Advanced high energy battery systems are sought for use in Exploration Medical Capabilities mission applications such as power for mobile oxygen concentrators. There are only a few battery chemistries with a reasonable chance of achieving the target specific energies. Metal/air battery systems are the most likely candidates. The most common type of commercial metal/air battery utilizes zinc/air chemistry and has a practical specific energy of ~370 Wh/kg. While this battery chemistry has a theoretical specific energy of 1350 Wh/kg, it is not possible for this chemistry to meet the specific energy goals for these applications (>2000 Wh/kg). In addition to zinc/air batteries, aluminum/air batteries are also available in the commercial market, although only in a limited fashion. Aluminum/air batteries have a much greater theoretical specific energy (8140 Wh/kg) and although they currently have a practical specific energy of ~350 Wh/kg, the potential for significant near-term improvement exists. The highest theoretical specific energy for a metal/air battery chemistry is lithium/air at 11,500 Wh/kg giving it and aluminum/air batteries the best potential to realize the high specific energy values needed for Exploration Medical Capabilities mission applications.

The focus of this solicitation is on the development of a high specific energy battery that can meet the following goals:

- Specific energy (battery level) >2000 Wh/kg;
- Operating Temperature Range from 0°C to 35°C;
- Shelf life >2 years.

All classes of metal-air batteries (aqueous, non-aqueous, and solid state) as well as other battery chemistries will be considered if they fall within the guidelines of performance. Additionally, the battery system will be used inside a crewed space vehicle and must meet the requisite safety guidelines stated in "Crewed Space Vehicle Battery Safety Requirements".

Phase I research should be conducted to demonstrate technical feasibility and deliver multiple cell-level...
demonstration units at the conclusion of the contract. Additionally, a path toward a Phase II hardware demonstration should be shown which leads to the delivery of multiple module-level demonstration units mid-way through the phase II contract and multiple TRL 4 battery-level demonstration units for TRL 5/6 validation and verification testing at the end of the phase II contract.