

## Air and Space this Week

### Item of the Week

# TWO TITANS OF THE MANNED SPACE PROGRAM

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**KEY WORDS:** Christopher Kraft Deke Slayton Mission Control Flight Director

*The Manned Spaceflight Program of the 1960s required the combined efforts of thousands of dedicated, hard-working people. The astronauts, understandably, got the lion's share of credit and news coverage. However, they were but the "tip of the spear," and their spectacular successes would not have been possible without the skill and effort of others. Some of those behind the scenes are pretty well known, like Gene "Failure is not an Option" Kranz; others are known only to Space buffs, such as John Aaron, who [saved the Apollo 12 mission](#) from disaster.*

*Two of the most important behind-the-scenes people would have had 100<sup>th</sup> birthdays in a few weeks. A good educational program could be built around them as examples of the work and teamwork NASA requires. Chris Kraft was born on February 28, 1924 and Deke Slayton was born on March 1 of that year. This is their story.*

### CHRISTOPHER COLUMBUS KRAFT, JR.

*Could there possibly be a better name for a person who played a huge role in the effort to explore a strange new world?*

#### THE EARLY YEARS

Chris Kraft was born in Phoebus, Virginia. His father was the child of Italian immigrants who lived near Columbus Square in NYC. His grandfather was also no doubt proud of the first Columbus' contributions in history, so both his father, and he, got the name. Chris would later say in his autobiography that he felt in regards to his name that "some of my life's direction was settled from the start." Exploration wasn't his only boyhood love; he was the NY State American Legion champion bugler as a boy and was successful at college-level baseball at (what is now) Virginia Tech, where he matriculated in the Fall of 1941.

After Pearl Harbor, Kraft tried to enlist in the Navy's V-12 pilot program, but was medically disqualified due to a hand injury he had suffered when he was quite young. His interest in aviation was still strong, and he opted to continue his studies in aeronautical engineering at VT, receiving a BS in December, 1944.

#### NACA/NASA

The aeronautical industry was booming in 1945, and Kraft applied to Chance Vought, an airplane manufacturer best known for the Corsair fighter plane during the War and the F-8

Crusader for the Navy in the late 40s and 50s. He also applied to the National Advisory Committee for Aeronautics' Langley Research Center in Virginia. He initially favored Chance, but didn't like their corporate attitude, so he accepted a position with NACA. Langley was experimenting with high-speed aerodynamics and aircraft designs that would soon lead to the Bell X-1 rocket plane. The Langley Head of Research at the time was Robert Gilruth, who would play a large role in the nascent Space program a few years later. Kraft conducted important research into turbulence and how its effects could be mitigated.

Then Sputnik happened, on October 4, 1957.

The U.S. military/governmental community was aghast at the USSR's technological lead. One response was the National Aeronautics and Space Act of 1958, signed into law by President Eisenhower, which established NASA. NASA absorbed NACA's mission, facilities, and much of its personnel, including Gilruth and Kraft.

Robert Gilruth was given the job of assembling a team within the new Agency that would work out the technology and management that would be necessary to put an American in orbit. He remembered Chris Kraft's work at Langley and invited him to be part of the 33-person Space Task Group that Gilruth was putting together. The STG led directly to ...

## **PROJECT MERCURY**

The Flight Operations Division was one of the key sub-groups of the STG. It would be responsible for the operation of the Mercury spacecraft in flight and the monitoring and control of the mission from the ground. Chuck Mathews was the FO Division head, and Kraft became his assistant. They had to invent all sorts of plans, procedures, rules, and support policies; a huge job!

The STG had a number of engineers highly experienced in the development and testing of high-performance aircraft in the 1950s. But the inherent nature of Spaceflight was very different than that of supersonic fighter planes. Fighter pilots had to have the run of the sky, where the pilots were essentially untethered from the ground, at least away from their base. But Spaceflight and orbital mechanics did not allow for such independence. Further, the complexity of dealing with the hostile Space environment required a lot of real-time engineering support, without the engineers being present on board.

Kraft recognized those differences, and originated the concept of what would become NASA's Mission Control Center. He knew that any MCC would need to have a number of engineers operating together, each with responsibility over one of the spacecraft's systems. To ensure the engineers' efforts could be managed effectively, Kraft knew that a Flight Director would be needed, the one person that called the shots based on the inputs received from the engineering team. Kraft went to Mathews with these ideas, and a statement that he wanted to be the Mercury Flight Director. Mathews agreed.

