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March 24, 2015

Statement of

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before the
House Subcommittee on Space
Committee on Science, Space and Technology
United States House of Representatives

Chairman Palazzo, Ranking Member Edwards, and other Members of the Subcommittee, I am delighted to appear before you to discuss the status of the James Webb Space Telescope Program, a project that would not have been possible without the consistent support demonstrated by Congress.

Science at NASA seeks to answer fundamental questions about our Universe and our place in it. How did the cosmos evolve from its first moments into the stars and galaxies we now see? What is the nature of the worlds orbiting other stars, and are there any that look like Earth? To study the first stars and galaxies in the Universe and peer into the dust-shrouded environments where planets are born, we are building the James Webb Space Telescope (Webb). Webb will extend our view of the Universe, building on the great discoveries made by the Hubble Space Telescope and other observatories, with truly transformational exploration capabilities.

This next great space observatory, and indeed the world's most powerful planned space telescope, remains within budget and on track to meet its October 2018 launch readiness date. Just as important to the success of the program, NASA will meet the science community's ambitious goals with Webb.

This infrared-optimized observatory, built to see the faint infrared signals from the earliest stars and galaxies features a 21.5-foot diameter primary mirror, the largest space telescope ever constructed. Kept cool via a five-layer, tennis-court-sized sunshield, JWST will use its advanced technology to view the first stars and galaxies in the Universe, study distant galaxies, probe nearby clouds of dust hiding forming stars and planetary systems, measure the composition of the atmospheres of planets around other stars, and let us study our own outer planets in ways never before possible.

I will defer the detailed discussion of Webb science to my colleague Dr. Mather, but want to take this opportunity to tell you about the great progress we are making on the mission.

This year is an important year for Webb development. We like to call 2015 the 'year of telescope assembly,' for it is later this year that the 18 mirror segments that comprise the 21.5-foot diameter mirror will be installed on the composite backplane structure, which is undergoing its final assembly and tests as we speak. Also this year, we will conduct the final test of the science instrument package confirming that these cameras and spectrographs from our U.S. and international partners meet their stringent requirements. Importantly, 2015 is the last year in which the Webb program has significant manufacturing activities. After 2015, almost all of the activities on the program will involve integration and test of major hardware elements and the testing of those integrated components.

Because of the importance and visibility of this mission, NASA briefs this committee's staff on a quarterly basis about progress, issues and concerns with the program. I'm happy to take this opportunity to update the committee members about Webb.

Program Cost and Schedule

Since replanning the program nearly 4 years ago, Webb has remained within its yearly budgets. Critical to the replan is that the budget included adequate funding reserves in each year, enabling the project to address design, manufacturing, or integration issues as they arise without deferring significant work. The project has done an excellent job of managing its budget reserves, and this ability to efficiently address problems as they come up has enabled Webb to remain on schedule for its 2018 launch. The Fiscal Year (FY) 2016 budget request needed to fund Webb is the same amount defined in the profile that came out of the 2011 rebaseline activity, another indicator that the plan is sound.

In 2011, we laid out a plan for Webb that contained funded schedule reserve as well as budget reserves. Traditionally, NASA science missions allot 1 month of funded schedule reserve per year for missions in development, and 2 months per year for missions in their integration phase. Webb is a complex observatory operating at cryogenic temperatures, the first of its kind. As a result we included additional schedule reserve at the time of the replan, totaling 13 months of funded schedule reserve. This reserve was distributed throughout the span of the project to allow for resolution of issues throughout the assembly, integration, and test phases. For example, sophisticated cryogenic vacuum tests are conducted at component levels and in sub-assemblies, before integration and test of the more complex flight articles. This approach allows the project team to build up experience with the hardware and procedures over the whole development cycle to ensure the flight integration and test activities proceed according to schedule as much as possible.

In nearly 4 years, funded schedule reserve has been reduced from the replan total by only 3 months; so that as of today, we have 10 months of funded schedule reserve. This is a good position to be in as we approach our major integration activities. In fact, we have more schedule reserve today than we had planned to have at this stage and more than is customary for NASA missions at this stage.

Hardware Status

There are four main hardware elements of the James Webb Space Telescope: the integrated science instrument module or ISIM, the optical telescope element, the sunshield, and the spacecraft bus. This year we will complete all the planned microshutter array work and infrared detector replacement in the ISIM, which holds the science cameras and spectrographs, and run it through its final test late in the calendar year. The optical telescope element will come together with the addition of the 18 mirror segments to their support structure. The five tennis-court-sized sunshield membranes will be manufactured (one is complete and three more are in process), and work will continue on the acquisition and integration of subsystems like communications, power, and data handling into the spacecraft bus.

