3-1-2004

March 2004 Report of Progress

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Air and Water Focus Area:

BREATHe

- Presented at ASCE Earth and Space Conference
- Setup of 6 reactor system including gas distribution system
- Setup and operation of new GC -Determined biodegradability of Pert Plus for Kids surfactants using respirometry. Toxicity was observed for high levels of discodium cocoamphodiacetate.

Biofiltration

- Set up for a biofiltration experiment (a primary test) to see a short-term performance in biofilter operation.
- Completed the process modeling and calculated the predictive data of biofilter operation.
- Started the modeling of the indoor air quality in ALS cabin.
- Presented Air/water group seminar, 3/4/2004.
- Presented project plan 3/26/2004 to all ALS NSCORT members.

LiFT

- Completed design/construction of second system prototype. Chamber was not able to sufficiently hold vacuum required for sublimation of water.
- Currently, constructing third prototype which is a more simplistic design.
- Upon completion of construction of the third prototype, microbial tests will be run on water product and solids residue after doping of urine with E. coli.

Solids Focus Area:

STAR

- Began participating in John Fisher's ALS Solid Waste working group to develop solid waste requirements for future missions. Assigned research topic of "Evaluating the adequacy of Shuttle and ISS waste systems".
- First run of STAR completed including human fecal waste, complete analysis.
- Distribution of STAR effluent to dewatering fish and mushroom growth research groups.
- Hosted Wea Middle School group tour of labs, discussing research.

Crops Focus Area:

- Received four strawberry cultivars, four blueberry cultivars, two cranberry cultivars and are optimizing growth conditions.
- On March 15-18, Cary Mitchell traveled to Brisbane, Australia and presented a talk on the development of novel LED lighting strategies to NCR-101 and ACEWG. (Australasian controlled environments working group).
- Prepared a paper on nutrition and productivity of sweet potato as a result of available root volume and selective vine removal for ICES.
- Initiated development of structure for mounting LED array.
- Continued ongoing tests of hydroponic system.
- Continued ongoing tests of six basil cultivars in greenhouse.

- Fungal strain/substrate tests indicate excellent growth on soybean and cowpea, moderate growth on wheat straw and tomato, slow growth on rice straw, very poor growth on basil, and no growth on sweet potato non-edible residues.
- Fungal mycelial growth was best in fine, less in moderate, and least in coarse textured substates

Integrated Systems Group Focus Area:

- The March 8 Integrated Systems Group meeting covered NSCORT project planning, updating the process map of the current model, and utilizing or extending an available simulator such as Biosim or Ecosim. The group met Guy Gardner, the new Director of Superproject Development, Discovery Park, Purdue. He offered a few initial insights on ALS/NSCORT as an astronaut on STS-27 and STS-35. The group discussed the prospective lunar mission, but decided not to direct all efforts at a particular scenario.

- George Applequist and Wendy Madore delivered an ALS TIM on March 11 introducing the ALS community to a website created at Purdue, the ALS Interchange, http://research.e-enterprise.purdue.edu/nasa-als. Members of the ALS mailing list were issued unique usernames and passwords and provided with access instructions. The site is intended to provide current information from the NASA ALS Program Office on-demand which has usually been disseminated by email. The site was planned with Dan Barta late last year, and George Applequist trained Chantel Whatley while at JSC in January.

- The group organized the Mar. 26 project planning workshop, a 5-hour NSCORT-wide meeting, including phone calls from Howard and Alabama A&M and web conferencing with recording for future reference. **Formal plans of a year's research for a total of 12 projects have now been presented.** All PI's, researchers, and the systems group had a worthwhile discussion about the up-to-date plans and proposed technologies.

- Dr. George Applequist gave the March 30 lecture in the Space Advanced Life Support telecourse, covering NSCORT systems research.
- Selen Aydogan submitted the manuscript entitled "A Prototype Simulation Based Optimization Approach to Model and Design an Advanced Life Support System" for the ICES 2004 meeting.
- Yan-Fu Kuo, working with the waste group, completed the energy and ESM analysis for the LiFT urine sublimation system.
- Chit Hui Ang has learned and reviewed BIOSIM. She is currently
- comparing the difference between BIOSIM and our zeroth order model to assess the advantages and disadvantages of each approach.
- Chit Hui Ang assisted subsystems to develop BREATHe I, BREATHe II, Iodine and UV project plans. All are completed. She also completed her project plan.

Food Focus Area:

Processing:

- Completed preliminary characterization of Apogee, Perigee, and 3 terrestrial varieties of wheat.

- Submitted Equipment ESM paper to ICES with extensive appendix of ESM-important parameters of currently available small scale food processing equipment.

- Submitted Grain Milling ESM paper to ICES.
- Ilan Weiss, M.S. student on NSCORT project, successfully defended his thesis on March 26.

