National Aeronautics and Space Administration

# SRW Project Monthly Report for FA Program Office

## July 2012

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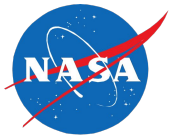
based on financial data from end of June 2012

# Overall SRW Project Status

## Project Summary




- Management
  - NRA call 5
    - Contracts negotiations under way.
      - LaRC is negotiating two contracts and GRC is negotiating one.
- Resources
  - NRA contracts are the only major procurements left to obligate.
  - In-house FTE at ARC is tracking well, GRC and LaRC are under running.
    - Dollars are being moved from labor to procurement
- Schedule
  - HECC testing schedule slipped several weeks in CE-18 due to hardware issues
  - Icing Tunnel test slipped from April 2013 to September 2013.
    - SRW management is assessing impact.
- Technical
  - KIOWA 3 Warrior Test is underway. The model was installed during the last week of July and the aerodynamic performance portion of the test is scheduled to begin on August 6th. After completing our final system checks in the lab, we plan to move our equipment and begin installation of our systems on August 7th. Shakedown runs for the Laser Velocimeter and PIV systems are scheduled to begin on August 13th.
  - Tim Krantz will serve as Conference Chair for the ASME 2013 Power Transmission and Gearing Conference in August 2013, Portland, Oregon.
  - Final interior noise predictions for the Large Civil Tiltrotor (LCTR2) due to turbulent boundary layer fluctuating surface pressures were completed. Both Cockburn/Robinson and Efimtsov power spectral density profiles were used as excitation mechanisms. Several details of the finite element (FE) and statistical energy analysis (SEA) subsystem details were corrected and/or modified. The NASA Technical Memorandum (NASA/TM) “LCTR2 Interior Noise Predictions due to Turbulent Boundary Layer Noise Excitation” is being updated.

# WHAT'S GOING WELL

## Recent Key Meetings

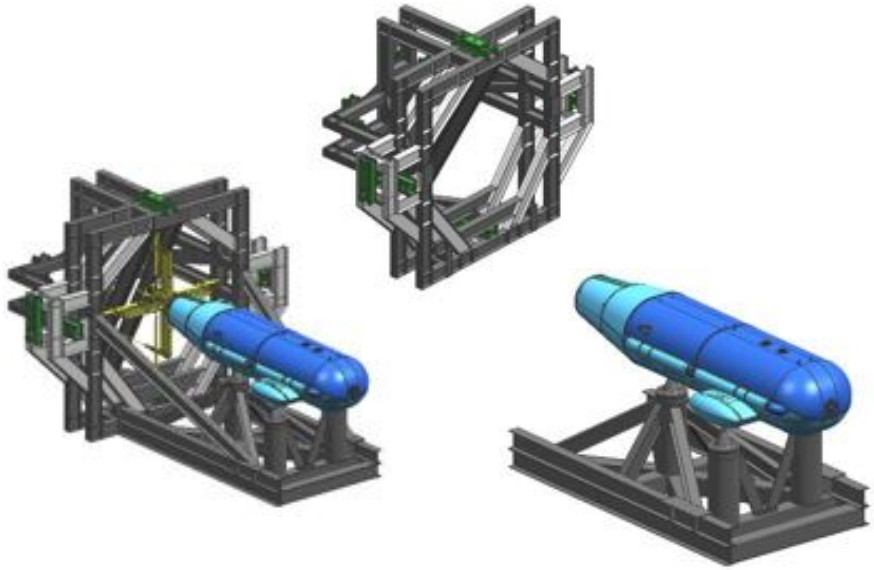
| Month | Date | Event | Significance |
|---|---|---|---|
| Jul | 11 | RW Team Planning meeting—Hampton Convention Center | Many |
| Jul | 12 | RW Planning meeting with line management– Hampton Convention Center | Many |
| Jul | 18-20 | International Crashworthiness Conference (ICRASH) Milano, Italy | Annett, invited keynote speaker, invitational travel |
| Jul | 18 | NASA Aeronautics Day on the Hill | Gorton |
| Jul | 23-25 | Industry Visits, Boeing, UTRC, Sikorsky | Gorton, Dryer |
| July | 24 | Mississippi State Visit | Prof. K. Walters visited GRC to discuss his current and past efforts in transition modeling with Glenn Researchers |
| July | 29 | Joint Propulsion Conference, Atlanta, GA | Susan Gorton led panel on "Challenges for Future Rotorcraft Propulsion". Ashlie McVetta (GRC/RTT) presented paper. Welch, López |
| July | 31, 1 Aug | Future Vertical Lift Rotorcraft Planning Meeting | Theodore, Handschuh: Government, Academia, and the rotorcraft industrial partners met to discuss the requirements for technology for the military's Future Vertical Lift - Medium (FVL-M) Sized aircraft. |

