

# 4



## The first Mission Specialists

*“Step past our places of comfort,  
to walk over to the edge of our abilities  
and then move beyond that edge.  
The unknown is mysterious.  
The unknown is frightening.  
But you can only become a winner  
if you are willing to walk over to the edge  
and dangle over it just a little bit.”*

Ronald E. McNair, STS-41B post-flight lecture at MIT, 1984.  
From *Ronald McNair, Astronaut*, by Corinne Naden

Between August 2 and November 21, 1977, the astronaut applicants were subjected to tests, interviews, evaluations and careful scrutiny at the Johnson Space Center (JSC) in order to assess their eligibility as astronaut candidates. Of the 128 applying for the newly-created role of Mission Specialist (MS), 21 were women. In all, 208 applicants came to Houston, in ten groups, for their week of medical and psychological testing, as well as facing a selection panel armed with probing, analytical questions both personal and technical.

On January 16, 1978, NASA announced the selection of 20 MS, which included six pioneering women. The 20 successful candidates assigned for training as NASA Group 8 MS were:

### **GUION S. BLUFORD, JR.**

When selected as a member of NASA’s Group 8 astronauts, Guion (“Guy”) Bluford was a veteran of 144 combat missions during the Vietnam War. In his youth, he had spent many happy hours building aircraft, with a determination that

his future was in aircraft design or even mechanical engineering, like his father. “It wasn’t until I got in the Air Force ROTC [Reserve Officer Training Corps] program at Penn State that I started to develop a strong interest in flying,” he once told *Time* magazine. “My thinking was that if I were a pilot, I would be a better engineer.” [1]

Guion Stewart Bluford Jr., PhD, was born in Philadelphia, Pennsylvania, on November 22, 1942. He graduated from Overbrook Senior High School in 1960, and in 1964 he received a Bachelor of Science (BSc) degree in Aerospace Engineering from Pennsylvania State University, also graduating as a distinguished Air Force Reserve Officer Training Corps (AFROTC) graduate. He then attended pilot training at Williams Air Force Base (AFB), Arizona, and received his pilot wings in January 1966. He went on to F4C combat crew training in Arizona and Florida, and was assigned to the 557th Tactical Fighter Squadron, based in Cam Ranh Bay, Vietnam. Of his 144 combat missions, 65 were over North Vietnam. In July 1967, he was assigned to the 3630th Flying Training Wing, Sheppard AFB, Texas, as a T-38A instructor pilot. He served as a standardization/evaluation officer and as an assistant flight commander. In early 1971, he attended Squadron Officers School and returned as an executive support officer to the Deputy Commander of Operations and as School Secretary for the Wing.

In August 1972, Bluford entered the Air Force Institute of Technology (AFIT) residency school at Wright-Patterson AFB, Ohio. On graduating in 1974, he was awarded his Master of Science (MSc) degree with distinction in Aerospace Engineering, and was assigned to the Air Force Flight Dynamics Laboratory at Wright-Patterson AFB, Ohio, as a staff development engineer. He served as Deputy for Advanced Concepts for the Aeromechanics Division and as Branch Chief of the Aerodynamics and Airframe Branch in the Laboratory. In 1978, again through AFIT, he would also receive his doctorate (PhD) in Aerospace Engineering with a Minor in Laser Physics. While completing his PhD, he responded to NASA’s call for astronauts, believing that – if selected – it would give him the chance to combine his interests in flying and engineering.

## **JAMES F. BUCHLI**

As it turned out, James Buchli was the sole representative of the U.S. Marine Corps (USMC) selected for NASA’s Group 8 astronaut cadre. Previously, only five Marines had become NASA astronauts – John Glenn, C.C. Williams, Jack Lousma, Jerry Carr and Bob Overmyer.

Captain (Capt.) James Frederick Buchli, USMC, was born on June 20, 1945, in New Rockford, North Dakota. He also considers Fargo, North Dakota, as his hometown. Buchli graduated from Fargo Central High School in 1963, and received a BSc in Aeronautical Engineering from the U.S. Naval Academy in



Fig. 4.1: The first 20 Mission Specialist candidates

1967, during which time he also completed a stint aboard a submarine<sup>1</sup>. Buchli received a commission in the USMC following his graduation from the Naval Academy in 1967. He subsequently graduated from the USMC Basic Infantry Course, after which he was sent to the Republic of Vietnam for a one-year tour of duty. Once there, he served as Platoon Commander, 9th Marine Regiment, and then as Company Commander and Executive Officer, “B” Company, 3rd Company, 3rd Reconnaissance Battalion. He returned to the United States in 1969 for naval flight officer training at Pensacola, Florida, and spent the next two years assigned to Marine Fighter/Attack Squadron 122 (VMFA-122), at Kaneohe Bay, Hawaii, and Iwakuni, Japan. In 1973, he was assigned to VMFA-115 at Namphong, Thailand, and Iwakuni. After completing this tour of duty, he returned to the United States and participated in the Marine Advanced Degree Program at the University of West Florida, where he received his MSc in Aeronautical Engineering Systems in 1975. He was then assigned to VMFA-312 at the Marine Corps Air Station, Beaufort, South Carolina, and, in 1977, to the U.S. Test Pilot School at Patuxent River, Maryland.

At the time of his selection, he had logged over 4,200 hours flying time, 4,000 of them in jet aircraft.

### **JOHN M. FABIAN**

A highly experienced aeronautical engineer, John Fabian had always thought about becoming an astronaut, but knew that his height would preclude him from achieving his ambition. Then, in NASA’s call for astronauts in June 1977, he noticed that the height limit had been raised from 5 feet 11 inches (1.80 meters) to 6 feet 4 inches (1.93 meters). He subsequently requested an application form for the category of MS, filled it out and sent it off to NASA.

John McCreary Fabian, PhD, was born on January 28, 1939, in Goosecreek, Texas, but considers Pullman, Washington, to be his hometown. He graduated from Pullman High School in 1957, and received a BSc in Mechanical Engineering from Washington State University in 1962. While studying at the university, he became an AFROTC student, and was commissioned upon graduation. He would then receive an MSc in Aerospace Engineering from the AFIT at Wright-Patterson AFB, Ohio, in 1964. Following further duties at AFIT, he was assigned as an aeronautics engineer in the Service Engineering Division, San Antonio Air

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<sup>1</sup>When he flew STS-51C in 1985, Buchli became, by definition, the first submariner in space due his short-term service on a submarine while at the U.S. Naval Academy. However, Michael J. McCulley (NASA Class of 1984, Group 10) is recognized everywhere as the first *qualified* submariner in space when he flew on STS-34 in 1989, with Stephen Bowen (NASA Class of 2000, Group 18) becoming the second by flying STS-126 in 2008.