NASA was developing and testing rocketry technology at a rapid pace by 1959. The Redstone booster was available, but it wasn't powerful enough to put a human into orbit. The Atlas missile was, but it had some teething problems that had to be worked out. Animals were

involved in flight test (see [here](#) for more on that), first for the smaller rockets, then for the Atlas.

Kraft's Mission Control concept got an acid test during the Mercury-Atlas 5 mission, which launched on February 29, 1961. It would be the final test flight of the Mercury-Atlas program; John Glenn would become the first American to orbit the Earth aboard MA-6 on February 20, 1962.

A chimpanzee named "Enos" was aboard the Mercury capsule that day, on a three-orbit trip. However, one of the capsule's attitude control thrusters failed, giving FD Kraft a decision to make. Should he continue the flight and perhaps have it and Enos burn up on reentry, or should he abandon the third orbit and bring the capsule down prematurely. He chose the latter, and Enos made it back OK. An astronaut probably could have overcome the malfunction and made the third orbit without further problem, but to Kraft the situation vindicated the whole Mission Command concept.

The first two Mercury flights were very short sub-orbital hops, there was little need or opportunity for Mission Control to affect the flight in real-time. John Glenn's MA-6 was a different matter entirely.

Glenn's flight was planned for three orbits of the Earth. Launch was uneventful (other than the thrill of putting an American in orbit!), so was the first orbit. But a potentially-bad problem arose on the second orbit.

The Mercury capsule was designed to land in the ocean, because making the capsule sturdy enough to withstand landing on hard ground posed an unacceptable increase in spacecraft weight. Even hitting the ocean while under parachute was going to be a potentially-damaging impact. To cushion the blow, engineers designed a system not too unlike today's automobile air bag. Once the capsule had come through most of the atmosphere protected by its heat shield, the shield would detach and separate from the bottom of the capsule. The heat shield wouldn't fall away because it was the bottom of an air bag whose upper part remained attached to the capsule. The bag had small vents that would allow it to fill with air, and upon impact, the air being released from the bag would cushion the impact. The system worked pretty well in test flights and in actual Mercury missions, however ...

Mission Control received an unwelcome bit of telemetry from Glenn's capsule during orbit number two. The heat shield, vital to the protection of the spacecraft and its astronaut, had come loose prematurely. If the signal was correct, Glenn would likely burn up on reentry.

Chris Kraft immediately consulted with his team of flight control engineers and came to the conclusion that the "loose" signal was the malfunction, not the heat shield. He recommended that no change in the reentry procedure should take place.

But Kraft wasn't the total boss here; he had two superiors present, Max Faget, the lead designer of the Mercury capsule, and Walt Williams, Kraft's boss in the FO Division. They overruled Kraft's recommendation, and ordered Glenn *not* to jettison his retro-rocket package after firing them. The package was attached to the heat shield by straps, and Faget and

Williams wanted those straps to stay on, should the shield actually be loose. The only problem was the retro-rocket package did pose a danger, both aerodynamically and operationally. The package could adversely affect the airflow around the capsule, causing it to tumble and burn up. The solid fuel of the retro-rockets, if not burned completely, could explode/burn during reentry causing the loss of the capsule. [One can only imagine Glenn's state of mind when he got the order to not jettison the package, because a problem with the vital heat shield would be the only reason such an order would have been given!]

The heat shield held and a post-mission analysis showed the "loose" signal was erroneous.

The near-tragedy really caused both Kraft, and his assistant for the flight, Gene Kranz (who came to call Kraft "The Teacher"), to really dig in their heels on the belief that key decisions regarding manned spaceflight should be left to the FD and engineers closest to the situation, not their bosses. *Kraft vowed to never again allow someone outside of Mission Control make decisions affecting the mission while in flight.* That philosophy led directly to saving the *Gemini 8* mission from calamity, *Apollo 11* from aborting its landing due to low fuel, *Apollo 12* from disaster when it was hit by lightning just after launch, and getting *Apollo 13* safely back to Earth after an on-board oxygen tank explosion.

