

Profiles in Leadership #3

Bonnie J. Dunbar: Inspiring Youth to Reach High

Retired astronaut and now a university professor, Bonnie J. Dunbar, Ph.D., NAE, Texas Epsilon '83, let nothing obstruct her childhood dream of flying in space—demonstrating that, with hard work, no goal is too high.

by Trudy E. Bell © 2013 Trudy E. Bell

“I GREW UP on a 90-acre cattle ranch and farm in the Yakima Valley of south central Washington, where my parents homesteaded in 1948 just after World War II,” recounted former NASA Space Shuttle astronaut Bonnie J. Dunbar, veteran of five space missions between 1985 and 1998.

“My parents also rented about a thousand acres of federal sagebrush land in the summers for summer feeding of the herd of Hereford cattle. There was no room for traditional gender role-playing in the family business. As the eldest of four kids, my parents expected me to work.” Duties included rounding up cattle, checking fence lines, picking rocks from arable fields, and weeding cash crops like sugar beets. “It was very egalitarian: if one of us kids had an idea for a better way to do something, our parents listened.”

Moreover, “when you grow up farming and ranching, you are doing science and engineering,” Dunbar continued.

“You learn to understand and respect the weather, understand soil chemistry and geology in order to grow the best crops and gardens, learn biology from assisting animals give birth, and botany from farming. You learn the proper-

ties of materials, such as the difference between conductors and insulators: we had electric fences, and if you didn't want to get shocked, you learned to hold down the fence with a wooden stick and not a metal bar when you walked over it.”

What does it mean to be a leader? In this series “Profiles in Leadership,” Tau Beta Pi is exploring that essential question through the lives of member engineers who attained leadership positions in their fields. The first two profiles were of Maria Klawe, President of Harvey Mudd College, (Fall 2012) and Norman R. Augustine, former President and CEO of Lockheed Martin Corp. (Spring 2013).

but “we had to learn to make everything.”

Her father repaired his own equipment, welding with an acetylene torch. As Dunbar and her two brothers and sister

had few store-bought toys, “we made our own teeter-totter and learned ourselves about where to put the fulcrum because we were different weights.”

The lack of amenities generally found in urban areas did not deter the family from sharing a strong culture of education. “My grandfather, who had emigrated from Scotland to homestead in Oregon early in the 20th Century,



Dunbar with Joseph F. Sutter, *Washington Alpha '43*, Boeing design team manager for the 747 project, during her 2005-10 tenure as president and CEO of The Museum of Flight.

once said to me, ‘Your greatest possession is knowledge, for no one can take it from you,’” Dunbar recalled.

As a result, she loved learning at the rural K-8 school in the nearby town of Outlook. She spent all her free time reading; H.G. Wells and Jules Verne were her favorite authors. In the summer, when the school library was closed and she rarely traveled to the nearest larger town (Sunnyside), Dunbar looked forward to each week’s visit of the bookmobile. On black-and-white TV, she was captivated by *Watch Mr. Wizard* (1951–1965), in which Don Herbert demonstrated the science behind everyday things to a young boy and girl, and *Flash Gordon*, who explored the universe before the days of computer special effects.

In October 1957, the Soviet Union shocked the world with its launch of *Sputnik I* into Earth’s orbit. A year later, the U.S. founded the National Aeronautics and Space Administration (NASA). “It was an exciting time for Americans,” Dunbar recalled. And at age nine in 1958, she determined she “wanted to design spaceships and ride in them.”

“Oh, sure, there were dinosaurs around who thought girls shouldn’t think about science or engineering,” Dunbar tossed off, “but all my friends, teachers, and parents were very supportive. If there was negativity, I just ignored it.” She was very athletic—“you have to be to work a ranch”—and played team sports. The Outlook school was so small there were not enough boys to make a baseball team, so girls had to play some of the positions. In the farming community, she played touch football often as quarterback.

Education program

When she graduated from eighth grade, her teacher Mr. Miller asked her what she wanted to do with her life. “When I told him, he encouraged me to take algebra in ninth grade at Sunnyside High School.” She did, followed by geometry, trigonometry, and math analyses. She also took biology, chemistry, physics, and two years of Latin, and was active in cheerleading, math club, and debate. Dunbar excelled in high school. “My high school physics teacher, Mr. Anderson, recommended that I consider a career in engineering.”