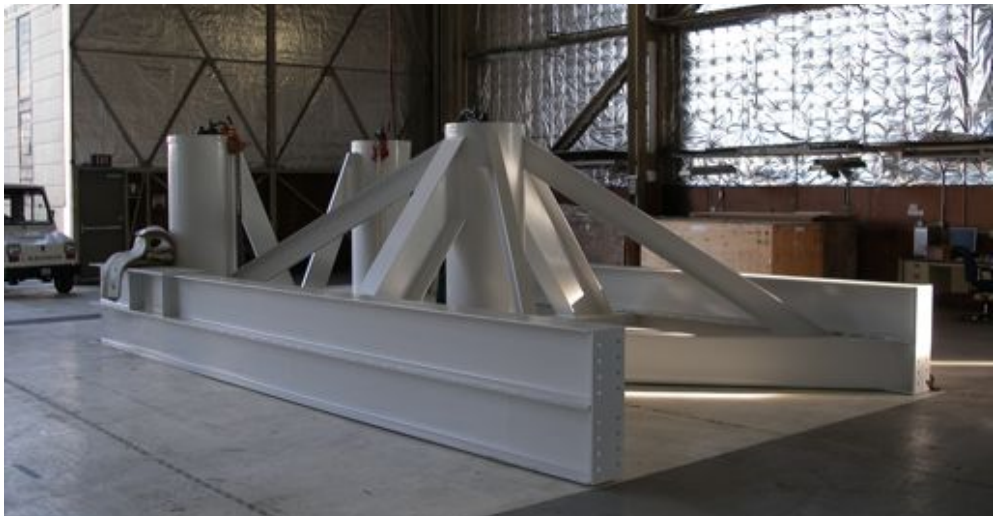
# LOOK AHEAD

| Month | Dates | Event | Attendees |
|---|---|---|---|
| Aug | 7-8 | Vertical Lift Consortium's (VLC's) Summer Review" of the proposed 2013 NRTC Projects | Gorton,Colin, other by WebEx |
| Aug | 13-16 | 2012 AIAA Modeling and Simulation Technologies Conference, Minneapolis, MN | |
| Aug | 13-17 | 23rd Thermal & Fluids Analysis Workshop (TFAWS) Westin Pasedena Hotel , Pasadena, CA - hosted by JPL | |
| Aug | 13-27 | Annual Leave - S. Gorton | |
| Aug | 14 | ARC - OMB (Brooke Owens) Review | |
| Aug | 17 | *RW Version 1 Roll-up of FY 13 Plan Due* | |
| Aug | 17-27 | Annual Leave - B. Kufeld | |
| Aug | 20 | *No SRW Telecon Today* | |
| Aug | 20-24 | AATD Joint Multi-Role (JMR) Critical Technology Design Review | I. Lopez, C. Theodore |
| Aug | 27-29 | Meeting at Bell Helicopter - Fort Worth, TX / Co-op Prjct Rev & update on drive system topics | B. Handschuh |
| Sep | 4-7 | 38th European Rotorcraft Conference - Amsterdam Marriott, Amsterdam/The Netherlands | |

# TTR Progress

1. All hardware deliveries under RA-1 are now complete.
2. The control console and all hardware have been delivered to NASA Ames.
3. All three NASA blades have been molded. Two blades are complete except for installation of the pitch horns, paint and balance. One of the two is currently in the process of being instrumented. The third blade is beginning the post bond activities. Bell anticipates all three blades will be delivered in September.
4. Triumph progress on the metric balance remains on schedule. Triumph is on-track for completion of the gaging and temperature compensation by the end of August. The Instrumentation and Calibration report will complete 3 weeks following completion of the balance.
5. The first modified mast bearing is available at Bell. A second bearing is being held for rework at Bell pending the final results of the 699-616-402 output shaft.





