The U. S. Air Force Experimental Sealed Cabin

By H. Strughold, M.D., Ph.D.

MODERN rocket powered planes in which the breathing air is furnished from the ambient air, are attaining altitudes where the conventional pressurized cabins are becoming unsuitable for use.[5,11,20] This altitude limit is reached at about 80,000 feet for the following reasons:

1. *Technical.*—Because of the low air density, compressing the ambient air is technically prohibitive, due to the necessary weight and space requirements of the compressors.

2. *Thermodynamical.*—Compressing the rarified ambient air to a physiological useful range according to Mayo[11] would produce a temperature of about 400° F. in the cabin, which would be intolerable for the occupants.

3. *Toxicological.*—At about 60,000 feet a region of the atmosphere is reached in which various photochemical reactions occur, the most important of which is the formation of ozone.[17] By compressing the air of this ozonosphere or "chemosphere,"[8] the concentration of ozone may reach the threshold of toxicity.

For flights in the higher regions of the stratosphere, the conventional pressurized cabin must be replaced by a new type of cabin—the sealed cabin.

From the U. S. Air Force School of Aviation Medicine, Randolph Air Force Base, Texas. Dr. Strughold is chief of the department of Space Medicine.

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This type of cabin represents a hermetically closed ecological system in which the breathing air is not pumped in from the air outside the craft, but must be taken along at the start. The oxygen consumed by the occupants of the sealed cabin must be replaced from stores within the ship. The carbon dioxide must be removed, and temperature, humidity and odors must be controlled. These are the main problems involved in sealed or hermetic cabin flights.[2-4,6,12,13]

While the altitude limit for the use of oxygen equipment lies at about 40,000 feet, and for the pressure cabin at about 80,000 feet, the sealed cabin has no limitation on altitude. This type of cabin gives us the green light into space.

The forerunner of the sealed cabin was the sealed gondola used by the Piccard brothers[14] and by Stevens and Anderson in their record breaking balloon flight of 72,395 feet in the *Explorer II* in 1934.[18] The areomedical knowledge gained from the latter flight has been evaluated by Armstrong, in a paper published in 1936.[1] A more general review of the problems involved in sealed compartments has been reported by Fenno.[6] The knowledge gained in submarines and bathyspheres is also of great value.[15] However, the coming development of the hermetic cabin craft will make necessary more detailed and specific studies.[9,10,16] The possibility of carrying out such studies on the ground are offered by an exper-

imental sealed cabin. The construction of such a chamber was initiated in 1952 by this school from blueprints designed by Dr. Fritz Haber. The

1. To what extent, and in what direction, are the various climatic factors changed by the presence of occupants in the cabin.

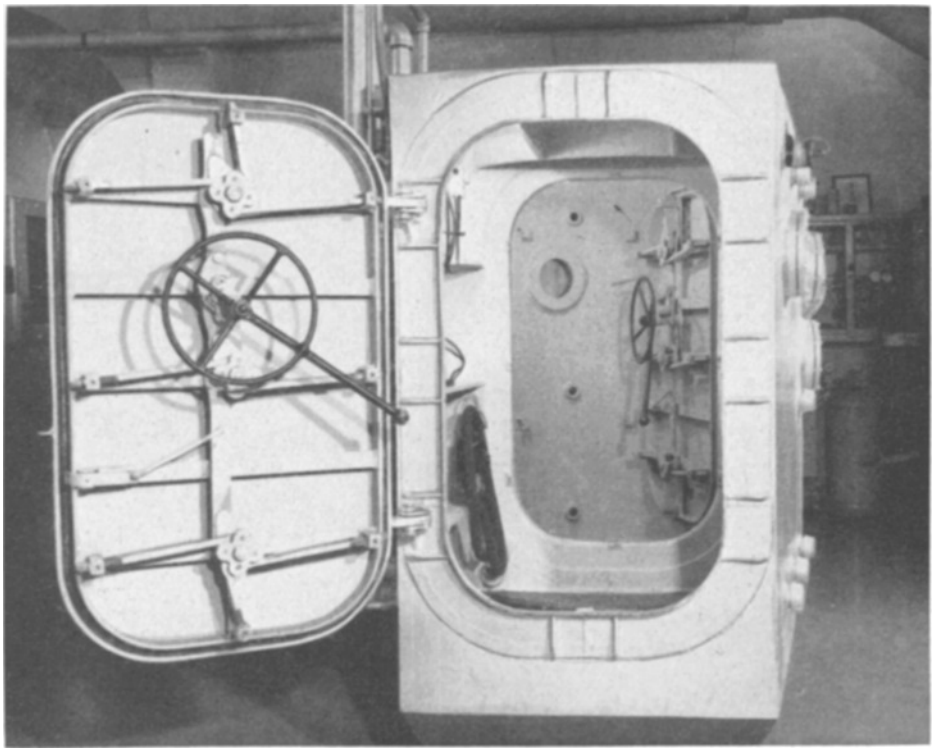

Fig. 1. The experimental sealed chamber of the U. S. Air Force School of Aviation Medicine, Randolph Air Force Base, Texas.

chamber was constructed by the Guardite Company of Chicago, Illinois, and delivered the summer of 1954. (Fig. 1.)

The experimentation program for this experimental sealed cabin is a combined research project of the space medicine and of physiology-biophysics. It is not within the scope of this paper to discuss the various research tasks. I would like to say, however, that the project involves two main problems which warrant investigation:

2. How can these changes be counteracted by physical, technical, or biological means.

This experimental chamber also can serve as a training device to indoctrinate the occupant with the problems encountered in a closed ecological system and to familiarize him with the procedures necessary to handle any emergency situations such as the failure of the automatic control systems and an eventual puncture of the cabin itself.

The Air Force experimental sealed cabin is a prototype of the cabin that may be built into future space ships. This type of cabin will also be required in the coming phase of "global space-equivalent flight" at supersonic speed through the space-equivalent regions of the atmosphere.

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Strength in the Air

We are living today in a world that contains at least one very powerful nation, the leaders of which have ambitions of world domination. Our greatest safeguard against enemy aggression lies in his knowing without question that we have the ability to retaliate instantly against his homeland through the medium of long-range bombers carrying atomic weapons. Our military seem to be quite well agreed that the principal deterrent to enemy attack is a strong retaliatory force.—WILLIAM H. ALLEN: *Boeing Magazine*, 25:8, 1955.