**Biosphere2**

Biosphere2 was built near Oracle, Arizona, outside of Tucson. It was originally financed by the [Ed Bass](http://en.wikipedia.org/wiki/Ed_Bass) Company, Decisions Investment, costing US$200 million from 1985 to 2007, including land, support, research, [greenhouses](http://en.wikipedia.org/wiki/Greenhouse), test module, and staff facilities. Since the planet Earth is Biosphere1, this was supposed to be a completely independent living system as might be built on Mars. The design was quite impressive with a concrete base and a glass-enclosed, sealed area that was intended to provide completely independent living space for 8 “Biospherians” who started their two-year mission in 1991. The only external system that was used was the natural gas power generation system. Some living quarters were also built on site for the staff that monitored progress of the initial two-year experiment which entailed living in an independent enclosed system.

So what happened here? I have attempted to find out, but the facts are not entirely clear.

Chemistry The equation PV=nRT states that the volume of a closed area is proportional to the temperature. Since the temperature inside an all glass building in the desert will rise during the day, two large 25 meter cylinders with expandable tops was used to keep the pressure constant with rising temperature. The plan was to have enough plants that took CO2 out of the air and produce O2. However the massive amount of concrete used had a surplus of CaO in the mix like it should, but the CO2 in the inside air was absorbed into the concrete with the reaction CaO+CO2 = CaCO3. This meant that the O2 in the air gradually kept decreasing until it was equivalent to an altitude of 5000 meters, so the Biospherians suffered from altitude sickness. More O2 had to be injected into the system to maintain efficiency. Later, all the concrete was painted so it would not absorb CO2,

Biology Five distinct climate zones were designed into the space: jungle, savanna, desert, ocean, and swamp. The variety of plants is quite interesting. It was quite a job to maintain all these ecosystems. Most of the plan went well except for a few errors: 1. Bees could not find their way due to the screening of ultraviolet light by the glass panels, 2. Cockroaches that were used to assist in the decomposition of dead vegetation over-expanded and ate live plants and food, 3. One kind of ant went wild and took over several areas.

Food Some crops like bananas did well, others did not produce at all. The coffee plants produced only enough beans for eight cups every three weeks. The animals were less efficient than hoped and did not prosper. There were constant food shortages leading to caloric deprivation of the people. There were rumors that emergency rations and animal sacrifice were used to keep the experiment going. After the two-year period, the average weight loss was 20%.

Psychology The US Navy puts people on submarines for six months routinely. Everyone knows the rules, and the captain is in charge. The eight scientists on this mission quickly separated into two groups of four and became quite hostile towards the other group. The mission directors were outside the area and did not provide decent leadership. The doctor in the group was conducting experiments in caloric deprivation; others had other private specialized agendas. The memoirs of the group did not agree on many aspects of the two-year experiment. However, the first group did make it through the two years and exited to congratulatory speeches. Jane Goodall was keynote speaker.

Publicity The second expedition started about one year later, after the initial problems had been supposedly fixed. This group was dominated by theater people who were interested in getting more publicity for the project; they emphasized relations with the news media, not science. There were several problems from inception with several overly personal involvements among the group and the outside directors. There were rumors of people leaving for the night, pizza being brought in and hidden food stores. Two of the original group came by one night and broke several of the glass panels “to prevent oxygen starvation”. The costs kept escalating, and finally the Bass brothers decided to terminate the entire second expedition activity after six months.

Epilog The overall experiment had cost a lot of money and the site was then used for research by Columbia University. The founders then decided to exit the entire deal and get as much money out of it as possible. The large acreage including the site and all the buildings were sold in 2007 to the highest bidder, a housing developer. After much local protest, the developer contributed the buildings to University of Arizona in Tucson as a research facility (for a tax break). By this time, the local power grid had expanded, so the site was connected to the grid. Biosphere2 is still used for some research, and has been opened up to tourists, so it is no longer a closed system. Walkways were constructed inside, and informational guides provide tours of the facility for a fee. It is an exceptionally interesting place to visit and attempt to understand. The people giving tours are proud of the science experiments performed there and also being listed in the 50 most significant buildings in the USA. Parts of several movies have been filmed on location there. The topic of Biosphere2 still attracts attention, derision, and speculation. I wonder what would happen with a human Mars expedition? I think that robots are a better choice as they can collect information efficiently over a long period of time without requiring a lot of resources to keep them around on the planet.