270

Griffith, R., W. Nordberg, & W. G. Stroud 1956 THE ENVIRONMENT OF AN EARTH SATELLITE. (U. S. Army, Signal Corps Engineering Labs., Fort Monmouth, N. J.) SC Proj. 172A, DA Proj. 3 99 07 021, Tech. Memo. NR M 1747, March 1956, Rev. Nov. 1956

ABSTRACT: This report is a collection of graphs, tables, and other data relevant to the environment of an earth satellite during both the launching and in-orbit phases. The information was assembled from recent sources and to some extent unpublished. The major topics include mechanical-thermal considerations composition of the atmosphere, properties of the atmosphere, radiation at high altitudes, cosmic rays, variation of g with height, the earth's magnetic field, temperatures, pressures, densities, and winds, micrometeorites and meteorites.

271

Grishina, M. 1960 OTVAZHNAYA' IN OUTER SPACE AGAIN. Meditsinskiy Rabotnik, (Moscow) p. 3, 17 July 1960. (translation)

ABSTRACT: Animal training is described for a female rabbit named Zvezdochka, and dogs named Malek and Otvazhnaya (the latter of whom has made five previous flights into outer space), and the subsequent space flight results are briefly given. During the training period a high-speed centrifuge was utilized and physiological data was obtained from medical devices attached to the animals. "The centrifuge is set at a definite rate of rotating motion. The effect of G-forces on the animal organism can be observed on the screen of the apparatus. Training was also conducted on the vibration platform, where the animals were subjected to vibration similar to that experienced in a rocket flying through space. "During the actual flight cardiovascular and respiratory observations were made on the dogs with pulse rate, respiration, arterial pressure, and "cardiac biocurrents" being recorded. The telemetry system also provided information concerning changes in muscular tonus during weightless of the rabbit. "They did not suffer any kind of injury; there were no signs of even slight hemorrhages. No serious disturbances in physiological functions were noted in the animals. Otvazhnaya and Malek feasted on beefsteak and Zvezdochka ate radishes with fresh grass".

272

Gurfinkel, V. C., P. K. Isakov, V. B. Malkin, & V. I. Popov 1959 KOORDINATSIIA POZQ I DVIZHENII CHELOVEKA V USLOVIIAKH POVYSHENNOI I PONIZHENNOI GRAVITATSII (COORDINATION OF POSTURE AND MOVEMENTS OF MAN IN CONDITIONS OF INCREASED AND DECREASED GRAVITY) Biul. Eksperimental Noi Biologii I Med. (Moscow) 48(11):12-18, Nov. 1959

ABSTRACT: The effect of rapidly alternating phases of increased and decreased gravitational force on motor coordination and posture was studied in seven human subjects. Experiments were conducted in the elevator of Moscow University, which permits changes in gravity ranging from 2 G to 0.3 G within two to three seconds.

Positional changes of body and extremities and motor coordination were recorded graphically. Under the experimental conditions no significant disturbances were registered either in coordination of positioning of the body and limbs or in the adequacy of motor performance. The role of the visual analysor in maintaining equilibrium does not increase significantly under conditions of subgravity, as shown by analysis of equilibrium reactions of subjects with their eyes closed or open. It is concluded that a 50 per cent increase or decrease in gravity does not materially affect the system which regulates posture and movement on the basis of proprioceptive afferentation. (AUTHORS)

273

Gurovskiy, N. N., & M. A. Gerd 1962 IN THE SPACEFLIGHT LABORATORY
Nauka i Zhizn' (10):21-28 (Translation Services Branch, Foreign Technology Division, Wright-Patterson AFB, Ohio, Trans. No. FTD-TT-62-652-1+2+4; ASTIA AD-286 201; 8 June 1962)

274

Gurovskii, N. and M. Gerd 1962 THE STATE OF WEIGHTLESSNESS
Trans. from Komsomol'skaya Znamya (USSR) (21):1 and (22):4, 1962.
(Joint Publications Research Service, New York, N. Y.)
April 30, 1962 JPRS: 13619

ABSTRACT: General conclusions about the effect of weightlessness (or rather its lack of effect) on the human body are drawn from the flights of the space dogs and from the flights of Gagarin and Titov. When Titov's body became weightless he temporarily lost his orientation in space and felt that he was flying upside down. The orientation was quickly reestablished when he looked around his cabin. Cessation of signals from the vestibular apparatus was compensated for by means of vision and muscle sensation.