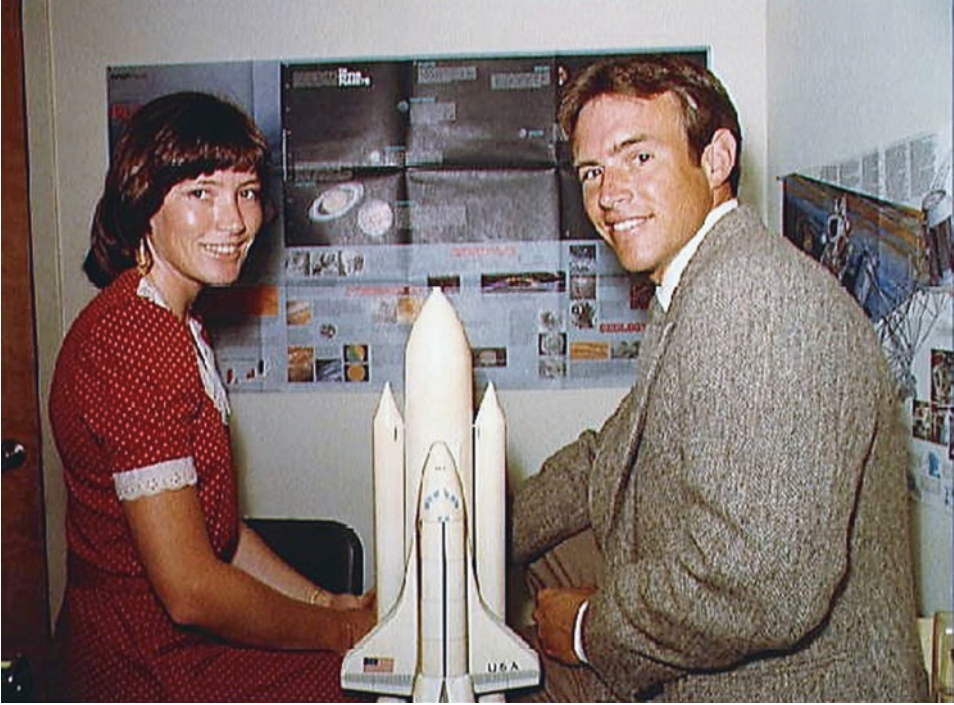
Materiel Area, at Kelly AFB, Texas. He then attended flight training at Williams AFB, Chandler, Arizona, and subsequently spent five years as a KC-135 pilot at Wurtsmith AFB, Michigan. Fabian lost his original pilot training slot in July 1965 to newly-selected Scientist-Astronaut Owen Garriott and had to wait six months to join the next class. He saw action in Southeast Asia, flying 90 combat missions before returning home. Fabian was airborne above Laos in Southeast Asia, listening to *Voice of America* over the onboard long-range radio they had on the aircraft, when Apollo 11 launched from the Cape on July 16, 1969, and again four days later as Armstrong and Aldrin landed *Eagle* on the surface of the Moon. “That was an interesting place to be,” he recalled in 2006, “over Laos and listening to something which is as world shaking as the first lunar landing.” [2] Following additional graduate work at the University of Washington, he earned a PhD in Aeronautics and Astronautics in 1974. Prior to his selection by NASA, he served on the faculty of the Aeronautics Department at the United States Air Force (USAF) Academy in Colorado. As a pilot, he had logged 4,000 hours flying time, including 3,400 hours in jet aircraft.

## ANNA L. FISHER

When she mailed her application to NASA in 1977, Dr. Anna Tingle was working as an emergency room physician at Harbor General Hospital in Torrance, California. In her youth, she had decided there would be a need for physicians on future space stations, and this was too good an opportunity to miss. On her only Shuttle mission in 1984, Anna Fisher made the headlines as the first mother to fly into space.

Anna Lee Fisher, MD, was born in New York City on August 24, 1949. Dr. Fisher considers San Pedro, California, to be her hometown. On May 5, 1961, she was in seventh grade listening to a small transistor radio her teacher had brought into the class to hear the flight of Alan Shepard, America’s first man in space. “Wow, I would love to go and do something like that,” she remembered thinking at the time, as she recalled in her 2009 Oral History, “but of course all the astronauts at the time were male. They were all test pilots.” That did not interest her, but she did think that someday there would be a space station and, always gravitating towards math and science, she looked towards a career in science or medicine. [3] After graduating from San Pedro High School in 1967, she attended the University of California Los Angeles (UCLA), and received her BSc in Chemistry in 1971. After graduating from UCLA, Fisher spent a year in graduate school working in the field of X-ray crystallographic studies of metallocarboranes. She co-authored three publications relating to these studies for the *Journal of Inorganic Chemistry*. She began medical school at UCLA in 1972 and achieved her Medical Doctorate (MD) in 1976. Following her graduation that year, she began a one-year

internship at Harbor General Hospital in Torrance, California. After completing her internship in 1977, she specialized in emergency medicine and worked at several hospitals in the Los Angeles area.



**Fig. 4.2:** Anna and Bill Fisher, the first married couple to be chosen to train as astronauts. Bill Fisher was chosen in the Class of 1980 (Group 9).

## **DALE A. GARDNER**

In 1984, Dale Gardner made space flight history when he participated in the world's first space salvage operation during his second Shuttle mission. He also became the last of six astronauts to use the Manned Maneuvering Unit (MMU) jetpack, as he and spacewalking companion Joe Allen worked to retrieve two malfunctioning satellites for their return to Earth. In a humorous moment, Gardner acknowledged the successful retrieval of the satellites by holding up a large "For Sale" sign, for what has become one of the iconic images of the Shuttle program.

Dale Allan Gardner was born on November 8, 1948, in Fairmont, Minnesota, and grew up in Sherburn, Minnesota and Savanna, Illinois, although he considered his hometown to be Clinton, Iowa. He graduated as Valedictorian of his class from Savanna Community High School, Illinois, in 1966, and received his BSc in

Engineering Physics from the University of Illinois (Urbana-Champaign) in 1970. After graduating, he entered into active service with the U.S. Navy and was assigned to the Aviation Officer Candidate School at Pensacola, Florida. He was commissioned an ensign and selected as the most promising naval officer from his class. In October 1970, he began Basic Naval Flight Officer training with the VT-10 squadron at Pensacola, graduating with the highest academic average ever achieved in the history of the squadron. He proceeded to the Naval Technical Training Center at Glynco, Georgia, for Advanced Flight Officer training and was selected as a Distinguished Naval Graduate and awarded his Naval Flight Officer wings on May 5, 1971. He then attended the Naval Air Test Center at Patuxent River, Maryland, from May 1971 to July 1973, where he was assigned to the Weapons Systems Test Division and involved in initial F-14 *Tomcat* developmental test and evaluation as Project Officer for Inertial Navigation and Avionics Systems.

