NASA is currently building the Bioregenerative Planetary Life Support Test Complex (BIO-Plex) for long duration testing of advanced life support systems and procedures. One of the primary objectives of BIO-Plex is the development and testing of an integrated monitoring and control system to coordinate the complex interactions of the numerous life support systems. A three-tiered software tool, 3T, is being used for this task. The planning tier of 3T currently consists of AP, an adversarial planner developed for the battlefield management planning domain. A planner is needed for BIO-Plex missions because of the large number of activities and limited crew time available to spend on planning and scheduling these activities. This research proposes to develop an electrical power utilization model and incorporate it into the planning tier of 3T. This model will allow the planner to select and schedule activities that meet the available power limits. This model takes into account the interactions between systems that effect the consumption of electrical power. For example, the kitchen stove, clothes dryer, incinerator, and lights all consume power but also increase the load on the thermal control system causing it to consume additional power. A model is required since an individual activity, such as running the growth bay lights, cannot accurately predict the additional power required by the thermal control system. A model-based planner can select and schedule activities to minimize the peak power demands and increase the effectiveness of power utilization.

Table 1. Partial List of BIO-Plex Devices

<table>
<thead>
<tr>
<th>Device</th>
<th>Direct Use</th>
<th>Produce Heat</th>
<th>Consume O₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lights</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Incinerator</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>TCS</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Crew</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Stove/Oven</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Clothes Dryer</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Computers</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Germination Box</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 1. Model Elements and Interactions

Publications

Hsu, Y. C., G. R. Chen, and H. Malki. "Fuzzy Logic and Neural Network Based Adaptive Controller Design," *Proc.* of Int'l Conf. on Neural Networks, Houston, TX, June 8-12, 1997. 1705-09.


**Presentations**


**Funding**


"The Development of a Fuzzy-Logic-Based Approach for Smart Oil Recovery." Univ. of Houston Energy Laboratory, 1997, $12,797.


**Investigative Team**

**UH PI:** G. Ron Chen, Ph.D., Professor, Department of Electrical and Computer Engineering  
gchen@uh.edu

**JSC Co-PI:** Jane T. Malin, Ph.D., Automation, Robotics, and Simulation Division, SLSS  
jmalin@gp301.jsc.nasa.gov

**UH Post-doctoral Fellow:** Mike Dowell, Ph.D., Electrical and Computer Engineering, completed Aug. 1997

Ya-Chen Hsu, Ph.D., Electrical Engineering  
Jialiang Lu, Ph.D., Electrical Engineering