

# Labs technology launched in first test flight of Army's conventional Hypersonic Weapon

By Heather Clark



Seven seconds remained in the countdown to launch a conventional hypersonic glide vehicle from the Kauai Test Facility (KTF) in Hawaii, when a technical issue stopped the count. The Sandia launch team scrambled to find the offending software script error and craft a solution to keep the first test flight of the US Army's Advanced Hypersonic Weapon (AHW) on track.

"It was very nerve-racking," says David Keese, director of Integrated Military Systems Development Center 5400, who was at KTF's Launch Operations Building to view the flight in the early morning hours of Nov. 17. "We had to hold the countdown, examine what the problem was, define a solution to the problem, coordinate the solution with the flight test director, and implement that solution, which we did in about 30 minutes."

Problem solved, the countdown resumed, and the US Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT) AHW flew a non-ballistic glide trajectory at hypersonic speed in its successful first test flight.

The three-stage booster system and glide vehicle were developed by Sandia under the direction of the  
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THE US ARMY'S Advanced Hypersonic Weapon on a non-ballistic flight path after launch from Sandia's Kauai Test Facility. (Illustration courtesy of Sandia National Laboratories)

## California Friends and Family Day

More than 1,100 members of the workforce, spouses, parents, siblings, children, and friends turned out for Sandia/California's Friends and Family Day on Saturday, April 28. Story and photos on pages 6-7.



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## Bonnie Apodaca named Business Ops Div. 10000 VP and Chief Financial Officer

Bonnie Apodaca has been selected as VP of Business Operations Div. 10000 and Chief Financial Officer. Her appointment was effective May 11.

In announcing the appointment last week to members of the workforce, Sandia Deputy Director and Executive VP for Mission Support Kim Sawyer said of Bonnie, "I am confident that her contributions will move Sandia forward, improve our business efficiencies, and ensure continued excellence in mission support."

Bonnie brings a range of experience in multiple business areas. For the past four years, she has been director of Business Management Operations Center 10600. Previously, she was director of Supply Chain Management Center 10200. Bonnie's first position as a director came with her service from 1998 to 2005 as controller and director of Pension Management Center 10500. Bonnie started at Sandia as a contract auditor in 1988, and was promoted to manager of the business office for the Satellite Center and Non-proliferation program in 1991.

Before she came to Sandia, Bonnie was the controller for private companies in Albuquerque and Colorado Springs, Colo. She earned a Bachelor of Science in accounting from the University of Colorado and an Master of Business Administration from the University of New Mexico. She became a Certified Public Accountant in 1985.

Bonnie is a member of the Central New Mexico Community College Accounting Advisory Board, an alumna of Leadership New Mexico, a member of the Rio Grande Chapter of Blue Star Mothers, serves as an adviser to the Hispano Chamber of Commerce, and has participated in the Manos education outreach program for 16 years.

Kim thanked Jeffrey Kallio for his service as CFO and acting VP of Div. 10000. "His steady hand," Kim said, "has kept Sandia in great shape through the many challenges we've faced during that period."



BONNIE APODACCA

# Sandia's assurance

## It's our way of doing business

By Chris Miller

Last month, two Sandia materials handlers inspected a shipment of 15,000-pound load-hugger tie downs — destined to secure high-risk hazardous materials during shipment — and found them to be counterfeit and of questionable quality.

In 2011, Division 6000 determined during a management assurance review that growing issues with procurement and reapplication in the Supply Chain Policy Area were impacting mission work and creating safety hazards.

In 2009, a self-assessment in Sandia's Explosives Technologies Group discovered that the material specification provided to a vendor and used to fabricate a component was imprecisely worded and could lead to confusion. This assessment grew out of an issue discovered by the quality inspector during the acceptance process.