275

Gurovskiy, N.N. & M.A. Gerd 1962 WEIGHTLESSNESS
Translation Services Branch, Foreign Technology Division, WP-AFB, Ohio
FTD-TT-62-1310/1+2+4 October 30, 1962 ASTIA AD 292 227
(Original Source: Nauka i Zhizn', No. 11, 1961, pp. 86-91)

ABSTRACT: A detailed report is given of Titov's reactions to weightlessness during space flight. Both an electrocardiogram and an electromyogram were recorded during the flight. Also, the physical action of his heart and the depth and frequency of his respiration were registered. During the flight, it was found that the cosmonaut had normal muscular movements; he was able to work and carry out complicated tasks; and he ate, drank, slept, and used the toilet facilities.

WEIGHTLESSNESS

H

276

Haber, F. & H. Haber 1950 POSSIBLE METHODS OF PRODUCING THE GRAVITY-FREE STATE FOR MEDICAL RESEARCH.
J. Aviation Med. 21(5):395-400.

277

Haber, F., & H. Haber 1951 POSSIBLE METHODS OF PRODUCING THE GRAVITY-FREE STATE FOR MEDICAL RESEARCH. In (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item #2, Jan. 1951
See also J. Avia. Med. 21(5):395-400, 1950

ABSTRACT: The purpose of this paper is to present some theoretical considerations as to the procurement of means suitable for studying the medical phenomena associated with the lack of weight. The following requirements must be met in eliminating gravity: (1) The means must be equipped with a controllable force in order to make it capable of overcoming and eliminating the support originating in friction from the air. (2) The means must be able to cope with high velocities which it must attain and subsequently break down. The modern aircraft is such a means. It is more suitable than the elevator method. The aircraft, in contrast to the elevator, is not limited to a single dimension, namely the vertical in its motion. The aircraft-method also affords the possibility of producing certain values of sub-gravity. Furthermore, the zero-g aircraft affords durations of the gravity free state more than twenty times as long. (CARI)

278

Haber, F. 1952 STUDY ON SUBGRAVITY STATES
In USAF School of Aviation Medicine, Randolph AFB, Texas, Epitome of Space Medicine, Item 4
See also (School of Aviation Medicine, Randolph AFB, Texas) Project No. 21-34-003; Rept. No. 1, April 1952

ABSTRACT: Equations are derived for calculating the duration of gravity-free or subgravity states as functions of gravity and initial speed or gravity and elevation. Plots are given for (1) minimum speed required as a function of gravity for different initial angles of climb and an initial velocity of 450 m.p.h. (2) speed as a function of time for 0.0 and 0.5 g, (3) duration of sub gravity flights for various initial angles of climb at an initial speed of 450 m.p.h., and (4) two trajectories of flight for 0.0 and 0.5-g states, at an initial angle of climb of 45 degrees and initial speed of 450 m.p.h. An airplane with an initial speed of 450 m.p.h. makes possible the maintenance of zero gravity for 35 seconds. (TIP ABSTRACT)

279

Haber, F. 1952 STUDY ON SUBGRAVITY STATES
(School of Aviation Medicine, Randolph AFB, Texas) Project No. 21-34-003; Rept. No. 1, April 1952
See also USAF School of Aviation Medicine, Randolph AFB, Texas, Epitome of Space Medicine, Item 4

ABSTRACT: Equations are derived for calculating the duration of gravity-free or subgravity states as functions of gravity and initial speed or gravity and elevation. Plots are given for (1) minimum speed required as a function of gravity for different initial angles of climb and an initial velocity of 450 m.p.h. (2) speed as a function of time for 0.0 and 0.5 g, (3) duration of sub gravity flights for various initial angles of climb at an initial speed of 450 m/p.h., and (4) two trajectories of flight for 0.0 and 0.5-g states, at an initial angle of climb of 45 degrees andinitial speed of 450 m.p.h. An airplane with an initial speed of 450 m.p.h. makes possible the maintenance of zero gravity for 35 sec. (TIP abstract)

