

Session I Batteries

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SESSION SUMMARY

AUV 2002 was focused on energy systems and the battery session had a full agenda with 8 papers being presented. The topics of the papers covered a broad spectrum of battery types, from commercial off the shelf batteries such as lead-acid and manganese alkaline to more exotic couples such as large lithium-Ion and magnesium-hydrogen peroxide semi-fuel cells. Both primary and secondary (rechargeable) battery types were well represented at the session. The consensus at the completion of the battery session was that there is no existing battery chemistry that will fulfill all the cost, performance and safety requirements for AUVs, but improvements are being made. A good overview of the current state of the art on batteries and their applications in AUVs was presented to the audience.

Edgar An of Florida Atlantic University started off the session with a paper entitled "AUV Energy Systems for FAU AUVs". The presentation reviewed FAU's experiences with three generations of AUVs and their development of the OEX energy system for these vehicles. OEX is a modular system that is expandable for different mission scenarios and can use various primary and secondary battery cell types. The paper provided a good basis for the user community to evaluate AUV energy requirements based on factors such as cost and mission scenario.

Joe Szymborski of GNB presented the second paper of the session. GNB is a manufacturer of Lead Acid Batteries and Joe has considerable experience in the use of Lead Acid Batteries in Submarine Applications. He presented the history of lead acid use in submarines and discussed the size and performance of state of the art lead acid batteries that GNB currently offers to the user for submarine and submersible applications. Lead-acid batteries seem to be a good fit for large submersible applications. This was borne out by the subject of the next paper of the session.

Karl Sette of NSWC gave the third paper of the session entitled "Energy Storage Systems for Large Scale Vehicles". Karl is the Propulsion Engineer for the large-scale vehicle at the acoustic research detachment in Bayview, ID, a detachment of NSWC Carderock Division. The paper discussed the use of lead acid batteries in the Navy's large-scale vehicle model used for acoustic testing of submarine designs. It detailed the rigors involved with the installation and maintenance of a large battery bank, which requires continuous usage to support program objectives.

Pete Stevenson of Southampton Oceanographic Center, UK, which developed and operates its own AUV, presented the fourth paper of the session, entitled "The Experience and Limitations of Manganese Alkaline Primary Cells in a Large Operational UUV". Again, this paper discussed batteries in AUVs from the user's perspective in a real world application. It presented the use of manganese alkaline primary cells due to cost and maintenance issues, which ruled out more exotic chemistries. Practical considerations regarding AUV design, operation and mission planning necessary to make the use of the manganese alkaline primary cells possible was presented.

Pat Imhof of, BST Systems, Inc. presented the fifth paper of the session, entitled Silver Zinc Batteries for AUV Applications. This paper gave a general overview of the silver-zinc chemistry and discussed submersible and AUV applications to date.

The move to more exotic chemistries continued with the sixth presentation of the session by Damian Drozd of Boeing. His paper "Performance, Safety Characterizations and Systems Integration of a Large Lithium Thionyl Chloride Battery for Unmanned Undersea Vehicles" discussed the intricacies of developing a battery for the Navy's LMRS program. Due to the potentially destructive nature of this chemistry when mishandled along with the application's requirement to be fielded by Navy personnel, this paper focused on the many safety aspects of the program. Damian discussed the technical and safety aspects of the design, development, and testing for this program.

N. S. Raman of Saft America Inc. presented the seventh paper of the session, entitled "Lithium Ion Batteries for Autonomous Underwater Vehicles". Raman presented Saft's latest work in developing large capacity lithium-Ion cells/batteries. Specifically the paper discussed the 320 AH battery developed for the SAMs vehicle and the advantages of the lithium-Ion chemistry over other rechargeable batteries.

The last paper of the session was given by Eric Dow of NUWC. Eric provided a good transition to the next session, fuel cells, with his presentation of a paper entitled "The Development of a Magnesium - Hydrogen Peroxide Semi-Fuel Cell". Eric described the work done by NUWC to develop a Magnesium-Solution Phase Catholyte Semi-Fuel Cell (Mg-SFC) as an energy source for UUV applications. The focus of this work was the development of a unique catalytic compound of palladium, iridium and carbon and a novel high surface area microfiber carbon electrode to enhance the electrochemical reduction of hydrogen peroxide.