

RUFF GE. *Psychological effects of space flight.* J Aviation Med 1961; 32: 639–642.

This Classic paper was one of the first to discuss the potential psychological problems of spaceflight and was published before any manned space missions had occurred. Dr. Ruff based his article on data derived from analogous experiences such as polar expeditions and on laboratory experiments in single-person isolation and group confinement. He noted that physiological factors affect human behavior and “psychological variables may be sensitive measures of the intensity of physiological stress” in space from sources including acceleration, heat, noise, vibration, radiation, toxic exposure, waste removal, and life support systems. He predicted that isolation would be one of the most important factors, especially when coupled with prolonged immobility and sensory deprivation. Aloneness, cultural isolation, and removal from familiar surroundings were all named as needing attention. For instance, problems with interpersonal relationships might arise within a multi-person crew during a long space mission, especially if different cultures were involved. The usual response to such conflicts on Earth is withdrawal, but that would not be an option in a space cabin. Prolonged exposure to danger might be an additional, unique factor as “perhaps the Earth represents a source of support to man which cannot be left behind without consequences.” Failure to meet basic human needs might lead to increasing anxiety with adverse physiological effects.

Having summarized the problem, Ruff proceeded to discuss methods for reducing psychological problems in space. These included minimizing cultural isolation and establishing communication with people on Earth with whom a crewmember has prior relationships, as well as providing a structured environment with constant spatial and temporal orientation and meaningful, varied sensory input to combat monotony. Since helplessness and inability to understand the nature of problems are psychologically destructive, Ruff said that everything possible should be done before a flight to train crewmembers to respond to all foreseeable problems. Ruff further argued that a psychologically skilled clinician should be involved with preflight planning and individual crew training, in-flight monitoring, and postflight evaluation and follow-up.

Ruff concluded by discussing examples of 15th-century exploratory expeditions. The crews were usually formed from the dregs of society; they faced unknown dangers and did not anticipate a safe return. He concluded, “If they could do it, it is hard to see why potential psychological problems should not prevent man from exploring space.”

Background

Dr. George Ruff, M.D., was a research psychiatrist and chief of the Stress and Fatigue Section at the USAF Aerospace Medical Laboratory (AML) at Wright-Patterson AFB from 1957–1959. He was a pioneer in the psychology of spaceflight and adaptation to stress. He stated in other papers that “space flight will impose no intolerable stress on carefully selected, trained crews” (1). Ruff was heavily involved in the initial psychological screening and selection process of the Mercury astronauts along with Dr. Edwin Levy in February 1959, material that was presented elsewhere in another paper (2). Many of the principles outlined in this Classic were derived from experiments performed by his research group at the AML (3). In those studies, groups of five subjects were confined for 5 d in a 120-sq.-ft. chamber. In a second study, individuals were subjected to sensory deprivation for up to 7 d.

Sensory-deprivation studies had been conducted in U.S. and Canadian universities since 1951. The experiments indicated “a general loosening of the subject’s ability to perceive reality and the weakening of the stable norms against which perception is evaluated (4,5).” A sealed 100-cu.-ft. “Space Cabin Simulator” at the USAF School of Aerospace Medicine was used for such experiments beginning in 1955 and, in a well publicized 1958 experiment, Airman Donald Ferrell spent 18 wk in that chamber. The daily log kept by Farrell showed deterioration from initial good spirits to “the seemingly abrupt onset of frank hostility” and his mental condition “reached the point of becoming the single conceivable reason for a premature termination of

the flight” (6). In addition, Farrell’s proficiency at assigned tasks deteriorated severely as the experiment progressed (7,8). Although studies of two-man crews confined to a similar chamber for up to 30 d showed that subjects “with rather marked personality differences” maintained a satisfactory working relationship, the consensus was that “The psychological problems presented by the exposure of man to an isolated, uncomfortable void seem to be more formidable than the physiological problems” (9).