Although before the dawn of the Space Age, college would have been beyond her family’s means (“for much of my childhood, I grew up in a house without an indoor toilet”), the 1958 National Defense Education Act (NDEA) with its program of low-interest loans and grants for academically qualified students studying science and engineering changed everything. “I entered the University of Washington in 1967 on the NDEA,” Dunbar declared, majoring in ceramic engineering because the department chair, **James I. (Doc) Mueller**, Ph.D., *Washington Alpha ’39*, explained that they had NASA grants to help design parts of the new Space Shuttle.

Upon graduation in 1971, she worked two years for Boeing Computer Services as a systems analyst followed by two more back at the University of Washington to earn her M.S. in ceramic engineering. After a summer at Harwell Laboratories (Atomic Energy Research Establishment) in England, Dunbar was hired as a senior research engineer at Rockwell International Space Division in Downey, Califor-



This Leader In Brief

Full professional name: Bonnie Jeanne Dunbar

Current position: M.D. Anderson Professor of Mechanical Engineering, University of Houston; Professor, Biomedical Engineering; Director, UH STEM Center; Director, Aerospace Engineering Graduate Program.

Birthplace: Sunnyside, WA.

Highest degree: Ph.D., mechanical and biomedical engineering, University of Houston, 1983.

Major career highlights: Senior research engineer, Rockwell International Space Division, 1976–78; payload officer/flight controller, NASA Johnson Space Flight Center (JSC), 1978–80; NASA astronaut 1980 (flown five Space Shuttle missions: STS-61A *Challenger*, 1985; STS-32, *Columbia*, 1990; STS-50 *Columbia*, 1992; STS-71 *Atlantis*, 1995, first docking to Space Station *Mir*; STS-89 *Endeavour*, 1998, docking mission to Space Station *Mir*); Deputy Associate Administrator, Office of Life and Microgravity Sciences, NASA Headquarters, 1993; Assistant Director, NASA JSC, 1998–2003; Deputy Associate Director, Biological Sciences and Applications, NASA JSC, 2003–05; President and CEO, Seattle Museum of Flight, 2005–10; engineering professor and Director of STEM Center, University of Houston, 2013.

Board memberships: National Science Foundation (NSF) Engineering Advisory Board (1993–1999); Aerospace Corporation (current).

Honors: Fellow of American Ceramic Society, American Institute of Aeronautics and Astronautics, and Royal Aeronautical Society. Awarded NASA Space Flight Medal five times, NASA Outstanding Leadership Medal, and NASA Distinguished Service Medal. Elected in 2002 to the US National Academy of Engineering. Seven honorary academic degrees. 2012 AAES Norm Augustine Award for Outstanding Achievement in Engineering Communications, 2009 ASME Ralph Coats Roe Medal. In 2013, selected into Astronaut Hall of Fame.

Greatest accomplishments: “Not for me to judge. My life is still a work in progress.”

Hero: John Glenn, for both his achievements and his character.

Hobbies: Music (pianist); flying (private pilot); hiking and mountain climbing: “Summitting Mount Rainier is on my bucket list.”

Favorite books: “I like the classics.” Favorites include Verne’s *From the Earth to the Moon* and Michener’s *The Drifters*.

Personal motto: “From my father: ‘Don’t build your own fences [barriers]. If the gate is shut, go around.’” And—“To be a team player, one must also know how to be a good follower.”

If you could do one thing over: “I don’t think I’d do anything differently. You make mistakes, but through them you learn life’s lessons.”



TOP: Dunbar “driving” her first tricycle with youngest brother Gary hitching a ride. Note the wild sagebrush country of the family ranch in south central Washington in the background. CENTER: As an undergraduate in engineering at the University of Washington, Dunbar was selected to join the Air Force ROTC Auxiliary, Angel Flight, and is still involved as a board member. The organization, is now called Silver Wings (as Angel Flight is a group of pilots who fly free medical flights). BELOW: With President and Mrs. George H. W. Bush in 1990. After Dunbar captured a satellite with a robotic arm on STS-32, the Shuttle crew was invited to the White House.



nia. There she found herself in the center of manufacturing for the Space Shuttle, developing equipment and processes for its ceramic tiles, and spending much of her time working on the Space Shuttle in Palmdale, CA.