Gardner's next assignment was with the first operational F-14 squadron (VF-1) at Naval Air Station (NAS) Miramar, San Diego, California, where he participated in two Western Pacific and Indian Ocean cruises while deployed aboard the aircraft carrier USS *Enterprise* (CVN-65). From December 1976 until July 1978, he was assigned to Air Test and Evaluation Squadron 4 (VX-4) at NAS Point Mugu, California, involved in the operational test and evaluation of Navy fighter aircraft.

## TERRY J. HART

The first time Terry Hart experienced the mysteries of space was the night when Sputnik, the first Soviet satellite, flew over his childhood home in Pittsburgh, Pennsylvania, in October 1957. He recalls stepping outside to catch a glimpse of the beach ball-sized satellite traversing the evening sky and was immediately captivated. But not everyone was quite as enthralled. "My neighborhood was panicked," he reflected. Americans were fearful that similar Soviet satellites could be armed with nuclear weapons, ready to rain down on them, but Sputnik fascinated Hart. "The space race was on," he said. [4]

Terry Johnathan Hart was born on October 27, 1946. He graduated from Mt. Lebanon High School, Pittsburgh, Pennsylvania, in 1964 and then graduated with a BSc in Mechanical Engineering from Lehigh University in 1968.

From 1968 to 1978, Hart was employed as a member of the Technical Staff of Bell Telephone Laboratories (now known as AT&T) in Whippany, New Jersey, where he received two patents. During those years, he also earned an MSc in Mechanical Engineering from the Massachusetts Institute of Technology (MIT) in 1969, and entered active duty with the USAF Reserve in June 1969. He completed undergraduate pilot training at Moody AFB, Georgia, in December 1970, and from then until 1973 he flew F-106 interceptors for the Air Defense Command at Tyndall AFB, Florida, at Loring AFB, Maine, and at Dover AFB, Delaware.

In 1973, he joined the New Jersey Air National Guard. During this time, Hart – who by now had logged 3,000 hours flying time, 2,400 of them in jets – saw an advertisement calling for new NASA astronauts in a magazine for the National Guard, and decided to apply.

### **STEVEN A. HAWLEY**

Steven Hawley applied to be an astronaut after seeing a flier on a bulletin board in graduate school at the University of California Santa Cruz. Although he had followed America's space program in his youth – creating his own cardboard box spacecraft – and had given serious thought to becoming a pilot, he decided to choose a career in astronomy and took on an undergraduate degree at the University of Kansas, where he received a BSc in Physics and Astronomy in 1973 with the highest distinction. Four years later, NASA began recruiting scientists to become astronauts at just the right time for Hawley. In his astronaut career, he launched the Hubble Space Telescope (HST) and flew another mission to work on it. He later said that, as an astronomer, it gave him a great thrill to be involved directly with the science that the telescope helped to uncover.

Steven Alan Hawley, PhD, was born on December 12, 1951, in Ottawa, Kansas, but considers Salina, Kansas, to be his hometown. He graduated from Salina (Central) High School in 1969. He then attended the University of Kansas, and received Bachelor of Arts (BA) degrees in Physics and Astronomy (graduating with highest distinction) in 1973. He spent three summers employed as a research assistant: in 1972 at the U.S. Naval Observatory in Washington, D.C.; and in 1973 and 1974 at the National Radio Astronomy Observatory in Green Bank, West Virginia. Hawley attended graduate school at Lick Observatory, University of California Santa Cruz, where he was awarded his PhD in Astronomy and Astrophysics on August 26, 1977. Five months later, he was named as one of America's newest astronauts, and at the tender age of just 26, one of the youngest.

Prior to his selection by NASA in 1978, Hawley was a postdoctoral research associate at Cerro Tololo Inter-American Observatory in La Serena, Chile.

### **JEFFREY A. HOFFMAN**

Jeffrey Alan Hoffman, PhD, was born in Brooklyn, New York, on November 2, 1944, but considers Scarsdale, New York, to be his hometown. Growing up with a love of science fiction, he can recall one clear night watching the first Soviet Sputnik fly over with his dad and a few friends, in the football field of the Scarsdale High School from which he subsequently graduated in 1962. He recalled that the



older brother of his best friend was a ham radio operator, and was able to tune in to Sputnik's 'beep beep' signal.

Hoffman received a BA in Astronomy (graduated *summa cum laude*) from Amherst College in 1966, and in 1971 he was awarded his PhD in Astrophysics from Harvard University. Dr. Hoffman's original research interests were in high-energy astrophysics, specifically cosmic gamma rays and X-ray astronomy. His doctoral work at Harvard was for the design, construction, testing, and flight of a balloon-borne, low-energy, gamma ray telescope.

From 1972 to 1975, during postdoctoral work at Leicester University in England, he worked on several X-ray astronomy rocket payloads. "That was very interesting because I got some insight into the European space program. I have had a long-standing interest in European affairs," he stated in 2009, which culminated in him becoming the NASA European representative for four years towards the end of his astronaut career. [5] From 1975 to 1978, Hoffman worked in the Center for Space Research at MIT, as project scientist in charge of the orbiting HEAO-1 A4 hard X-ray and gamma ray experiment launched in August 1977. His involvement included pre-launch design of the data analysis system, supervising its operation post-launch, and directing the MIT team undertaking the scientific analysis of the flight data being returned. He was also involved extensively in analysis of X-ray data from the SAS-3 satellite being operated by MIT. His principal research was the study of X-ray bursts, about which he authored or co-authored more than 20 papers.

An avid mountaineer and sky diver, he once found himself in dire trouble when his parachute failed to open fully and he began to spin wildly as he hurtled to the ground. Remaining calm despite the circumstances, he cut the half-open parachute from his back, knowing from his altimeter that he only had seconds to spare. Still spinning, he then deployed his reserve chute which, to his immense relief, popped open. He was just 244 meters from the ground.

## SHANNON M. W. LUCID

The oldest of the Group 8 female candidates, Shannon Matilda Wells Lucid, PhD, was born in Shanghai, China, on January 14, 1943, the daughter of Baptist missionaries J. Oscar and Myrtle Wells. She came into the world at the height of World War II, and was just six weeks old when her parents were captured at gunpoint by advance troops of the Japanese army. She was held in Shanghai's Chapei Civil Assembly Center prison camp over the next year and a half. Eventually, late in 1944, the family would be transferred back to the United States aboard the Swedish ship *Gripsholm* as part of a peaceful exchange of noncombatant citizens. Following the Japanese surrender and subsequent withdrawal from China, the

family returned to Shanghai where her parents wanted to continue their missionary work. Unfortunately, they were captured and held once again, this time by the advancing Communist Chinese, and thrust into yet another prison camp. Shannon was just six years old. Eventually, the family was expelled from China and returned home. After living for a time in Lubbock, Texas, they moved back to Bethany, Oklahoma, the family's original hometown.



