

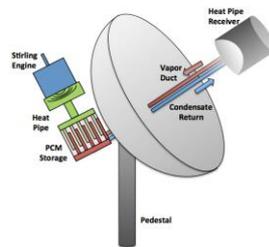
PROJECT OBJECTIVES

Goal:

- Demonstrate the feasibility of significant thermal storage for dish Stirling systems to leverage their existing high performance to greater capacity
- Demonstrate key components of a latent storage and transport system enabling on-dish storage with low exergy losses
- Provide a technology path to a 25kW_e system with 6 hours of storage

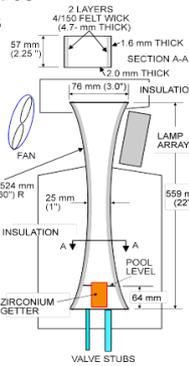
Innovation:

- Leverage high performance heat pipes to support feasible system layout
- Develop and test high temperature, high performance PCM storage
- Optimize storage configuration for cost and exergy performance
- Latent storage *and* transport matches Stirling cycle isothermal input¹



APPROACH

- PCM development and selection
 - Literature searches and modeling to develop candidate eutectics
 - Sample fabrication and characterization to develop properties
 - Modeling of compatibility with potential containment
 - Long-term testing of compatibility
- PCM Compatibility enhancement
 - Identify and develop or optimize coating chemistries to protect containment materials
 - Short-term and long-term compatibility exposure testing
 - Compatibility coating development and testing
- Heat Pipe
 - Felt wick enhancements for robust high performance²
 - Long-term performance and durability testing
- Proof-of-concept hardware subscale demonstration

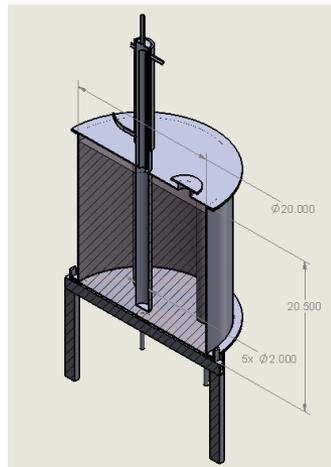


¹Andraka, C.E., Rawlinson, K.S., Siegel, N.P., "Technical Feasibility of Storage on Large Dish Stirling Systems," Sandia report SAND2012-8352 (2012).

²Baturkin, V., Vladilen Zaripov, Charles E. Andraka "Development of Advanced Capillary Porous Structures of High Temperature Heat Pipes for Solar Receivers for Dish/Stirling Systems," Proc. 14th international heat Pipe Conference (14th IHPC).

Q4 KEY RESULTS AND OUTCOMES

- Heat pipe advanced wick
 - Over 5000 hours of operation on a robust high performance wick
 - X-ray analysis at 5469 hours indicates less than 3% loss of wick thickness
- Compatibility studies
 - Ambiguous compatibility results due to partial melt of PCM
 - 20k-hour test designed and fab, awaiting coatings
- Integrated storage module
 - Major elements received
 - Assembly progressing
 - Final coating selection pending
 - Heat pipes delayed



Integrated Storage Module design

NEXT QUARTER

- Heat pipe advanced wick development
 - Complete 7000 hours of wick operation at representative operating conditions
 - Next thickness evaluation at 10,000 hours
- Coating development and PCM compatibility
 - Duplicate short-term compatibility testing with refined methods
 - Downselect 1-3 coatings for long-term testing
 - Downselect 1 coating for integrated storage test unit
 - Begin long term (20k hour) PCM exposure testing with selected coatings and methods
 - Initial assembly and coating of integrated thermal storage test unit
 - Sodium charging and processing of test unit
 - Complete PCM uniformity and sensitivity testing