, 1967. A number of modifications to the X-15 were made, depending on the objectives for that particular flight in the flight test program. There were several mishaps along the way, one fatality, and two X-15 pilots became astronauts (Joe Engel and Neil Armstrong). Eight pilots made at least one flight higher than 50 miles, qualifying them for “astronaut” status according to the USAF (the Air Force pilots got their astronaut wings immediately, the non-AF guys eventually did). Only Joe Walker qualified under the 100-kilometer altitude definition for “astronaut.” He did it twice, both times setting a new altitude record.

The first test of X-15 aloft was the unpowered drop test, piloted by Scott Crossfield, on **June 8, 1959**. Crossfield would make a total of 14 powered X-15 flights, including the first powered flight of the second X-15 built. The X-15 had teething problems; Crossfield had mechanical failures and on-board fires on the second and third X-15 flights (9/17/59 and 10/17/59). On November 5, 1959, Crossfield’s X-15 (#3) suffered an engine explosion just before landing. The aircraft sustained damage during the landing, but Crossfield was not injured.

Two Big Days for Scott Crossfield

Albert Scott Crossfield was born on October 2, 1921, in Berkeley, CA. He served with the U.S. Navy in WWII, as a fighter pilot and instructor. He flew both the Hellcat and the Corsair, and a variety of other aircraft. After the War, he earned a B.S. and M.S. in aeronautical engineering at the University of Washington.

After graduation, Crossfield joined NASA and was assigned to be an aeronautical research pilot at Dryden FRC (now the Armstrong FRC), where he flew a variety of high-performance aircraft, including the X-1, the XF-92, the X-4, the X-5, and the D-588-1 Skystreak.

Crossfield became the first person to fly at Mach 2 on November 20, 1953, piloting the Douglas D-588-2 Skyrocket, dropped from a B-29 mothership. He left NACA and became the Chief Engineering Test Pilot at North American Aviation in 1955. There he played a major role in the development of the X-15, and would make the very first X-15 flight, a non-powered drop test, on **June 8**, 1959. That flight proved to be challenge, because the controls had not been set up correctly, and the rocket plane suffered severe pilot-induced-oscillations as it neared landing (the same situation that wrecked Bruce Peterson and the M2-F2; see:

<http://www.airandspacehisweek.com/assets/pdfs/20201102%20Bruce%20Peterson%20-%20The%20Real%20Six%20Million%20Dollar%20Man.pdf>). But Crossfield skillfully set down the X-15. He also flew the first powered X-15 flight, on September 17, 1959.

The XLR-99 rocket engine designed for the X-15 had problems and was not ready for the initial phase of flight test, so a pair of smaller rocket engines were used. On Crossfield's third X-15 powered flight (November 5, 1949), one of them caught fire not long after igniting. The ensuing damage kept Crossfield from dumping fuel, and he had to make for the nearest emergency landing zone while very heavy and going very fast. The X-15 #2 hit hard, and [broke in half](#) just aft of the cockpit. Scott Crossfield was unhurt.

On **June 8**, 1960, exactly one year after the first unpowered drop test of the X-15, Crossfield was in the cockpit of X-15 #3 while it was undergoing a variety of ground tests of its larger XLR-99 engine. As the tests were concluding, the engine blew up, driving the cockpit forward and exposing Crossfield to a brief, but incredibly high, acceleration, that would cause him vision problems later in life. X-15 #3 was eventually re-built and flown again, but was eventually lost with its pilot, Major Mike Adams, the only pilot fatality of the X-15 program.

Crossfield completed 16 captive X-15 test flights (in which the X-15 stayed mated to its B-52 mother ship), the unpowered first flight, and 13 powered flights. He stayed with North American until 1967, in a variety of important projects.

Crossfield left NA and became the R&D VP at Eastern Airlines, then as staff VP working on Air traffic control technologies. He finished his career with Hawkey Siddeley as a senior VP, retiring in 1993. During this time, he was on the House Committee investigating the *Challenger* disaster.

Educating the next generation of pilots was always important to Crossfield, so he worked with the Civil Air Patrol and established the A. Scott Crossfield Aerospace Teacher of the Year award,

first under CAP management, then later under the National Aviation Hall of Fame. His accomplishments would be recognized by a large number of awards and honors, but he was most proud of the Teacher of the Year award. The *Star Trek* folks even recognized his piloting when they established the “Crossfield Class of Starships” for *Star Trek: Discovery*!

A Loudoun County (VA) elementary school was named in his honor, and his daughter, a good friend of the National Air and Space Museum, has worked with the Loudoun County Public Schools on a variety of projects.

Crossfield was an avid private pilot in his retirement, piloting a Cessna 210A most capably. He flew to Maxwell AFB in Montgomery, Alabama to give a speech to a class of young Air Force officers attending Maxwell’s Air and Space Basic Course. On his way back to Virginia, he encountered severe weather, his plane broke apart and crashed, killing him.

