To: Hashima Hasan, JWST Program Scientist

From: John Mather* for the JWST Science Working Group

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Re: James Webb Space Telescope status

* Chair, James Webb Space Telescope Science Working Group (JWST SWG)

The House Appropriations Subcommittee for Commerce, Justice, and Science (CJS) has just released a draft bill that would cut NASA's budget by $1.9B below the President's 2012 request. NASA's science programs would be cut by $431M below last year's level, and the James Webb Space Telescope (JWST) would be terminated. The JWST Science Working Group is deeply disturbed by this turn of events. We summarize here some specific points for the NASA Astrophysics Subcommittee to consider.

JWST OPENS NEW FRONTIERS IN ASTROPHYSICS

There is no mission planned by NASA or any other agency that can achieve the science goals of JWST. These goals are transformative and will open a new era in astrophysics.

- JWST will see the first stars and galaxies, and show how they influenced the early Universe.
- JWST will study the assembly and evolution of galaxies.
- JWST will find liquid water on planets around other stars.
- JWST will reveal the births of stars and planetary systems.

Astronomers interested in answering the question, "What can JWST do for me?", are encouraged to quantify the telescopes scientific impact through the recently released JWST Exposure Time Calculators, which include support for all four science instruments and are available at jwstetc.stsci.edu/etc.

Support for JWST represents support for the Astronomy and Astrophysics Decadal Survey process. JWST was the top ranked program in the prior 2000 Decadal Survey, and is identified numerous times in the 2010 Decadal Survey as a foundational program for future astrophysics research.

JWST ENSURES LEADERSHIP IN SPACE SCIENCE

JWST is recognized as the successor to the Hubble Space Telescope and will ensure US leadership in space astronomy for the next decade. The telescope is the cornerstone of future

space astronomy and is the foundation upon which the 2010 Astronomy Decadal Survey, "*New Worlds, New Horizons in Astronomy and Astrophysics*", was built.

Cancellation of JWST would have a profound impact on astrophysics far into the future, threatening US leadership in space science. Cancellation would not enable funding for future major missions. In the proposed CJS budget, the funds released by the cancellation of JWST will not be reallocated to astrophysics, any other theme within the Science Mission Directorate, or NASA as a whole. They go directly to deficit reduction.

JWST WILL INSPIRE THE NEXT GENERATION OF SCIENTISTS AND ENGINEERS

The Hubble Space Telescope's impact on the public has been legendary and culturally transformative. Hubble has inspired school children around the world and rewritten classroom textbooks. The science results from Hubble inspire many STEM (Science, Technology, Engineering, and Math) programs. JWST is the "Hubble" for the next generation of young scientists and engineers. Its research accomplishments and images will be equally profound and the discoveries will be just as unimaginable. JWST will explore the Universe beyond what Hubble could see.

JWST PUSHES THE BOUNDARIES OF TECHNOLOGY

JWST has been a technical success despite being much more challenging than any of NASA's earlier Great Observatories. The Independent Comprehensive Review Panel (ICRP) recently evaluated the project upon Senator B. Mikulski's request, and confirmed both the investment to date and the excellence of the technology. For example, the ICRP states "...*the JWST project has invested wisely in advancing necessary technologies and reducing technical risk.*"

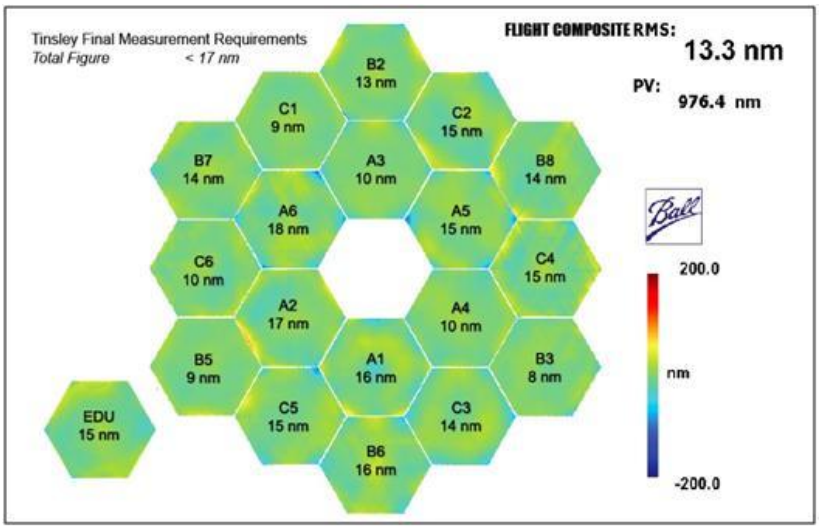
The JWST project required the development of at least 10 new technologies that have now been successfully conquered. The telescope requires the following simultaneous technologies:

- Spacecraft deployment and operation at cryogenic temperatures,
- Thermal control requiring a deployable tennis court-sized sunshade, and
- 6.5 m deployable mirror.

The combination of new technologies developed by JWST is something that only NASA, in collaboration with its ESA and CSA partners, can do. Together, these technologies enable a facility with unique new capabilities that sets us aside from competition anywhere else in the world. JWST will open the next frontier in the universe.