280

Haber, F. 1953 HUMAN FLIGHT AT THE LIMITS OF THE ATMOSPHERE: G-FORCES AND WEIGHT IN SPACE TRAVEL. Sky and Telescope 12(4):97-98, 114
See also J. Brit. Interplanetary Soc. 12:32-34

ABSTRACT: This is a general discussion of the problem of body weight with respect to human subjects traveling in rockets to the upper limits of the atmosphere and beyond. In a rocket take-off, the acceleration (and weight) will increase toward the end of the propulsion period. The human body can, for a maximum of 3 minutes, tolerate 11 g in the prone position and 14 g in the supine position. These tolerances will effectively limit the acceleration of a rocket with human cargo. Assuming that the initial stage of rocket flight is achieved with the passengers still in good condition, the problem of weightlessness must next be overcome. It is expected, on the basis of animal experimentation, that no major circulatory disturbances will develop; but there might be some difficulty in orientation and muscular coordination. The effects of prolonged weightlessness, are however, unknown---either with regard to animals or humans.

281

Haber, H., & F. Haber 1950 POSSIBLE METHODS OF PRODUCING THE GRAVITY-FREE STATE FOR MEDICAL RESEARCH. J. Avia. Med. 21:395-400
See also (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item #2, Jan. 1951 (F)

ABSTRACT: The purpose of this paper is to present some theoretical considerations as to the procurement of means suitable for studying the medical phenomena associated with the lack of weight. The following requirements must be met in eliminating gravity: (1) The means must be equipped with a controllable force in order to make it capable of overcoming and eliminating the support originating in friction from the air. (2) The means must be able to cope with high velocities which

it must attain and subsequently break down. The modern aircraft is such a means. It is more suitable than the elevator method. The aircraft, in contrast to the elevator, is not limited to a single dimension, namely the vertical in its motion. The aircraft-method also affords the possibility of producing certain values of sub-gravity. Furthermore, the zero-g aircraft affords durations of the gravity free state more than twenty times as long. (CARI)

282

Haber, H. Nov. 1951 GRAVITATION AND WEIGHT. (Symposium on the Physics and Medicine of the Upper Atmosphere, San Antonio, Texas, 6-9 Nov. 1951)

283

Haber, H., & S. J. Gerathewohl 1951 ON THE PHYSICS AND PSYCHOPHYSICS OF WEIGHTLESSNESS. J. Avia. Med. 22(6):180-189, June 1951
See also (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item #14 (F)

ABSTRACT: In an analysis of the effects of weightlessness on the human organism, two possible situations may be assumed: (1) the subject is adapted to g=1, and (2) the subject adapts himself to g=0. In the first instance the subject will experience a continuous sensation of falling, while the second condition will give rise to sensations of being lifted upwards. Some of the ensuing sensations will be overcome by the visual sense when observing objects which are stationary in respect to the body. However, if one accepts the validity of Fechner's law for the highly complex sense of gravity, serious consequences may result from the weightless state. Thus the intensity range for sensations from 0 to infinity corresponds to a stimulus range from g=1 to g=00. However, the intensity range for sensations from 0 to -00 will correspond to a stimulus range of g=1 to g=0. Therefore, in reducing the gravity to zero, the same range of sensations is obtained as in an unlimited increase of acceleration. The sensation of gravity becomes particularly critical when values of g approximate 0. At this point very minor changes in acceleration will result in highly intense sensations. At zero gravity self-induced accelerations through voluntary or forced movements of the organism become critical, because of the intensity of sensations evoked. These sensations are not experienced at normal gravity, since according to Fechner's law normally the small additional accelerations remain below the sensory threshold