Safety:

- A recombination system was developed for the modification of the *E. coli* O157:H7 bacteriophage V10 by isolating a V10 lysogen of *E. coli* O157:H7. The strain was subsequently transformed with pKD46 which containing an arabinose inducible recombinase allowing electroporation of linear for insertion of reporter genes into specific regions of the phage genome.

- The complete genome *E. coli* O157:H7 bacteriophage V10 has been sequenced and we have identified over 30 open reading frames (putative genes). Initial analysis has identified regions for modification allowing insertion of reporter genes which do not affect the phage life cycle.

- Utilized previously developed *Salmonella* P22 recombination system to construct a functional phage based bioreporter for detection of *Salmonella spp.*

- Completed preliminary work on the use of pulsed light sterilization and combination of disinfectants on reduction of spoilage bacteria on lettuce

- Tyrico English, M.S. Student, utilized impedance technology to determine the growth of biofilms on lettuce

Outreach Focus Area:

- **What**: Mission to Mars
  Who: Julia Hains-Allen
  When: March 9, 2004
  Where: Imagination Station

  The "Mission to Mars" program uses cutting edge research in design of each activity within the module, engaging students in relevant, authentic research driven experiences. Home School Association of Tippecanoe County is participating in the Mission to Mars program. This will involve 30-35 home school students for 12 weeks beginning March 9, 2004.

- **What**: ESTME EXPO
  Who: Guy Gardner and Macon Fish (Graduate student in ALS/NSCORT Outreach)
  When: March 16, 2004
  Where: Washington D.C.

  Submitted to Sean O'Keefe by Bonnie McClain:

ALS/NSCORT was invited to sponsor a booth for the upcoming Excellence in Science, Technology and Mathematics Education (ESTME) EXPO in Washington, D.C.

Located in the ALS/NSCORT display, will be the actual prototype bioreactor designed by Purdue Engineering researchers to remove surfactants from gray water in the Mars habitat. Purdue researchers have performed extensive research on this bioreactor, including reactor performance assessment with a representative gas and liquid influent. Visitors to the ESTME-EXPO display will participate in one of the "Mission to Mars" activities, "**Cleaning Water on Mars.**"

Directly linked to the bioreactor research, participants will design a water cleaning system from household supplies and test the system with simulated gray water. Thus, students and teachers explore futuristic concepts using materials and methods that are familiar, cost effective, and obtainable.

Former astronaut and two-time shuttle pilot, Guy Gardner, will be on hand to answer questions about space travel, the use of the "Mission to Mars" module to stimulate student interest in science, and to distribute module materials and contact information so that educators can begin the "Mission to Mars" program in their schools. ALS/NSCORT Outreach will provide on-going support to educators using the "Mission to Mars" materials in their classrooms.

- **What**: Professional Development Day
  Who: Julia Hains-Allen
  When: March 17, 2004
  Where: Hammond City School Corporation, Hammond IN

  Julia Hains-Allen will conduct a professional development workshop on "Using Inquiry Methods to Teach Science". This hands-on workshop will introduce 6-8th grade teachers to the "Mission to Mars" curriculum and provide an opportunity for the teachers to perform the experiments in the module.

- **What**: Project Lead The Way
  Who: Julia Hains-Allen
  When: March 19, 2004
  Where: National Program among Public Schools

  ALS/NSCORT Education and Outreach in association with Orbitec and Gus Koerner ALS has developed a new partnership with Project Lead The Way to assist in promoting the Biomass Production Education System (BPES) to high schools nation wide. Project Lead The Way Inc. is a national program forming partnerships among Public Schools, Higher Education Institutions and the Private Sector to increase the quantity and quality of engineers and engineering technologists graduating from our educational system.

- **What**: Mission to Mars School Program
  Who: Julia Hains-Allen
  When: March 31, 2004
  Where: Marion County Extension Office

  A one-day professional development workshop will be offered to instruct Extension Educators in the state of Indiana on the use of the "Mission to Mars" 4th-6th grade module in classrooms across Indiana.
  Included in the workshop:
  - Hands-on instruction for the 11 activities in the "Mission to Mars" module
  - Complete manual including teacher guides and materials Lists
  - Instructions on using the activities independently or as a 11 week module
  - Background information needed to present "Mission to Mars" curriculum
  - Assessment materials

  Extension educators will disseminate the lessons and gather assessment data on the module. This data will be used to further develop the program.

Center Related Activities:

- 3/3/04, Dave Kotterman presented "**Artificial Closed Eco-Systems for Human Habitation of Space"** to Lafayette Optimists Club at MCL cafeteria, 35 people.
- 3/18/04, Dave Kotterman presented "**Artificial Closed Eco-Systems for Human Habitation of Space"** to the Industrial College of the Armed Forces at Pfendler Hall, Department of Agriculture, Purdue University, 40 people.
- 3/23/04, Dave Kotterman presented ALS NSCORT Poster Session for **"Energizing the Enterprise"**, South Ballroom, Purdue Memorial Union, 150 people.
- 3/25/04, Received year two funding from NASA. Processing AAMU and Howard Universities first.