Kraft was the head Flight Director for the rest of the Mercury missions, and for the first half-dozen Gemini missions. The situation with the Gemini missions was very different than that for Mercury. Mercury flights were short, only the final flight, by Gordon Cooper, lasted more than a day. But Gemini flights were slated to be much longer, up to two weeks, so no one FD could handle them from start to finish. Mission Control had to move to a three-shift system.

Kraft stepped back from being a hands-on Flight Director after *Gemini 7*. He devoted his time to planning for the Apollo program, serving on review boards at North American Aviation, the lead contractor for the Apollo spacecraft. His work had made him well known at the time. He was even on the cover of *Time* magazine; the glowing story inside compared him to an orchestral conductor, and to the other Christopher Columbus.

The Apollo/Saturn system had been undergoing flight test, building up to the first crewed test flight, scheduled for launch in early 1967. Kraft would have been the lead FD for that flight, and he was in the blockhouse at the Cape on January 27, when the crew was conducting tests on the capsule. He was listening in on the test conductor's comm system when the fatal fire broke out, but could do nothing about it by listen. Betty Grissom asked him to be one of Gus' pallbearers at Arlington.

Kraft was one tough guy. He made his edict about no interference from outside Mission Control stick. Kraft's motto was, "To err is human, but to do so more than once is contrary to Flight Operations Directorate policy." Maybe not even once. A few astronauts failed to follow his instructions sufficiently. As a result, Scott Carpenter (MA-7) and the crew of *Apollo 7* never flew in Space again. For more on Kraft vs. *Apollo 7*, see [here](#).

Kraft had been involved deeply in the development of the Apollo program, but was turning over more and more direct responsibility to younger engineers. He was named the Deputy Director

of the Manned Spacecraft Center in 1969, and in 1972 he became Director (replacing Gilruth). He retired from NASA at the end of 1982.

## **POST-NASA**

Chris Kraft served as a consultant for Rockwell International and IBM, and chaired the Space Shuttle Management Independent Review Team, which issued a report in 1995 that proved to be somewhat controversial. The IRT had been tasked with making recommendations on how to make the Shuttle program more cost-effective. A number of policies and procedures had been put in place after the *Challenger* disaster that, in the opinion of the IRT, were “duplicative and expensive.” The loss of *Columbia* in 2004 caused additional controversy with the IRT report.

Kraft received many honors and awards during and after his career, starting in 1963 when JFK personally awarded him NASA’s Outstanding Leadership Medal in the White House’s Rose Garden. He won NASA’s Distinguished Service Medal twice, among many other accolades, and was inducted into the National Aviation Hall of Fame. Mission Control at the Johnson Space Center is now named in his honor, and I had the pleasure of meeting him in person when he was at the National Air and Space Museum to receive the prestigious NASM Trophy for Career Achievement (now called the Michael Collins Trophy) in 2010. That was the same year that Sullenberger and crew won the annual award for the Miracle on the Hudson, and both Kraft and Sully’s team were featured in a live on-line program managed in large part by the NASM Educational Division.

Christopher C. Kraft Jr. passed away on July 22, 2019, in Houston, two days after the 50<sup>th</sup> anniversary of the Apollo 11 Moonwalks.

## **DONALD KENT SLAYTON**

### **THE EARLY YEARS THROUGH WWII**

Donald K. Slayton was born on a farm near Leon, Wisconsin. Conditions were quite primitive; the farm did not have indoor plumbing or electricity. The Slaytons raised cows and sheep, and grew some tobacco on the side. The equipment available was as primitive as the plumbing, with horses, not tractors, providing the motive power. Young Donald worked hard as a boy, and lost a finger while cleaning the family’s hay mower when he was only five years old. His elementary school was more modern than some; it had *two* rooms. He would graduate from high school in Spring, 1942, with his notable activities including boxing, playing the trombone, and membership in the Future Farmers of America.

Pearl Harbor happened early in his senior year of high school, and like many young men, he wanted to sign up right away, but he wasn’t 18 yet and he still had several months of high school remaining. He had been making plans to join the Navy upon graduation, but when he found out that the Army was accepting high school graduates for flight school, he joined up with them. He entered the Aviation Cadet Training Program, but had trouble getting in because of his missing finger. But he persevered and was sent to Primary Flight Training in Vernon,

Texas. Three months later, he was in Waco striking to become a fighter pilot, but instead, he was slated for multi-engine training. He finished flight training on April 22, 1943, and given his lowest-preference assignment: co-piloting the B-25 Mitchell medium bomber.