**TTR balance calibration rig design (top).**
**Components being delivered to Ames (bottom).**

# SRW Highlights

- LCTR2H/HETR Wind Tunnel Test in Army 7x10 Foot Tunnel
  - Data analysis from the wind tunnel test of the LCTR2H configuration is continuing
  - The US Army is conducting a follow-on test with the HETR model in the hover chamber to perform PIV tests with rotors mounted above the nacelles in the hover configuration. The figure 1 shows the test set-up in the hover chamber.
  - The figure 2 shows a close-up of a rotor mounted above the nacelle. Note that the rotors are mounted from above and are not physically connected to the nacelles. This allows the distance from the rotor hub center to the nacelle to be changed. This test set-up will allow the aerodynamic interactions between the rotors and HETR fuselage, wing, nacelles and tail to be measured using PIV in hover.

Figure 1

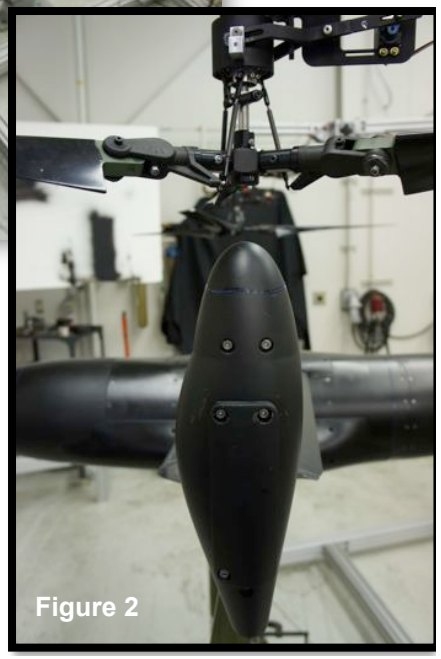
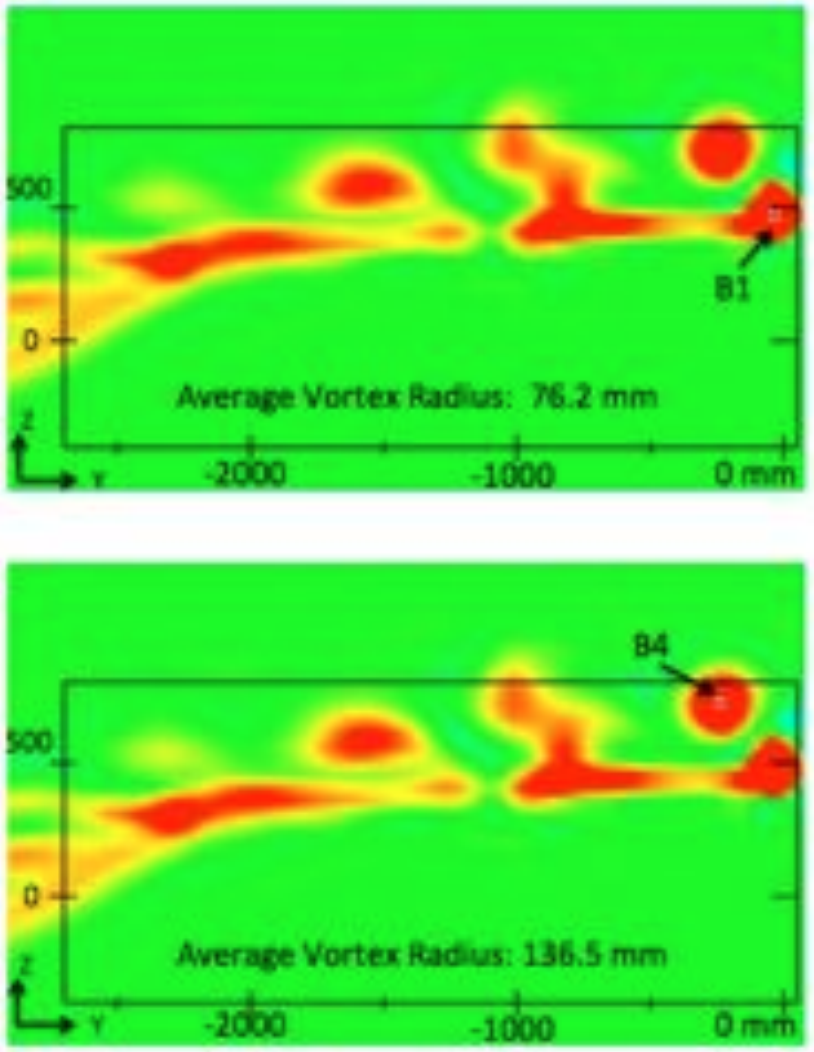