**Fig. 4.3:** A young Shannon Lucid (left) during her upbringing in China

Shannon Wells graduated from Bethany High School in 1960, and was accepted at Wheaton College in Illinois, where she majored in chemistry before transferring to the University of Oklahoma. She attained her BSc in Chemistry from there in 1963. While studying at university, her passion for airplanes led her to take flying lessons, paid for by babysitting and cleaning college dormitory rooms. Following her graduation, Shannon took on work at the Oklahoma Medical Research Foundation while continuing her flying lessons, eventually accumulating sufficient flying hours to be awarded a commercial pilot's license with instrument and multi-engine ratings. In 1970, she decided to resume her studies and obtain her doctorate in biochemistry. She would be awarded her MSc and PhD in Biochemistry from the University of Oklahoma in 1970 and 1973, respectively, before returning to her work at the Foundation.

Dr. Lucid's experience includes a variety of academic assignments, such as teaching assistant at the University of Oklahoma's Department of Chemistry from 1963 to 1964; senior laboratory technician at the Oklahoma Medical Research Foundation from 1964 to 1966; chemist at Kerr-McGee in Oklahoma City from 1966 to 1968; graduate assistant at the University of Oklahoma Health Science Center's Department of Biochemistry and Molecular Biology from 1969 to 1973, and research associate with the Oklahoma Medical Research Foundation from 1974 until her selection to the astronaut candidate training program.

JSC Director George Abbey later stated that Dr. Lucid's motherhood (of three children) had not been taken into consideration when judging her application to become an astronaut. Interestingly, Dr. Lucid had been so keen to join NASA's astronaut corps that her application was the first to reach JSC.

## RONALD E. McNAIR

A softly-spoken African-American physicist, Ron McNair grew up in rural Lake City, South Carolina, the son of an auto body repairman and an elementary school teacher. It was here that he developed an interest in and a drive for everything, but his early education was very much up to himself. "It was catch-up all the way for me," he said during his astronaut training. "I learned most of my high school science on my own. It was truly a disadvantaged situation. Even though I graduated first in my class, I had lots of catching up to do and I knew it. I was a hungry kid, academically." His specialty was research on lasers and molecular spectroscopy, but he was prepared to set that aside for the chance to fly into space. "I had a game plan at one time," he added, "but this has kind of interrupted it. After this, it will be hard to go back to the lab and turn knobs." [6]

Ronald Erwin McNair, PhD, was born on October 21, 1950, and as a first-grader who was always talking about the Soviet Sputnik satellite, he gained the nickname "Gizmo." [7] He graduated from Lake City's Carver High School in 1967 and subsequently received a BSc in Physics from North Carolina A&T State University in 1971 and a PhD in Physics from MIT in 1976. An accomplished saxophone player and a sixth-degree black belt in taekwondo, he co-authored a study, published in the *Scientific American*, which analyzed the physical aspects of a karate strike and its interaction with a target. One of the images in the paper showed McNair breaking three concrete patio slab blocks (each measuring 40 cm long x 19 cm wide and 4 cm thick) using the heel of his right palm. [8]

While at MIT, Dr. McNair produced some of the earliest developments in chemical HF/DF and high-pressure CO<sub>2</sub> lasers. His later experiments and theoretical analysis on the interaction of intense CO<sub>2</sub> laser radiation with molecular gases provided new understandings and applications for highly excited polyatomic

molecules. Earlier, in 1975, he had studied laser physics with many authorities in the field at École d'Été de Physique Theoretique in Les Houches, France. Following his graduation from MIT in 1976, he became a staff physicist with Hughes Research Laboratories in Malibu, California. His assignments included the development of lasers for isotope separation and photochemistry, utilizing non-linear interactions in low-temperature liquids, and optical pumping techniques. McNair also conducted research on electro-optic laser modulation for satellite-to-satellite space communications, the construction of ultra-fast infrared detectors, ultraviolet atmospheric remote sensing, and the scientific foundations of the martial arts. He published several papers in the areas of lasers and molecular spectroscopy and gave many presentations in the United States and abroad.

In 1978, Dr. McNair was presented with an honorary Doctor of Law degree from North Carolina A&T State University.

### **RICHARD M. MULLANE**

Growing up in New Mexico with a passion for space and rocketry, Richard (“Mike”) Mullane would pour his dreams of satellites and space travel into a number of model rockets that he built as a hobby during his high school days in Albuquerque. After building them, Mullane would take them out into the desert and fire them off. He even won first prize for his rockets in a high school science fair. Although he knew his poor eyesight would preclude him from becoming an astronaut – or so he thought at the time – he had always been keen on joining the USAF, but his eyesight also prevented him from qualifying as a pilot. Instead, he turned his attention to aeronautical engineering, and following his graduation from the U.S. Military Academy, he trained as a weapons systems operator and served in Vietnam, where he completed 150 combat missions. He was subsequently awarded six Air Medals and the Air Force Distinguished Flying Cross, among many other honors.

Richard Michael Mullane was born on September 10, 1945, in Wichita Falls, Texas, but considers Albuquerque, New Mexico, to be his hometown. He graduated from St. Pius X Catholic High School, Albuquerque, in 1963. Setting his sights on a career in the USAF, he achieved a BSc in Military Engineering from the U.S. Military Academy at West Point in 1967. Following graduation, he elected to join the Air Force, was commissioned a second lieutenant and was then assigned to Mather AFB, California. He then completed 150 combat missions as an RF-4C weapon system operator while stationed at Tan Son Nhut Air Base, Vietnam, from January to November 1969. He subsequently served a tour of duty from 1970 to 1973 with the 32nd Tactical Reconnaissance Squadron of the Royal Air Force in Alconbury, England.

On his return home, Mullane was awarded an MSc in Aeronautical Engineering from AFIT in 1975. Then, in July 1976, upon completing the USAF Flight Test Engineering Course (Class 75B) at Edwards AFB, California, he was assigned to the 3246th Test Wing at Eglin AFB, Florida, as a flight test weapon system operator. He was serving there when he applied for a position as an MS with NASA.

## GEORGE D. NELSON

George (“Pinky”) Nelson flew on the crews of Shuttle missions STS-61C and STS-26, the flights which immediately preceded and followed the loss of Shuttle *Challenger* in January 1986. His first space flight was on STS-41C in April 1984, when he and fellow Group 8 astronaut James ‘Ox’ van Hoften walked in space twice to repair a malfunctioning satellite named Solar Max, earlier deployed to make observations of solar phenomena. In doing so, Dr. Nelson became one of only six astronauts (four from the 1978 selection) to fly untethered in space using NASA’s MMU<sup>2</sup>, and the first astronaut to repair a satellite in orbit. On STS-61C, Nelson attempted to capture light-intensified images of Halley’s Comet. Though he saw the comet, the light intensifier failed to work, frustrating the astronomer who hoped for the best as he took regular 30-second exposures.