In the years following publication of this Classic, Ruff and his colleague, psychologist Sheldon Korchin, developed a NASA program to study the seven Project Mercury astronauts and their psychological adaptation to stress and the space environment. Unfortunately, that program was prematurely terminated by NASA in 1962 and his data were eventually lost or destroyed (10).

All of Ruff’s observations in this Classic were later validated. Of course, he could not anticipate the specific psychological countermeasures now available on the International Space Station, including video Private Family Conferences, personal e-mail, and even individual cell phone connection through advanced communication technology.

Commentary by Dr. Christopher Flynn NASA Flight Surgeon and Chief, Psychiatry, at Johnson Space Center, 1996–2004

At the time of Dr. Ruff’s classic article, both the USSR and the United States were on the verge of launching the first astronauts into space. Ruff’s areas of focus in the 1960s are still crucial today in preparing astronauts to manage interpersonal interactions during missions; recognized factors include establishing compatibility before naming a crew, managing the balance between “ground” workload demands vs. “spontaneous” crewmember activities, assuring contact with emotionally important individuals on Earth, and guaranteeing the time and equipment to prevent deterioration of physical health while on orbit. He perceived much of what would be most valuable to an astronaut’s psychological well being and foreshadowed the later importance of cross-cultural interpersonal skills to support both multicultural crews and the presence of space tourists in-flight.

Dr. Ruff envisioned that extended missions (envisioned as several weeks long) would require extra psychological training and support. These days, missions routinely last 6 mo or longer and we are now planning how to keep astronauts healthy on a Mars journey lasting well over a year. Reading Dr. Ruff’s Classic brings freshness to the work to be done now: The astronauts must have reasonable assurance that their physical health will be protected, they are adequately trained to respond to all kinds of technical challenges, can maintain crew relationships to benefit themselves and the mission, have the tools to diagnose and treat anticipated behavioral health problems, and have access to a ground support team of behavioral specialists attuned to each crewmember’s personal needs to provide support over the course of the mission.

Research on psychological countermeasures today focuses on these key areas: developing methods for astronauts to restore self-regulation, developing strategies that can be used to maintain positive crew interactions for psychosocial problems, identifying common interpersonal issues in flight, managing work schedules to optimize performance and avoid exhaustion, identifying an astronaut’s deteriorating mood by optical recognition of facial expressions or by computerized cognitive assessment, preventing errors due to inadequate sleep or circadian en-

Dr. Flynn does not currently have a position at NASA and his views do not represent NASA.

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training, and training astronauts to adapt to the prolonged isolation and confinement of extended duration missions. The results of these research efforts will bring even better countermeasures to achieve the goals that Dr. Ruff identified in 1961: to keep astronauts psychologically healthy while completing ever-longer missions in space.

Commentary by Dr. George Ruff



Fig. 1. Dr. George Ruff from *J. Aviat. Med.* 1959; 30(5):369.

This paper was written after a conversation with General Don Flickinger, USAF Systems Command Surgeon and a member of the NASA Special Committee for Life Sciences, who said that he would like for me to write up some of the things that I had mused about and that he would have it published in *Aerospace Medicine*. At that time, I was involved in a study of stress encountered by the Project Mercury astronauts. Papers on the preliminary results were cleared by NASA and presented at a symposium (11,12). Then, for reasons that we never understood, the Manned Spaceflight Center gave the project “classified” status and the final work was never published. I believe that the Project Mercury management was uncomfortable with the close involvement of outside experts in this area and, after successful completion of two suborbital and three orbital flights with few signs of stress, they simply didn’t see any point in continuing the study. Furthermore, although a few of the astronauts on early flights, e.g. Glenn and Carpenter, were interested in the study, others viewed our interviews and tests as an unnecessary annoyance.

Termination of the study meant the loss of valuable data that would have been useful later. It is worth noting that Pat Santy included some of our data and conclusions in her book, “Choosing the Right Stuff,” which came out of her working group on crew selection for the space station (10).

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