Foreword

The general objective of the third NASA Space Electrochemical Research and Technology (SERT) Conference was to assess the present status and general thrust of electrochemical research and development required to enhance and enable aerospace missions throughout the 1990s and into the next century. An additional objective of the conference was to foster greater interaction between the workers in three areas of electrochemical technology: the production and improvement of electrochemical systems for current aerospace missions; the development of enabling technologies and the evaluation of new concepts for future missions; and the basic research that provides the underpinning for both of these areas. The goal was to broaden the perspectives of the participants and to encourage a greater degree of communication between scientists and engineers in the three technology areas.

The SERT Conference was held at the Lewis Research Center on April 9–10, 1991 with attendees representing thirty-nine industrial, academic and government organizations. Papers were presented in three technical sessions: (1) Electrochemistry for Non-energy Storage Applications; (2) The Electrochemical Interface; and (3) The Next Generation in Aerospace Batteries and Fuel Cells. The first session considered recent research and development related to the application of electrochemistry to life support and environmental control systems (ECLSS), *in situ* resource utilization on planetary surfaces to produce reactants for chemical processes or propulsion, water electrolysis for orbital propulsion reactants, etc. The second session included recent work in the areas of catalysis, hypotheses of reaction sequences, *in situ* real-time analysis of surface changes and reaction products, destructive and non-destructive post-test analysis of surfaces, etc., in order to increase the understanding and improve the performance of electrodes in aerospace electrochemical systems. The subject of the third session was research and development, including high-risk approaches, directed toward significant improvements in performance, or expansion of the operating envelope, of existing or proposed aerospace batteries and fuel cells.

The conference was opened by J. Stuart Fordyce of Lewis, who discussed the intrinsic tension in the technical community between technologists and mission users, and the resulting frustrations for both. Henry Brandhorst of Lewis followed, stressing the impact that power system technology improvements (specific power, specific energy, life, cost, etc.) can have upon ultimate mission capabilities. A total of twenty-seven technical papers were then presented, preceded by an advanced mission overview by Gary Bennett of NASA HQ and a discussion of the NASA program for advanced mission life support systems by Ed Force of Ames.

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With respect to the conference sessions and papers, the following generalizations may be made.

(1) Of the eight presentations for the session on the electrochemical interface, six had to do with the nickel electrode. This reflects the complexity of the structure and the electrochemical processes associated with the electrode, and the variety of analytical tools being brought to bear upon it.

(2) Of ten papers relating to fuel cells and electrolyzers, seven had to do with polymer electrolyte membrane (PEM) cells. This indicates the considerable advances recently made in this technology, and the great promise for long life and high efficiency so necessary for the NASA Space Exploration (Lunar/Mars) Initiative (SEI) missions.

(3) The papers presented in the session on electrochemistry for non-energy storage applications made important points in the areas of environmental control and life support systems, and in *in situ* resource utilization.

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