With his youthful good looks, bright blond hair and blue eyes, Nelson looked more like a champion surfer than a dedicated scientist who once did research in solar physics in a New Mexico observatory. He also came into the astronaut cadre with the nickname “Pinky,” which he said he received shortly after his birth due to his complexion, and it just stuck (his middle name, Driver, was his mother’s maiden name).

George Driver Nelson, PhD, was born in Charles City, Iowa, on July 13, 1950, but considers Willmar, Minnesota, to be his hometown. In his NASA Oral History, Nelson admitted that “I can’t remember the time when I didn’t want to be an astronomer, from the time I was [four at least].” [9] He graduated from Willmar Senior High School in 1968 (after attracting the interest of baseball scouts), and achieved a BSc in Physics (with distinction and departmental honors) from Harvey Mudd College in Claremont, California, on June 4, 1972. He would later attain his MSc in Astronomy from the University of Washington in 1974. The following year, he became a researcher in solar physics at the Sacramento Peak Solar Observatory in Sunspot, New Mexico.

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<sup>2</sup>The six, in order of first MMU flight were: Bruce McCandless, *Bob Stewart*, *Pinky Nelson*, *Ox van Hoften*, Joe Allen and *Dale Gardner* (Group 8 astronauts in *italics*).

In 1976, Dr. Nelson travelled to Europe, where he spent a further year performing astronomical research at the Astronomical Institute in Utrecht, the Netherlands, and the University of Göttingen Observatory in West Germany. On March 17, 1978 he received his PhD in Astronomy from the University of Washington with a dissertation entitled, “Convection in the Surface Layers of the Sun and Stars.”

At the time he was selected by NASA, Dr. Nelson was a postdoctoral research associate at the University of Colorado’s Joint Institute for Laboratory Astrophysics in Boulder, Colorado.

## **ELLISON S. ONIZUKA**

Ellison Onizuka began reaching for the stars early in his life. As a young boy, he used to cut out pictures of airplanes from magazines, telling his grandmother he wanted to be a pilot when he grew up. He once said that he first thought of becoming an astronaut when he was just 13 years old. His grandfather patiently told him not to waste his time, saying he should study something useful, like medicine or dentistry. Back then, flying into space was still the stuff of dreams for any youth, but he loved nothing better than looking up at the stars and planets through a telescope at Honolulu’s Bishop Museum. His fascination with space travel really took root in October 1962, when Mercury astronaut Wally Schirra splashed down near Hawaii after completing his epic six-orbit space flight and spent a few hours in Honolulu before flying back to the mainland.

Ellison Shoji Onizuka was born on June 24, 1946, in Kealahou, Kona, Hawaii. He graduated from Konawaena High School, Kealahou in 1964. An Eagle Scout, he considered his experiences in the Boy Scouts of America program a positive influence in his life: “The leadership, self-confidence and development of personal attributes ingrained [at] youth by the scouting program is tremendous,” he wrote to his former Boy Scout Advisor Norman Sakata in November 1982. [10] He attained his BSc and MSc in Aerospace Engineering in June and December 1969, respectively, from the University of Colorado. He then entered active duty with the USAF in January 1970, after receiving his commission at the University of Colorado through the four-year ROTC program as a distinguished military graduate. As an aerospace flight test engineer with the Sacramento Air Logistics Center at McClellan AFB, California, he participated in flight test programs and systems safety engineering for the F-84, F-100, F-105, F-111, EC-121T, T-33, T-39, T-28, and A-1 aircraft. He attended the USAF Test Pilot School from August 1974 to July 1975, receiving formal academic and flying instruction in performance, stability and control, and systems flight testing of aircraft as a member of Class 74B. Also in his class was future fellow Group 8 astronaut Dick Covey, as well as Capt. Jane L. Holley, the first female pilot to attend the elite pilot school.



**Fig. 4.4:** Ellison and Lorna Onizuka on their wedding day, June 7, 1969 (Image courtesy of the Onizuka family).

In July 1975, Capt. Onizuka was assigned to the Air Force Flight Test Center at Edwards AFB, initially serving on the USAF Test Pilot School staff as Squadron Flight Test Engineer and then later as Chief of the Engineering Support Section in the Training Resources Branch. His duties involved instruction of USAF Test Pilot School curriculum courses and management of all flight test modifications to general support fleet aircraft (A-7, A-37, T-38, F-4, T-33, and the NKC-135 *Stratotanker* military aerial refueling aircraft) used by the Test Pilot School and the Flight Test Center. Prior to his assignment as a NASA astronaut, he had logged more than 1,700 hours flying time.

## JUDITH A. RESNIK

Dr. Judy Resnik, who attained her PhD in Electrical Engineering from the University of Maryland in 1977, was an obvious choice for NASA. She came to the space agency not only as a gourmet cook and classical pianist, but also as an outstanding student. While attending Firestone High School in Akron, Ohio, she

had excelled in solid geometry and calculus in an age when girls rarely studied math, earned a perfect score of 1600 in her SATs, and graduated as Valedictorian of her class. She attended Carnegie-Mellon University in Pittsburgh, initially as a math major but later switching to engineering.

Judith Arlene Resnik, PhD, was born in Akron, Ohio, on April 5, 1949. As a child, she attended Hebrew School at Beth El Synagogue, where she celebrated becoming Bat Mitzvah. She then graduated from Firestone High School in Akron in 1966, and attained her BSc in Electrical Engineering from Carnegie-Mellon University in 1970. Upon graduating from university, she was employed by RCA in Moorestown, New Jersey, and in 1971, transferred to the RCA operation in Springfield, Virginia. Her projects while with RCA as a design engineer included circuit design and the development of custom integrated circuitry for phased-array radar control systems; specification, project management, and performance evaluation of control system equipment; and engineering support for NASA sounding rocket and telemetry systems programs. She authored a paper concerning design procedures for special-purpose integrated circuitry.

From 1974 to 1977, Dr. Resnik was a biomedical engineer and staff fellow in the Laboratory of Neurophysiology at the National Institute of Health in Bethesda, Maryland, where she performed biological research experiments concerning the physiology of visual systems. Also in 1977, she received her PhD in Electrical Engineering from the University of Maryland. Immediately prior to her selection by NASA in 1978, she was a senior systems engineer in product development with the Xerox Corporation at El Segundo, California.

