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## High temperature Molten salt reactor pump component development and testing.

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**Program:** RC-5: Pump  
scaling Technology for  
Molten Slat reactors

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### ABSTRACT:

The promise for developing new, advanced nuclear reactor concepts for improved safety, economics, and U.S. energy resilience rests heavily on developing cost-competitive nuclear technology. For advanced nuclear concepts to achieve cost competitiveness with other low-cost production, three significant challenges must be met: 1) higher operational temperatures for improved efficiency, enabling hybrid energy systems beyond electricity production; 2) reduced capital cost for construction and deployment to lower the levelized cost of electricity (LCOE), and 3) reduced operation and maintenance (O&M) costs to ensure deployed reactors remain in operation and cost competitive. Molten salt reactors (MSRs) present one of the best opportunities to meet these challenges. MSRs operate at high temperatures enabled by the highly stable and very high boiling point of the reactor coolant. Their high energy density and near-atmospheric operating pressure enables both large and smaller reactor systems. Significant reductions in capital cost can be achieved using conventional, ASME Code-approved, commercially available materials. Reduction in O&M costs requires, at least in part, the potential for reduced or simplified inspection requirements and long-term failure free operations of key components such as pumps and valves and heat exchangers.

Pumps for molten salt reactors are key components for the system overall reliability and present unique challenges for the operation and maintenance of molten salt reactors both for primary and secondary coolants. This proposal will provide relevant key information on the tribology of bearing material and components (magnets, couplers, ceramic coated wire, and coatings) in high temperature molten salts that will be required in the design of advanced reactor pumps. Investigation of in-service inspection and monitoring of the pump internals will also be addressed in an effort to reduce down time and O&M costs for future reactor.

The following objectives will be completed.

**PROJECT OBJECTIVES:** The key project objectives include:

1. Develop a database of friction factors and wear rates on different combinations of pump bearing materials in different nuclear relevant salts over a range of temperatures, speeds and loads.
2. Evaluate materials compatibility of cermets, SmCo magnets and ceramic coated wire in molten salts.
3. Test down selected wetted bearing materials in a prototypic pump configuration for durations of up to 500 hours.
4. Develop advanced pump design concepts with high wetted cermet bearings, high temperature magnets and advanced ceramic coated wire. Construct and test on existing molten salt loop.
5. Develop in-situ pump inspection techniques and pump health monitoring strategies to minimize O&M outages due to pump failures.