U. S. NAVAL SCHOOL OF AVIATION MEDICINE
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PSYCHOLOGICAL FACTORS IN SPACE TRAVEL

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by

Henry A. Imus, Ph.D.

Approved by

Captain Ashton Graybiel, MC, USN
Director of Research

Released by

Captain Clifford P. Phoebus, MC, USN
Commanding Officer

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SUMMARY PAGE

THE PROBLEM

Reports concerning the psychological factors in space travel are reviewed in order to form a basis for predicting the ability of man to perform in a manned vehicle flight. Speculation concerning anticipated psychological problems is presented for consideration.

FINDINGS

Scientific data and first hand observation from balloon flights, and from simulated space cabin flights, have provided basic information essential to the prediction of human performance in a manned vehicle missile and orbital flights. Motivation and morale may be controlled by extensive physiological, psychological, and psychiatric screening procedures. Boredom and fatigue may be controlled, in part, by scheduled activity appropriate to the mission. The effects of isolation may be reduced by adequate communication with ground stations encircling the earth. Anxiety may be minimized by developing the cabin and equipment to such a condition of high reliability prior to launch that the Astronauts have complete confidence in their successful return and recovery. The selection of men who have demonstrated consistent and reliable performance in a variety of hazardous missions over a period of years provides the best guarantee of a successful mission into outer space.

INTRODUCTION

The key to successful completion of a manned vehicle flight, assuming that the reliability of the space cabin and of its equipment is as high as the designers claim, lies in the motivation and competence of the astronauts selected for the journey. The history of exploration has shown repeatedly that strongly motivated men will accomplish difficult missions against almost overwhelming odds. Many examples could be mentioned of adventures in the Arctic, the Antarctic, the Atlantic and Pacific, and the balloon flights into the stratosphere (1-14).

DISCUSSION

MOTIVATION AND MORALE

The significance of motivation has been investigated experimentally. For example, in a study (15) of naval aviation cadets who were asked to volunteer for extra-hazardous duty at Pensacola, Florida, it was found that the volunteers were superior to nonvolunteers in attitudes and performance in aviation training. In addition, among those who were dropped from aviation training at their own request, the nonvolunteers outnumbered the volunteers by a ratio of four to one.

Sells and Berry (16) stated that test pilots already have demonstrated strong motivation as well as aptitude, physiological fitness, and psychological adaptability by their stability, good judgment under pressure, and competency to deal with the hazardous emergencies which are common occurrences in their daily routine of work. These factors were given special consideration in the selection of the Project Mercury Astronauts by the National Aeronautics and Space Administration (17). Each man volunteered twice, once for consideration and again for selection, following complete briefing and testing. They were free to decline further consideration without any adverse entry being made in their personnel record. During the time since selection, they have been able to maintain their flight proficiency in high performance aircraft in addition to becoming familiar with every phase of the projected mission and every aspect of the equipment. Not one has asked to be released.

THE ASTRONAUT'S PERSONALITY

In the selection of the Project Mercury Astronauts, Ruff and Levy (18) established the following *a priori* requirements based upon data from military operations, survival experiences, and laboratory experiments. Although the tasks of the Astronauts in the actual missile and orbital flights may involve only reading instruments, recording observations, and certain decision-making functions, the preparations for the flight necessitate that the Astronauts have high intelligence, be able to interpret complex instruments, and have excellent appreciation of mathematical and spatial relations. Their drive and creativity should be strong, and they should be free from conflict and anxiety irrelevant to their mission, and present no exaggerated or stereotyped defenses. They should not be overly dependent upon others, but should be able to accept such dependence when required for the success of the mission. They should be able to tolerate both close association with others and extreme isolation. They should be able to function appropriately in unfamiliar surroundings when usual patterns of behavior are impossible. Similarly, they should be able to respond predictably to foreseeable situations yet adapt themselves with flexibility to unforeseen circumstances. Their motivation for space flight should demonstrate primary interest in the mission rather than in the satisfaction of exaggerated needs for personal accomplishment. Any indication of self-destructive wishes or overcompensation for felt inadequacy would be undesirable. They should be prepared to take well-considered and deliberate action when necessary and yet be able to refrain from impulsive action when inactivity is appropriate. They must tolerate stress situations without requiring motor activity to dissipate anxiety.

BOREDOM AND FATIGUE

According to Sells and Berry (16) the principal effects of boredom and fatigue are carelessness and inefficiency in performance. In an intensive study of decrement in performance during confinement in a space cabin simulator at the USAF School of Aviation Medicine (19-21) volunteers monitored aircraft indicators for thirty consecutive hours. The task required that they take corrective action whenever the indicators departed from the null position. During this time there was no change in physiological function. Performance was high for fifteen hours, but then declined to 20-30 per cent and showed an endspurt to only 50 per cent of the original level. As a result of these and other studies, it has been recommended that planned schedules of continuous diverse activity be arranged for the Astronauts in order that capacity to react promptly to emergency situations may be maintained.

