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A SURVEY OF ADVANCED BATTERY SYSTEMS FOR SPACE APPLICATIONS

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The results of a survey on advanced secondary battery systems for space applications are presented. The objectives were: (1) to identify advanced battery systems capable of meeting the requirements of various types of space missions, with significant advantages over currently available batteries, (2) to obtain an accurate estimate of the anticipated improvements of these advanced systems, and (3) to obtain a consensus for the selection of systems most likely to yield the desired improvements. 205 battery experts from government, industry and universities were invited to respond to a questionnaire on advanced batteries and their potential applications in space; 55 responded.

In the opinion of the respondents, few advanced systems are likely to exceed a specific energy of 150 Wh/kg and meet the additional requirements of safety and reliability within the next 15 years. The few that have this potential are:

1) Regenerative fuel cells, both alkaline and solid polymer electrolyte (SPE) types for large power systems.

2) Lithium-intercalatable cathodes, particularly the metal oxides intercalatable cathodes (MnO_2 or CoO_2), with applications limited to small spacecrafts requiring limited cycle life and low power levels.

3) Lithium molten salt systems (e.g., LiAl-FeS_2).

4) Na/Beta" Alumina/Sulfur or metal chlorides cells.

Likely technological advances that would enhance the performance of all the above systems are also identified, in particular:

1) Improved bifunctional oxygen electrodes.

2) Improved manufacturing technology for thin film lithium electrodes in combination with polymeric electrolytes.

3) Improved seals for the lithium molten salt cells.

4) Improved ceramics for sodium/solid electrolyte cells.