PIONEERS IN EARLY SPACEFLIGHT

# FRIENDSHIP 7

## The Epic Orbital Flight of John H. Glenn, Jr.


COLIN BURGESS

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# Friendship 7

The Epic Orbital Flight of John H. Glenn, Jr.

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Front cover: John Glenn is inserted into *Friendship 7* ahead of his MA-6 mission. (Photo: NASA)
Back cover: John Glenn suited up in 1962 prior to his Mercury flight (left) and thirty-six years later, for his flight aboard Space Shuttle *Discovery*. (Photos: NASA)
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*The legacy of heroes is the memory of a great name and the inheritance of a great example.*

– Benjamin Disraeli, British politician
and author (1804–1881)

*A lot of people ask why a man is willing to risk hat, tail and gas mask on something like this space flight. I've got a theory about this. People are afraid of the future, or the unknown. If a man faces up to it and takes the dare of the future he can have some control over his destiny. That's an exciting idea to me, better than waiting with everybody else to see what's going to happen.*

– Lt. Col. John H. Glenn, Jr.,
U.S. Marine Corps, NASA astronaut

# Foreword

As the first American to orbit the Earth, John Glenn's accomplishments during his 20 February 1962 flight aboard *Friendship 7* are well documented and beautifully summarized in the pages that follow. The national prestige and sense of technological achievement were tremendous outcomes from his three-orbit flight. It got America firmly back in the Space Race with the Soviet Union.

One of the lesser known impacts of his flight was the effect it had in recruiting another generation of space explorers that would go on and follow in his footsteps. If you asked a hundred shuttle-era astronauts who or what event most influenced them to become an astronaut, you would find John Glenn and his *Friendship 7* flight at or near the top of the list. He is that iconic within the history of human space flight.

John Glenn with the All-Ohio crew of shuttle mission STS-70. From left: Don Thomas, Terry Henricks, Glenn, Mary Ellen Weber, Nancy Currie, and Kevin Kregel. (Photo courtesy of Don Thomas)

For me personally, watching Alan Shepard's launch on 5 May 1961 on a small black-and-white TV screen in my elementary school gymnasium first planted the seed of exploration in my head. Then the next year we all returned and watched America's newest hero, John Glenn, as he blasted off into space aboard a much larger and more capable Atlas rocket. He carried the dreams of many young students along with him that day, and I was right there with him.

After the launch we all marched single-file back to our classrooms. Fortunately my desk was in the back of the room along the windows which overlooked the school playground. Sitting in my seat I spent the rest of the morning not paying attention to my


Shuttle astronaut Don Thomas, Ph.D. (Photo: NASA)

first-grade teacher, but staring out the window. My eyes strained as I searched the sky hoping to see Glenn's *Friendship 7* capsule passing overhead. Little did I know at the time that his capsule was too small to ever be seen or that his orbital ground track was nowhere near Cleveland or the rest of my home state of Ohio, but that mattered little to me that day. My imagination ran wild with the thought that an American, and someone from my home state, was now orbiting the Earth. The evening paper ran the bold headline "Glenn Orbits the Earth and Safely Returns." In the following weeks *Life* magazine ran incredible stories and pictures from his flight. Everything I saw and read was awe inspiring.

One thing that particularly struck me was Glenn's descriptions of watching sunrises and sunsets and other views of the Earth. They were vivid which made me feel that I was right there with him inside *Friendship 7* looking out the window myself. But as good as the descriptions were, I craved more detail. I wanted to see the Earth and her glorious sunrises and sunsets with my own eyes. I knew I had to follow in Glenn's footsteps. While only six years old at the time, I was even more excited about becoming an astronaut myself and flying in space one day. And it is fair to say Glenn's *Friendship 7* mission had a similar impact on thousands – if not millions – of young students across the United States and around the world.

Thirty-two years later, I finally had the opportunity to reach space myself aboard Space Shuttle *Columbia* on the STS-65 mission, my first of four flights. Minutes after achieving orbit I floated to the window and got my first glimpse of the Earth, 175 miles below. I gasped and exclaimed, "Wow! How beautiful!" Even though I had read many descriptions of the view and had seen countless photos and movies of the Earth taken from space, I, like Glenn and most astronauts that followed, was unprepared for the beauty of it all. I was totally honored to have the opportunity to see the Earth as Glenn had first seen it decades earlier. The view was every bit as "tremendous" as Glenn had said.

