ACCOMPLISHMENTS AND LESSONS-LEARNED FROM THE SPACE NUCLEAR THERMAL PROPULSION (SNTP) PROGRAM. R.X. Lenard, Chief Technical Manager, Little Prairie Services, 16 Dunkin Road, Edgewood, NM 87015, rxlenard@gmail.com

Introduction: The Space Nuclear Thermal Propulsion (SNTP) program was a DoD-sponsored high thrust-to-weight nuclear thermal rocket engine technology program that ran from Oct 1987 through Jan 1993[i]. The Strategic Defense Initiative Organization was teamed with the Department of Energy's Defense Programs Office (now NNSA) to conduct the program in accordance with the Atomic Energy Act[ii]. The centerpiece of the program was the Particle-Bed Reactor technology and featured a team of Brookhaven and Sandia National Laboratories, Babcock and Wilcox, Grumman Space Systems Division (now Northrop Grumman), Garrett Air Research (now Honeywell). The program designed, fabricated and tested a new particle fuel form, designed a series of particle bed fuel elements, designed a ground test facility, developed 2 Environmental Impact Statements and made substantial technical and programmatic progress. This presentation will cover the high points and lessons learned from this very productive and exciting program.

For example the SNTP program was the first nuclear thermal rocket program to be required to generate a comprehensive Environmental Impact Statement. Initially, the program was highly classified, so it was necessary to determine how to conduct public hearings within the restrictoins of a classified program. Eventually major portions of the program were declassified, so a second Environmental Impact Statement was generated where essential portions of the complete project were open to public scrutiny. The SNTP pogram was also the first nuclear thermal rocket development program to be required to uperate without open-air testing. This required extensive facilities to be designed[iii].

The SNTP program, due to a requirement for extremely high thrust-to-weight needed to meet the military mission demands, developed a small niobium carbide coated fuel particle ~1mm in diameter. An entirely new coating process have to be developed, although some portions of the silicon carbide fuel particle technology could be used. Silicon carbide simple could not operate at the desired temperatures. All of the fuel particles were packed in a fuel element as shown in Figure 1.

Figure 1. Prototypic PBR Fuel Element

The above fuel element was tested in a special test fixture where hydrogen was flowed through the fuel element in the Annual Core Research Reactor at Sandia National Laboratories as sown in Figure 2.

Figure 2. Nuclear Element Testing in the ACRR

When completed, a series of 39 fuel elements were to have been incorporated in a hexagonal closed-packed arrangement as shown conceptually inFigure 3 .

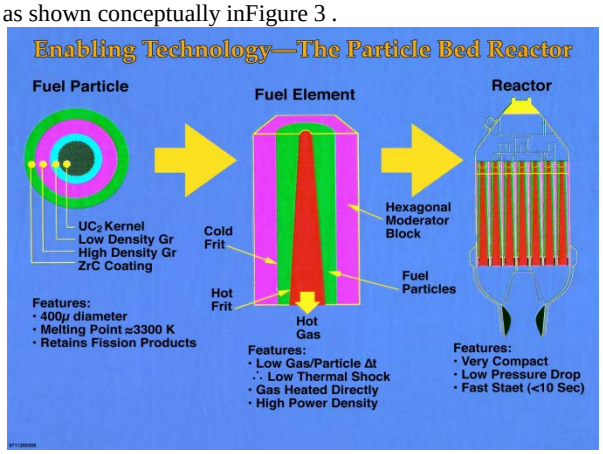

Figure 3. Progression of Technologies from Fuel Particles to Complete Reactor

Perhaps the greatest issue to be address was that of ground testing the system with full engines, at full thrust, and at full operating time. Since open-air testing was not feasible, it became necessary to developa new facility or to attempt to recrudesce the Jackass Flats facility. Ultimately, the Jackass Flats facility was too expensive, too large, and not well suited to contained testing[iv], so a new facility was proposed, The Saddle Mountain Test Station approcimately 20 miles

from Jackass Flats. A graphic concept of the facility layout is shown in Figure 4.

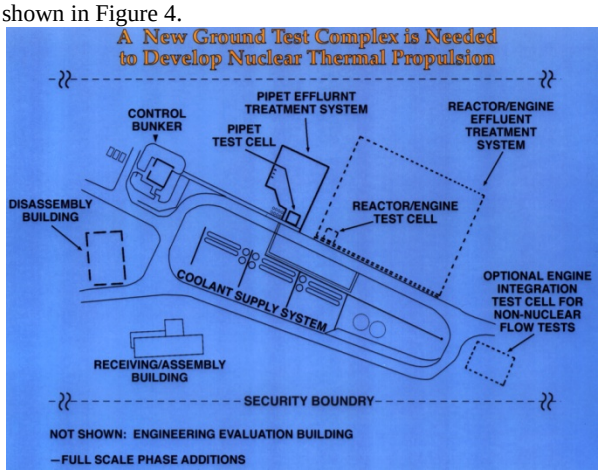

Figure 4. Saddle Mountain Test Facility (proposed)

These and many other aspects of this rapidly paced development program will be discussed.

References:

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i Haslett, R.A., "*Space Nuclear Thermal Propulsion Program Overview*," Final Report, PL-TR 95-1064, May 1995.

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