Technical Assistance

Ultra-High Temperature Logging Tool for Geothermal Wells

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The proposed solution aims to use a combination of dissimilar materials in the additive manufacturing process and topology optimization to enhanced the thermal insulation that provides protection to the electronics package in downhole PTS tooling, thus extending their temperature range and operating times. The proposed solution is reasonably ambitious and will require the support of the experience, creativity and ingenuity of the American-Made Network and US National Laboratory system.

We believe the vouchers and technical support that are part of the opportunity made available upon successfully meeting the series of Ready!, Set!, Make!, and Geo! HeroX challenges can assist us with meeting our goal of building a successful, fully-functional prototype in a timely manner. In particular, we foresee the following unique challenges and needs that a National Laboratory, private facility and AM connector could help us resolve:

Subject matter expertise: Geothermal Entrepreneurship Organization (GEO)

Our team will benefit in the design process from access to the Geothermal Entrepreneurship Organization's contribution as an American-Made connector to this project. We foresee that GEO will be able to assist us with ascertaining that our proposed solution will indeed target real needs for the geothermal industry and provide us with important additional considerations as we seek to advance the technology readiness level of the proposed solution.

High temperature electronics, limitations and lifetimes: Oak Ridge National Laboratory (ORNL)

In our application, we propose to prolong the lifetime of electronic packages in downhole tooling through optimization of the tool design. Oak Ridge National Laboratory expert Dr. Yarom Polsky can provide our team with complimentary know-how regarding the thermal stability of electronics modules, and has expertise in novel high-temperature components such as transistors that could add additional value to our design.

Materials thermal transport modelling and simulation: Sandia National Laboratory (SNL)

A critical aspect of our design is to utilize modeling and simulation to optimize the topology of our electronics package casing to maximize the thermal insulation provided by the "complexity for free" implicit in the selection of additive manufacturing for part production. Sandia National Laboratory has performed simulations using finite element methods to optimize part topologies in a recent paper that addresses potential applications of AM to the geothermal industry. We seek to utilize this capability during our development pathway for this competition.

AM materials and methods, and hybrid manufacturing (AM is one piece of the remaining conventional design): Matter Hackers and ORNL MDF

Connectors in the American-Made network such as Matter Hackers and ORNL's MDF will be able to provide the necessary expertise for us to realize the potential that AM holds for optimization of the ultra-high temperature logging tool. Materials selected will need to be printable, provide the sufficient thermal conductivity characteristics, and be compatible with the desired topological complexity and/or ability to be combined in a multi-materials design. The AM component will also need to be integrated into the non-AM parts of the design, requiring some knowledge-base and experience in joining and hybrid manufacturing.

Field-testing support: Oak Ridge National Laboratory (ORNL)

In addition to geothermal stakeholders who have provided letters of support to our application, we will seek to involve national lab scientists and engineers, such as the Geothermal Resources groups at ORNL and NREL, in the field testing of the fully functional advanced prototype. They will assist with siting, the design of the field tests, and the independent collection and analysis of the results to help improve and validate the design

Techno-Economic Analysis: Oak Ridge National Laboratory (ORNL)

ORNL scientist Dr. Polsky has experience managing and conducting techno-economic analyses of proposed designs that utilize AM to replace conventional parts in the geothermal industry. We seek to utilize Dr. Polsky's network and experience to help with this TEA at the later stages of the process to fully demonstrate the value that the advanced capabilities of our tool will provide to the geothermal industry.