NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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NASA Ames Contributions to Return to Flight

For the past two years, NASA Ames Research Center has tapped into its core capabilities to provide research and test support for the Return to Flight effort. NASA Ames has played an integral role in ensuring astronaut safety and mission success and will continue to provide on-going technical, scientific and engineering support for the STS-114 flight and beyond.

After the loss of the Space Shuttle Columbia and crew on Feb. 1, 2003, NASA engineers and scientists turned their grief into a determined resolve to prevent a repeat of the tragic accident and to return the shuttle to safe flight.

After a lengthy inquiry, the Columbia Accident Investigation Board (CAIB) presented NASA with 15 recommendations that needed to be addressed before space shuttle flights should resume. For the past two years, NASA has tapped the wealth of knowledge and expertise within the agency in preparation to certify the space shuttle's flight worthiness, ensure astronaut safety and develop plans for in-flight contingencies ranging from minor tile damage to a major structural breach.

NASA Ames Research Center, located in California's Silicon Valley, has played a vital role in the Columbia accident investigation and in NASA's subsequent Return to Flight effort. During the investigation, NASA Ames

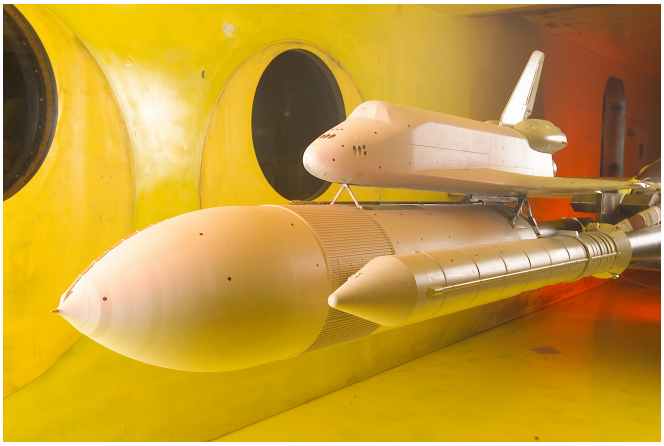
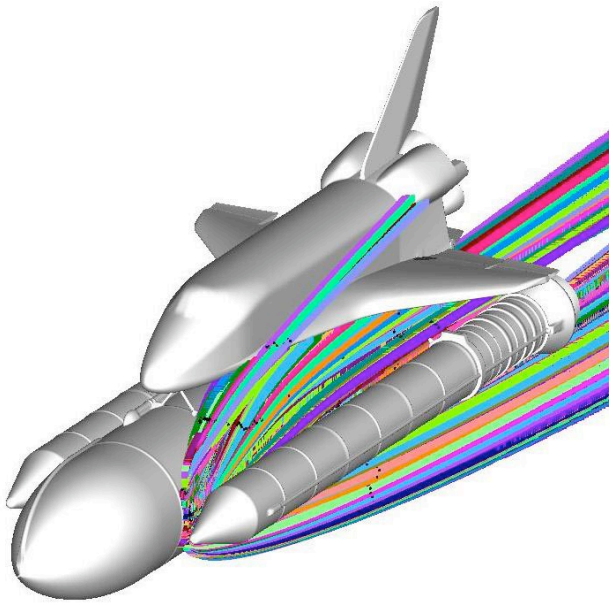


Photo of the 3 percent wind-tunnel model of the Space Shuttle in the NASA Ames Unitary Wind Tunnel.



Plot of several trajectories depicting the path of debris shed from the External Tank generated by the Columbia

Center Director G. Scott Hubbard served as the lone NASA representative on the Columbia Accident Investigation Board and conducted the definitive foam impact studies. NASA Ames engineers, scientists and technical staff also supported the CAIB as a technical resource and using Ames facilities, were a source of critical data analysis of space shuttle systems.

After the CAIB report was issued, NASA Ames personnel and facilities played an integral role in several aspects of NASA's Return to Flight effort, from the analysis of new space shuttle system designs to development of in-flight analysis tools; from improvements in thermal protection durability and repair

to the analysis of large data sets used in complex simulations by one of the world's fastest supercomputer, the Columbia supercomputer.

The NASA Ames Return to Flight effort taps into the center's critical core capabilities in computational fluid dynamics, information technology and thermal protection systems. These core capabilities meld the expertise acquired through decades of aerospace research and development with cutting-edge information technology and unique facilities.

Computational fluid dynamic (CFD) models are helping NASA develop design modifications to Space Shuttle systems, characterize debris flow patterns and understanding the conditions the shuttle's thermal protection system experiences during re-entry. The CFD models are being created and validated using a refurbished 3 percent Space Shuttle model in the center's 9-foot-by-7-foot supersonic wind tunnel. The model was built during the development of the original Space Shuttle design in the 1980s. NASA Ames' ballistic gun range, originally used in the past to develop Apollo capsule designs, was used to develop debris trajectory CFD models.

Using the center's Columbia supercomputer, engineers and scientists are able to compile and analyze the tremendous amounts of data collected from tests at Ames and at other NASA centers. Using this capability, NASA will be able to simulate various conditions the space shuttle may encounter pre-launch, during ascent, on orbit and during descent. The speed of the computer allows for the creation and analysis of these simulations in a fraction of the time previously required, a capability not available even six months ago. Other information technology expertise is helping NASA gather, organize and analyze information before, during and after space shuttle operations and monitor vehicle health.

Repair panel heated in the arc jet stream of the NASA Ames Interaction Heating Facility

As a recognized leader in thermal protection systems, Ames is using its expertise to develop increasingly durable thermal protection systems (TPS) and on-orbit TPS repair systems. Concepts for fixing cracks or holes include plugs (cover plates), patches (pre-ceramic polymers impregnated cloth) and paste-like materials (pre-ceramic polymers) are being assessed for effectiveness in the NASA Ames arc jet facility at up to 3000 degrees Fahrenheit to simulate re-entry conditions.

NASA Ames played an integral role in the investigation of the Columbia disaster and will continue to provide on-going technical, scientific and engineering support for the STS-114 flight and beyond. NASA Ames' personnel and facilities stand ready to support NASA's mission, to return the space shuttle to flight and to explore the moon, Mars and beyond.

Contact Information
Jonas Dino
NASA Ames Research Center
650/604-5612 or 650/604-9000
Jonas.Dino@nasa.gov