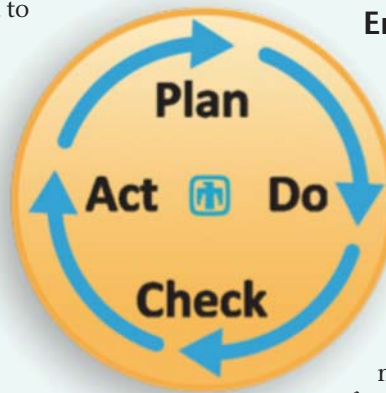
Each of these issues was discovered and corrected in the course of performing day-to-day job responsibilities.

They are just three examples of how members of Sandia's workforce routinely take steps to verify that work is meeting mission requirements. In today's vernacular, this process is called "assurance."

### Ensuring optimal Labs performance

During his all-hands meeting with Sandia's management in October 2011, President and Laboratories Director Paul Hommert described assurance as "the way we do business; it is what we do for ourselves to ensure optimal performance by the Labs." He further explained that "our performance assurance system is just one piece of Sandia's overall management system, and central to performance assurance is plan, do, check, act, which provide a rhythm and a framework for assurance implementation."

Manager Susan Gardner (5342), who assisted Paul during his presentation, used the plan-do-check-act framework to describe how her department delivers and helps maintain 10 radars for a military customer. Those activities, she said, include extensive conversa-  
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## Tales of courage

Students from public and private schools in the Albuquerque area were honored recently as 2012 Thunderbird Award winners for overcoming significant personal challenges on the path to high school graduation. See page 12.



CONVOY! — The last scheduled shipments of remote-handled transuranic (TRU) waste leave Sandia, headed directly for permanent disposal in DOE's Waste Isolation Pilot Plant near Carlsbad, N.M. These shipments end Sandia's final stage in DOE's Legacy TRU Waste Program, which works to

safely remove such waste from sites throughout the DOE complex. The waste is the byproduct of nuclear defense program research and weapons production. Much of the waste removed from Sandia came from programs completed in the 1980s. (Photo by Randy Montoya)

## Hypersonic

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USASMDC/ARSTRAT. Thermal protection system development for the glide body was the responsibility of the US Army Aviation and Missile Research Development and Engineering Center in Huntsville, Ala. The test flight was launched from Sandia's Kauai Test Facility.

The AHW program is part of DoD's Conventional Prompt Global Strike effort to develop conventional weapon systems that can deliver a precision strike anywhere in the world within an hour. Success would mean the US would have an alternative to nuclear weapons to prevent a crisis and it would decrease the conventional military response time significantly, David says.

The test flight represented about four years of work for up to 200 Sandia employees across the Labs. It came from a foundation of work on projects from as long as 25 years ago, David says, including the Sandia Winged Energetic Reentry Vehicle Experiment (SWERVE), the Strategic Target System (STARS), and the Tactical Missile System-Penetrator (TACMS-P).

### A flight of many firsts

About 50 Sandia employees, including Defense Systems & Assessments Div. 5000 VP Jeff Isaacson, viewed the test in Kauai. Eric Schindewolf, deputy director of Strike and Aerospace Systems 5420, says large screens projected digital animation driven by the actual data coming from the AHW in real-time along with displays of the vehicle's condition as it reached certain milestones.

The historic flight had many firsts, David says. It was the first time a Sandia-developed booster had flown a low-altitude, long-range horizontal flight path at the edge of the Earth's atmosphere; the first time eight grid fins (designed by Sandia and Huntsville, Ala.-based Dynetics Corp.) were used to stabilize a US missile system; and the first time a glide vehicle flew at hypersonic speeds at such altitude and range. This flight test incorporated lessons and data from previous DARPA flight tests conducted as part of the Defense Department's Prompt Global Strike Program.

"You could almost feel the tension change to jubilation as the launch occurred and the booster performed well and the grid fins deployed," David says. "At each milestone along the way, Sandia employees were becoming more excited about the success because you could see how the missile was flying. . . . Cheers would go up every time we would meet one more mission milestone."