Slayton was assigned to the 340<sup>th</sup> Bombardment Group after three months of training in the B-25, and sent to the ETO. He fought out of several bases in Italy, and was upgraded to pilot, and after a total of 58 combat sorties, he returned to the U.S. in May, 1944. He was still only 20 years old.

His next duty was as a B-25 instructor, and then applied for and was accepted to fly the new A-26 Invader, hoping to fly in the Pacific Theater. He got it, but did not arrive at Okinawa until July, 1945. He flew seven combat missions over Japan, the last one on VJ Day. After the War, he served as a B-25 instructor again, and in the post-War draw down, he separated from Army service in November, 1946, but remained in the Air Force Reserves.

### **PRE-NASA**

Slayton liked flying, and opted for additional education. He earned a B.S. in Aeronautical Engineering from the University of Minnesota in 1949, flying with the Minnesota Air National Guard. After he got his degree, he took a job with Boeing in Seattle as a junior engineer and left the Minnesota ANG.

When the Korean Conflict heated up, Slayton wanted to join the Seattle ANG unit, but was denied, because his reserve status had expired. A call to his former CO in Minnesota got him restored to the AF Reserves there, but still faced medical issues barring his full return. He overcame those, serving as a maintenance officer then when his flight status was restored, as a maintenance flight test officer. He got additional schooling at the Air Command and Staff School, then joined the Twelfth Air Force in Germany, with duties as both a maintenance officer and as a pilot for the F-86 jet fighter.

Slayton wanted to become an Air Force test pilot, but was denied; he had to complete his three-year tour in Germany first. As soon as he was eligible, he applied again and was accepted. He graduated from the USAF Test Pilot School in December, 1955, and became a test pilot at Edwards AFB, where he flew the full range of "Century" jet fighters, starting with the F-102. It was there that he picked up his nickname. To avoid confusion in radio calls to a squadron-mate named Don, everyone began referring to Slayton by his initials, "D.K." Over time, "D.K." got shortened to "Deke," and it is by that name he is most known.

### **NASA!**

When he heard about NASA's call for test pilots for Project Mercury, he applied. He wasn't *gung ho* at first, but he passed the many medical and other tests and was accepted as one of the Mercury Seven, the first class of NASA astronauts. His first assignment at NASA was to work on the version of the Atlas missile that would be used in the latter part of the Mercury program. But during a centrifuge test, medical monitoring equipment detected an idiopathic [atrial fibrillation](#); bad but not so severe that he was removed from flight status. He was selected to

be the pilot of the MA-7 mission, the second orbital attempt, but increasing management concerns about his heart condition caused NASA Administrator James Webb to medically disqualify Slayton from any NASA flights, just two months before the mission, which was taken over by Scott Carpenter, Chris Kraft's future nemesis.

Of course, Deke was heartbroken by the decision (sorry). But there was a pretty good consolation prize heading his way. Since he knew the Mercury astronauts well and knew the ins-and-outs of astronaut training, he was selected to be the senior manager of NASA's Astronaut Office. His job portfolio there would include being the one to make final selections for the second group of Astronauts and making all flight assignments for upcoming missions, all the way through to the end of the Apollo program.

Slayton had retained his status as Air Force officer up until this time, but when he could not maintain his flight status due to his heart condition, he opted to resign his commission and join the NASA management team as a civilian, in November, 1963.

Deke wasn't the only Astronaut to have medical problems that affected their flight status. John Glenn was grounded temporarily, as was Alan Shepard, who contracted Ménière's Disease, an inner ear disorder which affected his balance. Shepard was given the job of running the Astronaut Office, and Deke got promoted to Director of Flight Crew Operations in 1966.

Like Chris Kraft, Deke was in the blockhouse on the awful day of the Apollo 1 fire. Like Kraft, he was a close friend of Gus Grissom, and had thought about joining the crew aboard the test to work on the electrical problem that ended up causing the fire. Had he done so, he would have been killed along with the Gus, Ed White, and Roger Chaffee. On the other hand, it might have been the case had he been there working on the problem, he could have stopped the fire as it began....

