

**Y-12 NATIONAL SECURITY COMPLEX'S CONTRIBUTION TO NUCLEAR SPACE APPLICATIONS: PAST, PRESENT, AND FUTURE.** W. T. Rogerson, Jr.<sup>1</sup> S. W. Brown<sup>2</sup>, and D. R. Smith<sup>3,1,2&3</sup> Y-12 National Security Complex, P.O. Box 2009, Oak Ridge, TN, 37831, <sup>1</sup>[yyr@y12.doe.gov](mailto:yyr@y12.doe.gov), <sup>2</sup>[bws@y12.doe.gov](mailto:bws@y12.doe.gov), <sup>3</sup>[srd@y12.doe.gov](mailto:srd@y12.doe.gov).

The Y12 National Security Complex has a long history of successful contributions to National Aeronautics and Space Administration (NASA) programs, and has been a part of every space mission that carried a nuclear package. Over the more than 50 years of collaboration with NASA, Y-12 has designed and manufactured many unique pieces of enabling space equipment.

An early example was the *Blood in Gemini* (BIG) program which resulted from the 1958 – 1963 NASA Mercury space missions. Early scientific papers from the Soviet Space Program had reported a possible radiation effect on human blood in space that was greater than that expected from the same amount of radiation here on earth. The BIG program used a unique fixture designed by the Oak Ridge National Laboratory, and built at Y-12, to conduct confirming experiments on the blood of Mercury astronauts.

This first interaction with NASA soon led to a second opportunity for Y-12 to solve an important technical problem. The Apollo Mission program needed a tightly sealed container to bring lunar materials back to Earth in a pristine condition without being contaminated with the Earth's atmosphere. NASA needed a leak proof, seamless container that could be manipulated by astronauts in space suits and yet seal completely every time.

The Apollo Lunar Sample Return Container was designed and built at Y-12. Commonly called "Moon Boxes," these boxes were specially designed to be seamless except for the top, and were used to gather samples by the Apollo mission crews. There were six missions that landed on the moon and two of Y-12's moon boxes accompanied each mission. A total of over 840 pounds of lunar materials was brought back to earth in these boxes.

In order to provide a pristine environment for lunar sample removal and processing, Y-12 also designed and constructed the Lunar Sample Laboratory Facility at the Johnson Space Center in Houston, TX. Samples returned from the moon in these boxes are still considered to be some of the most pristine samples ever recovered from space.

As the national repository for enriched lithium and uranium metals, Y-12 has considerable technical expertise in the safe and reliable handling, machining, and assembling of the materials necessary for extraterrestrial nuclear power plants and has considerable expertise in neutron moderation and shielding for light weight nuclear reactors.

In the 1960's, Y-12 fabricated the fuel elements and other components for the Rover nuclear powered rocket program. Y-12 also produced the lithium hydride neutron shield and fuel components for the System Nuclear Auxiliary Power Program (SNAP) reactor. The SNAP-3 reactor was the only nuclear reactor plant launched in space by the United States.

More recently, Y-12 produced composite neutron shielding of lithium hydride, beryllium, and boron for the SP-100 program during the 1980's and 90's and also produced the iridium clad vent sets for the general purposes heat sources for Cassini-Huygens program. In the 2000's, Y12 again produced composite neutron shielding for the Jupiter Icy Moon Program. Today, Y-12 components are a part of

the radioactive thermal generators that still power the Voyager Mission in space more than 30 years after launch

This paper will provide specific details and time line of the historical relationship between Y-12 and NASA, and discuss opportunities for future contributions to nuclear systems for deep space travel and long duration stays on the moon and other planets.