Figure 2

# SRW Highlights

- **Automated Rotorcraft Flow Field Visualization**
  - Develop automated procedure for analyzing and profiling vortex core attributes in rotorcraft wake flowfields. Develop automated procedure for on-the-fly flowfield visualization for rotorcraft applications
    - Continued with the comparison of the PIV and CFD data. One of the goals is to compare the blade tip vortex properties from the rotor blades.
    - Enhanced a software program to automatically extract vortex core properties from a user specified location.




**Vorticity contour from UH60 computational results (Ahmad) on the experimental PIV plane (Yamauchi et al). The average vortex radii for the blade 1 tip vortex and blade 4 tip vortex are 76.2 mm and 136.5 mm, respectively. The average vortex radius is computed based on the four points (the white dots) near the vortex center. The time step corresponds to blade 1 is at 5 degrees.**

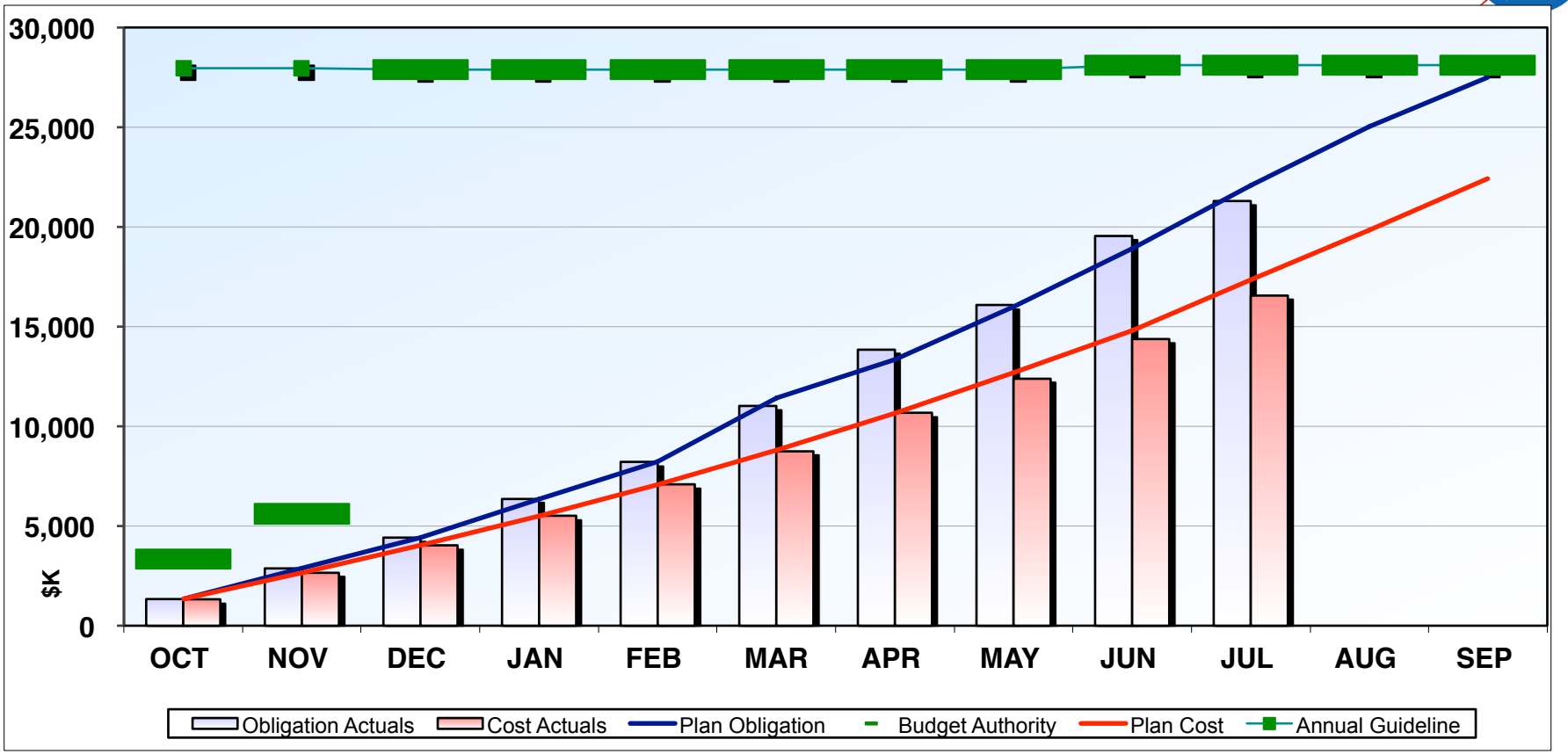
# SRW Highlights

- **Improved Transducers for Active Noise Control**
  - Ran Cabell and Noah Schiller traveled to ONERA's Centre Midi-Pyrenees, located in Toulouse, France, on July 16-20 to test a vibration control system on a roof trim panel installed in ONERA's helicopter cabin mockup. While the system had been evaluated on simple structures at Langley, this test provided the opportunity to evaluate the system in a more realistic cabin environment. The test was supported by Delphine Sebbane and Frank Simon from ONERA. Preliminary results show that the vibration control system successfully attenuated the vibration of the roof panel, however the attenuation was less than expected. Discussions were held with colleagues at ONERA regarding modifications that might improve subsequent designs. Personnel from ONERA intend to use a post-processing technique based on structural intensity to provide further insight into the test results.