## **SALLY K. RIDE**

At the age of 11, with the encouragement of her mother, Sally Ride took up the sport of tennis. She learned quickly under the instruction of Alice Marble, a four-time U.S. Open women's singles champion, and within a few years she was a regular on the junior tennis circuit, ranked 18th nationally. Her confidence and prowess in the sport won her partial scholarship to Westlake, an exclusive prep school for girls in Beverley Hills, California. While studying there, she found the subject of physics intriguing, and was able to combine the two interests until her graduation in 1968, when she enrolled at Swarthmore College in Pennsylvania as a physics major. After three semesters, however, she dropped out to concentrate on her tennis. Still maintaining an interest in physics, she later signed on for a physics course at the University of California. At one stage, tennis champion Billie Jean King tried to steer her into the professional tennis circuit, but Ride had decided to return to her studies and took on a double major in Physics and English Literature at Stanford University, graduating with two BSc degrees in 1973. From there, she moved into



the field of astrophysics, and tennis took a back seat to her exciting new career. [11] Years later, when a child asked her what made her decide to become a scientist rather than a tennis player, she laughed and said, “A bad forehand.”

Sally Kristen Ride, PhD, was born in Encino, Los Angeles, California, on May 26, 1951. She attended Portola Junior High (now Portola Middle School) and then Birmingham High School before graduating from the private Westlake School for Girls in Los Angeles on a scholarship. She then attended Swarthmore College for three semesters, took physics courses at UCLA, and then entered Stanford University as a junior, graduating with BSc degrees in English and Physics. She would later earn an MSc in Physics in 1975 and a PhD in Astrophysics in 1978, also from Stanford. Her graduate work involved research on the interaction of X-rays with the interstellar medium, with astrophysics and free electron lasers as her specific areas of study.

Dr. Ride was finishing studies at Stanford University and on the lookout for a job when she happened to see an advertisement in the *Stanford Daily* that said NASA was calling for a new group of astronauts, including women. “A light flashed,” she said of that momentous day. “As soon as I saw the ad, I knew that’s what I wanted to do.” She read the list of qualifications, said to herself, “I’m one of those people,” and wrote off for an application form.

## M. RHEA SEDDON

When she was selected by NASA in 1978, Rhea Seddon, who stands at just 5 feet 2 inches (1.57 meters), was the smallest person to become an astronaut. As a result, she struggled to cope with ladders and spacesuits that were designed for more traditionally-sized pilot types. A medical doctor and trained surgeon, Rhea Seddon flew on three Space Shuttle missions, logging more than 722 hours in space and orbiting the Earth 480 times. In her role as an MS, she performed numerous scientific and medical experiments, which included recording the first ultrasound of a human heart in space.

Dr. Seddon’s medical background, she believes, was what helped to raise her profile over many others interviewed by the NASA selection panel. That, and the fact she held a private pilot’s license.

Margaret Rhea Seddon, MD, was born in Murfreesboro, Tennessee, on November 8, 1947, and graduated from Central High School in Murfreesboro in 1965. As a young girl, like so many others in that era, Seddon was interested in the space program and would have liked to have been a part of it, but she also knew that NASA only hired male pilot astronauts, and that women were still excluded. Instead, she decided to go to medical school and pursue surgery, because she knew she would find the work interesting and challenging. Nevertheless, she maintained

the hope that one day things would change at NASA, and felt that a background in surgery would make her an attractive candidate. With this determination in mind, she also undertook flying lessons at a local flight school, at the end of which she received her private pilot's license. During July 1969, Seddon's father took her and some friends water skiing near to their home. After an exhausting day out in the sun and water skiing, they stayed up all night to watch the Apollo 11 moonwalk on TV.

In 1970, Seddon received a BA in Physiology from the University of California, Berkeley, and her Medical Doctorate from the University of Tennessee College of Medicine in Memphis in 1973. After medical school, Dr. Seddon completed a surgical internship and three years of a general surgery residency in Memphis, with a particular interest in nutrition in surgery patients. Between her internship and residency, she served as an Emergency Department physician at a number of hospitals in Mississippi and Tennessee, also serving in this capacity in the Houston area in her spare time. She also performed clinical research into the effects of radiation therapy on nutrition in cancer patients.

## **ROBERT L. STEWART**

When selected by NASA in January 1978, Robert ("Bob") Stewart became the first astronaut who was attached to the U.S. Army. On his first flight into space in February 1984, he became one of the first two American astronauts to make an untethered spacewalk using the MMU.

Robert Lee Stewart was born on August 13, 1942, in Washington, D.C. In his youth he absolutely loved anything to do with aviation, checking out as many books from the local public library as he could. His mother was not happy about finding aviation books everywhere she looked, "...under a pile of dirty clothes on the floor, I stuck them in the refrigerator and everywhere around [the house]," he said in 1984. She eventually gave up harassing him and told him to "Go fly if you want to." [12]

Stewart graduated from Hattiesburg High School, Mississippi in 1960, the same year he received his private pilot's license, and taking part-time civilian flying jobs gave him extra money while studying for his math degree. He attained his BSc in Mathematics from the University of Southern Mississippi in 1964. He then entered active duty with the United States Army in May 1964, completing the Air Defense Officer Basic Course later that year and following that with an assignment as an air defense artillery director at the 32nd NORAD Region Headquarters (Semi-Automatic Ground Environment – SAGE), Gunter AFB, Alabama. In July 1966, after completing rotary wing training at Fort Wolters, Texas, and Fort Rucker, Alabama, he was designated an army aviator. He flew 1,035 combat hours

from August 1966 to 1967, primarily as a fire team leader in the armed helicopter platoon of "A" Company, 101st Aviation Battalion (designated 336th Assault Helicopter Company).

In November 1968, Stewart became an instructor pilot at the U.S. Army Primary Helicopter School (USAPHS), Fort Wolters, Texas, serving one year in the pre-solo/primary-1 phase of instruction and about six months as Commander of Methods of Instruction Flight III, training rated aviators to become instructor pilots. He is a 1969 graduate of the U.S. Army's Air Defense Artillery School Air Defense Officers Advanced Course, and Guided Missile Systems Officers Course. He was subsequently reassigned from the USAPHS in March 1972, the same year that he attained his MSc in Aerospace Engineering from the University of Texas at Arlington.

