# Space Telescope ready at last

The long delay in launching the Hubble Space Telescope, caused by the Challenger disaster, has given the Space Telescope Science Institute time to develop strategy, and to win the respect of the community.

***Baltimore***

WHEN the Hubble Space Telescope (HST) is finally launched, maybe in December, the most sophisticated automatic telescope yet built will be in a 90-minute orbit 300 miles above the Earth, but its users will be left firmly on the ground. The Space Telescope Science Institute (STScI) here will be the nearest they can get to it, which may be regarded as a way of carrying to its extreme the growing belief among those who operate major telescopes that the presence of live astronomers is often an inconvenience, sometimes even a hazard.

As at observatories everywhere, users will submit proposals which will be assessed for scientific merit and their particular suitability for the instrument they intend to use. Successful proposals will be worked up in detail, with the help of staff astronomers at the STScI, and interleaved with all the other successful proposals to make the most efficient use of available observing time and instrumentation.

But HST has to fulfil expectations beyond the relatively straightforward hopes of scientists: it (or more particularly the people who operate it) must prove that the money and anxiety spent on it, especially during the enforced hiatus caused by the Challenger disaster, have not been in vain. The US Congress, and US taxpayers generally, will be looking eagerly over the users' shoulders for surprises and novelties. Some astronomers may regard this element of showmanship as an intrusion; fortunately, the director of STScI, Riccardo Giacconi, is not one of them. But what spectacles to provide?

The charter of STScI contains the useful provision that its purpose is to "conduct" an observing programme on the Space Telescope. This gives the director the freedom to act either as the passive arbitrator of proposals or as the dictator of what observations should be made. The more pharaonic extreme will be valuable in the early days.

Even if the Space Telescope is launched as intended during December this year (and difficulties with the imminent launch of Discovery cast some doubt on this), it will not be ready to spring instantly to life. The first six months have been allocated to commissioning the telescope and its various instruments. This period can be stretched by one more month, but after that STScI intends to gain control of the Space Telescope because, as one astronomer said, the engineers would carry on commissioning the instrument for the whole of its fifteen-year lifetime, given the chance.

During commissioning, trial observations will be made with the telescope's six instruments (two cameras, two spectrographs, a photometer and a fine-guidance system for astrometry). Some data and images will therefore be coming down to Earth before observations officially begin. Will these do for Congress?

STScI is working under a written obligation from NASA that any such 'first light' images used for promotional or other purposes must specifically not have any scientific interest. The supposed danger is that if, for example, *Nature* were to publish on its cover sometime next January an unprecedentedly fine picture of a nearby globular cluster, in which the central stars could be made out individually instead of blurring together, then eager astronomers around the world would get out their plastic rulers and start counting stars, uncovering long-held secrets about the internal dynamics of dense stellar systems and depriving whichever group of astronomers had the first proposal to do the same thing of their chance for glory. STScI is thus faced with the task of producing first images which are both spectacular and uninteresting, a riddle not yet solved.

Once the observing programme begins in earnest, scheduling tactics will be more conventional, but some special difficulties remain. For the Space Telescope, the cycle of day and night is replaced by the 90-minute orbital period, and although an object near the North or South pole can be observed continuously, those parts of the sky are generally empty of interesting objects: the galactic plane is close to the plane of the Solar System and the Earth's Equator, which means that most observing will have to be done in the 45-minute portions of time when the Earth is not in the way. On top of that, the Space Telescope must not be allowed to point at the Moon or the Sun, which would be fatal to some of the instrumentation.

The speed of the orbit combined with the telescope's lack of speed in slewing across the sky (its direction can be changed only a little faster than the minute hand moves on a clock) combine to make efficient scheduling difficult. During the launch delay, STScI has developed scheduling algorithms to maximize the time that observations are being made.

Switching from one instrument to another is a headache, involving as it does choosing between six detectors, selecting one of about fifty filters, changing filters and detectors during an observing run, and perhaps running two instruments simultaneously. STScI will be pleased to be making observations one-third of the time.

Deciding what observations to make is the final part of STScI's strategic puzzle. Ultimately, one of the Space Telescope's greatest virtues may lie in its ability to perform long-term projects, such as dissecting and cataloguing distant clusters of galaxies or searching for infrared emission from nearby subdwarf stars.

The deadline for the first round of proposals passed last October, and almost 600 proposals from 1,500 astronomers in 30 countries have been received. About 15 per cent of the observing time is guaranteed to investigators from the European Space Agency, which has provided the Faint Object Camera and the solar panels for HST, but the 15 per cent target is intended only as a long-term average, and there will be no lawsuits if the proportion during the first year or so is a little amiss.

Observing time is oversubscribed by about seven to one for this first period, which has allowed Giacconi and his staff to exercise their discretionary powers to slant observations in chosen directions without sacrificing quality. Many of the programmes that STScI favours are of cosmological importance: finding Cepheid variable stars at the distance of the Virgo cluster of galaxies, for example, would bypass several rungs of the cosmological distance ladder and could at a stroke reduce our ignorance of the Hubble constant and the age of the Universe.

Giacconi has understood from the outset that the ability of STScI to impose, to some extent, its designs on the rest of the astronomical community depends on the standing of his institute. STScI scientists win about 20 per cent of the observing time at Kitt Peak National Observatory.

It is a trite comment now that the years of delay to HST's launch have been beneficial, allowing the instruments to be improved, a satisfactory number of guide stars to be catalogued, and scheduling problems to be overcome. But more important is that the delay has allowed STScI to become an astronomical institution of the first rank whereas, had HST been launched on time, it might have been merely a service station. **David Lindley**