EL PASO/YSLETA SCHOOLS GET-AWAY SPECIAL SPACE SHUTTLE STUDENT PROJECTS

2.0.1 DAVID BOWDEN - EXP. 1-B - GROWTH OF LETTUCE SEEDS

PURPOSE: The purpose of this project is to see how the Lactuca Sativa (lettuce) seed will germinate and grow in a weightless environment. This project will also answer many questions such as: what the health of the plants will be, the biomass of plants grown in microgravity, and the formation of new root structures in microgravity.

PROCEDURE: The experiment hardware is a self-contained and fully automated growth chamber providing all the required factors for proper germination. It provides a terrarium environment (on a small scale) with pilot light, to one chamber level, temperature control and thermal insulation. The project also preserves all specimens for further ground based testing.

This experiment is designed to run 112 hours. The first function, after activation, will involve pumping growth solution into the various chambers. The second pumping will occur at 72 hours. The final pumping will be the fixative into the chambers. The lighting cycle will be 10 minutes of light every hour.

2.0.2 GISELE BRYANT - EXP. 2-B - SEED GERMINATION

PURPOSE: This experiment will observe genetic changes in barley seeds germinated in microgravity. Further, the experimenter plans to determine if these seeds will have genetic changes in future generations.

PROCEDURE: Place 100 raw seeds in the container. Bring the temperature to $20^{o}C$ +/- $5^{o}C$. Inject approximately 40 cc of hydroponic H_2O. Turn LEDs on 72 hours after H_2O is injected in intervals of 10 minutes every hour. Inject final 15 cc. hydroponic H_2O into chamber prior to termination.

2.0.3 DONALD R. CAKE - EXP. 3-B - GROWTH OF BRINE SHRIMP

PURPOSE: The goal of the experiment is to study the growth rate of brine shrimp and morphological development during the hatching of brine shrimp eggs over a 72-hour period. The data from this experiment will add information to an organism that has already received a great deal of study.

PROCEDURE: Brine Shrimp will be injected at 0 hours, 24 hours, 48 hours, and 60 hours into the hatching chamber of the canister. At T=112 hours, during deactivation, a fixative will be injected into the chamber.

2.0.4 PRISCILLO CAMPOS - EXP. 4-B - GERMINATION OF TURNIP SEEDS

PURPOSE: The goal of this experiment is two-fold. The first is to collect statistical data on the germination rate of turnip seeds in microgravity. The second goal is to conduct a post-flight analysis of the plant biomass and cellular structure. Since plants are being considered for use in the Close Life Support System, this data could provide useful information on what types of plants are best suited for such a system.

PROCEDURE: The turnip seeds will grow in space for approximately five days and then be preserved for examination. The container will be kept at a constant temperature of 70°F (20°C). The container also has linear actuators to inject water or preservative onto the seedbed automatically.

The container is made of clear plexiglass . It is secured by four bolts with nuts, washers, and split washers. The container has three main sections and it will be divisible for easy classification. The first section is the experiment electronics, the linear actuators. One of the actuators will inject water while the second injects preservative onto the seeds. The second level is the liquids container measuring 5" x 5" x 3". It has two holes bored into it, and each one has a plunger which will individually push water and formalin. The third level is the seedbed which measures 5" x 5" x 1" and has a 4" diameter circle bored into it. There 200 seeds will be placed with about eight layers of paper towels, four above and four below the seeds.

At T=1, the linear actuators will inject 15cc of water into the seed chamber. After the water has been injected, the plunger will be raised to release air pressure. At the same time, the heaters will keep a stable temperature inside the seed chamber. The seeds will continue to germinate for about five days. The heaters will be turned on and off during the five days as well. At T=112, another linear actuator will inject 10 cc of formalin into the seed chamber. The seeds will be preserved to prevent the turnip seeds from decaying. Data will be recorded to determine how many of the seeds have germinated and the structure of the plants.

2.0.5 CLAY CASAREZ - EXP. 5-P - LIQUID LASER

PURPOSE: The laser has many physical uses in space, and this experiment will evaluate the changes in the effectiveness of a Dye Laser in a zero gravity environment.

PROCEDURE: Bring the temperature up to 0°C and maintain at 0°C+. Then follow procedures on flow chart for liquid laser project.

2.0.6 MONICA CHAVEZ - EXP. 6-B - PLANARIA REGENERATION

PURPOSE: The planaria regeneration objective is to observe the effect of microgravity on cell regeneration. Further, this project will determine if regeneration will be altered by either being accelerated or decelerated. In the near future, surgery will be performed in outer space; with this cell regeneration

information available, potential hazards or benefits can be anticipated in the healing process.

PROCEDURE: This experiment will send 15 Planaria Dugesia Tigrina (brown planaria) into the growth chamber of the experiment. They will be kept alive by the circulation of the liquid medium both prior to flight and through five days of the mission. Prior to deactivation, a fixative will be diffused throughout the solution in order to preserve the Planaria. The fixative will enable the observation of their survival.

