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Nevada Gloveboxes Improves JASPER's Efficiency

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One Voice

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The gloveboxes (Figure 1) at the Device Assembly Facility (DAF) are used by Lawrence Livermore National Laboratory (LLNL) to assemble plutonium targets for Joint Actinide Shock Physics Experimental Research (JASPER) experiments. The plutonium targets are assembled and installed into an experiment assembly using the gloveboxes and then packaged and transferred to the JASPER Facility. The experiments at JASPER are in support of the National Nuclear Security Administration (NNSA) Stockpile Stewardship mission.



Figure 1 - Glovebox operations being performed

To date, the gloveboxes have been used to assemble nineteen experiment assemblies. In November 2013, the gloveboxes were used to assemble the most recent JASPER experiment, which was a Photonic Doppler Velocimetry Encapsulate Alpha (PDVEA) plutonium target (Figure 2). JASPER successfully performed the PDVEA experiment in December 2013. This experiment was the fifth in the PDVEA target design series. The PDVEA series of experiments are designed to measure the shock Hugoniot of alpha plutonium and have yielded extremely high accuracy data (less than 1% error bars) on fundamental properties of the material. The high quality of the JASPER data provides new insights into the behavior of plutonium. The high standard of the JASPER data is obtained from the collaboration between LLNL and National Security Technologies (NSTec).



Figure 2 - PDVEA plutonium target

The gloveboxes (Figure 3) are used because plutonium material is too hazardous to handle without them. The plutonium material is contained inside the gloveboxes and is isolated from the people handling it. Technicians handle the plutonium using gloves installed in the gloveboxes ports. In addition, the atmosphere inside the gloveboxes is a pure Nitrogen environment with very little moisture and oxygen to keep the plutonium material in a pristine condition for experiments.



Figure 3 - Target bonding operations inside the glovebox

The plutonium samples and experiment assemblies are shipped individually to the DAF from LLNL located in Livermore, California. The plutonium samples are fabricated at LLNL in their plutonium facility. The experiment assemblies are also fabricated at LLNL, but in their engineering fabrication

facilities. The plutonium samples are typically discs similar in size to a nickel or half dollar and are extremely flat and parallel to a couple of microns (less than a 50th of a human hair thickness). The experiment assemblies (at this stage without plutonium target installed) are the experiment diagnostic package containing the optical probes and electrical pins for measuring the plutonium target during the experiment. These items are shipped separately to the DAF and are assembled together using the gloveboxes.

There are two gloveboxes used for different stages of the experiment assembly process. The first glovebox is for preparing the plutonium target, which consists of inspecting the plutonium samples and then gluing them together with other non-radioactive materials to form a target. The other non-radioactive materials typically used are LiF windows and metal discs of tantalum or aluminum. The materials used to make the plutonium targets vary depending upon the experiment and plutonium target design needed. There have been fourteen different plutonium target designs used to date with many more different designs planned for the future.

The second glovebox is for installing the plutonium target into the experiment assembly (Figure 4). In this portion of the assembly process, the experiment assembly is attached to the glovebox and the plutonium target is installed into the experiment assembly through a valve port in the glovebox wall. This process is used to maintain the exterior of experiment assembly clean and free of plutonium contamination. The experiment assembly is then detached from the glovebox and radiologically surveyed to verify no exterior contamination. In addition, this process maintains the plutonium target in a pure Nitrogen atmosphere during the entire assembly process.

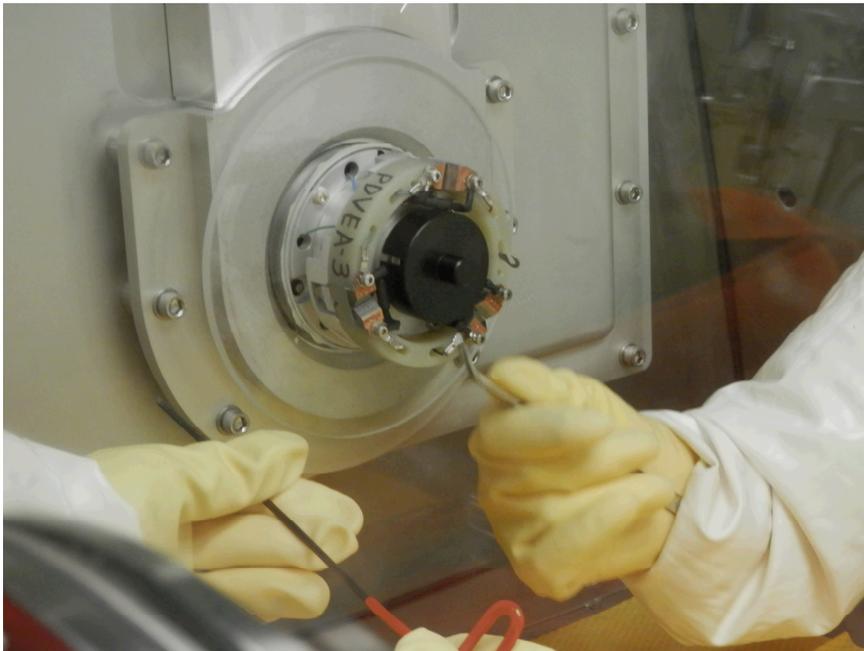


Figure 4 - Installing Plutonium Target into Experiment Assembly

The gloveboxes at the DAF play a critical part in supplying JASPER with experiment assemblies. Since gloveboxes at the DAF and the JASPER facility are both located at the National Nuclear Security Site (NNSS), this simplifies the transfer of the experiment assembly to JASPER and the experiment can be performed quickly after assembly. Before the gloveboxes were operational at the DAF, the experiment assemblies were assembled at LLNL and due to shipping logistics the assembly had to be done months

prior to conducting the experiment at JASPER. The gloveboxes at the DAF provide schedule flexibility and throughput efficiency in the JASPER experiment program, which has increased the number of experiments JASPER can perform in a year.

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