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Comments for the HST-JWST Transition Plan Review Panel July 31, 2003

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I appreciate this opportunity to weigh in on the future of the Hubble Space Telescope, a matter of great importance to everyone with an interest in astronomy. Most of the comments that the HST-JWST Transition Plan Review Panel will receive, and those that rightly will be given the most weight, will come from the scientific research community. But as the charter from NASA's Office of Space Science states, "the panel should solicit input from...other experts" too. Although I have a Ph.D. in astrophysics and have worked on several research projects in ground- and space-based astronomy, I have spent most of my career (nearly 17 years now) at *Sky & Telescope*, the world's leading magazine of popular astronomy, so I properly fall in the category of "other experts."

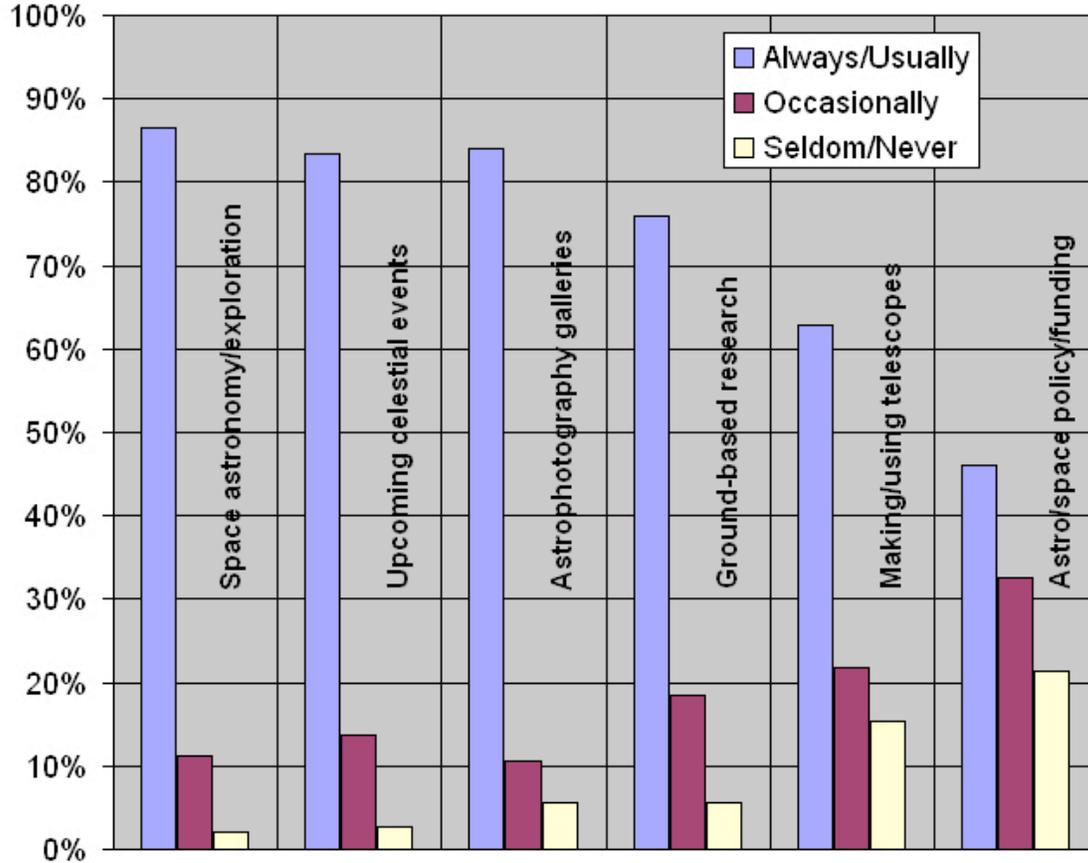
In their "Dear Colleague" letter on behalf of AURA informing the astronomical community of today's public meeting, Garth Illingworth and Mike Shull wrote, "HST is widely recognized as an extraordinary scientific, educational, and inspirational national asset." Most of the other astronomers the panel will hear from today will testify to the scientific case for keeping HST operational beyond 2010. I will mainly address the educational and inspirational aspects, though I won't be able to resist making some comments about the science too.

First, a note about the constituencies I represent here today. *Sky & Telescope* has a paid monthly circulation of 120,000; the magazine is mailed to 135 countries, though 75% of subscribers and newsstand buyers live in the United States. Most of *S&T*'s readers are active amateur astronomers who own one or more telescopes and observe the night sky as often as time and weather permit. The magazine also goes to many science teachers, planetarium specialists, and science journalists. *S&T* readers are arguably more interested in, and more supportive of, astronomy than any other segment of the public.