284

Haber, H., & S. J. Gerathewohl 1951 ON THE PHYSICS AND PSYCHOPHYSICS OF WEIGHTLESSNESS. In (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item #14
See also J. Avia. Med. 22(6):180-189, June 1951

ABSTRACT: In an analysis of the effects of weightlessness on the human organism,

two possible situations may be assumed: (1) the subject is adapted to g=1, and (2) the subject adapts himself to g=0. In the first instance the subject will experience a continuous sensation of falling, while the second condition will give rise to sensations of being lifted upwards. Some of the ensuing sensations will be overcome by the visual sense when observing objects which are stationary in respect to the body. However, if one accepts the validity of Fechner's law for the highly complex sense of gravity, serious consequences may result from the weightless state. Thus the intensity range for sensations from 0 to infinity corresponds to a stimulus range from g=1 to g=00. However, the intensity range for sensations from 0 to -00 will correspond to a stimulus range of g=1 to g=0. Therefore, in reducing the gravity to zero, the same range of sensations if obtained as in an unlimited increase of acceleration. The sensation of gravity becomes particularly critical when values of g approximate 0. At this point very minor changes in acceleration will result in highly intense sensations. At zero gravity self-induced accelerations through voluntary or forced movements of the organism become critical, because of the intensity of sensations evoked. These sensations are not experienced at normal gravity, since according to Fechner's law normally the small additional accelerations remain below the sensory threshold.

285

Haber, H. 1951 THE HUMAN BODY IN SPACE
Scient. Amer. 184:16-19, Jan. 1951
See also (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item 12, (F)

ABSTRACT: Article discusses the measures which must be taken to enable men to survive in the alien environment of the void beyond our atmosphere.

SECOND ABSTRACT: This article discusses the measures which must be taken to enable men to survive in the alien environment of the void beyond our atmosphere The first problem to be dealt with is acceleration. Another problem is weightlessness. Control of cabin temperature and oxygen supply is another consideration. Meteors are a field of real danger for astronauts. The author discusses each of the preceding problems. (CARI)

286

Haber, H. 1952 PHASING AND CO-ORDINATION OF MEDICAL RESEARCH WITH TECHNICAL AND ENVIRONMENTAL DEVELOPMENT
In C.S. White, et al (Eds.) Physics and Medicine in the Upper Atmosphere: A Study of the Aeropause. (Alburquerque: Univ. of New Mexico Press, 1952) pp. 575-581

ABSTRACT: The basic environmental changes resulting from human flight beyond the earth's atmosphere are briefly outlined. These changes will impose on space medicine the task to overcome the following basic problems: (1) the problem of explosive decompression, temperature control, and bottled air; (2) problems arising from ionizing radiation (cosmic rays) and meteors; and (3) problems arising from the occurrence of weightlessness. A projected phase schedule is presented in diagrammatic form.

287

Haber, H. 1952 MANNED FLIGHT AT THE BORDERS OF SPACE. THE HUMAN FACTOR OF MANNED ROCKET FLIGHT. In (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine , Item no. 18
See also J. American Rocket Society 22(5):269-279, Sept.-Oct. 1952

ABSTRACT: A functional border between atmosphere and space is defined as a level at which the atmosphere fails as a supporting medium, and space-equivalent conditions begin. Depending upon a particular kind of function the corresponding limit is located at a certain altitude. The major functions of the atmosphere for man and craft are the following: Contributing to respiration, preventing boiling of body fluids, sustaining combustion of fuel, absorbing heavy primaries of cosmic radiation, absorbing solar UV-daylight, absorbing meteors, interacting thermally with the craft, and interfering by air drag over long periods of time (permanence of satellite orbits). Depending upon the nature of a particular function, the functional borders so defined are more or less extended regions. The various functional borders of space lie in the region between 10 and 120 miles of altitude. The significance of the above mentioned factors for manned rocket flight is discussed with special emphasis upon problems of aero-medical and space-medical nature. The use of the term "aeropause" for the border region between atmosphere and space is proposed. (AUTHOR)

288

Haber, H. 1952 STUDY ON SUB-GRAVITY STATES (USAF School of Aviation Medicine, Randolph AFB, Texas) Project No. 21-34-003, Report No. 1, April 1952.

