



Michael S. Turner is the director and Rauner Distinguished Service Professor at the Kavli Institute for Cosmological Physics, University of Chicago, Chicago, IL, and is a member of *Science's* Senior Editorial Board. E-mail: mturner@uchicago.edu.

Much More Than a Telescope

IMAGINE THAT THE HUBBLE SPACE TELESCOPE NEVER EXISTED—THAT IT FELL VICTIM TO BUDGET overruns, schedule slips, and the tragedy of the Challenger disaster, and was ultimately canceled. Breakthroughs in our understanding of the universe would not have occurred, countless young people around the world would not have been inspired, and U.S. leadership in science and space would be far less. The United States is at a similar crossroads today. Last month, an appropriations committee in the House of Representatives voted to terminate Hubble's successor, the James Webb Space Telescope, as part of the 2012 budget for the National Aeronautics and Space Administration (NASA). The Senate has yet to be heard from, but the numbers in the Budget Control Act of 2011 that passed earlier this month suggest that the Senate could make the funds available to restore funding for the Webb, to the benefit of astronomy and the nation.

The James Webb Space Telescope is a worthy successor to Hubble. It will have 100 times Hubble's sensitivity and operate a million miles from Earth, allowing us to see what we can only imagine right now: the first stars and galaxies that formed a few hundred million years after the Big Bang, the assembly of galaxies from gas and dark matter, and evidence of life on distant exoplanets. Like Hubble, the Webb Telescope will rewrite the textbooks, inspire the next generation of scientists and the public worldwide, and be a source of national pride. For these reasons, the U.S. National Academy of Sciences' Astronomy and Astrophysics Decadal Survey made this project its top priority in 2000, and the 2010 survey made it a cornerstone for the current decade.

Last year, because of growing concerns about the Webb Telescope project, Senator Barbara Mikulski (D-MD) called for a review. In October, the Independent Comprehensive Review Panel reported that the project would cost at least \$1.6 billion more (assuming launch in 2015) than the NASA estimate and that there were serious management problems. On the bright side, the panel found that money had not been wasted and that technical progress had been excellent. So far, about \$3.5 billion dollars have been spent (about half the total cost), 75% of the parts are in fabrication or have been completed, and NASA has responded positively to criticism in the panel's report by formulating a new plan for launch in 2018. To put things in perspective, the cost of Hubble in comparable dollars was about \$13 billion (not including five servicing missions).

From most of NASA's science missions, we only hear exciting results, as it should be. However, the real game-changers such as Hubble and the Webb Telescope have been different. In both cases, their unplanned budget growth has not only cost the taxpayer but has also squeezed out other important space science (including astrophysics). NASA must continue to think big, but to avoid a repetition of this budgetary calamity in the future, it needs to recognize that these large, complex missions require special management; early investment in technology; sufficient project reserves to cover the unexpected; and most of all, honesty with themselves and Congress about the cost and schedule.

Following in the footsteps of the Hubble, the Webb Telescope will awe us with its discoveries about our place in the universe. Although the United States has key international partners (Canada and the European Space Agency are contributing close to a billion dollars in total to the Webb Telescope), and the capabilities of other nations in space are on the rise, at present only the United States can carry out an undertaking this ambitious. The Webb Telescope is more than an instrument of scientific discovery—it is a powerful symbol of U.S. leadership in science and space. Terminating it now would save a few billion dollars, but would be both wasteful and short-sighted. By restoring funding for the Webb in this difficult budgetary time, Congress can let the world know that the United States still has the vision and audacity to do things that inspire both the nation and the world.

— Michael S. Turner

