

Calling the “Shots” at JASPER for National Security

By Lory Jones

Ever handled a gun that is 65 feet long? That can shoot faster than the speed of sound? That uses not only gunpowder, but also light gases to shoot its target? That has a heavy steel chamber attached to the end of it? And more importantly, is designed to aid national security?

Meet the light gas gun at the Joint Actinide Shock Physics Experimental Research facility, or JASPER, at the Nevada National Security Site. NSTec conducts experiments at the JASPER facility called “shots” – “surrogate” and “hot” – to study the behavior of actinides and other materials under sudden high pressures and temperatures. (An actinide is one of 15 chemical elements, is radioactive and releases energy when activated through nuclear reactors and nuclear weapons.) The shots are an essential part of shock physics experiments that provide key physics data necessary to meet the National Nuclear Security Administration’s Defense Program milestones. These experiments show that our country’s defenses are up-to-date and ready to go “live,” if needed.

Remotely located in Area 27, the light gas gun is the heart of the JASPER facility. How the gun works is this: Gunpowder is placed in the gas gun’s breech to drive the gun’s first stage. The long pump tube is filled with a light gas, typically hydrogen, and is the main driving force that fires the projectile down the launch tube. The launch tube shoots the projectile to the end of the gun, where an 8-foot-diameter chamber contains the actinide target, and the projectile hits the target. This entire “shot” only lasts about a millionth of a second because it happens at extreme velocities.

In a control room separated from the gun



The JASPER 65-foot-long light gas gun. The breech chamber is in the foreground, left.

room, researchers control the shots and collect the experiment’s data. These data lead to more accurate models of actinide properties. That in turn leads to increased confidence in the overall performance and safety of stockpile nuclear weapons.

“Our national stockpile is 30 years old. At JASPER, we’re trying to see if any stockpiled materials have degraded. These gas gun experiments tell us how the materials, including plutonium, behave,” says **Jim Medley**, NSTec’s JASPER operations manager.

Normally, the JASPER facility can conduct up to 12 experiments per year. For the past year or so, the JASPER facility had been converted from a less-than Hazard Category 3 Nuclear facility to a full-scale Hazard Category 3 Nuclear Facility. (A full-scale Hazard Category 3 nuclear facility requires increased formality and

rigor in operations and maintenance. This impacts many of our activities in design engineering, procurement, construction and maintenance, as well as the actual facility operations.) This conversion included facility modifications (as needed), a start-up testing phase and a readiness review. During the start-up testing phase and readiness preparations, two surrogate shots – 88 and 89 – will be performed. When these are successful, the Nevada Site Office approves operations for shot number 90, using special nuclear materials. Its most recent “surrogate” shot, number 87 using non-nuclear material, was successfully conducted March 11.

Neil Holmes, a senior scientist at Lawrence Livermore National Laboratory (LLNL) and JASPER chief scientist, is the founder of the JASPER concept and has been in charge of the scientific program since its inception in 1996. “These shock physics



Researchers in the JASPER control room prepare for the March 11 "surrogate" shot.

experiments are designed to study equation of state, namely, the relationship among pressure, volume and energy at high pressure. We need these data to accurately

predict the performance of nuclear weapons. We were able to use the same methods to study the properties of aged plutonium to unprecedented accuracy."

Although LLNL operates the experiments with NSTec scientists, Neil recognizes this as teamwork. "JASPER is not a Livermore thing. This is collaboration between the labs and the contractors like NSTec."

"We at JASPER have the opportunity to wear many hats," adds Jim. "The people around me are highly trained, very competent and very professional, and I am so proud to work with them. Supporting the Stockpile Stewardship Program for nuclear weapons is keeping us safe and secure, and maintains us at the highest level of quality and reliability."

NSTec is accomplishing one of the top 10 goals for the Nevada Enterprise in fiscal year 2011: that JASPER executes its experimental program. JASPER is committed to perform shot number 90 by Sept. 30, 2011.

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Photos: Don Western (Development Services & Support) and Lory Jones (Workforce Enhancement & Communications), NSTec