**Ran Cabell (left) and Frank Simon (right) in front of ONERA's helicopter cabin mockup.**

# SRW

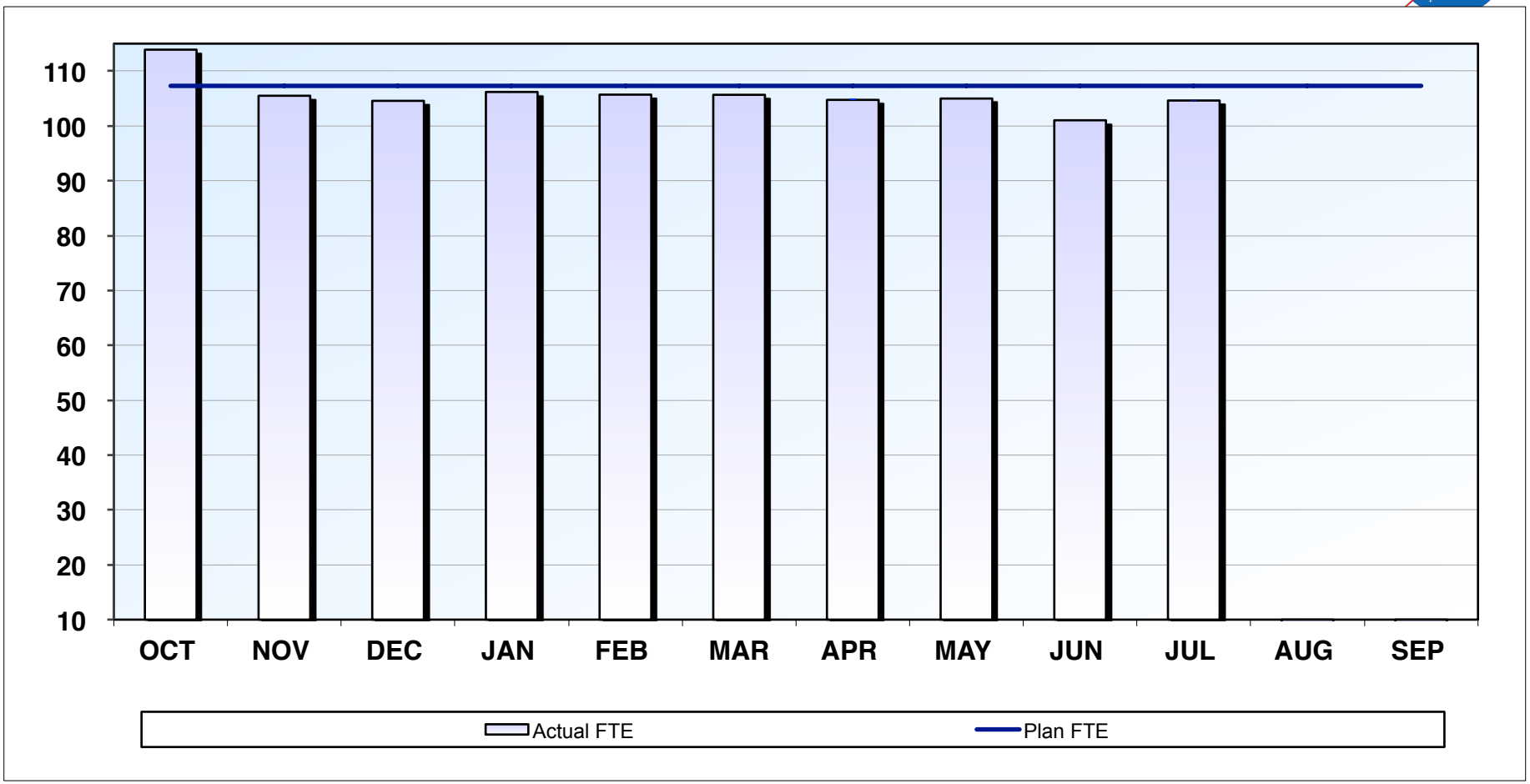
## Full Cost Summary



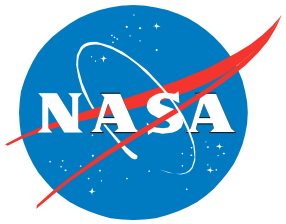

| FY2012 | Full Cost Summary | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **OBLIGATION** | CARRY IN | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | CARRY OUT |
| Plan | - | 1,334 | 2,873 | 4,417 | 6,355 | 8,215 | 11,434 | 13,358 | 15,999 | 18,930 | 22,087 | 25,032 | 27,483 | |
| BW Actual | - | 1,334 | 2,873 | 4,417 | 6,355 | 8,215 | 11,021 | 13,841 | 16,083 | 19,543 | 21,297 | - | - | 613 |
| Variance (Actual-Plan) | | - | - | - | - | - | - | (413) | 483 | 84 | 613 | (790) | (25,032) | (27,483) | |
| Percentage ((Actual-Plan)/Plan) | | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | -3.6% | 3.6% | 0.5% | 3.2% | -3.6% | -100.0% | -100.0% | |
| **COST** | CARRY IN | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | CARRY OUT |
| Plan | - | 1,325 | 2,653 | 4,031 | 5,514 | 7,090 | 8,793 | 10,640 | 12,677 | 14,810 | 17,346 | 19,834 | 22,434 | |
| BW Actual | - | 1,325 | 2,653 | 4,031 | 5,514 | 7,090 | 8,744 | 10,678 | 12,384 | 14,375 | 16,555 | - | - | 613 |