Glenn's *Friendship 7* flight, along with follow-on missions involving Ohio astronauts Jim Lovell, Neil Armstrong, and others, was a tremendous influence for me and an entire generation of future space explorers. And in the pages that follow you will be able to experience some of the pride, drama, excitement, and thrills we all felt as we followed John Glenn's mission and began our dreams of flying in space ourselves one day.

Donald A. Thomas, Ph.D.
NASA Mission Specialist STS-65, STS-70, STS-83, and STS-94
Author of *Orbit of Discovery: The All-Ohio Space Shuttle Mission*

# Acknowledgements

As I research each new book I always keep a running sheet listing the names of those who have assisted me in its compilation in order that I can thank them in the acknowledgements section. I am indebted to them for their kindness and willingness to help.

There are always the stalwarts; those who have helped me over many years with practical advice and suggestions, who supply me with information and photographs, and who read through my drafts in search of any obvious factual or grammatical errors. My continuing thanks therefore go to Joachim Becker (spacefacts.com), Kate Doolan, Francis French, Al Hallonquist, Ed Hengeveld, Robert Pearlman (collectSPACE.com), J.L. Pickering (Retro Space Images.com), and Eddie Pugh.

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Special thanks go to the NASA astronaut and accomplished author Don Thomas, a veteran of four space shuttle missions. Born and raised in the "Buckeye State," he was truly privileged to have his fellow Ohioan John Glenn pen a foreword to his sublime 2013 book, *Orbit of Discovery: The All-Ohio Space Shuttle Mission*, and he was delighted to repay the compliment by writing the foreword to this book.

I have now been associated with the good folks at Springer-Praxis for a number of years, and they are great (and fun) people to deal with. I therefore thank most sincerely Clive Horwood of Praxis Publishing in the United Kingdom; my superb copyeditor, fellow author, and good mate David M. Harland; and Jim Wilkie, who produced the glorious cover art for this and all my Springer books. At Springer Books, New York, my effusive and ongoing thanks to the hard-working Maury Solomon, Senior Editor, Physics and Astronomy, and her incredibly helpful Assistant Editor Nora Rawn, who has worked miracles for me in so many ways.

This book was written at a troublesome time for me, when I was (and still am) overcoming a serious double-knee injury as the result of a domestic accident which meant that I was not easily mobile for some time. So I must express my deep love and appreciation to Pat, my wonderful wife of 46 years, for not only helping me physically and supportively on the difficult path to recovery but for abiding me spending excessive amounts of time at my office keyboard when I would normally have been taking care of other, more pressing chores around the house.

I thank you, profoundly, one and all.

# Author's prologue

It was Sunday, 15 July 1962; a date I remember well, and for all the right reasons. Back then, I was a 15-year-old Australian space enthusiast and NASA's Project Mercury was in full and glorious swing. I was following the space program with all the youthful zeal and devotion I could muster, and that momentous day in Sydney would dawn with a promise that, to me, was tantamount to a dream come true.

