# Dish Stirling High Performance Thermal Storage

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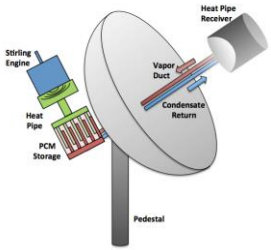
## PROJECT OBJECTIVES

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:

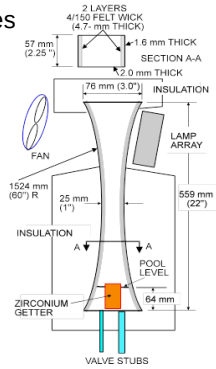
- Leverage high performance heat pipes to support feasible system layout
- Develop and test high temperature, high performance PCM storage
- Optimize storage configuration for cost and exergy performance
- Latent storage *and* transport matches Stirling cycle isothermal input[1]




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

## 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
- Heat Pipe
  - Felt wick enhancements for robust high performance[2]
  - Long-term performance and durability testing
- Proof-of-concept hardware subscale demonstration




[2]Baturkin, 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).

## Q1 KEY RESULTS AND OUTCOMES

- PCM Candidate Evaluation
  - Metallic PCM candidates ranked and prioritized
  - Primary candidate successfully manufactured, characterization underway
  - Project plan revised to develop PCM/shell acute interaction issues
  - 6 potential protective coating chemistries identified for containment through thermodynamic analysis
  - Novel rapid screening method of coating chemistry compatibility developed and implemented, testing 6 coating chemistry plus null samples of containment constituents with two PCM materials. Results analysis underway
- Heat pipe advanced wick development
  - One of two wicks completed for durability test implementation:

## NEXT QUARTER

PCM candidate evaluation

- Complete thermal properties characterization of primary metallic PCM
- Complete final attempt to manufacture second PCM selection
- Complete XRD analysis of rapid compatibility samples and make final selections of coating chemistry candidates for coating development
- Begin coating development and optimization process
- Apply successful coatings to short-term test coupons for exposure to candidate PCM's
- Design 150 hour applied coating compatibility test, fabricate hardware

Heat pipe advanced wick development

- Complete fabrication of advanced wick(s) on test device substrate, and assemble wicks into test device at Sandia

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