NATURE|Vol 437|29 September 2005

Mountain at the top

With one ageing telescope in space, and another mired in construction troubles on Earth, Matt Mountain has a tough job to do. Jeff Kanipe meets the new custodian of everyone's favourite space telescope.

Mattias Mountain seems cheerful as he sits at a desk littered with spreadsheets and organizational charts. This month he has become the director of the Space Telescope Science Institute in Baltimore, Maryland, at a time when the 25-year-old body is making an even bigger transition — from managing the popular workhorse of space astronomy, the Hubble Space Telescope, to its planned successor, the James Webb Space Telescope (JWST). Amid concerns that Hubble will be retired sooner than expected, and with JWST running behind schedule and over budget, the outlook for the institute seems far from rosy. Mountain admits that some of his friends have questioned his reasoning for taking the job but says he assures them: "I wouldn't have come here if I thought we were in our death throes."

Under a contract with NASA, the 400-person institute is responsible for research done with the $1.5-billion Hubble telescope. When the space shuttle lofted Hubble into orbit in 1990, it launched a bold new era in observational astronomy — albeit after a false start. The incorrect curvature of Hubble's 2.4-metre primary mirror prevented light rays from converging at a single focus, blurring its vision. Only after a shuttle mission in 1993, during which astronauts installed corrective optics, did the bold new era truly begin.

And what a time it has been. In the ensuing years, Hubble has narrowed the age of the Universe to between 13 and 14 billion years, probed the violent hearts of galaxies, revealed dusty cocoons around newborn stars, helped to establish that cosmic expansion is accelerating and scoured the darkest, deepest reaches of space for primordial galaxies coalescing in a Universe less than a billion years old. Those were good times at the institute, which gained a reputation for smooth data management and slick public outreach. And beyond the pretty pictures, some 400 to 600 science papers are generated each year from Hubble-based data.

Hoping to keep Hubble working productively until 2010, the institute planned a fifth shuttle servicing mission to replace ageing batteries and gyroscopes, and to add new instruments. But events outside the institute's control have made such hopes ever more remote. First, the disintegration of the Columbia orbiter during re-entry in 2003 led NASA to suspend shuttle missions. Then, this July, the shuttle Discovery narrowly escaped debris damage during the first shuttle launch since the Columbia disaster. In response, the new NASA administrator, Mike Griffin, has grounded the fleet for a second time.

NASA

NORTHROP GRUMMAN

Matt Mountain hopes astronauts may once more extend Hubble's life (right), but technicians developing the James Webb Space Telescope will get no such second chances (bottom).

Looking into a void

Although Griffin has said publicly that he is willing to reconsider a Hubble mission, time is running out. Even if shuttle flights resume next year, it is unlikely that a servicing mission would fly before late 2007. This may be too late to save Hubble should it lose battery power or if any more of its stabilizing gyroscopes should fail in the meantime. Just last month, NASA announced that engineers were shutting down one of the three remaining gyroscopes to extend the telescope's operating life until, possibly, mid-2008. Despite this, Mountain

©2005 Nature Publishing Group

remains optimistic about Hubble's future. "I think everybody thinks one shuttle servicing mission is a good idea, including the administrator," he says.

More critical to the future of the institute are the budgetary woes of the James Webb Space Telescope, projected to launch in 2011 at a cost of $3.5 billion. Although not a direct successor to Hubble — JWST will observe mainly in the infrared — US astronomers picked the telescope as their top priority following a decadal review in 2000. The potential science to be done with the 6.5-metre infrared telescope is impressive: from observing the motions of young planetary systems around other stars to imaging the first ever galaxies to form in the Universe. But cost overruns are forcing astronomers to consider reducing the telescope's overall sensitivity and, perhaps, dropping other instruments entirely.

There is also a good chance that the launch date will slip to 2013. This could mean a long, dry period for the institute, whose staff are used to issuing a stream of data to astronomers worldwide. But Mountain is not worried about morale: "The spirits I detect around the corridors here are fairly upbeat. Now, I wouldn't say they're bubbling over, because NASA is putting budget constraints on this place, and that's a new experience for them."

As the former director of the Gemini Observatory, which operates two identical 8-metre telescopes in Hawaii and Chile, Mountain is no stranger to budgetary and instrumentation challenges. At Gemini, he learned that tight budget constraints can be another way of stimulating creativity. "I'm a great believer in the partnership between science, engineering and project management," he says, "To me it's a creative tension."