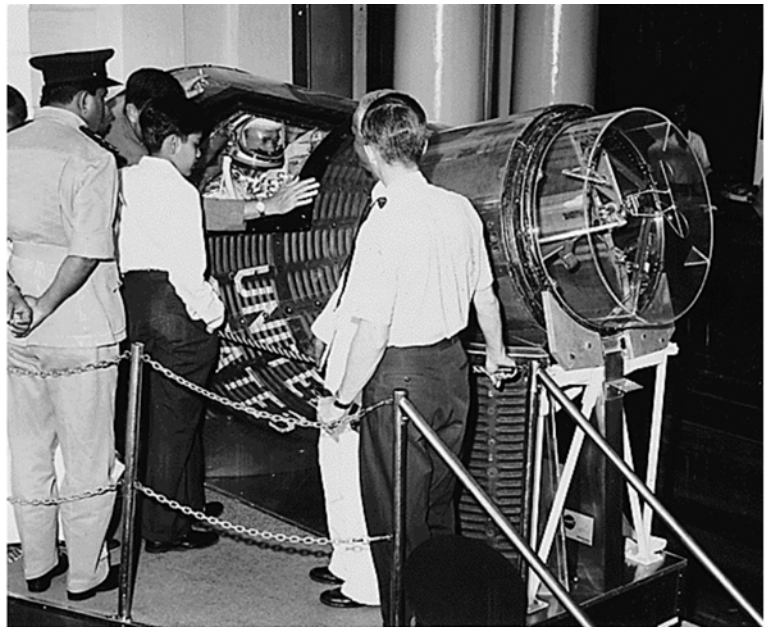
While it might have been a time of personal euphoria, in July 1962 global tension was rife. It was the height of the Cold War, the divisive Berlin Wall had recently been constructed, and it seemed that the Russians were well ahead in the Space Race. The world was just three months away from what would be the catastrophic prospect of global nuclear war resulting from the Cuban missile crisis. It was a time when the United States was in dire need of some good news and a patriotic boost, and Marine war hero John Glenn gave his nation both, as a timely and popular icon of renewed American pride.

Accompanied by two interested friends I had made my way to Queen's Square at the end of Sydney's Hyde Park, where later that day John Glenn's spacecraft *Friendship 7* would be on display over four days as part of a triumphant global tour of the historic vehicle. That morning a Military Air Transport Systems B-29 Globemaster touched down at Sydney's Kingsford Smith airport, having transported the capsule from an earlier public display in Perth – the city that turned on all its lights for a grateful orbiting Glenn as he soared over the Western Australian coastline by night just five months earlier.

Around lunchtime and amid much excitement, the history-making spacecraft arrived at Hyde Park, mounted on a special trailer, and was rapidly installed under a marquee with a short staircase leading up to and then down from the Plexiglas window, through which one could view the interior of the capsule. Inside, the astronaut's couch was occupied by a space-suited mannequin representing the astronaut. By 3:00 p.m. a line 450 yards long stretched across Hyde Park, but eventually it was our turn to mount the four steps. We were only permitted a few seconds each before being moved along by the uniformed attendants, but gazing inside that incredible piece of famed machinery provided me with one of the most memorable experiences of my life; certainly one of the best since I had first discovered a fascination with human space flight activity less than a year before. To me, John Glenn was the ultimate hero, a dynamic icon of our age, and a true inspiration.


The B-29 that brought the spacecraft to Australia was emblazoned with the words, "Around the world with *Friendship 7*" and the craft's so-called fourth orbit of the globe was depicted on a map of the four continents that the spacecraft would ultimately visit. (Photo: NASA)


Curious airport workers gather around as *Friendship 7* is unloaded from the U.S. Air Force cargo plane, ready for transportation into the city of Sydney. (Photo: Sydney Morning Herald)



After leaving Australia, *Friendship 7* went on display in Manila, Philippines, on 20 July 1962. The mannequin can clearly be seen inside the capsule. (Photo: NASA)

Space Shuttle *Discovery* roars into the Florida sky on 29 October 1998 carrying a crew of seven which included John Glenn, making his second flight into space. (Photo: NASA)

Following Glenn's Mercury flight, the *Friendship 7* spacecraft became nearly as famous as its pilot, traveling on its own celebratory global tour. In 17 countries around the world, including Australia, millions of people stood patiently in line to catch a glimpse of it. When the tour was over, the capsule took an honored permanent place at the Smithsonian Institution in Washington D.C., right alongside the Wright brothers' original history-making airplane and Charles Lindbergh's *Spirit of St. Louis*.

On 29 October 1998, some 36 years after viewing *Friendship 7* in Sydney, I was seated in the VIP stand at the Kennedy Space Center to witness the second launch of John Glenn, this time aboard Space Shuttle *Discovery* on mission STS-95. It was an event I was determined not to miss, and I had flown all the way from Sydney the previous day through the

kindness of a launch invitation sent to me by shuttle crew member Scott Parazynski, M.D, whom I had earlier met at a space school in Sydney. On that day my spirits soared along with *Discovery* as it lifted off the pad and blazed a brilliant trail of fire and smoke into the clear blue skies over Florida. I stood there in awe, exhilarated in the knowledge that my boyhood hero had once again ascended into the final frontier of space – and this time I was there to see it happen.