In addition to this work developing the flight hardware, we are exercising the operations aspects of the mission through the involvement of the Space Telescope Science Institute (STScI), where software is being written to run tests over the next few years that will mature into the software that runs the observatory once it is operational. This philosophy of having the operational entity being intimately involved in the creation and development of the hardware facilitates a seamless transition of testing on orbit to a functioning science mission.

Program Technical Concerns

There are several technical areas that currently have the greatest attention from program and project management. These include reintegration of the science instruments back into the ISIM for final testing later this year, completion of testing for components within the spacecraft bus that hold the telescope during launch, and delivery of the final portion of a cooling system that is required by one of the science instruments. I would like to briefly summarize where we are in each of these areas.

After two highly successful tests of the science instrument module in 2013 and 2014, NASA performed its planned fixes to three of the science instrument detector systems in December 2014. The process of updating hardware and subsequent testing of the new hardware revealed some additional technical issues that are being fixed prior to re-installation of the science instruments. Solutions have been developed and adequate funding exists to cover those costs.

This spring, NASA will be conducting its final testing on actuators that fasten the telescope and spacecraft bus together for the rigors of launch. Once in space, these

actuators release the telescope so that it is free to extend away from the spacecraft and deploy for operations.

One of the Webb science instruments is sensitive to longer infrared wavelengths than the other three and therefore requires a special refrigeration unit, or cryocooler, to cool its detectors to roughly minus 449 degrees Fahrenheit (or 6 Kelvin). This crycocooler, the first and only one of its kind, is required by the science requirement to observe in the infrared. The design and development of this cryocooler has proven to be quite challenging. Today, two thirds of the cryocooler hardware has been delivered; the remaining third of the hardware is undergoing final assembly and testing with a planned delivery in 3 months.

FY 2014 GAO Report

Since the replan in 2011, NASA has worked closely with the GAO in support of their yearly studies of the Webb program. NASA submitted its formal response to the FY 2014 GAO report on February 9, 2015. In that response we made several points that I would like to reiterate for the committee. Webb is managing schedule, cost, and risk extremely well, and has demonstrated the ability to responsibly apply reserves without deferring work. Through careful management of risk, schedule and cost reserves, the Webb program has maintained the 2018 launch readiness date unchanged since the 2011 replan. As noted before, Webb cost and schedule reserves as of March 2015 are above the 2011 projected cost and schedule reserves for this stage of the project.

The Webb project will continue the approach of incremental testing throughout the remainder of the project, allowing the project to continuously evaluate performance and make course corrections as needed, rather than wait until higher levels of testing are completed. Although no project can prevent all possible delays encountered during integration and test, the practices and procedures put in place by the Webb program have, over almost 4 years, proven to be effective for this complex project.

In response to the December 2014 GAO report, NASA has completed the actions NASA said it would take in response to both recommendations made by GAO. The Webb program and project use a range of tools to assess the performance not only of Northrop Grumman Aerospace Systems (NGAS), but of all major Webb contractors. These analyses use the formalism of Earned Value Management (EVM) metric analysis, including Estimate-at-Completion tracking (which incorporates the current risk posture). NASA also conducts comprehensive schedule analysis and reviews the top program and project risks on a monthly basis. This approach is consistent with NASA best practices and we will continue to use those tools to effectively manage the Webb program.

In response to GAO recommendations, the Webb project initiated a cost-risk analysis of the NGAS 'prime contract' portion of the Webb program. The results of this analysis showed that as of July 2014 the program budget is sufficient to complete the NGAS tasks on schedule, including accommodation for anticipated risks. NASA will update this cost-risk analysis when required by NASA program management guidelines.

The GAO also recommended NASA ensures its performance evaluation plans for its award fee contracts reflect total contract performance and clearly describe the contractor performance evaluation process prior to the final evaluation. In response, NASA has modified its performance evaluation plans for the NASA-NGAS and NASA-Exelis contracts to clarify that the criteria contained in the existing performance evaluation plans applied to both the interim evaluations and to total contract performance for the final award fee determination. NASA also provided those modifications to the GAO.

Summary

Webb has been making good progress with significant accomplishments being realized on the science instruments, telescope and sunshield elements. Now, nearly 4 years into its replan, the program is within budget with adequate reserves and is currently carrying more than the planned amount of schedule reserve. We are soon to enter the exciting and challenging integration and test phase when major components are brought together for the first time and subjected to the simulated environments of launch and space. The rigorous cost, schedule and risk controls that have been employed over these 4 years give me confidence that we will meet the challenges we face for launch in 2018. The scientific promise of Webb is great. The team engaged in its development is world class in its experience and capabilities. Programs like Webb demonstrate to the world that NASA leads the way in expanding the frontiers of human inquiry and innovation. Thank you for listening. I am happy to answer any questions you have about this one-of-a-kind observatory.