# MONKEY BUSINESS

The Story of "Miss Baker" and Bio Flights 1 & 2
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In late August of 1958 the animal house at the Naval School of Aviation Medicine suddenly came alive with the shrill whistles and lively chatter of a colony of South American squirrel monkeys. At the same time the physiology and electronic labs began to bustle with-activity centered around peculiarly shaped containers, electronic recorders, and other paraphernalia strongly suggestive of space travel. Although no sentries were posted, guarded conversations and evasive answers indicated that something big was in the wind. As the weeks passed, the tempo of activity increased and by mid-November lights burned in the labs, night after night, until the early morning hours.

And then in early December everything suddenly became quiet again. The strange apparatus, some of the monkeys, and several staff members suddenly disappeared. About a week later, on the 13th of December, the explanation for it all appeared in the national press.

The U.S. Army had fired a Jupiter IRBM Missile with a live monkey aboard. Unfortunately, due to a malfunction of the missile nose cone, it sank in the ocean and the monkey was lost, but telemetered data received by shore and ship monitors indicated that the monkey had successfully survived the trip into space, the weightlessness, and the re-entry into the atmosphere. The design and development of the biocapsule, preparation of the monkey, and much of the fabrication of the biocapsule had been done at the Naval School of Aviation Medicine.

The experiment was repeated on May 28, 1959. Basically the same configuration of the biocapsule was used with several minor changes and improvements. In addition, this nose cone carried a second capsule

containing a larger rhesus monkey. Although preliminary design of this larger biocapsule and life support system had been done at the School, the responsibility for constructing it and preparing the larger monkey was assumed by the Army. The results of this experiment were even more widely publicized, probably because the successful recovery of the two monkeys caught the public fancy.

The "monkey business" started late in the summer of 1958 when the Army Ballistic Missile Agency made space available in the AM-13 Jupiter Test Nose Cone Recovery for a biological pay load. The U.S. Naval School of Aviation Medicine was selected to prepare the first biocapsule and Its passenger. The space available on a non-interference basis, measured 10 inches by 13 3/4 inches and sloped from 4 3/4 inches to 7 Inches in depth. This allowed a total volume of 789 cubic inches for the animal, life support equipment, and recording devices. The flight capsule weighted 29.5 pounds.

The requirements set forth for the experiment were: (1) a self contained capsule having a 24-hour life support capability, (2) recovery of a live animal, and (3) use of an animal as high on the phylogenetic scale as possible. Young South American squirrel monkeys were selected as the animals best fitting the requirements and Limitations imposed.

For the first experiment (Bio-Flight 1, December 13, 1958) the monkey, with knees folded up over the abdomen, was placed in an open metal cylinder lined with form-molded silicon rubber. The head was supported by a chamois lined, reinforced, molded rubber helmet fastened to the cylinder to prevent movement. This cylinder was placed inside a second Cylinder with rubber insulation between the two. For Bio-Flight 2 (May 28, 1959) this support was modified by eliminating the inner cylinder and replacing the molded silicon rubber with molded polyurethane foam covered with a thin layer of rubber potting compound. The animal was oriented in a face down, prone, position during countdown and launch of the missile, and face up, or supine, on re-entry of the nose cone into the atmosphere.

Oxygen was supplied from a standard parachute bailout bottle (the only "off the shelf" item of equipment used in the biocapsule) charged to 180O pounds per square inch. It was bled into the chamber through a reduction and bleeder valve at a rate predetermined to be the approximate consumption rate of the animal.

Carbon dioxide was removed from the atmosphere by chemical absorption, using "Baralyme" in Bio-Flight 1, and lithium hydroxide in Bio-Flight 2. Humidity was controlled with fused silica gel, and activated carbon was included to remove noxious odors. These chemicals were contained in pelon fabric containers which permitted free diffusion of gases but would limit the escape of chemical dust if vibration were encountered. Temperature was controlled by insulating the capsule with an aluminum foil covered, inch-thick blanket of glass wool and the inclusion of a thermostatically controlled 8 watt resistor.