2.0.7 KELLY FOSTER - EXP. 7-P - WICKING EXPERIMENT

PURPOSE: This project is designed to collect data on the accumulation of fluid on a metallic screen due to wicking. This information will help evaluate the fuel recovery efficiency of the Space Shuttle fuel cells.

PROCEDURE: A small sample of the fuel screen used in the fuel system of the space shuttle, to transport fuel from the storage tanks to the combustion section, is used in this experiment. The screen is placed in between two single sided pieces of copper clad material creating a capacitor. The dielectric of the capacitor consists of the screen and the fluid. In this case freon 113 represents the fuel, which will wick on the screen. The increasing and decreasing of the fluid on the screen will cause the capacitance of the capacitor to change. The changing capacitance will be digitized and stored in two 2k EEPROMs.

The experiment will be turned on by the noise generated by the engines at liftoff. The noise will be converted to electrical energy by a piezo crystal, which turns on a transistor, which picks up a relay, which puts power on the experiment.

Power will remain on the experiment for approximately 15 minutes. This is accomplished through a timing circuit which will remove power after approximately 15 minutes. Power is fed through a magnetic latching relay which is controlled by GCD relay B. When GCD relay B is in the "latent" position, power is fed through the magnetic latching relay to the experiment. When GCD relay B is made "hot", the power is removed from the experiment and remains removed even when GCD relay B goes back to the "latent" position.

2.0.8 KAREN HERMAN - EXP. 8-B - EFFECTIVENESS OF ANTIBIOTICS ON BACTERIA

PURPOSE: This experiment will determine the effectiveness of antibiotics on bacteria in microgravity as compared with that action on earth. The data will be obtained on a photographic plate being exposed through the plexiglass container by LEDs. The significance of this experiment will be to provide data to future human space colonies, as to the use and effectiveness of antibiotics to treat bacterial diseases.

PROCEDURE: Once in orbit, the heater will be turned on to heat

the container to 37°C. Then a linear actuator will push down the plunger of the syringe and puncture a membrane. This allows the lyophilized bacteria to become active by being mixed with nutrient broth. It will be in this state in the syringe for 6 hours. Then the linear actuator once again pushes the plunger and punctures another membrane so that the mixture of the bacteria and broth are sprayed out onto a surface of agar in the growth chamber. Two minutes later two antibiotic discs will be lowered and placed onto the surface of the agar by the linear actuator. After 20 hours have passed, a picture will be taken from the bottom of the container using a photographic plate and two yellow LEDs. On the completion of the photograph everything will be turned off, including the heat.

2.0.9 REBECCA LOPEZ - EXP. 9-B - OBSERVING GROWTH OF SOIL MOLD

PURPOSE: This experiment will examine the growth patterns of the mold Mucor rouxii under anaerobic and aerobic conditions while exposed to microgravity. The growth of the mold is affected by the environmental culturing conditions. In an aerobic environment M. rouxii closely resembles the morphology of common bread mold. Sporangium is produced with spores and rhizoids. Under anaerobic conditions the M. rouxii morphology is similar to that of yeast. The data from this project may gleen new knowledge about the life cycle of M. rouxii. It would be useful since M. rouxii can cause severe crop damage.

PROCEDURE: Both of the containers that will be used for this experiment will be made out of plexiglass, sealed with RTV sealant, and bolted together with one quarter inch stainless steel all-thread bolts. Before this experiment is placed in the canister 75 milliliters of agar medium will be poured into each of the plexiglass containers, and the atmosphere of one of the containers will be changed to the anaerobic condition with carbon dioxide and nitrogen gases. The following steps will be the time line for this experiment: At T=1 the two heaters will bring the temperature to 28°C plus 5° or minus 3° and this temperature will be maintained throughout this experiment. Then the #1 linear actuator will be turned on, driving syringes A and B to each inject 20 microliters of Mucor rouxii spore into the growth chambers. After 35 1/2 hours have elapsed, the two yellow LED lights will be activated for 40 seconds. This will take photographs of the growth structure of the Mucor rouxii culture before injecting the preservative. After 10 minutes have elapsed, #2 linear actuator will be turned on, driving syringes C and D to each inject 3 cc of Formalin preservative on one side of the agar medium. Finally, the experiment can be turned off.

2.0.10 JAMES MARTINEZ - EXP. 10-B - POST FLIGHT EXAMINATION OF PLANT GENETIC STRUCTURE

(Will not participate in flight operations)

2.0.11 MICHAEL MOORE - EXP. 11-B - CRYSTALLIZATION IN ZERO G

PURPOSE: This experiment is to test for similarities or changes between crystals of Potassium Aluminum Sulfate grown in zero gravity and those grown on earth. The crystals grown aboard the shuttle will be compared to a like set of crystals grown under the same conditions in El Paso. Several tests which are standard to crystal testing will be used. It is expected that better, or even close-to-perfect, crystals will be grown. They will probably be much clearer and may possibly have a different shape than those grown on earth.