In late 2002 we conducted a survey of US subscribers. Among other things, we asked how often they read articles on various topics that we routinely cover in the magazine. The graph at the top of the next page shows the responses for the three topics that proved

most popular, as well as for two moderately popular ones and one that our readers rated as relatively unpopular.

Sky & Telescope Topic Readership



Note that the most widely read articles in *Sky & Telescope* are those dealing with space astronomy and planetary exploration. Such articles garner more readership than previews of upcoming celestial events for backyard observers, *Sky & Telescope's* “bread and butter.” We did not ask specifically about our readers’ interest in the Hubble Space Telescope, but like many magazines and newspapers that have been reviewed by the HST project, more of *Sky & Telescope's* space-astronomy articles deal with images and science from HST than from any other single mission. This results in part from our editorial judgment (bolstered by reader feedback) that Hubble’s beautiful pictures and astronomical discoveries are more compelling and easy to understand than results from missions that record the sky at invisible wavelengths or gather only spectra, not images.

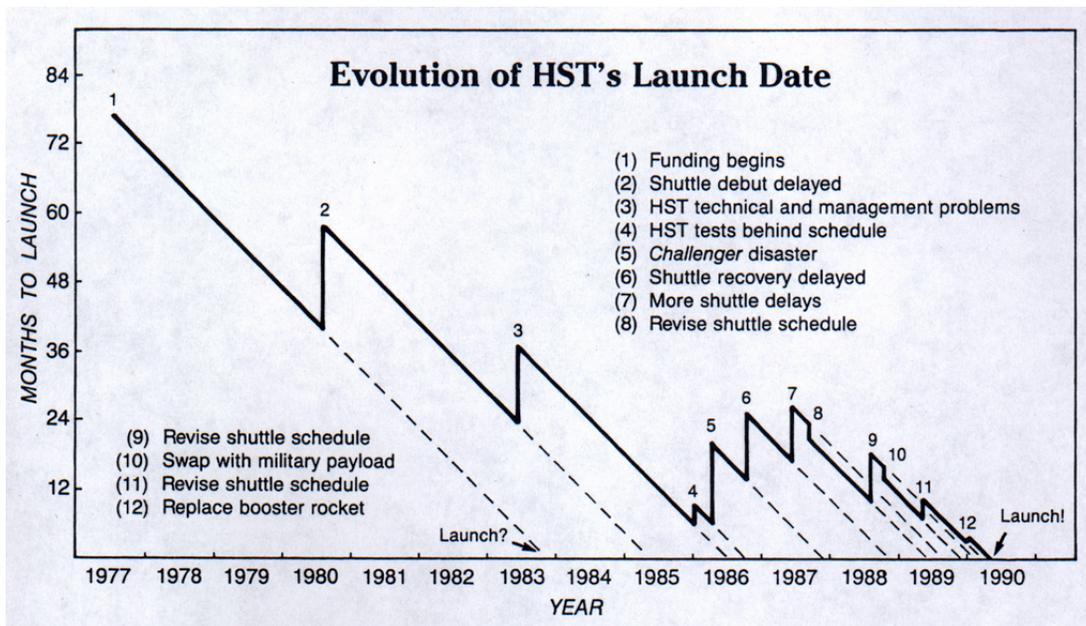
As the subscriber survey also shows, our readers are not particularly interested in the policy and funding aspects of space astronomy — they want to see the results of the missions, not to dwell on political and management issues.

All this bears on the question of how our readers might react to the shutdown of the

Hubble Space Telescope before its successor, the James Webb Space Telescope, is in orbit or at least on the launch pad. NASA has published clear explanations of why it makes sense to curtail the HST mission before 2010 in order to keep the JWST mission on track for launch in 2011, but even if I repeat those arguments in *S&T*, a significant fraction of our subscribers won't bother to read them. And those who do are unlikely to accept NASA's reasoning. Why not? Because we've learned from bitter experience.

In 1995 NASA decided to stop flying the Kuiper Airborne Observatory so that the money saved by discontinuing operations could be applied to the development of the KAO's larger, more capable successor, the Stratospheric Observatory for Infrared Astronomy (SOFIA), then scheduled to begin flying in the year 2000. Here we are in mid-2003, and SOFIA's first science flight is still more than a year away thanks to myriad technological and budgetary problems. By the time SOFIA begins routine operations, far-infrared astronomy, which is virtually impossible to do from the ground, will have gone nearly a decade without the benefit of an airborne observatory, more than twice as long as promised at the time the fully-functional KAO was grounded.