The story of John Glenn and his two flights into space has been told in meticulous detail in a veritable mountain of books, magazines, newspapers, and other publications, but his story and legacy still excite and inspire me, and many others. Today he is the last surviving member of the legendary seven Mercury astronauts, and it is a privilege for me to relate the story of his much-delayed and heart-stopping 1962 flight aboard the cramped spacecraft *Friendship 7*, in the sincere hope that it might serve to inspire a whole new generation of space enthusiasts.

Colin Burgess
Bangor, NSW, Australia

# 1

# Developing the Mercury-Atlas program

The year was 1961. The National Aeronautics and Space Administration (NASA) had only been in existence for three years, but already two spectacularly successful space missions completed by Soviet cosmonauts were having a dramatic effect on the civilian space agency's carefully planned, step-by-step human space flight program.

## A PROBLEM OF COMPLACENCY

The single-orbit flight of cosmonaut Yuri Gagarin in April 1961 hit America hard.

Unexpectedly divested of the historic prestige of placing the first person into space, NASA was accused of being too complacent. Every indication suggested that the Soviet Union was building up to this achievement, albeit with a program progressing under a strict shroud of secrecy.

This was in direct opposition to the open way in which NASA operated, with their events timetable openly announced. The Russians knew approximately when the first ballistic Mercury flight would take place, and even the names of the three prime astronaut candidates. With this and other technical knowledge available to their space chiefs, they were able to work to their own covert timetable and prepare to launch one of their cosmonaut team into orbit. They knew that the United States would only conduct a suborbital mission using a converted Redstone intermediate-range ballistic missile (IRBM), which was far less powerful than their own R-7 booster.

As a former administrator of NASA, James Edwin Webb later admitted in hindsight, the Russians had made several data-gathering, unmanned flights in early 1961. "We made a number of important, less spectacular, but very important flights. So both countries were coming down the line in flight programs that involved meteorological and other satellites.

"We were flying monkeys and they had earlier flown dogs. Soon thereafter they were flying men. But by and large there were a number of quite important flights that showed increased horizons as to what could be done. Now, it was perfectly clear that they had been flying a booster that could lift 10,000 pounds into orbit, and the biggest thing we could put up was a Mercury, which is about 3,000 pounds. It was perfectly clear that we were behind them, and that they had been working at least four or five years before we got started on these bigger boosters."[1]



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President Kennedy shakes hands with NASA Administrator James E. Webb during a meeting in the Oval Office, 30 January 1961. (Photograph by Abbie Rowe in the John F. Kennedy Presidential Library and Museum, Boston)

## BOOSTING "OLD RELIABLE"

In January 1959, just three months after NASA was established, the newly formed civilian space agency settled upon one of the most reliable large rockets ever produced in the United States, the Redstone, as the prime launch vehicle for its ambitious plans to place the first American astronauts – yet to be selected – into space. NASA also chose the McDonnell Aircraft Company to design and build the Mercury spacecraft.

A modified and enhanced version of Nazi Germany's deadly A-4/V-2 missile, the U.S. Army's Redstone was widely known as "Old Reliable" due to its renowned dependability and an impressive record of successfully completed launch and flight operations. Ahead of being selected by NASA, the Redstone had undergone several years of development and testing as a medium-range, tactical surface-to-surface missile for the Army Ballistic Missile Agency (ABMA) at what was called the Redstone Arsenal in Huntsville, Alabama. This reliability was a clear factor in its selection by the space agency.

With the cooperation of the Army, NASA issued a request to the ABMA for eight Redstone missiles to be launched in the first phase of what was now called Project Mercury, to one day send a number of astronauts on proving ballistic or suborbital space missions.

However, with a thrust of just 78,000 pounds, it was also recognized that the Redstone was incapable of inserting a manned spacecraft into Earth orbit. NASA was already looking beyond the ballistic program, and specifically at the Atlas series of rockets for their future manned orbital plans.