From March 1972 through April 1974, Stewart served in Seoul, Korea with the 309th Aviation Battalion (Combat) as Battalion Operations Officer and Battalion Executive Officer. He next attended the U.S. Naval Test Pilot School at NAS Patuxent River, Maryland, completing the Rotary Wing Test Pilot Course with Class 65 in June 1974. He was then assigned as an experimental test pilot to the U.S. Army Aviation Engineering Flight Activity at Edwards AFB, California. His duties there included Chief of the Integrated Systems Test Division, as well as participating in engineering flight tests of UH-1 and AH-1 helicopters and U-21 and OV-1 fixed-wing aircraft. He also served as Project Officer and Senior Test Pilot on the Hughes YAH-64 advanced attack helicopter during government competitive testing, and participated with Sikorsky Aircraft Corporation test pilots in developing an electronic automatic flight control system for the new army transport helicopter, the UH-60A *Black Hawk*. He came to NASA with military and civilian experience in 38 types of airplanes and helicopters and had logged approximately 6,000 hours total flight time. In 1980, while still a serving U.S. Army officer on secondment to NASA and after completing Ascan training, Stewart attended the U.S. Army Command & General Staff College. [13]

## **KATHRYN D. SULLIVAN**

Among her many outstanding accomplishments with NASA, MS Kathy Sullivan entered the history books as the first American woman to complete a spacewalk. History also records that she was beaten to the honor of becoming the world's first woman to complete that feat by just under three months, by cosmonaut Svetlana Savitskaya who left the Salyut-7 space station on a 3-hour 35-minute EVA on July 25, 1984. During the STS-41G mission, Dr. Sullivan spent an equivalent amount of time on her spacewalk, together with fellow astronaut Dave Leestma, successfully completing a satellite refueling test outside Shuttle *Challenger* on October 11, 1984.

Kathryn Dwyer Sullivan, PhD, was born on October 3, 1951, in Paterson, New Jersey, but considers Woodland Hills, California to be her hometown. For a short time in elementary school, she and fellow Group 8 candidate Sally Ride were classmates. Sullivan graduated from Taft High School, Woodland Hills, California, in 1969. With a deep interest in maps and oceanography, she went on to become an Earth Sciences major at the University of California Santa Cruz, then spent 12 months from 1971–1972 as an exchange student at the University of Bergen in Norway. Her BSc (with honors) in Earth Sciences was awarded in 1973 from the University of California. Five years later, in May 1978, Sullivan would receive her PhD in Geology from Dalhousie University, in Halifax, Nova Scotia.

Her doctoral studies at Dalhousie University had included her participation in a variety of expeditions, under the auspices of the U.S. Geological Survey, Woods Hole Oceanographic Institute, and the Bedford Institute. This research included the Mid-Atlantic Ridge, the Newfoundland Basin, and fault zones off the coast of southern California. Further adding to her impressive résumé, she taught second-year and first-year labs and tutorials at Dalhousie from 1973 to 1975 and worked for the Geological Survey of Canada as a research student in the summer of 1975. She also became a lieutenant commander in the U.S. Naval Reserve.

In 1977, Dr. Sullivan learned of NASA's call for several new astronauts from her younger brother who was a jet pilot, and decided to fill out an application. Her brother did likewise, but was unsuccessful.

## **NORMAN E. THAGARD**

Norman Earl Thagard, MD, was born in Marianna, Florida, on July 3, 1943, but considers Jacksonville, Florida, to be his hometown. He once told his high school classmates at Paxon Senior High School in Jacksonville that he wanted to be a medical doctor, a fighter pilot, an engineer, and an astronaut. He became all four. Thagard graduated from high school in 1961, after which he attended Florida State University where he received BSc and MSc degrees in Engineering Science in 1965 and 1966, respectively, and subsequently performed pre-med course work.

Thagard joined the USMC Reserve in September 1966, achieved the rank of captain the following year, was designated a naval aviator in 1968, and was subsequently assigned to duty flying F-4s with VMFA-333 at Marine Corps Air Station Beaufort, South Carolina. From January 1969 to 1970, he flew 163 combat missions while serving with VMFA-115 in Vietnam. For his service, he was awarded 11 Air Medals, the Navy Commendation Medal with Combat "V", the Marine Corps "E" Award, the Vietnam Service Medal, and the Vietnamese Cross of Gallantry with Palm.

After returning to the United States, Thagard received an assignment as Aviation Weapons Division Officer with VMFA-251 at Marine Corps Air Station Beaufort, South Carolina. He resumed his academic studies in 1971, pursuing additional

studies in electrical engineering, and a degree in medicine. He went to the University of Texas Southwestern Medical School, earning his Medical Doctorate in 1977. Prior to coming to NASA, he was interning in the Department of Internal Medicine at the Medical University of South Carolina.

As a pilot, Dr. Thagard had logged over 2,200 hours flying time, the majority in jet aircraft.

## JAMES D. A. VAN HOFTEN

On the STS 51-I mission in August 1985, James van Hoften (nicknamed “Ox”) performed the first manual grapple and manual deployment of a satellite in orbit. During their seven-day mission, the crew aboard Shuttle *Discovery* was tasked with salvaging, repairing and redeploying the ailing Navy Syncom IV-3 satellite. This would all be achieved during an EVA by MS van Hoften and Bill Fisher. Attached to the spindly robot arm, or Remote Manipulator System (RMS), van Hoften was able to grasp the satellite and coax it into *Discovery*’s payload bay, where Dr. Fisher carried out the necessary repairs. Then, still perched on the end of the RMS, van Hoften managed to heave the hot-wired, seven-ton satellite back into orbit, concluding a breathtaking service operation in orbit. “There that bad boy goes!” van Hoften reported after re-launching the now fully-functional communications satellite.

James Dougal Adrianus van Hoften, PhD, was born on June 11, 1944, in Fresno, California, but considers Burlingame, California to be his hometown. He graduated from Mills High School in Millbrae, California, and then entered the University of California Berkeley, where he earned his BSc in Civil Engineering in 1966. He then did his graduate work at Colorado State University, and earned his MSc in Hydraulic Engineering in 1968. Several years later, he resumed his graduate studies, completing his PhD in Hydraulic Engineering in 1976. The eight-year gap between his master’s and doctorate degrees was due to his participation in the Vietnam War as a pilot with the USN.

“Ox” van Hoften enlisted in the USN in 1969, and received his initial pilot training in Pensacola, Florida, before completing his jet pilot training in Beeville, Texas, in November 1970. He was then assigned to NAS Miramar, California, where he flew the F-4 *Phantom*. In 1972, he was assigned to the VF-154 Air Group on the aircraft carrier USS *Ranger* (CV-61), and participated in two cruises to Southeast Asia where he flew approximately 60 combat missions during the Vietnam War. He remained on active duty status with the USN until 1974, when he was able to resume his academic studies.

Following the completion of his PhD at Colorado State University in August 1976, van Hoften accepted a position as Assistant Professor in Civil Engineering at the University of Houston, where he taught fluid mechanics and performed research into artificial heart valves. To earn extra money, he also sold swimming pools [14].