He left us with this philosophical note, “My flying was only primarily because I felt that it was essential to designing and building better airplanes for pilots to fly.”

A Worse Day for Joe Walker, Al White, and Carl Cross

The already-venerable B-52 was built to carry nuclear weapons very long distances to their targets, and had a long record of carrying conventional bombs in Korea and Vietnam. It could fly fast and high, but Air Force strategists of the late 1950s wanted a supersonic bomber as its future replacement. A lot of aeronautical, financial, and political issues were involved, but North American was finally able to build two prototypes of the XB-70, nicknamed the “Valkyrie,” capable of flying at Mach 3+ at 70,000 feet. Such performance would make it invulnerable to defensive fighters of the time. But missile technology was advancing rapidly, too, and when the Russian SA-2 missile was used to shoot down Francis Gary Powers in 1960, the vulnerabilities of the Valkyrie to missile fire were exposed, bringing the future of the B-70 into doubt. The two prototypes were finished anyway, but the Valkyrie program was canceled in 1961. The two Valkyries were redesignated XB-70A (AV-1 and AV-2) and were used for supersonic test flights from 1964-1969.

The Valkyrie had a number of problems uncovered during initial flight testing. On one occasion, an electrical problem prevented the lowering of its landing gear, until the test pilot Joe Cotton used a paper clip to jump a bad circuit breaker. Imagine saving a \$750M plane (in 1966 dollars) with a paper clip worth at most a few pennies!

The Valkyrie engines were built by General Electric, as were many military jet engines. Their PR department wanted a good visual to showcase their engines, and arranged for a photo op of a number of military jets using GE engines, including the Valkyrie. The request for the group flight did not go through proper channels and was not officially approved.

On June 8, 1966, XB-70A AV-2 flew in formation with an F-4 Phantom, an F-5, a T-38, and an F-104 Starfighter, along with a photo plane. Experienced X-15 pilot Joe Walker, NASA’s Chief Research Test Pilot, was driving the F-104, and the Valkyrie was commanded by Al White, The Valkyrie program Chief Test Pilot, who had been assigned to the X-15 program in its later stages and never got a flight. His co-pilot was Carl Spencer Cross, a 40-year-old WWII vet with some

Vietnam combat flight experience, on his first mission in the XB-70A. The Valkyrie flew a few tests, then formed up with the other planes for photos.

[Joe Walker was an extremely-experienced pilot; see more about him in the Didja Know? segment in the website's Calendar section.]

The delta wing of the Valkyrie had a hinged tip that could generate strong vortices, whose detailed aerodynamics were not fully understood. For whatever reason, not being able to see the Valkyrie's wing tip as he approached or a desire to have a real tight formation to make a dramatic photo, Walker's F-104 hit the right wing of the Valkyrie and was whipped into a half-roll and slung to the left, shearing off the right vertical fin of the Valkyrie completely, and most of the left. The F-104 exploded, killing Walker instantly. The Valkyrie flew on for a few seconds, and then went into a flat spin.

Bailing out of a damaged airplane in the jet age was a lot tougher than climbing out of a cockpit and jumping off the wing. Aerodynamic forces were too strong to climb out in, so some sort of ejection seat was used. That would work well for faster sub-sonic flights, but the wind blast at Mach 1+ caused severe injuries, and at Mach 3, there would be no way for an unprotected pilot to survive.

The Valkyrie had a new system for protecting the pilots during a high-speed ejection. Their seats would retract backwards into a clamshell-like pod, the pod would close, and then be rocketed from the dying Valkyrie.

Al White ejected, but his arm was hurt badly when it got caught in the clamshell mechanism, and he suffered other injuries during his ordeal. Cross was unable to retract his seat into the pod, likely due to centrifugal forces caused by the Valkyrie's spin, and he died in the crash.

The Valkyrie was already obsolete as a deep-penetration bomber, because of possible Russian countermeasures, and after the loss of AV-2, the testing program was canceled, too. AV-1 is now on display at the National Museum of the U.S. Air Force in Dayton, Ohio, along with X-15 #2. X-15 #1 is at the Smithsonian National Air and Space Museum.

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(keep watching this one, it has a lot more info on other aircraft, including the LLRV)

Albert Scott Crossfield

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XB-70A Valkyrie

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Didja Know?

“Cowboy Joe” Walker flew the hottest jets during his fifteen years at Edwards AFB (now the Neil A. Armstrong Flight Research Center), much of that time as Chief Research Pilot. He flew the Bell X-1 variants twenty-four times, the D-558 Skystreak variants nineteen times, the X-3 Stiletto twenty times, the X-4 twice, and the X-5 seventy-eight times, in addition to his twenty-five flights of the X-15.

But didja know he also was the first test pilot for the dangerous Lunar Landing Research Vehicle, the one that almost killed Neil Armstrong? A total of thirty-five times, no less! See more about the LLRV and Neil at:

<http://www.airandspacehisweek.com/assets/pdfs/20200316%20Neil%20Armstrong%20and%20Gemini%208.pdf>.

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