Two's Company

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SPECIAL ASSIGNMENT

The Shuttle gets some company for two upcoming launches

by Catherine E. Borsché

The Space Shuttle will not be alone as it soars into the sky for Return to Flight. This time around, WB-57 chase planes will escort the orbiter into the upper reaches of the Earth's atmosphere, taking video and images while trailing behind.

These high-flying chase planes will provide NASA with extra "eyes in the sky" to watch *Discovery*'s flight and help safeguard its crew.

The jets will carry innovative, on-board video imaging systems, dubbed the WB-57 Ascent Video Experiment (WAVE). The system will capture detailed images of how the Space Shuttle behaves as it climbs toward orbit.

"No one has ever built a sensor that can do what this can do," Andrew Roberts, WB-57 program manager, said. "The WAVE System has an 11-inch telescope on it with a 4.2-meter focal length, and off the back of that it has both a high-definition TV camera and an infrared camera."

"Shuttle video captured by the chase vehicles will help us see the launch in greater clarity than ever before," said Bob Page, project manager for NASA's Inter-Center Photography Working Group at JSC. "Along with cameras on the ground and in and on the Shuttle itself, this imaging system will provide an unprecedented look at Shuttle liftoff and atmospheric flight."

A large amount of legwork goes into the daunting task of having the planes keep pace with *Discovery* to obtain the imagery.

"We'll launch the planes a few hours before the actual Shuttle launch to get into position. We have developed flight patterns, and we'll be able to fly those to track the Shuttle," Roberts said. "The planes will come towards the Shuttle as it's launching and then start turning as it begins to pass us. When the Shuttle comes past us it's going to be up at about 120,000 feet – pretty far up above us."

Above: *Johnson Space Center is the home of the NASA WB-57 High Altitude Research Program. Two fully operational WB-57 aircraft are based near JSC at Ellington Field. Both aircraft have been flying research missions since the early 1960's.*

The jets will keep pace with *Discovery*, flying at a distance of 15 to 20 miles. The WAVE systems will track the Shuttle for approximately 150 seconds, from liftoff to main engine cutoff. However, the jets will get their best views of the Shuttle during the separation of the Solid Rocket Boosters.

By using the WB-57 planes to obtain the imagery, scientists will be able to get excellent resolution from the cameras.

"The ground cameras have to look through the atmosphere to see the vehicle. We fly above 90 percent of the Earth's atmosphere," Roberts said. "Where we're flying, we should get some very clear information with little atmospheric effect."

The WB-57 planes are a perfect fit for the experiment. Once NASA video technicians built and tested the high-definition imaging system earlier this year, they needed a way to get the complex, bulky WAVE systems airborne.

Each system had to be mounted in the nosecone of the chase planes using a large gimbal and a stabilizing anchor to keep the cameras focused on the Shuttle, even if turbulence caused the plane to dip or drift.

Both planes have been flying research missions since the early 1960's, and continue to be an asset to the scientific community. The WB-57 is capable of flying at altitudes well over 60,000 feet. At 12 miles high, the environment is very inhospitable to people. In fact, there is less than 1 psi of atmospheric pressure and temperatures approach -70° Fahrenheit. For these reasons, flight rules mandate that for flight above 50,000 feet, all crewmembers must wear a full pressure suit similar to what astronauts wear. If the cabin was to depressurize or the crew was forced to eject, it would be the only means of survival.

