Q&A

Former astronaut **John Grunsfeld** is the latest deputy director of the Space Telescope Science Institute in Baltimore, Maryland, and will oversee the launch of the James Webb Space Telescope.


NASA

Did serendipity play a part in your career choice?
Yes. Growing up in the 1960s, I was captivated by the firsts in exploration: the first successful US attempt to climb Mount Everest, Jacques Cousteau's marine explorations and the Moon landing. So when my third-grade teacher told me to write a biography of Enrico Fermi, I was crushed. I had no idea who he was. But I soon learned that he was both an extremely creative physicist, straddling the line between experimental and theoretical physics, and an adventurer. That appealed to me greatly. I unwittingly locked onto Fermi as a model.

What was the best piece of advice you followed?
My graduate-school mentors at the Massachusetts Institute of Technology in Cambridge knew that I was interested in cosmology and the Universe. They advised me that if I wanted to be a great theoretical physicist, I had to do a real experiment. I resisted, but they were emphatic. I found a project to develop detectors for a small balloon payload designed to look at neutron stars in binary star systems. I fell in love with experimental astrophysics and spent the rest of my career doing it.

Did any opportunities alter your career trajectory?
In 1992, I was a senior research fellow at the California Institute of Technology in Pasadena. I found it unbelievable that I was paid to go up mountains to work on satellites. I couldn't imagine a more rewarding career. Then, scientists at the Johnson Space Center in Houston, Texas, asked if I wanted to be interviewed for astronaut training. I wanted to jump at the opportunity, but I was trying to become a faculty member and was concerned about throwing my career away. My mentor, Bruce Margon, reminded me that I would only get one chance to be an astronaut, and that I could be an astronomer any time. After astronaut training, I went on five space flights, three to service the Hubble Space Telescope. Those experiences helped me to design crew-safety measures aboard the International Space Station.

What was the most important lesson you learned during that period?
I learned that complexity is the enemy in engineering systems. When I became an astronaut, I looked at the *Challenger* space-shuttle accident for ways to reduce the complexity of these systems. I led a team that developed displays and controls for complex systems to avoid any such accidents on the space station.

Did your experiences in space change your view of the role of science?
When I viewed Earth from 600 kilometres up, I saw a scarred planet. It was still incredibly beautiful, but I couldn't see anywhere that didn't show the impact of people. I realized that scientists need to be thought of as citizens, and to think of themselves that way. We need scientists to provide the information necessary to make decisions about our stewardship of Earth. Unfortunately, large parts of the population do not have the tools to make good decisions.

Why did you leave NASA?
I decided I needed to find new challenges, so I explored a number of places and career changes. I still love astronomy and enabling science. At this institute I have the challenge of maintaining high operational cadence for Hubble at the end of its life, while preparing the way for the James Webb Space Telescope. That takes us through the next decade. Here, I can mix science and operation. There are not many places you can do that.

Do you think big scientific collaborations increase or decrease opportunities for young scientists?
I used to think that the increasing focus on large collaborations ultimately offered fewer opportunities and meant fewer individual lab experiments. But I think I was wrong. I think I misinterpreted how they work. It takes a village to conduct this type of complex science and it definitely takes more collaboration earlier on in these experiments to be successful. As a result, many scientists get the chance to contribute. The concept of building a career based solely on experience with small, individual laboratory experiments is one that is now being challenged.

When do you expect to start recruiting for the James Webb Space Telescope?
The telescope will launch in June 2014. That may seem far away, but in the context of big experiments, it is right around the corner. I anticipate having a big recruitment effort during 2011 and 2012 to bring people in while we make the final scientific preparations and ramp up the expertise needed to operate the telescope. Unlike Hubble, the James Webb Space Telescope is going to be too far away to be serviced, so there is more pressure on the team to ensure that data will flow back to investigators. Astronauts can't travel the 1.5 million kilometres from Earth to fix any problems. ■

Interview by Virginia Gewin

IN BRIEF

India plans science boost

India's federal government has announced improved opportunities and funding for young scientists with the aim of boosting the scientific workforce. Science secretary Thirumalachari Ramasami said on 27 January that at least 7,000 PhD-qualified researchers will be needed to fill faculty positions at existing and new institutions by 2014. The number of postgraduate fellowships will be doubled and their value increased by 40%. Five-year grants for unrestricted PhD research will be available for graduates who pass an entrance exam. Currently, a junior research fellow studying for a PhD earns around 12,000 rupees a month (US$258).

Research output falls

Of 45 nations monitored by the US National Science Foundation (NSF) for its *Science and Engineering Indicators 2010*, Russia was one of only two (the other was Ukraine) whose research output fell between 1995 and 2007. Russia's scientists published 18,603 papers in 1995, 3.2% of the global total, but only 13,953 in 2007 — 1.8% of the total. In comparison, China's output rose by 16.5%, Brazil's by 10.9% and India's by 5.7% over the same period, the NSF report finds. As detailed in a 27 January Thomson Reuters report, *The New Geography of Science: Research and Collaboration in Russia*, the country's research output reached a high of about 29,000 papers in 1994.

Chinese students stay on

Some 92% of students from China who gained a doctorate in the United States in 2002 were still in the country in 2007, the highest percentage from any foreign nation. This compares with 62% of all foreign-born PhD recipients for that year. The figures come from a study by Michael Finn at the Oak Ridge Institute for Science and Education in Tennessee, and appear in the National Science Foundation's *Science and Engineering Indicators 2010*. Five-year stay rates for students from other countries include 81% for India and 77% for Russia. Nearly three-quarters (73%) of PhDs in either physical or life sciences remained for five years after earning their degrees compared with 51% of those with PhDs in agricultural sciences.