| Variance (Actual-Plan) | | - | - | - | - | - | - | (49) | 38 | (293) | (435) | (791) | (19,834) | (22,434) | |
| Percentage ((Actual-Plan)/Plan) | | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | -0.6% | 0.4% | -2.3% | -2.9% | -4.6% | -100.0% | -100.0% | #DIV/0! |
| Annual Guideline | | 27,958 | 27,958 | 27,886 | 27,886 | 27,886 | 27,894 | 27,894 | 27,894 | 28,094 | 28,094 | 28,094 | 28,094 | - |
| Budget Authority | | 3,342 | 5,617 | 27,884 | 27,884 | 27,884 | 27,894 | 27,894 | 27,894 | 28,094 | 28,094 | 28,094 | 28,094 | |

# SRW

## FTE




| FY2012 FTE | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | Cumm Ave |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plan | 107.3 | 107.3 | 107.3 | 107.3 | 107.3 | 107.3 | 107.3 | 107.3 | 107.3 | 107.3 | 107.3 | 107.3 | 107.3 |
| Actual | 113.9 | 105.5 | 104.6 | 106.2 | 105.7 | 105.7 | 104.8 | 105.0 | 101.0 | 104.6 | - | - | - |
| Variance (Actual-Plan) | 6.6 | (1.8) | (2.7) | (1.1) | (1.6) | (1.6) | (2.6) | (2.3) | (6.3) | (2.7) | (107.3) | (107.3) | |
| Percentage ((Actual-Plan)/Plan) | 6.2% | -1.7% | -2.5% | -1.0% | -1.5% | -1.5% | -2.4% | -2.2% | -5.8% | -2.5% | -100.0% | -100.0% | |


NASA