In one study (22) it was found that a rapid series of signals and responses helped to counteract the effects of monotony and boredom. This procedure might restore the Astronaut to a more efficient level of performance if presented prior to a critical series of actions, such as preparation for reentry into the earth's atmosphere.

That morale can be maintained and that boredom and fatigue can be eliminated was demonstrated quite effectively during the transpolar cruise of the submarine NAUTILUS (23). The well-known reliability of the power plant, the capability of the sonar gear to detect obstacles, the advanced equipment for navigation while submerged, and the closed circuit television which permitted visual observation of the ice formations and surface reconnaisance without breaking the seal contributed greatly to the confidence of the men in their safety while on the mission. An ideal environment was maintained, with temperatures ranging from 72° to 76°, humidity 40-50 per cent, oxygen 20 per cent and carbon dioxide less than 1.5 per cent. Emergency air-breathing systems were available for immediate use in the event of equipment failure. The supply of fresh water was plentiful for drinking, bathing, and washing clothes. The food was excellent in quality and unlimited. Hi-fi music was played almost continuously, and reading and movies provided leisure entertainment. Planned schedules of games and tournaments appropriate for such close quarters were conducted, and special incentive awards of liberty in England were the prizes. Friendly arguments, physical horse-play, and joking among the men relieved the tension.

ISOLATION AND SENSORY DEPRIVATION

During extended flights in space, man will be physically, psychologically, and emotionally separated from his long-accustomed environment. Such separation may affect his behavior and performance seriously. For example, pilots flying at very high altitudes have experienced for short periods a feeling of being isolated, detached, and physically separated from the earth. Clark and Graybiel (24), who interviewed many jet pilots about this stiuation, have named it the "break-off" phenomenon. Ross (9-11) and Simmons (12-14) reported similar experiences in the balloon flights of Manhigh and Strato-Lab. Giffen (25) interviewed 137 pilots in Europe and found that 90 per cent of them reported this phenomenon. In addition, 38 per cent of these men noted feelings of apprehension, while 71 per cent reported loneliness while flying at high altitudes. Bennett (26) made similar observations in the Royal Air Force in Great Britain.

Sensory deprivation has been produced experimentally (27) by reducing sensory input, using several procedures. Lilly (27) submerged his subjects in a constant temperature water bath, while Solomon et al. (28) placed frosted glasses on the eyes of recumbent subjects or plugs in their ears for a period of three days. Levy et al. (29) used isolation chambers. In all cases, hallucinatory and illusory experiences occurred; the subjects were unable to think clearly; suggestibility and irritability increased. Feelings of inadequacy were expressed also. The position and relationships of objects with the visual field would change, sometimes vertigo occurred, and kinesthetic sensations were distorted.

Sells and Berry (16) suggested that the effects of isolation and sensory deprivation might be offset, in part, by habituation and conditioning prior to embarkation on a space flight. Ruff (30) claimed that the most important aspect of isolation is the reduction of incoming information. He believed that many of the effects of isolation could be counteracted by providing space crew members with ties to familiar customs and surroundings, thus duplicating the diversity of experience on earth. He indicated that the limitations of the artificial environment, such as restriction of movement, knowledge that escape is impossible, and the deprivation of communications, might result in increased suggestibility and illusions. The personality, background, and motivation of each individual would influence his responses to such situations as well as greatly affect interpersonal relations with fellow crew members. Goodson and Jones (31), on the other hand, were unable to demonstrate increased suggestibility as a result of isolation.

ANXIETY

Uncertainty about the reliability of the space cabin and equipment, lack of knowledge about the course and progress of the flight, and anticipation of the hazard of reentry are psychological obstacles which may lead to anxiety on the part of the space crew. If adequate flight information is not provided by the control equipment of the space cabin or by the ground station in communication with it, or if corrective actions taken by the pilot in response to his instruments or to the ground station do not seem to have the desired effect upon the course of events, the pilot is subjected to considerable stress. Davis (32) suggested that, under severe stress, the individual's efficiency might decline rapidly. This could result in a vicious circle of increased anxiety accompanied by a still further decrease in efficiency. If this cycle persisted, one individual would tend to give way to resentment and projection of blame upon others. Another individual might fall into a state of depression, inertia, and apathy. As a result of unusual patterns of sensory input, such as disorientation and vertigo from zero G and tumbling, some might experience hallucinations or delusions according to Giffen (25). In all cases, continuing frustration would lead to a complete lack of appropriate response, irritability or apathy, and irrationality. Here, again, the personality and background of the individual would determine the kind of behavior.

CONCLUSIONS

A review of the reports of scientific experiments simulating space cabin flights and of practical field experiences at extremely high altitudes, under the sea, and in the Antarctic, leads to the conclusion that an Astronaut, appropriately protected from an hostile environment, well-nourished, and provided with critical tasks essential for his physical survival, will be able to tolerate, compensate for, or overcome any psychological problems that may arise during an extended flight in outer space.

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