The flight path took the vehicle up hundreds of thousands of feet and then it flew toward the Earth's surface before pulling up slightly to fly horizontally within the atmosphere to the target, Eric says.

"We always knew the pull-up would be the most difficult part of this. We knew that success was going to be



NIGHT LAUNCH — The US Army's Advanced Hypersonic Weapon is launched from Sandia's Kauai Test Facility in Hawaii. (Photo courtesy of US Army)

historic," Eric says. "So as we watched this actually happen, the anticipation was really high. Once we saw the vehicle was climbing and leveled out at its glide altitude, we knew we had gotten through the hardest part. You could feel the relief as the team immediately sensed that the rest of the way would be comparatively easier."

The success was praised by Sandia's leaders, who flooded employee inboxes with congratulatory emails the next day.

Jeff called the flight a "stunning success" and a "real engineering achievement."

At a team celebration after the mission, Jeff told the attendees, "This success could not have been achieved without exceptional teamwork, which was evident to anyone in the Launch Operations Building that night."

Sandia President and Labs Director Paul Hommert, who says he couldn't have been more proud to be a Sandian as he listened to the test from Washington, D.C., wrote: "Once again today our Laboratory rendered exceptional service in the national interest. For your dedication, excellence, and professionalism thank you and congratulations!"

Eric shared the general scope of Sandia's work on the AHW. The technical challenges that faced Sandia were aerodynamic stability, aerodynamic heating, and control of the missile and glide vehicle, he says.

Typically, boosters fly missiles to heights of millions of feet above Earth, but the AHW flew only to a peak of hundreds of thousands of feet above the Earth's surface, before descending to a lower altitude for the remainder

of the flight. The modified STARS booster, which was about 40 feet long and 54 inches in diameter, powered maneuvers that had never been done before, Eric says.

The lower a missile flies in the atmosphere, the more it tends to tumble end over end, he says, so Sandia helped develop the eight grid fins to improve stability, which had never been used before on a US missile.

Eric says Sandia's researchers did not want to risk having the fins interact with the missile exhaust near the ground, so four opened right after clearing the launch tower and four more deployed when the first stage burned out nearly 60 seconds later.

"They provided the margins of aerostability and control needed to prevent the missile from tumbling," Eric says.

### 'String of pearls'

Because the 2,485-mile (4,000-kilometer) flight from Kauai to the Army's Reagan Test Site on the Kwajalein Atoll was so low, the curvature of the Earth prevented continuous monitoring from the takeoff and landing sites alone, he says.

Space, air, sea, and ground platforms collected vehicle performance data during all phases of the flight, according to a Pentagon news release. The Sandia booster and glide vehicle transmitted data to this network, called the "string of pearls," Eric says.

Sandia also led the design and development of the glide vehicle, including improved navigation, guidance, and control technologies and teaming with AMRDEC to use advanced thermal protection materials to protect it on the long flight in the atmosphere.

Sandia researchers also successfully designed and tested the Flight Termination System for the AHW. This system protects public safety by destroying the vehicle if it should fly off-course during a test flight, he says.

The test's objective was to collect data on the technologies and test range performance for long-range atmospheric flight. The mission emphasized aerodynamics; navigation, guidance, and control; and thermal-protection technologies, according to the Pentagon news release.

Eric says Sandia employees are analyzing the data from the test flight, which will be used by DoD to model and develop future hypersonic boost-glide capabilities.

"This was only a very first demonstration," Eric says. "This is not a weapon by any stretch of the imagination. There's quite a bit of work that needs to be done."

David says the information gathered also will be used to validate Sandia's computational models so they can be used with more confidence in the future.

David had nothing but praise for the people who spent nights, weekends, and many long hours working at KTF and the Labs.

"All the credit for the success of this effort goes to the team and its tremendous commitment and dedication that produced these extraordinary accomplishments that enhance our country's national security," he says.