Slayton wielded a lot of power over the astronauts, but he didn't win every dispute. When Shepard was restored to flight status, Slayton first considered him for command of Apollo 13, which some astronauts opposed immediately, due to Shepard working for Slayton in the Astronaut Office and not having flown a mission since his becoming the "First American in Space." After the Apollo 13 debacle, NASA higher-ups wanted Shepard to again be the First, in this case to resume the Moon landing program. Shepard was named Apollo 14 mission commander, over Slayton's serious objections. Deke had become familiar with Shepard's lack of relevant recent experience (and perhaps his disdain for maintaining his physical fitness level and training in lunar science, which ended up adversely affecting his performance on the Moon). But Deke was overruled. There was a scandal over postal covers on Apollo 15, and Deke ended the flight careers of those involved and made it stick, but he did want Joe Engle to be the Lunar Module Pilot for Apollo 17, and was overruled on that one, because Apollo 17 would be the last Moon landing and NASA top management wanted to have at least one professional geologist make a landing, rather than another ex-test pilot. Engle would get plum assignments, but [with the Space Shuttle](#), not Apollo.

## **FLIGHT STATUS RESTORED**

Slayton had spent a lot of time at NASA trying to get healthy enough to have his flight status restored. He tried exercise, diet, vitamins, and all sorts of things, but his condition did not improve until he started taking [quinidine](#), at the time an experimental medicine. Quinidine proved to be effective in his case, but it has a lot of undesirable side effects for some patients and is no longer made. Slayton was glad it worked well enough to allow his flight status to be restored in on March 13, 1971, but he was concerned enough to stop taking it without doctor's orders to do so well before then. Would Deke finally get to fly a mission?

Yes! He was selected as the Docking Module Pilot for the [Apollo-Soyuz Test Project \(ASTP\)](#), which resulted in the famous "Handshake in Space." The *ASTP* required a two-year commitment for intensive training in cooperation with his Soviet counterparts. He remained in NASA management for the Skylab program during the run-up to *ASTP*, but resigned from the Astronaut Office before his flight.

The *ASTP* mission went well until the end, when a bad switch setting allowed noxious nitrogen tetroxide fumes from its thrusters into the command module. The fumes are quite toxic, and the crew was hospitalized for observation and treatment. During the tests on Deke's lungs, a small lesion was found and removed, an event that would preclude him flying in Space again. He was the oldest astronaut to fly at that point, and at least he finally made it into Space.

As related above, Chris Kraft was in charge of the development of the Space Shuttle and its operating systems. Slayton had already been tabbed for managing the Approach and Landing Tests for the Shuttle, and he moved over to that full-time after *ATSP*, where he oversaw the atmospheric tests involving the Space Shuttle *Enterprise*, the development of F-104s and T-38s with controls that simulated the response of the Shuttle's flight controls, and the B747 *Shuttle Carrier Aircraft*. He would later manage the Space Shuttle Orbital Flight Tests and, in retirement, serve in an advisory capacity for STS-1. He even flew an F-104 chase plane for the landing of STS-2. His full retirement from NASA came on February 27, 1982.

## **POST-NASA**

Like many astronauts, Deke found employment after NASA in a variety of managerial roles. He served as CEO of Space Services, Inc., a company founded to develop small rockets for commercial payloads. He also served as the President of the International Formula One Pylon Air Racing association, served as a Director for the Columbia Astronautics company, and served on the U.S. Department of Transportation's Commercial Space Advisory Committee.

He would write two books in retirement: His biography, *Deke! U.S. Manned Space from Mercury to the Shuttle*, with Michael Cassutt, published in 1994; and *Moon Shot: The Inside Story of America's Race to the Moon*, with Alan Shepard and Jay Barbree. Both books came out in 1994, a year after Deke's passing. Slayton won a number of awards for his career, including the SETP's Doolittle Award for 1972 and Kincheloe Award in 1975 and the Collier Trophy with the other Mercury astronauts in 1962. He was inducted into the National Aviation Hall of Fame and the International Air & Space Hall of Fame.



Deke Slayton developed brain cancer in 1992 and died in his home in League City, Texas, near JSC, on June 13, 1993.

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