

Development of a Single-Fluid Consumable Infrastructure for Life Support, Power, Propulsion, and Thermal Control
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This proposal describes the concept of a highly innovative architecture of interrelated systems including portable life support systems for EVA suits, power supplies for rovers and robots, propulsion for in-space maneuvering and local surface ballistic hops, and thermal control systems, all based on the use of a single high-density room-temperature liquid consumable: an aqueous solution of hydrogen peroxide (H_2O_2). In this concept, the catalytic dissociation of H_2O_2 into water and oxygen provides electrical energy; the oxygen is used in life support systems for breathing, and the water for sublimation cooling in deep space and on the lunar surface. Due to the atmosphere and colder temperatures on Mars, the waste heat from the H_2O_2 dissociation can be utilized to provide selective warming of the space suit or robot components. Expansion potentials for this system are considered, including the use of waste heat to regenerate metal oxide-based CO_2 scrubbers or to heat an EVA suit in extreme conditions such as the lunar poles, external supply of H_2O_2 from a rover vehicle for extended EVA surface operations, and the provision of an integrated hot-gas H_2O_2 propulsion system for in-space activities or short ballistic transports on the surface of the moon or Mars. Due to the complex and life-critical nature of the life support function, the focus of the proposed Phase I investigation will be the detailed design and analysis of a hydrogen peroxide portable life support system (HyperPLSS) system for EVA suits, in parallel with the design of synergistic applications of the H_2O_2 technology in surface rovers, propulsion systems, and thermal control systems. Phase 2 will focus on the breadboard development of a single-fluid H_2O_2 PLSS system, and testing of the system against the analysis tools.

(no graphic provided)