As history records, Navy Comdr. Alan Shepard was launched atop a Redstone rocket in his Mercury spacecraft *Freedom 7* on 5 May 1961. Although he became the first American to fly into space, he was beaten to the honor of the world's first spacefarer by cosmonaut Yuri Gagarin, blasted into a single Earth orbit in his Vostok spacecraft just three weeks earlier. Still, NASA was persisting in its plans for an incremental space flight program, with future manned Redstone launches in its provisional manifest.


Alan Shepard is launched on America's first manned space flight, 5 May 1961. (Photo: NASA)

Soviet cosmonauts Yuri Gagarin and Gherman Titov. (Photo: Author's collection)

With the fervor of an international space race rapidly gaining momentum, the United States and particularly President John F. Kennedy could no longer ignore events in the new frontier of space. On 21 May 1961, the President took up the political and patriotic challenge in a special message before Congress on "urgent national needs," in which he asked for an additional $7 billion to $9 billion over the next five years to upgrade the American space program.

"If we are to win the battle that is now going on around the world between freedom and tyranny," he declared, "the dramatic achievements in space which occurred in recent weeks should have made clear to us all, as did the *Sputnik* in 1957, the impact of this adventure on the minds of men everywhere, who are attempting to make a determination of which road they should take …. First, I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth. No single space project in this period will be more impressive to mankind, or more important for the long-range exploration of space; and none will be so difficult or expensive to accomplish." With that, he had daringly thrown down the gauntlet to the Soviet Union.

But there were more shocks to follow. On 6 August 1961, following a successful Mercury suborbital space flight by U.S. Air Force Capt. Virgil ("Gus") Grissom – a flight in many ways similar to that of Shepard – NASA was once again left red-faced and self-questioning when the Soviet Union announced that cosmonaut Gherman Titov had been launched on an orbital space mission. His flight would last in excess of a day, and carry him through a total of 17 orbits of the planet. It was a massive propaganda coup for the Russians and their space efforts, and devastating news for NASA.

From left: John Glenn, Alan Shepard and Gus Grissom prior to Shepard's *Freedom 7* space flight. (Photo: NASA)

Under mounting pressure to speed things up, the space agency would re-evaluate its previous, carefully structured timetable. All of a sudden, "suborbital" became almost a dirty word in the NASA lexicon. The nation and its leaders were demanding that orbital missions begin immediately in an attempt to catch up to – and eventually surpass – the impudent but impressive efforts of the feared Russians and their largely unknown space technology.

## UNVEILING ATLAS

In only its second week as a space agency, NASA had begun discussing possible applications of the Atlas rocket to the Mercury program. It was clearly recognized that the Atlas had not been designed as a human-carrying vehicle, but had been specifically developed for the U.S. Air Force as a military weapon capable of carrying nuclear warheads, and hence the launch vehicle would require substantial modifications.

Developing the Atlas rocket program had been a protracted, but top-priority task. It began in the late 1940s, when the Air Force appointed a company known as Consolidated Vultee Aircraft Corporation (more commonly called Convair) to produce a proposed long-range missile, the hardware part of Project MX-774. In this, the Air Force planned to create a rocket that would fulfill a demanding role as America's first intercontinental ballistic missile (ICBM).

Project MX-774 was shelved in 1947, although several vehicles were test-fired over the following two years by Convair, who had continued to research the test project with

residual funds. In January 1951 the Air Force turned once again to Convair, awarding the company a substantial contract to produce a rocket-powered ballistic missile for Project MX-1593.

The single-stage test-bed prototype produced by Convair (which became the Convair division of General Dynamics in 1954) was initially known as the XSM-16A, but later redesignated the X-11 (Atlas). The contract called for the manufacture of twelve missiles; three of which would be used purely for captive or static test firings.

The liquid-fuelled Atlas was manufactured at Convair's Kearny Mesa plant in San Diego. Powered by rocket-grade RP-1 (highly refined kerosene) with a liquid oxygen oxidizer, it proved to be a vehicle of amazing contradictions. Weighing around 267,000 pounds when fully fuelled, the key feature of the missile's design was its extremely lightweight structure, conceived and designed for the most part by the imaginative Belgium-born Convair engineer, Karel J. ("Charlie") Bossart. The stainless steel skin of the Atlas was actually thinner in parts than a modern compact disc; so thin in fact that without the use of pneumatics to keep it erect, an unfueled Atlas would have rapidly collapsed under its own weight. The rocket would retain its shape when the highly pressurized tanks were filled with rocket fuel, but when empty, the tanks maintained their shape through pressurization from helium or nitrogen gas pressure; there was no stiffening by internal framework. The tanks had to be filled with gas at a positive internal pressure of 5 psi in order to maintain both rigidity and integrity.