289

Haber, H. 1952 MEDICAL RESEARCH IN THE DEVELOPMENT OF MANNED ROCKET FLIGHT
Technical Data Digest 17(2):12-13

ABSTRACT: A tentative schedule of present and future aviation- and space-medical research tasks is presented. The establishment of an artificial satellite would be the next step in line, with animal experiments preceding the employment of humans. Future studies will have to concentrate particularly on problems resulting from conditions in an environment without gravity and atmosphere (supply of climate and breathing air, filtering of radiation, and supply of mechanical support). (Literatuuroverzicht (Over Ruimtevaartgeneeskunke) (Space Medicine Bibliography) (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

290

Haber, H. 1952 ON SPACE MEDICINE PROBLEMS
(Hayden Planetarium Symposium on Space Travel, Oct. 12, 1951)
J. Brit. Interpl. Soc. 11:3-9

291

Haber, H. 1952 CAN WE SURVIVE IN SPACE?
In Ryan, C., ed., Across the Space Frontier
(New York: Viking, 1952) Pp. 71-97

ABSTRACT: A popular presentation of physiological and psychological problems arising in space travel from high acceleration, lack of atmosphere, from cosmic and solar radiations, lack of gravitational forces, and from hazards like meteorites and inadequate temperature regulation.

292

Haber, H. 1952 PROBLEMS OF SPACE TRAVEL
Science News Letter 62(12):180

ABSTRACT: An analysis of psychological, physiological, and physical problems of space travel, presented by the author in an address before the American Society of Mechanical Engineers, is summarized. Meteors constitute a danger above 90 miles; cosmic rays are a health hazard between 13 and 23 miles; and ozone and ultraviolet light require protective measures. Frictional heat and extreme temperature differentials between lighted and shaded parts of the rocket present an additional problem. Weightlessness in free space merely creates slight physiological disturbances; little is known, however, about the psychological consequences of subgravitational flight. (Literatuuroverzicht (Over Ruimtevaartgeneeskunke) (Space Medicine Bibliography) (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

293

Haber, H. 1952 DER MENSCH IM WELTALL (Man in Space)
Weltraumfahrt (Frankfurt), (1):13-16.

ABSTRACT: Space medicine cannot be considered merely a matter of the future. Human flight has reached heights which, for all practical purposes, approximate conditions of interplanetary space. The paper summarizes briefly and in general terms problems of temperature regulation in the space ship, the dangers of cosmic radiation, and neuromuscular difficulties arising from the lack of gravitational pull.

294

Haber, H. 1952 THE CONCEPT OF WEIGHT IN AVIATION
J. Aviation Med. 23(6):594-596, Nov. 1952.

ABSTRACT: For purposes of aviation engineering and medicine, the concept

of weight is redefined. The principle of d'Alembert states that the sum of the force of gravity, the force of inertia, and the external forces acting upon a body is zero. The weight of the body is then the resultant external force exerted upon the body by a restraining agent in response to forces of gravity and inertia. Six dynamic situations are illustrated, in which the three forces are represented as vectors

295

Haber, H. 1952 GRAVITY, INERTIA, AND WEIGHT
In C. S. White and O. O. Benson, Jr., Ed., Physics and Medicine of the Upper Atmosphere, (Albuquerque, New Mexico; Univ. of New Mexico Press, 1952) pp. 123-136.

ABSTRACT: To evaluate properly the physiological processes in flight, a new formulation of the concept of weight is required. In reversing and implementing the classical definition of weight (or the force of attraction which the earth exerts on a body, with its direction toward the center of the earth) the following definition is proposed: weight is the resultant external force exerted upon a body by a restraining agent in response to forces of gravitation and inertia. This definition makes it evident that weight of a body is not a constant nor a property of the body but depends upon the dynamic conditions to which the body is subjected (e.g. inertia, drag, or propulsion in an aircraft). On the basis of this definition a formula is developed to determine the weight of a pilot under all conditions of propelled and unpropelled flight. The possibility of prolonged weightlessness is a factor to be counted on in future flight and is going to become an outstanding aviation-medical problem. While no major distrubances in the normal physiological functions (such as digestion, breathing, etc.) are foreseen, normal orientation might be impaired.

