

Integrated Modular Propulsion and Regenerative Electro-Energy Storage System (IMPRESS) for Small Satellites

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The IMPRESS is a significant advancement in space system technology as it is able to operate alternately as a fuel cell to produce electrical power from a stored hydrogen and oxygen and as a water electrolyzer using electrical power to produce hydrogen and oxygen from stored water. Additional water is electrolyzed to provide high specific impulse (I_{sp}) rocket propellants. This integrated approach has several significant advantages over separate (battery) power and propulsion systems including:

- greatly reduced spacecraft launch weight
- improved charge/discharge characteristics (> 5-to-1 power peaking capability)
- increased orbital, probe, and planetary spacecraft mission flexibility
- lower deployment and operating costs with no toxic propellants
- outstanding thrust-to-weight ratios.

During periods of sunlight, the solar arrays power the URFC to produce hydrogen (H_2) and oxygen (O_2). These gases are stored at pressure and the function of the electrochemical cell stack is "reversed" to produce electrical power during the dark periods of the orbit or mission. During electrolysis, excess H_2 and O_2 is produced, and stored to be used for propulsion through H_2/O_2 bi-propellant V propulsion system to yield breakthrough gains in weight reduction, power density, and mission applicability.

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