In 1990, just before the launch of HST, we published the following diagram in *Sky & Telescope*. It shows that HST's road to space was longer and rockier than anyone could have imagined when NASA began funding the observatory in the late 1970s. Similar and



no less dramatic graphs could be plotted for the Chandra X-ray Observatory and the Space Infrared Telescope Facility, both of which were covered throughout their development in *S&T*. The lesson here is that cutting-edge space telescopes, especially ones that involve technology development, take significantly longer to get off the ground than even the best good-faith estimates would have us believe. This will no doubt be true of the JWST, and you can be sure that few of *Sky & Telescope's* readers will put any faith in NASA's claim that HST's successor will be in orbit by 2011.

This is all the more true in light of the ongoing International Space Station saga. In 1983,

when President Reagan announced that he was directing NASA to develop a manned space station, he said it would cost \$8 billion and be in orbit within a decade. In reality it took nearly twice that long at a cost about an order of magnitude higher. This week the news media reported a significant ISS milestone: 1,000 days of continuous occupation by astronauts and cosmonauts. But that was the entire story; nobody said a word about the important scientific discoveries made onboard during that time — because there haven't been any. This despite continued assurances that the ISS will revolutionize manufacturing processes and produce a cure for cancer, all while promoting world peace.

Most of *S&T's* readers, and the public at large, live and work outside the Beltway and don't know or care about the details of how government agencies operate. They see one NASA, not a collection of divisions and offices and codes all vying for dollars or arguing over who should pay for what. To these folks, the NASA of the Hubble Space Telescope is the same as the NASA of the ISS, the Space Shuttle, the various planetary missions, and so much else. In countless conversations with readers and fellow science journalists, I've heard the following sentiments repeated over and over: If NASA wants to do science, why not shoot the ISS white elephant between the eyes and use the money to launch more space telescopes, robotic probes to the planets, and human flights to the Moon and Mars? If the ISS is really about keeping the US aerospace industry and our international partners happy, surely ambitious space-science programs could do so just as well, if not better. And if the ISS *is* about international cooperation, let the State Department foot the bill so that NASA can spend its money on science and exploration.

The constituencies I represent are space buffs, not NASA bashers. The average *S&T* reader is 51 years old, so he grew up during the heyday of the US space program and was, in large part, motivated to pursue astronomy by the excitement of the Apollo Moon landings and the first wave of robotic missions to the planets. But we're becoming increasingly disillusioned as we realize that it's been 30 years since men walked on the Moon and NASA is talking about shutting down the most successful space mission in a generation while it's not just in its prime, but still getting better and better.

Believe me, we do *not* need HST to fill the pages of *Sky & Telescope* and other science-related publications. There is plenty else going on in astronomy. Ironically, though, just as we're discussing the fate of the endlessly refurbishable Hubble Space Telescope, some of the most exciting astronomical news is coming from old ground-based observatories upgraded with new instruments. I was just in Australia for the general assembly of the International Astronomical Union, and while there I visited the 3.9-meter Anglo-Australian Telescope. It was built nearly 30 years ago but still works as well as ever, and its newest instrument, the spectrograph for the 2dF (2-degree field) Galaxy Redshift Survey, just completed the most extensive map ever made of large-scale structure in the universe. And I've just learned that the Oschin Schmidt telescope on Palomar Mountain, built 55 years ago, before anybody heard of quasars, has just been outfitted with the world's largest CCD camera to do a survey of quasars and other faint, distant celestial objects. Rather than shutting down productive telescopes, astronomers have become adept at keeping them at the forefront of discovery with the addition of new instruments at modest cost — just as we've been doing with HST for the past 13 years.

HST is not just about science, so the decision about how long to keep it in operation should not be based just on science. After all, the public, not scientists, paid for it, and education, outreach, and motivation of the next generation of scientists and engineers are legitimate parts of NASA's publicly funded mission. In a 1999 study of the public impact of HST, astronomers Carol Christian and Anne Kinney wrote, "HST appears to hold a particular fascination for much of the public audience and also contributes to the general public understanding of science in both formal and informal educational areas.... Hubble appears to be a popular symbol of quality, integrity and the human drive for discovery." What are we saying if we simply turn it off?

I'd like to end with what I hope will be a constructive suggestion. You've solicited feedback from the astronomical research community. Why not solicit feedback from amateur astronomers, science teachers, and the science-interested public too? This could be done easily on the Web or via magazines or other media to which these crucial Hubble constituencies (and, more importantly, taxpayers) give their attention. It might also make sense to encourage the public to write to their representatives in Congress to express their opinions as to whether HST should be funded until the JWST is ready to fly. I certainly plan to encourage *Sky & Telescope's* readers to do exactly that, and I'm sure many will respond accordingly.

Thank you, on behalf of the astronomical community not engaged professionally in scientific research, for your consideration of these remarks.

Rick Fienberg