Atlas rockets under construction at the Convair/General Dynamics Kearny Mesa plant. (Photo: San Diego Air & Space Museum)

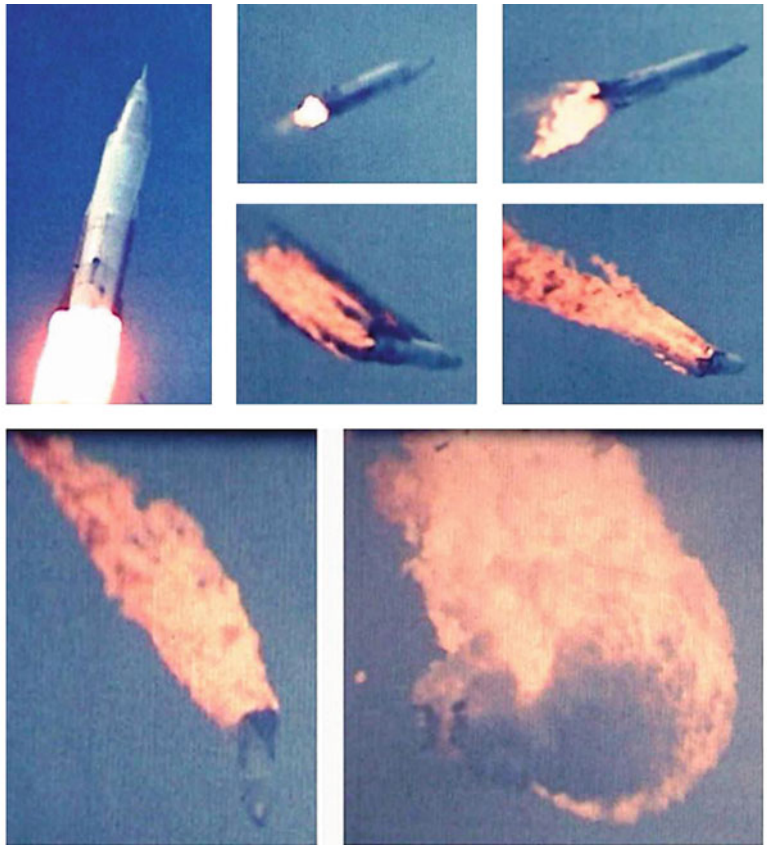
Cutting the thin metal skin for an Atlas rocket. (Photo: San Diego Air & Space Museum)

German-born rocket designer Wernher von Braun, then at the Redstone Arsenal in Huntsville, Alabama, actually felt that the Atlas rocket would not survive the stresses of launch, derisively calling it no more than a blimp, but fortunately he would be proven wrong.

The formal production of the Atlas commenced in January 1955, with captive test firings carried out at Edwards Air Force Base, California, the following year. A twelve-month flight test of eight single-engine prototypes then took place at Cape Canaveral, beginning in June 1957. The first Atlas-A launch on 11 June (Atlas 4A) ended in spectacular failure, owing to a problem in the booster system. The errant missile was remotely destroyed by the range safety officer, who would later press the red button to detonate explosives aboard a second wayward Atlas-A launched in September.

A successful launch and ballistic trajectory finally took place on 17 December, coinciding with the fifty-fourth anniversary of the Wright brothers' first successful flight. The following year, during a mixed launch program of successes and failures, an entire Atlas – now produced with three engines – reached orbit carrying the United States' first communications satellite, SCORE (Signal Communications by Orbiting Relay Equipment). On 19 December 1958 communications history was created when the satellite beamed down to Earth a pre-recorded 30-second Christmas message from President Dwight Eisenhower.

Atlas 6A on Launch Complex LC-14 prior to the 25 September 1957 launch. (Photo: NASA)



When Atlas 6A became erratic after lift-off it had to be destroyed by the range safety officer. (Photos: NASA)