Six channels of electronics were made available for telemetering bio-logical information during the countdown and flight of the missile. These were used as follows:
1) Fine platinum mesh, silver-plated electrodes were imbedded under the skin of the animal to record the EKG.
2) A tiny bead thermistor sensitive to air flow was mounted over the nostril to record respiration.
3) A pressure sensitive transducer was mounted over the chest of the animal and served as a microphone to transmit heart sounds, vocalization, and other extraneous sounds in the capsule. This was eliminated in Bio-Flight 2.
4) A glass probe thermistor placed in the axilla gave a continuous reading on body temperature.
5) A second thermistor mounted in the capsule recorded environmental temperature.
6) A pressure transducer mounted in the capsule recorded environmental pressure.

The miniaturized amplifier system included in the capsule was one of the

most remarkable developments of the project. On the basis of requirements set forth by the electronics laboratory at the Naval School of Aviation Medicine, this amplifier was designed and built in the electronics section at ABMA, Huntsville, Alabama. Already it has become apparent that developments such as this will find wide applicability in medical science.

The squirrel monkeys in the colony were screened several months before the projected missile flights, and a number were selected on the basis of size and temperament to be trained for space flight. This training consisted largely of accustoming them to handling and acclimatizing them to conditions of restraint and isolation in the biocapsule. The selected monkeys were subjected to restraint in a dark room for 5 to 7 hours several times week and were instrumented and restrained in the completely closed environment of the biocapsule for periods of 18 to 24 hours at least three times prior to the flight.

About a week prior to the date set for the launch of the missile, in December and again in May, the launch team proceeded to Cape Canaveral, Florida, and set up shop in a trailer housing the monkeys and all the necessary gear. On the afternoon prior to the launch two monkeys were prepared and sealed into two identical capsules. Then, approximately six hours before "T" (take-off) time, the capsule containing the monkey which showed the better responses was delivered to the Army for installation in the Jupiter nose cone. During the final six hours of countdown the reactions of the monkey were monitored from a block house until, with an earthshaking roar, the mighty Jupiter with its living passengers blasted skyward.

Fifteen minutes later the recovery team aboard a Navy ship in the range area was awed by the spectacular re-entry of the missile. There followed tense minutes that dragged into hours as the recovery task force sought the nose cone. Disappointment, tempered by the reception of excellent flight data, followed the first shot in December when the nose cone could not be found. In May, however, the second cone was recovered and two very much alive and unharmed space travelers were released from their

confinement. The subsequent jubilation and world-wide acclaim is now a matter of record.

An analysis of the data and reactions of the animals to space flight will be the subject of technical papers in the near future. Suffice to say that the animals survived the ordeal of acceleration on take-off, weightlessness, and deceleration on re-entry, of their 1700 mile long, 360 mile high, 10,000 mile per hour ride without any unusual or remarkable reactions.

This narrative would be incomplete without mention of one of the most remarkable aspects of such a project which is often only indirectly appreciated. This factor was the close, friendly cooperation, the team spirit, which existed among the scientists, engineers, and their associates on an intra-service, inter-service, and extra-service basis. This project could not have been successful, particularly in the short time available, were this not true.

In addition to the members of the NAVSCOLAVMED staff and their assistants who were primarily assigned to this work, many others contributed. It would be impossible and pointless to attempt to name all the individuals and organizations. It should be pointed out, however, that it was the U.S. Army who made the space available in their Jupiter nose cone and fabricated many of the biocapsule elements. The cooperation of Army scientists and engineers was outstanding. In addition to the U.S. NAVSCOLAVMED, many other departments and commands with the U.S. Navy helped. The U.S. Air Force contributed by providing testing facilities for various capsule elements and making basic research information available. Civilian manufactures were most accommodating in providing rush orders of materials and even working overtime and on weekends to complete certain components. Often times these contributions were made without knowledge of the purpose or intent of the project.

Thus another step is taken in man's assault on the assault. And the one who actually took that step, a little squirrel monkey named "Baker", is living, happily with her less illustrious friends in special air-conditioned quarters at

the U.S. Aviation Medical Center, Naval Air Station, Pensacola, Florida.

(This story was located on Familyorigins.org at http://www.familyorigins.com/users/l/i/v/Thomas-C-Lively/FAMO1-0001/d191.htm.)