In 1978, Dunbar joined NASA Johnson Space Center (JSC) in Houston, Texas, as a Payload Officer and flight controller, integrating items in the Shuttle’s payload bay, and then operating them during the mission. A year later, she was the guidance and navigation officer when the first U.S. space station, Skylab, then at the end of its life, was guided to reenter Earth’s atmosphere safely away from populated areas. In 1980, she finally achieved her dream: she was selected to begin training as a NASA astronaut.

Between 1985 and 1998, she flew five Space Shuttle missions [see sidebar for list] on four of the five craft in the fleet (all but *Discovery*), logging over 50 days (1,208 hours) in space. Before her fourth flight, she was tapped to qualify as a back-up crew member for a three-month flight on the Russian space station *Mir*, and sent to Star City, Russia, for 13 months of training. Although she never flew a long-duration mission on *Mir*, she qualified for both *Soyuz* and *Mir* flight, became fluent in Russian, and was on the first Space Shuttle to dock with *Mir* in 1995.

Dunbar’s knowledge of both space programs lined her up for her next assignment: from October 1995 to November 1996, NASA detailed her to the JSC Mission Operations Directorate as assistant director, where she chaired the International Space Station (ISS) Training Readiness Reviews and helped to train astronauts and cosmonauts for joint Russian-American operations aboard the ISS.

Final Mission

After her final mission (the eighth docking mission to *Mir*) in 1998, she served in several assistant and associate director positions at JSC. In 2002, she was elected into the National Academy of Engineering, which she called “one of my proudest professional moments.” She retired from NASA in September 2005 for the next phase of her career: dedication to science education of today’s youth as president and CEO of the Museum of Flight in Seattle, WA.

As JSC assistant director in the late 1990s, Dunbar and NASA’s senior staff observed it was much more difficult to find qualified U.S. citizen engineers to hire. Today she, like many engineering colleagues, is concerned that fewer than 5 percent of U.S. undergraduates today are enrolled in engineering. “More college students are majoring in hospitality and leisure industries than in science and engineering,” she declared. “Yet in Asian countries, 40 to 45 percent of undergraduate students are enrolled in engineering because they know it will transform their world and society.”

In addition to insufficient math and science preparation in K-12 education and declining public literacy in science and engineering, Dunbar points to a third culprit: popular media. “Negative stereotypes about scientists and engineers permeate popular culture,” she explained. “For example, girls who are good in math are often portrayed as being socially inept. One school guidance counselor said to me ‘I discourage students from considering careers in engineering because my students like to work with people’. A director of

an art gallery asked ‘Don’t engineers just make bombs?’ A Congressman stated during a budget hearing with NASA ‘Why do we need to fund more weather satellites when I can go onto the internet to see the weather every day?’

“How do we ‘change the conversation?’” she asked, quoting the title of a 2008 report by the National Academy of Engineering that became a NAE initiative. “Much of the responsibility can be laid at the feet of the popular public media, including Hollywood. Unfortunately, Hollywood is probably not aware how much of their own technology and business case is generated and created by engineers. How do we reach them? How do we turn around such appalling misunderstandings?”

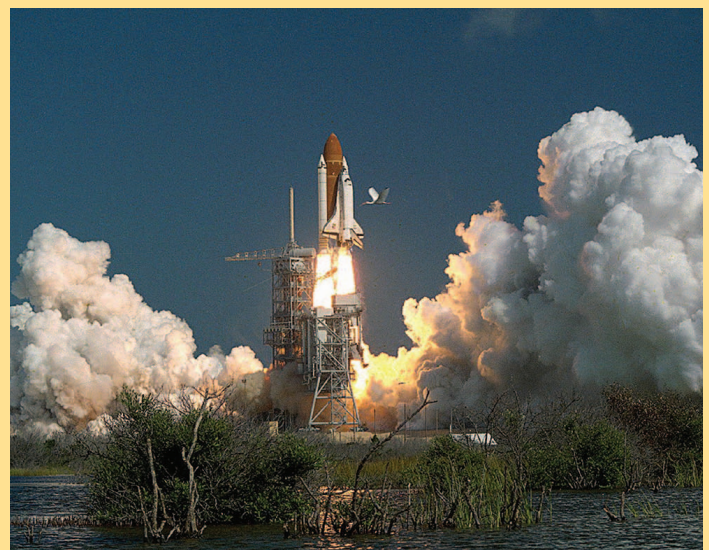
‘Another Sputnik moment’