In June 2011, JWST achieved a major milestone. The 18 segments of the 6.5-meter diameter primary mirror, the most critical element of the observatory and the largest mirror ever built for space, completed final polishing and demonstrate superb performance, with all RMS surface errors meeting specification.

Overall, 75% (by mass) of the observatory hardware is in fabrication. As we move forward, of course there will be technical issues that arise – this is expected when building a completely new observatory that pushes the envelope in many technologies. Recent issues, such as NIR detector problems, are being discussed forthrightly and solutions are at hand.



JWST HAS ADDRESSED MANAGEMENT ISSUES

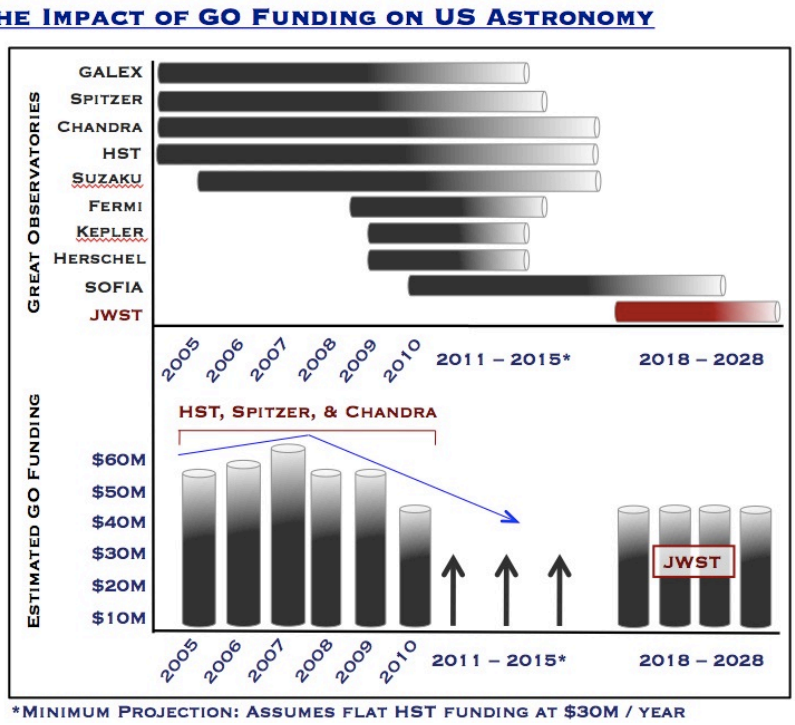
The ICRP recommended a viable path for NASA to correct the identified project management deficiencies. NASA has acted to correct the deficiencies, restructuring both within NASA Headquarters and at the Goddard Space Flight Center. Milestones are tracked and reported to stakeholders on a monthly basis. Since the management changes, the project has been on or ahead of schedule for every milestone; for example, the mirror polishing was completed 3 months ahead of schedule.

NASA has undergone an extensive replan of the Project. The SWG has been briefed on many of the details of this replan and supports the scientific and engineering path forward; the cost and schedule details are embargoed until the President's Budget Request is submitted in February 2012. Regular achievement of milestones has given the SWG confidence that NASA's replan represents a solid working plan.

JWST REPRESENTS THE FUTURE SPACE ASTRONOMY FUNDING LINE

General Observer funding through NASA's Great Observatories currently represents 35-40% of all NASA astronomy research grant funding. This funding ensures that the investment in flight hardware is matched by realization of scientific results. It is also essential to astronomical research, to technology development, and to developing the future PhD-level technical workforce. It:

- Permits education of hundreds of US PhD students in research & instrumentation,
- Provides avenues for postdoctoral researchers to lead high impact projects,
- Fosters cross-institution collaborative research projects and new initiatives,
- Leads to >1500 scientific research papers per year,
- Provides 1000 new awards to US astronomers and professors per year, and
- Has provided access to > 5000 observers and >10,000 archival researchers worldwide.



Although it is unknown how long individual missions will be able to operate, it has been expected that the legacy from the Great Observatories would pass to JWST. Cancellation of JWST would end 35-40% of astronomical funding by NASA, ending the support and training of thousands of students and postdocs.

JWST PROVIDES INTANGIBLE BENEFITS

JWST represents the strength and visibility world-wide of the overall US science program, not just astrophysics. Cancellation of JWST would reduce US credibility as an international partner, given the CSA and ESA partnerships on JWST and their substantial contributions to the program. Termination of JWST nearly simultaneously with the end of the space shuttle program would send the message that the US is relinquishing leadership in space science, if not major science projects in general.

JWST SWG SUMMARY FOR THE ASTROPHYSICS SUBCOMMITTEE

The JWST Science Working Group urges the Subcommittee to consider the above factors as it considers JWST in the context of tools available for astronomy and astrophysics (ground and space) in the coming decades. By its very nature, the process for moving JWST forward will continue for some time. The proposed budget by the House CJS committee is only the first step in a complex process. A statement in support of JWST would be useful at this time.

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