The Use of the Nevada National Security Site As a Reactor Test Center

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A major obstacle to the development of any reactor concept is the decision on whether or not to do a nuclear demonstration of the concept. Previous space reactor programs included a proposed ground nuclear demonstration, but the test was typically to be done in a facility built exclusively for the intended test and the cost was typically estimated to be in the billion-dollar range to perform. The time and cost of the demonstration was in many cases seen as a major reason not to proceed with a reactor development project.

This paper proposes an approach that utilizes the existing DOE facilities and operating infrastructure at the Nevada National Security Site as the place for future reactor testing. It is believed this approach would lower the cost and reduce the time for performing a nuclear demonstration of a space reactor concept.

The ideal location for developing a small space reactor is the Nevada National Security Site (NNSS) formerly known as the Nevada Test Site. The NNSS specializes in providing a unique and secure location for test beds supporting cutting edge research and development. The NNSS has the necessary attributes and infrastructure that make it the ideal site to pursue the goal of building and testing a space reactor.

There are several aspects of the NNSS that make it an ideal location for space reactor testing. First, the NNSS is remotely located yet near public transportation and services (Las Vegas, 65 miles south east).

The NNSS has existing Security Category 1, Hazard Category 2 nuclear facilities. Security Category 1 means that all levels of nuclear material up to the maximum quantities of Special Nuclear Material can be tested. Hazard Category 2 means that reactors up to 20 Megawatt thermal (~5 Megawatt electric) could be tested (see Figure 1 for a picture of a NNSS nuclear facility). Through careful planning and engineering, any potential releases from operations would be mitigated to avoid any impact to the public. These facilities are already being funded and maintained by the Department of Energy/National Nuclear Security Administration. Costs to the project would; therefore, be shared with other programs based upon space and time utilized in the facility.

Looking forward to new missions, the NNSS recently completed an Environmental Impact Statement that analyzed potential impacts from this type of testing. There is no need to conduct lengthly environmental impact studies prior to implementing this program.

Additionally, the NNSS has a diversified workforce with an exemplary safety record conducting high-hazard and nuclear operations.

These facilities offer an ideal spot to develop a test bed for small space reactors. It is believed a small space reactor would require minimal regulatory permitting for a nuclear demonstration. Most kilowatt level reactors have very low decay heat (~10 to 100s of watts). So fuel melting can easily be precluded using natural convection. Reactors in this size range also have very negligible fission products so radioactive doses from an accident are very, very small. These qualities mean that small space reactors are very low risk from an environmental or test operations mode.

The NNSS has room to grow a reactor concepts program to eventually testing at higher powers. The NNSS has an existing nuclear facility that is underground. This facility would be desirable for higher power nuclear reactors where decay heat and the dose from an accidental fission product release are more of a concern. This facility would provide excellent containment in the event of an accident. The facility authorization basis allows for efficient and effective methods to deal with materials during and after a test.

The unique features of the site and the existing infrastructure, and permitting aspects of the NNSS should make it easier for federal decision makers to move forward with a space reactor system. The

regulatory and cost decision should be easier to make because the risk of a small reactor system is much lower than that for a larger system. Once the process was established then small steps would be taken to the next higher power level system.

Finally, because the facilities and regulatory structure exists and are adaptable for this concept, the costs should be reasonable (on the order of 10's of millions, not billions).

Figure 1. Device Assembly Facility at the NNSS