

THE PRESENT SPACE MEDICINE EFFORT
AT THE SCHOOL OF AVIATION MEDICINE, USAF

by
Colonel Paul A. Campbell, USAF (MC)
Chief, Space Medicine Division
School of Aviation Medicine, USAF

Today, February 9, 1959, ten years after the founding of the Department of Space Medicine, one can safely say that Space Medicine has spread into each Division, every Department of the School of Aviation Medicine, and every nook and corner. This, I believe, was evident on your tour this morning, and thus will be only briefly sketched. The over-all effort in Space Medicine and Space Biology is coordinated through a Space Coordinating Committee--the research effort, through the Directorate of Research; and the teaching effort through the Directorate of Education.

Since its inception there have been no true divisional or departmental barriers at the School of Aviation Medicine. The team concept has been the rule. Divisional and departmental segmentalization has existed solely for administrative purposes.

Let us first consider the teaching effort. Here it must be pointed out that almost all of our teaching personnel are involved in research, and almost all of our research personnel in teaching.

As is quite evident to this audience, it is difficult, if not impossible, to draw a line and say--this is where Aviation Medicine ends, and this is where Space Medicine begins--but it is our duty to take the younger doctors who are in the Primary and Advanced Courses of Aviation Medicine

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2. The contents of this manuscript reflect the personal views of the author and are not to be construed as a statement of official Air Force policy.

and extend their horizons into the space concept, and to take the more mature Flight Surgeons and, through Refresher Courses, keep them informed of the effects of missilery on their jobs and the effects of the space concept on their profession.

Various support groups, such as the Physiological Training Officers Group, are also brought in from time to time for a review and for extension of their horizons. I believe it can be truthfully said that the School of Aviation Medicine is the only institution of the free world, and possibly of the entire world, with an organized sustained program for training relatively large groups of people in Space Medicine.

The impact of this program is evident from another point of view: large numbers of visitors from other institutions, industry, other agencies, information medias, and so forth, visit the School in quite substantial numbers for briefing and consultation. Through the organization of symposia, such as that held last November on the subject of "Medicine and Physics of the Atmosphere and Space," and participation in programs throughout the country and the free world, the new knowledge produced or organized by the School of Aviation Medicine is projected far and wide.

The research effort in Space Medicine and Space Biology is also spread throughout the School. The School of Aviation Medicine, USAF is the direct lineal descendent of the original unit at Hazelhurst Field, Mineola, Long Island, of World War I, extending through the School at Brooks Field of the twenties, and has been on Randolph Air Force Base since 1931. Since Mineola it has always had as a major mission, and

probably its most important research mission, the research and development of physical, physiological and psychological criteria for selection of flight personnel. Within its environs, its records, and within its people has accumulated the world's greatest storehouse of knowledge in this field. In every department this specialized knowledge, nurtured by validation projects, consultations, etc., is being extrapolated into the space concept. Other than in the field of selection, the broader efforts in Space Medicine are in the Space Medicine Division (which I shall come back to later), the Department of Radiobiology and the Departments of Physiology and Biophysics. The Departments of Physiology and Biophysics have, in cooperation with the Department of Radiobiology, developed the basic research and important hardware for mouse and primate biopack units; and have trained, acclimatized and conditioned animals for an adventure into space when they are called upon. They have also developed or have selected and modified miniaturized instruments for the recording of or the telemetering of the required information. Another effort in this Department is concerned with studies of the effects of acclimatization and conditioning in relation to the various parameters of space flight.

The Space Medicine Division is a direct outgrowth of the Department of Space Medicine. It is now divided into four Departments--Astroecology, Biogravics, Bioastrophysics and Bioastronautics. The Department of Astroecology is concerned with the development of closed ecological systems in which man can live in his own little encapsulated world with only those resources which can be carried along, or extracted from the energies of space. All the contents must be selected within the framework of minimum

weight allowances, miniaturization from the standpoint of volume, and maximum conservation. The recycling of nutrients, fluids and vital gases are under study. To meet these ends a series of studies have been completed for the development of base lines measuring most of the more important parameters of the individual in the isolated environment of the space cabin simulator for long periods of time. Now the studies are being directed toward weight and capacity reduction. Whereas it took a daily weight of about 100 pounds in food, oxygen, fluid, absorbants, and containers to support Airman Farrell in his well known 7-day run, ideally it should only require about 40 pounds per day. In present studies it is hoped to bring these figures together. From our studies it has become quite evident that a space cabin simulator will be an extremely necessary selection and indoctrination device for manned space flight. A new sealed cabin (figure 1), much more efficient than the present one, is now under construction and will be completed shortly after our move into our new facilities at Brooks Air Force Base.

Another study is under way concerning the use of algae, and so forth, as biological gas exchangers (figure 2). Mice can now be kept alive for long periods in this system. I am told that recently four mice were kept alive in a small closed system for 27 days. The state of the art of such biological gas exchangers is improving in leaps and bounds. In explanation of this effort, may I show a graph (figure 3). This graph demonstrates the weight costs of the various types of oxygen supply for the astronaut in terms of the time periods during which their efficiency becomes manifest. As can be seen, space flight for long periods will

probably require a biological gas exchanger of some type. Space stations or bubble colonies will most certainly require them.

The Department of Biogravics is concerned with studies of the effects of weightlessness on man. Through flights along Keplerian parabolas, they began with the ideas of the pioneers who are here today, then carried them into T-33 aircraft operations, then the faster F-94s, and now are ready to utilize the Century series of aircraft. Time in the weightless state has been extended into periods of more than 40 seconds, and will soon be increased to a period near a minute. Some of our people have accumulated many hours in the weightless state. One pilot who recently left had flown more than 2200 parabolas. Again our studies point to the necessity of using such a device for selection, indoctrination and training for space flight.

Bioastrophysics is concerned at this time with the design and instrumentation for the other Departments. With changing concepts, new ideas, and the development of the art, this is a huge task, as in each the field is virginal.

Bioastronautics, our final Department, is a new one and is just now in the course of organization. It will be under the able leadership of Lt. Col. David Simons, who is a pioneer in Space Medicine in his own right.

In conclusion, I am certain that we all hope to return on the twentieth birthday to see what has been accomplished in the decade which will place man in space, and possibly among the planets.