Dunbar is working tirelessly to raise awareness. Through the Museum of Flight in Seattle, which serves more than 140,000 students every year in STEM (science, technology, engineering, and mathematics) programs, she found that working directly with the public through informal science education was very effective. In 2010, she joined the faculty of the Cullen School of Engineering at the University of Houston, where she is both the director of the University STEM Center as well as director of the graduate program in aerospace engineering. The University STEM center coordinates approximately 34 university programs serving K-16+ students. As a professor of mechanical engineering, she intends to ensure a continued pipeline of talent that will take the nation back to the Moon and on to Mars.

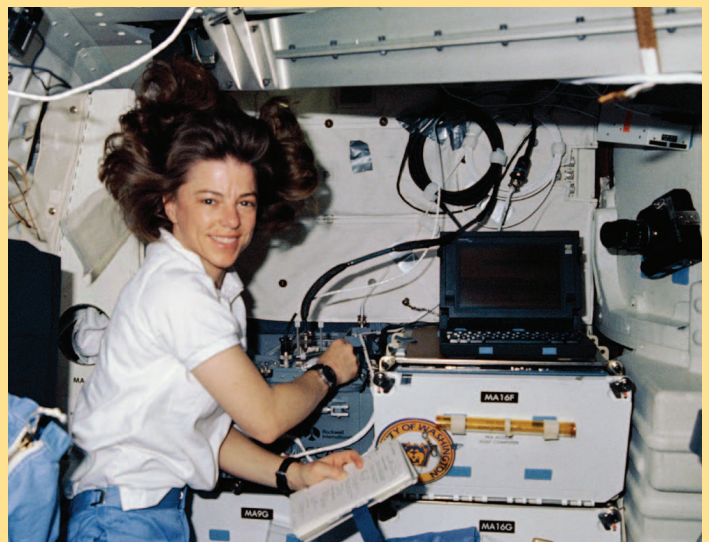
“I am concerned about the future of our nation,” Dunbar states. “We stand at a crossroads in terms of educating the scientists and engineers we need to prosper and lead. We need to remain a great nation that explores and innovates. In some respects, we are still living off the nation’s investment in the Apollo program to land a man on the Moon. That program alone gave us unparalleled investments in education, research and development, innovation, and new industries.

“However, where once we strove to be number one in technical indicators such as patents granted, percentages of graduating engineering and scientists, and academic math scores for high school students, often now we are not even in the top ten. And we seem to be satisfied by being just above average when compared to the rest of the world. I am not satisfied with that ranking. I remain an optimist about what this nation can do when motivated and mobilized forward—and we are at another Sputnik moment.”

Trudy E. Bell, M.A., (t.e.bell@ieee.org, www.trudyebell.com, and [@trudyebell](https://twitter.com/trudyebell)), is senior writer for the University of California High-Performance AstroComputing Center (<http://hipacc.ucsc.edu>) and a contributing editor for *Sky & Telescope* magazine. A former editor for *Scientific American* and *IEEE Spectrum* magazines, she has written a dozen books and nearly 500 articles, 19 of which have won top journalism awards. Bell shares two unusual commonalities with Dunbar: both were born not 50 miles apart in rural southeast Washington, and as a college senior Bell was a mission controller for sun-orbiting spacecraft *Pioneers 6, 7, 8, and 9* at NASA Ames Research Center. This profile is her 20th feature for *The Bent*.



Challenger leaves Kennedy Space Center October 30, 1985, carrying Mission Specialist Dunbar on STS-61-A, her first spaceflight.



On Dunbar’s third Shuttle flight, STS-32 in 1990, she operated the Fluid Experiment Assembly (FEA). Note the University of Washington Husky emblem on the experiment, which she helped to design.



Astronauts and cosmonauts of the combined *Mir* and *Endeavour* crews in the Spacelab, which was located in the payload bay of the Shuttle, during mission STS-71 in 1995. Dunbar is center at the bottom.