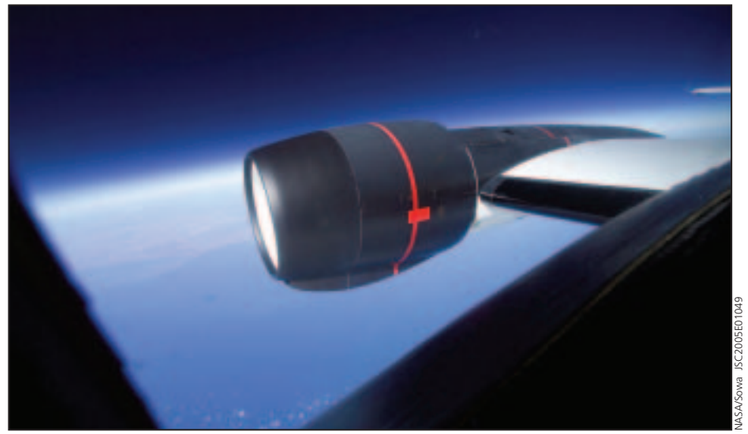
While Roberts fondly refers to the plane as a "great Tinkertoy airplane" due to its ability to be reconfigured for different missions, he emphasizes that "it's the only airplane that can take a '57 Chevy up to 65,000 feet."

The WAVE will be conducted during the STS-114 Return to Flight mission and the STS-121 mission thereafter. Since this study is in the experimental phase, there are currently no plans to implement the technology for all future missions.

"Once the experiment is over, which is after the first two launches, we will then decide whether or not we want to make this an operational thing. For instance, we may want to tweak it up a little and do different things with it," Roberts said.

The WAVE project has been made possible through teamwork from all NASA centers. A truly One NASA endeavor, this unique technology was only a concept on a drawing board in June 2004. The concept will become a reality when *Discovery* lifts off for the STS-114 mission.

"Across the Agency, we are all working to make the Space Shuttle safer," Rodney Grubbs, Marshall Space Flight Center project lead, said. "We're excited about what our imagery might mean for the safety of our astronauts."



NASA/Sowa JSC2005E01049

The WB-57 jet plane can fly at altitudes above 60,000 feet, which makes it the perfect vehicle for tracking and taking imagery of the Space Shuttle as it launches into space.

NASA JSC2005E21991

Two WB-57 jet planes, normally used by NASA for high-altitude weather research, will help track Discovery *during STS-114 and* Atlantis *during STS-121. The jets will carry a swiveling, nose-mounted video recording system designed to capture visible-light and infrared imagery of the Shuttle as it lifts off on its journey to orbit. The primary optic lens, a 4,150-millimeter reflector telescope, can be seen on the right of the WAVE turret.*

ASCAN "EXPLORATION" CLASS OF 2004

Beyond reality TV

by Amiko Nevills

They were ejected, spun, strapped, blindfolded, dunked in water, looped, rolled, flipped, floated, left in a forest, taught to eat leaves and roots, "injured" and rescued.

NASA/Blair JSC2004E38934

NASA's newest class of astronauts gathers for a group photo at the conclusion of land survival training at the Naval Air Station in Brunswick, Maine. From the left, front row, are Dorothy M. Metcalf-Lindenburger, James P. Dutton Jr., Christopher J. Cassidy, Robert S. Kimbrough, Joseph M. Acaba and Thomas H. Marshburn. From the left, back row, are Satoshi Furukawa, Shannon Walker, Richard R. Arnold II, Robert L. Satcher Jr., Akihiko Hoshide, Naoko Yamazaki and Jose M. Hernandez. Hoshide, Yamazaki and Furukawa represent the Japan Aerospace Exploration Agency.

It may sound a lot like a script from a hit reality show, but these challenges surpassed any task ever seen on an episode of "Survivor" or "Fear Factor." NASA's astronaut candidates, selected May 6, 2004, recently marked a major milestone – the completion of a year of training toward becoming the next generation of space explorers. One of their first tasks after selection was survival training.

Survival is the most critical factor in human space exploration. Unlike television reality shows, however, real survival is based on teamwork rather than elimination.

"Working as a team, whether it was through water survival training, ground or flight training, has been the most valuable lesson we've learned so far," said Educator Astronaut Joe Acaba. "Those stronger in some areas helped others and vice versa. We got through it all together."

The candidates, mere strangers 12 months ago, now consider each other family. It is through this common bond that their teamwork is recognized.

