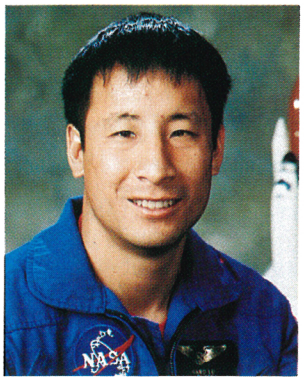
CAREER CHOICES

Taking the Ultimate Flight

Pamela Melroy and Edward Lu are crazy about flying. Coming from a physics background, they can appreciate the intricate mechanics involved in keeping an aircraft aloft. And then again, flying is fun. "Doesn't matter what it is, a jet or a little turbo-prop single-engine," Melroy says. As an Air Force pilot, she got to fly in over 45 different aircraft. "I'm a happy camper when I'm flying."

PAMELA MELROY



EDWARD LU

"I'd fly all the time if I could," offers Lu, who began flying airplanes while still an undergraduate at Cornell University. "There's always something new to learn."

Sometime soon, Melroy and Lu will take the ultimate flight, as astronauts aboard the US space shuttle. They are among an elite group of 23 who earlier this year completed NASA's astronaut training program. Lu, a mission specialist, is now preparing for his first shuttle journey, a docking with the Russian space station Mir scheduled for next May. Melroy is only the second US woman to qualify as a shuttle pilot (Eileen Collins is the first) and is now awaiting her first assignment.

Selection and training

Flying is just part of the job, of course. Candidates for the astronaut program must first pass through a highly competitive screening process that narrows down a field of about 4000 applicants to fill the 20 or so openings in each class. At a minimum, an applicant must be in excellent physical condition, possess a bachelor's degree (and preferably an advanced degree) in science, mathematics or engineering and have three years of related experience. In addition, those seeking to become shuttle pilots need at least 1000 hours of experience flying jet aircraft. For the hundreds of applicants who meet these requirements, there is a week-long series of interviews, medical evaluations ("You name it, they test for it," Lu says) and orientation. A NASA panel then makes the final selection.

And it doesn't stop there. Those fortunate enough to be named astronaut candidates must then complete a one-year training and evaluation period. During that time, they learn how each of the many systems on the space shuttle operates, from life support to communications to engines and propulsion. "Then they throw you in the simulator to figure out what to do when things break," Lu says. Over the course of hundreds of hours of simulator time, they learn how to diagnose and correct almost every conceivable malfunction.

Both mission specialists and pilots also spend time flying real aircraft—two-seat T-38 high-performance jets, as well as a much larger Grumman Gulfstream II that's been configured to handle like the shuttle. "In a simulator, you always know in the back of your mind that it's not real," Lu says. Flying an actual plane, by contrast, "we get used to being under the pressure of a real situation, with possible real emergencies."

The astronaut candidates also take classes in basic science and engineering, including math, meteorology, computer science and physics, and they practice parachute jumping, land and sea survival and scuba diving.

One of the most obvious aspects about space travel is being in a microgravity environment. The trainees get a taste of weightlessness aboard a modified Boeing jet. "They call it the vomit comet," Melroy says. Flying over the Gulf of Mexico, the plane executes a series of vertical parabolas; at the top of each loop, those on board experience about 20 seconds of near-zero gravity. "For someone with a physics degree, that's one of the most fun things. You can see simple forces at work without the influence of gravity," says Melroy. "I'll probably be one of those terrible people who's always twirling things around and throwing them, just to see what happens."

A long shot

On Lu's first journey into space next spring, the shuttle will deliver about two tons of supplies and experimental equipment to Mir and also drop off one US astronaut and pick up another. The shuttle crew will test a new docking system for the international space station now being developed. In case of an emergency, Lu may be called on to engage in "extravehicular activity"—that's NASA-ese for a space walk. He'll also get to test his Russian conversational skills (all of the astronauts are required to have some proficiency in the language). "I can sort of speak it," he allows.

Prior to joining NASA, Lu never gave much thought to being an astronaut, even as a kid. His father was a chemical engineer, and Lu thought he'd like to be an engineer too. At Cornell, he studied electrical engineering, receiving his BS in 1984. By then he'd grown more interested in physics, and so for graduate school he chose the applied physics program at Stanford University. After obtaining his PhD there in 1989, Lu accepted a postdoctoral position at the High Altitude Observatory in Boulder, Colorado. Two years later, he took a second postdoc at the Institute for Astronomy in Honolulu, Hawaii. "Most of my work was in statistical physics, solar physics and plasma physics, in particular, looking at the energy release process in solar flares," Lu says. He loved his research and was more than happy with the idea of pursuing a traditional academic career.

Then about two years ago, as Lu's postdoc in Hawaii was finishing up, his old office mate from Stanford, Russ Hamilton, said he had applied for the astronaut training program and suggested Lu do likewise. As graduate students, they had been through quite a bit together, jointly publishing sev-

eral papers and also coaching wrestling at a local high school. Hamilton had since switched from astrophysics to medical physics and was working at the University of Chicago Hospital.

"I wasn't looking to leave physics at the time," Lu admits, and it seemed like a long shot, but he applied anyway.

And he got in. Though most of his colleagues congratulated him, a few seemed less than enthusiastic. "My response was, This is a chance to do something that very few people will do. It was an opportunity that I couldn't pass up."

Piloting the shuttle

Unlike Lu, Melroy chose her future career early on. "I was a pretty serious little kid," she says. "I was probably about 10 or 11 years old when I decided that I needed to come to some conclusion about what I was going to do with my life—and by God, it had better be good. So I picked being an astronaut."

With that in mind, Melroy double-majored in physics and astronomy at Wellesley College, and she got her master's degree in Earth, atmospheric and planetary sciences from MIT. She then went on active duty with the Air Force. Trained as a pilot, she worked at Barksdale Air Force Base in Louisiana for six years.

During that time, Melroy says, she rarely used her physics training. That all changed when she enrolled in the test pilot school at California's Edwards Air Force Base in 1991. "It was extremely rigorous academically," Melroy recalls. "I found it very important that I had a physics degree." In flight control theory, for example, one deals with feedback loops—"all that electromagnetics theory I learned in my junior year."

Throughout her schooling and tour of duty in the Air Force, Melroy remained committed to her original goal. She applied three times to the astronaut program before being accepted in 1994.

Melroy now divides her time between the Johnson Space Center in Texas and the Kennedy Space Center in Florida, where she reviews hardware issues for the crew back in Texas and also prepares the shuttle prior to launch and again after landing. In her free time, she flies some more. Melroy and her husband, Christopher Wallace, own an aerobatics plane, and they're building another in their garage.

With her astronaut dream squared away, Melroy can now think about her next goal. "I'd like to get a PhD in astronomy," Melroy says. "Fortunately, there's no age limit on grad school."

JEAN KUMAGAI ■