PROCEDURE: The solution, H_2O and Alum, will be prepared in El Paso. It will immediately be placed in the growth chamber in the structure and the latter will be sealed and ready for shipment. When the experiment is turned on, a linear actuator will push a plunger down a small shaft, thus relieving the negative pressure within the growth chamber. The crystals should then begin to grow. At this time the experiment will be finished and ready for testing. (During all of this, the temperature will be maintained above zero degrees Celsius.) The time duration for the linear actuator to move the plunger will be one minute.

2.0.12 - RUDY SANTINI - EXP. 12-B - SYMBIOTIC GROWTH OF CHLORELLA AND KEFIR IN MICROGRAVITY

PURPOSE: The goal of this experiment is to establish a symbiotic life support system in microgravity and monitor the growth rate of the two biological organisms. Kefir, a composite lactose fermenting yeast, will provide the carbon source. Chlorella, a unicellular green algae, will use the carbon dioxide provided by the Kefir, and in turn produce oxygen. In effect, a closed ecosystem will be established. Closed loop life support systems, containing biological organisms have been proposed for use in space stations and manned interplanetary space craft. The data from this experiment would be a first step in understanding the operational dynamics of such a system in space.

PROCEDURE: When the power is turned on, the heater will be activated to maintain the container within the temperature range of 20°-25°C. Then the linear actuator will move a blade forward (3/16 inch) breaking the membrane which is holding back the nutrients from the Chlorella and Kefir. After the membrane is punctured, the linear actuator will pull the blade back 3/16 inch. After 112 hours growth time, the linear actuator will pull full back and act as a suction cup pulling the preservative into the chamber. After five minutes have elapsed, all of the power will be turned off.

2.0.13 JOHN THURSTON - EXP. 13-P - DRAM CHIPS

PURPOSE: This project is designed to find out if the conditions of space such as cosmic rays and weightlessness affect the performance of computer chips. This will be accomplished by testing computer memory chips on the ground and in space. Both Japanese and American chips will be used to see if there is any difference in their performance. After the flight, the results

obtained in space will be compared to the results previously obtained on the ground and any differences analyzed.

PROCEDURE: Dynamic Random Access Memory (DRAM) chips will be used. The DRAMs consist of thousands of transistors in which the gates can be charged to a certain voltage level. Because the charge on the gates leaks away slowly the charges have to be read and restored to their proper level periodically. This process is known as refresh. If refresh is not done within a certain time limit, the charge in the gates will have leaked away and any data stored in the chips will be lost.

Testing of the DRAMs will be done by using a microprocessor to write a test pattern to the chips and then count any errors that occur. A 2K EEPROM will be used to record the number of errors that occur. This testing will be done with different amounts of time between refresh cycles to determine how fast the charge is leaking away from the gates.

Clay Casarez- 9B
Project: Testing a liquid Laser

The problem to be studied is the construction of a liquid laser capable of comparing the behavior of a liquid laser on earth and one in space regarding:

a) the temperature of the laser unit - liquid laser and space surrounding the light pump area;
b) the condition of the generated beam in respect to color, intensity, and distortion;
c) the relative power output of the laser under both conditions.

The proposed experiment is to be limited to the use of a liquid laser only in order to observe how the liquid will react in the near zero gravity of space as opposed to the earth's gravity.

Laser stands for Light Amplification by Stimulated Emission of Radiation. There are four kinds of lasers. These are: solid, liquid, gas, and semi-conductor.

The solid laser consists of: a) a rod of aluminum oxide with small amounts of impurities such as chronium; b) a light source suspended around the laser rod consisting of xenon flash tubes or similar light intensity (the light tube being either linear or spiral); c) one fully reflective mirror and one semi-reflective mirror system placed at opposite ends of the laser rod, as shown in Figure 1.[1]

The lasing action occurs when the light source pumps or excites the chronium electrons causing the electrons to "jump" into a higher orbit. The chromium electrons then tend to return into their normal orbit and is so doing, liberate energy in the form of light. The light particles are then reflected back and forth between the mirrors until the beam becomes strong enough to pass through the semi-reflective mirror in a coherent beam.

The liquid of dye laser works on the same principle as the solid laser except the medium is pushed through the optical cavity by means of a mechanical liquid pump system. Tuning of the Coherent beam is accomplished by the use of a prism or a defraction grating[2] isolating only the part of the spectrum to be studied, as shown in Figure 2.[3]

The gas laser's operation consists of:
a gas discharge tube that is highly evacuated and then filled with gas, placed between two mirrors forming a resonant optical cavity. When the gas is excited via an external energy source such as a current discharge, photons are produced and due to the amplifying action of the cavity and mirrors, laser radiation is produced.[4]