The big picture

Mountain will certainly need creativity to navigate the obstacles ahead. Craig Wheeler of the University of Texas at Austin, and president-elect of the American Astronomical Society, cautions: "I don't have any particular reason to think that he's not up to it, but I don't know whether he's faced quite this kind of challenge before. It's a big job." Many of Mountain's former colleagues are confident that he can pull it off, though. "One of Matt's real strengths is that he doesn't lose sight of the big picture," says Phil Puxley, in charge of Gemini's southern telescope in Chile. "He's delivered instruments and telescopes on a very tight schedule and under a lot of budget pressure. That's a very rare thing to do once, and he's now done it more than once."

> "The spirits I detect around the corridor here are fairly upbeat. Now, I wouldn't say they are bubbling over." — Matt Mountain

The cost overruns, Mountain asserts, are not as bad as they seem. "If you ask a contractor what's the possible maximum cost," he says, "they always give you the worst-case scenario." When you add those contractors' estimates, he says, plus the cost of launch delays and NASA's estimates for unforeseen technical problems, the budget busts by a billion dollars. He argues the true figure for the overrun is closer to $500 million — one that, fortuitously or not, matches savings that project scientists have recently put on the table.

Whatever the true amount, JWST's science working group, of which Mountain is a member, has worked hard since May to make savings while preserving as much of the telescope's performance as possible. One option, to reduce the overall size of the mirror array to 4 metres, was quickly rejected. Another option, to polish the mirrors once instead of twice, preserves the array's size but reduces its sensitivity at wavelengths shorter than 1.7 micrometres, the range that includes visible light. JWST was designed to operate at wavelengths between 0.6 to 28 micrometres, but it has always been primarily an infrared telescope, so the loss of the optical range doesn't concern Mountain. "Beyond 1.7 micrometres, JWST is supreme," he says. "My view is you don't need the optical."

Not everyone agrees. "We have certainly not run out of intriguing problems to be addressed in the optical range," says former Hubble project scientist Robert O'Dell of Vanderbilt University in Nashville, Tennessee. "The loss of the optical band on the JWST will mean that there won't be a telescope that will do what we can right now. This loss will be serious."

W. M. KECK

Others warn of a potential observing 'gap' for certain observations, particularly if Hubble expires before JWST is operational. Astronomers say that further observations of type Ia supernovae, which they used to confirm that the Universe's expansion is accelerating, are needed to pinpoint exactly when acceleration began, and also to provide insights into the nature of dark energy, the force thought to be behind the acceleration. Losing the visible spectrum from 0.6 to 0.8 micrometres would not be a tragedy, says the institute's Adam Riess, whose team first announced the supernova result in 1998, but losing infrared from 0.8 to 1.2 would hurt without Hubble and "would leave us without any observatory to fill this niche". Mountain points out that JWST will have capabilities down to 0.6 micrometres, but without a second polish the performance will be degraded. He says astronomers will have to take what they can get at the shorter wavelengths.

While the JWST debate promises to dog Mountain's first year at the institute, he must also contend with a political tug of war over the ageing Hubble. Mountain says he understands Griffin's reluctance to commit to a servicing mission until there have been two safe shuttle flights. "It's the administrator's call," he says. "Both the current and previous NASA administrators have stressed that the decision is not a financial one but rather one of safety."

Griffin himself confirms that neither money nor safety is the primary concern. "The shuttle now operates under new constraints involving inspection requirements, use of spacewalk time and other factors which may limit its utility as a repair platform for Hubble," he explains. "It is too soon to be optimistic. If we fly the next mission in the spring of 2006, as we hope to do, and if all goes well, then we could be prepared to execute a Hubble mission in late 2007."

Although the current servicing mission is a big headache for the institute, JWST could be the source of many more, even once it is launched. Unlike Hubble, JWST will be stationed some 1.5 million kilometres from Earth, too far for rescue missions. This means the finished telescope must have no imperfections, nor parts that wear out fast. Mountain knows that the institute cannot rest on its laurels. "This is a very successful institution with a very motivated staff, and I think they feel that their past record justifies their continued existence," he says. "That's an understandable motivation, but it's not sufficient. We're going to have to earn our future." ■

Jeff Kanipe is a freelance writer based in Maryland.

©2005 Nature Publishing Group