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While he was a graduate student during his doctoral studies, he was able to remain in the USAF/USN Reserve, and so was able to maintain his flight status. Initially, he flew F4Ns with the Navy's Reserve Fighter Squadron 201 at NAS Dallas for three years from 1974 to 1977, before becoming a member of the Texas Air National Guard with the 147th Fighter Interceptor Group, and serving as a pilot in the F4C from 1977. He was at the University of Houston when selected by NASA, by which time he had logged more than 3,300 flying hours, most of it in jet aircraft.



**Fig. 4.5:** Class of 1978 Mission Specialist astronaut hopefuls. (clockwise from top left): Millie Hughes-Wiley; Byron Lichtenberg; Dr. Richard Terrile (image courtesy of SpaceFacts.de); Dr. Carolyn Griner; Dr. Mary Helen Johnston

### SOME WHO NARROWLY MISSED SELECTION

The NASA selection panel had to deal with selecting 20 MS candidates out of a pool of over 5,000 qualified hopefuls from an all-encompassing range of scientific and medical fields. Inevitably, some superbly proficient and disciplined people had to miss out at the last hurdle. These are just a few of those talented candidates.

**Millie Elizabeth Hughes-Wiley, BSc, PhD**

At the time of her JSC interviews and tests in August 1977, 31-year-old Millie Hughes-Wiley from Mineral Wells, Texas, was working at the Veterans Administration Hospital in San Francisco. She was later divorced and married once again, this time to George Fulford. Although never selected as a NASA astronaut, Dr. Hughes-Fulford flew into space in June 1991 aboard Shuttle *Columbia* as a Payload Specialist (PS) on the STS-40 Spacelab Life Sciences (SLS-1) crew. This was the first Spacelab mission dedicated to biomedical studies. The SLS-1 crew completed more than 18 experiments during a nine-day period, bringing back more medical data than any previous NASA flight. STS-40/SLS-1 would prove to be her only space flight. Today, Dr. Hughes-Fulford is a professor at the University of California Medical Center in San Francisco, where she continues her research.

**Byron Kurt Lichtenberg, Sc.B, Sc.D, S.M**

Originally from Stroudsburg, Pennsylvania, Byron Lichtenberg is an American engineer and former fighter pilot who, like Millie Hughes-Fulford, was never selected as a NASA astronaut but flew instead as a PS, in his case on two NASA Space Shuttle missions (STS-9 and STS-45). In 1983, he and German Ulf Merbold became the first PS to be launched into space when they flew on the STS-9/Spacelab-1 mission. Over the next ten days in orbit, Lichtenberg conducted multiple experiments in life sciences, materials sciences, Earth observations, astronomy and solar physics, and upper atmosphere and plasma physics. His second flight was on the ATLAS-1 (STS-45) Spacelab mission aboard *Atlantis* in 1992, conducting 13 experiments in atmospheric sciences and astronomy.

**Richard John Terrile, PhD**

Today, Richard Terrile is an astronomer and the director of the Center for Evolutionary Computation and Automated Design at NASA's Jet Propulsion Laboratory (JPL). He has a Doctorate in Planetary Science from the California Institute of Technology (CalTech) and has developed simulated missions to Mars and the outer solar system. He would also make unsuccessful applications for NASA astronaut groups 9 and 10 and was a semi-finalist for a Spacelab mission, but failed to be selected. Dr. Terrile is the discoverer of four moons around Saturn, Uranus and Neptune, and took the first pictures of another solar system around the nearby star Beta Pictoris. His other interests include planetary rings, planetary geology, evolutionary computation, and the development of medical instrumentation for tissue identification during neurosurgery.

### **Carolyn Spencer Griner, BSc**

In 1964, Carolyn Griner, from Granite City, Illinois, joined NASA as a co-op student, becoming one of only three women employed in technical positions at the Marshall Space Flight Center (MSFC) in Huntsville, Alabama. They were outnumbered by their male engineering counterparts at a ratio of more than 1,000 to one. She received her BSc degree in Astronautical Engineering from Florida State University in 1967 and completed graduate work in industrial and systems engineering at the University of Alabama. Dr. Griner then progressed to positions of increasing responsibility within several key program areas at NASA, and served a term as Acting Director of MSFC in 1998. Before and after this, she was Deputy Director at MSFC before retiring from NASA in 2000. She has received numerous awards throughout her career, including the NASA Exceptional Service Medal in 1986, the Presidential Rank of Meritorious Executive in 1992, and the Presidential Rank of Distinguished Executive in 1995. In 1999, Carolyn Griner also received the space agency's highest honor, the Distinguished Service Medal, for her exemplary contributions to NASA's missions.



**Fig. 4.6:** Carolyn Griner (at front), Mary-Helen Johnston (left rear) and Ann Whitaker wearing scuba gear at the MSFC Neutral Buoyancy Simulator.

### **Mary Helen Johnston, BSc, PhD**

Mary Helen Johnston (now McCay) was born in September 1945 in West Palm Beach, Florida. She gained her BSc degree in Engineering Science from Florida State University in 1969 and her Doctorate in Metallurgical Engineering from the University of Florida, Gainesville in 1973. Dr. Johnston began working at MSFC in Alabama and, following unsuccessful bids to join the astronaut corps in 1977 and 1980, was one of those chosen for Scientific Payload Specialist Selection 3 in 1984. She was then named as Alternate PS (together with Eugene Trinh), to the prime PS Taylor Wang and Lodewijk van den Berg, for Shuttle mission STS-51B/Spacelab 3. The mission eventually flew with Wang and van den Berg on



board, and then the loss of the *Challenger* Orbiter precluded her from flying any later Spacelab missions during the Shuttle program.

In 1974, Johnston was joined by Carolyn Griner, Ann Whitaker and fellow researcher Doris Chandler for a series of NASA/MSFC experiments. Their participation in a five-day simulated Spacelab experiment that year proved the benefit of having a highly-trained crew who were ready for anything, from identifying minor malfunctions to salvaging experiments.

In December 1975, Johnston again joined Carolyn Griner and Ann Whitaker, this time in the MSFC Neutral Buoyancy Simulator as part of their efforts to design and develop new experiments for astronauts to conduct in microgravity. Each specialized in a different field: Dr. Griner in material science; Dr. Whitaker in lubrication and surface physics; and Dr. Johnston in metallurgical engineering. Their job was to identify what tasks could be successfully completed in microgravity, and which would require additional foot- or hand-holds or specialized tools. The experiments they designed were eventually flown and operated within Spacelab, the European-built science module carried in the spacious cargo bay of the Space Shuttle.

Ann Whitaker was also a PS candidate for a time, along with Craig Fischer, Michael Lampton, Robert Menzies, Byron Lichtenberg and Rick Terrile. Although she never flew on the Space Shuttle, her materials experiments did, and these pioneering experiments provided data used to design the International Space Station (ISS). Today, Dr. Whitaker is head of the Science Directorate at NASA's MSFC and leads a team of 700 researchers.

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