"They have great enthusiasm for every challenge and have tremendous dedication to each other, which makes them a special group," said Astronaut George Zamka, the astronaut candidate class mentor. "You can take a lot of real smart, real aggressive individuals and put them together in one place, but you don't get a team like they have unless each one decides to put the team first."

Most of the class of 2004 astronaut candidates – a group of schoolteachers, doctors, scientists, engineers, military pilots and a Navy SEAL – met for their first training assignment at the Pensacola Naval Air Station in Florida to start what was only the beginning of extreme challenges of wit and tenacity. Pilots Jim Dutton and Randy Bresnik, and Mission Specialist Shane Kimbrough, who had already obtained military water survival training, met the rest of the class later in Houston for their next training missions.

Tapping into a diverse knowledge base, this class includes three educator astronauts chosen by NASA to help inspire the explorers of tomorrow.

"Having the educator astronauts in the group helps make us mini-educators to be more effective at inspiring the next generation of explorers," Bresnik said.

Mission Specialist Shannon Walker added that having international partners in the class proves to be valuable to the class as a whole.

Three Japan Aerospace Exploration Agency astronauts – Akihiko Hoshide, Satoshi Furukawa and Naoko Yamazaki – are training with the 11-member astronaut candidate class.

"Space exploration is an international endeavor," said Duane Ross, astronaut training program manager at Johnson Space Center. "To work with these people on a day-to-day basis can only add to that partnership to make space exploration successful."

Weeks of water survival activities, ejection techniques and T-34 simulations were followed by T-38 jet flights, emergency landing practices and virtual reality parachute jumps – all interspersed with studying flight texts and procedural manuals.

The astronauts-in-training then took a field trip to the wilderness of Maine and learned how to live off the land using its natural resources and their own ingenuity and teamwork.

After visiting each NASA center to learn more about the scientific research behind the scenes, they got a feel for weightlessness and a 20-second "walk" on both the Moon and Mars aboard the KC-135 aircraft. Rollercoaster-like climbs and dives, which simulate the weightless environment of space on the aircraft, were a collective favorite among the astronaut candidates.

"It's all about the zero-g," Mission Specialist Jose Hernandez said with a grin.

With only eight months left until completion of their initial training, the astronaut candidates are now hitting the books and spending a lot of time in classrooms. They are studying everything on the orbiter systems, ranging from propulsion to environmental controls and all areas of Shuttle vehicle operations.

They have begun to study Russian and will soon embark on learning about the International Space Station, astronauts' orbiting home away from home.

"We've been very happy with this group," Ross said. "They're a wonderful close-knit group, a great group to work with."

Selected as the first astronaut class since President George W. Bush announced the nation's Vision for Space Exploration, the class of 2004 meets tough expectations.

Preparing for spaceflight is hard work. Preparing to take the next steps on a journey that will take humans back to the Moon and onward to Mars is even more difficult, but is something this elite class looks forward to.

"Adding the human element to the Vision, and seeing the Agency take actual steps toward that Vision, is the best part of this," said Educator Astronaut Dottie Metcalf-Lindenburger.

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NASA/Blair JSC2004E38932

Left: *Astronaut Naoko Yamazaki, representing the Japan Aerospace Exploration Agency, boils water over a campfire during 2004 astronaut candidate land survival training in the wilderness of Maine.*

The newest class of astronauts conducts an emergency egress drill during land survival training in the wilderness near Brunswick, Maine. In the foreground, left to right, astronaut candidates James P. Dutton Jr., Akihiko Hoshide, Dorothy M. Metcalf-Lindenburger, and Satoshi Furukawa use a makeshift gurney to extract fellow astronaut candidate Robert S. Kimbrough from the woods. In the back, Joseph M. Acaba, Richard R. Arnold II, Robert L. Satcher Jr. and Thomas H. Marshburn carry Christopher J. Cassidy.