296

Haber, H. 1953 THE MECHANICAL ENVIRONMENT IN THE FUTURE AIRCRAFT
in Haber, H., ed., Frontiers of Man-Controlled Flight.

297

Haber, H. & S.J. Gerathewohl 1953 PHYSIK UND PSYCHOPHYSICK DER GEWICHTSLOSIGKEIT (Physics and Psychophysics of Weightlessness) Weltraumfahrt 4(2):44-50

ABSTRACT: During weightlessness, the human subject is adapted to g = 1 during which the subject experiences a continuous sensation of falling. The subject can adapt himself to g = 0 during which he experiences the sensation of being lifted upward. Observation of stationary items will overcome many of these sensations. The weightless state is very serious if one accepts the validity of Fechner's law for gravity. By reducing gravity to zero, the same sensations are obtained as those experienced during an increase in acceleration. When the values of g approximate 0, very small changes in acceleration will evoke highly intense sensations. At zero gravity, self-induced acceleration evokes extremely intense sensations not experienced at normal gravity.

298

Haber, H., ed. 1953 PROCEEDINGS OF A SYMPOSIUM ON FRONTIERS OF MAN-CONTROLLED FLIGHT, INSTITUTE OF TRANSPORTATION AND TRAFFIC ENGINEERING, UNIVERSITY OF CALIFORNIA, LOS ANGELES, 3 APRIL 1953

CONTENTS:

299

Haber, H. 1954 FROM HIGH-ALTITUDE FLIGHT TO SPACE FLIGHT.
In Kendricks, E.J., et al., "Medical Problems of Space Flight"
Reprint Instructors' Journal, Winter, 1954.

ABSTRACT: High-altitude flight will eventually become space flight as a natural result of our continual efforts to extend our vertical freedom of movement. During flight, high-altitude and high-speed go together. Several ways of avoiding the dangers of overheating are as follows: better structural materials which are more heat resistant than present ones; and, of course, flying at greater altitudes where the air is thinner. As high-altitude flight will eventually blend with actual space flight, the man in the rocket must be protected against the various hazards of space. The crew must sit in a pressurized cabin and wear a pressure suit. The crew will experience up to six minutes of weightlessness. It is the task of space medicine to help pilots avoid the disturbing effects of weightlessness. (CARI)

300

Haber, H. 1955 FROM HIGH-ALTITUDE FLIGHT TO SPACE FLIGHT.
In USAF School of Aviation Medicine, Randolph AFB, Texas,
Epitome of Space Medicine, Pp. 13-16. ASTIA AD-144 581.

ABSTRACT: High-altitude flight will eventually become space flight as a natural result of our continual efforts to extend our vertical freedom of movement. During flight, high-altitude and high-speed go together. Several ways of avoiding the dangers of overheating are as follows: better structural materials which are more heat resistant than present ones; and, of course, flying at greater altitudes where the air is thinner. As high-altitude flight will eventually blend with actual space flight, the man in the rocket must be protected against the various hazards of space. The crew must sit in a pressurized cabin and wear a pressure suit. The crew will experience up to six minutes of weightlessness. It is the task of space medicine to help pilots avoid the disturbing effects of weightlessness. (CARI)

301

Haber, H. 1955 CAN MAN SURVIVE IN SPACE
Flying Review 10: 15-16

ABSTRACT: Phenomena man will experience in space flight and his physiological reactions to them; hazards to space flight; use of space suits. Article is condensed from the author's. Man in Space (New York: Bobbs-Merrill, 1953)

302

Haber, H. 1959 THE PHYSICAL FACTORS IN THE SPACE ENVIRONMENT
In: Seifert, H.S., ed. Space Technology (New York: T. Wiley and Sons, 1959) Chapter 27

303

Haldane, J. B. S. 1951 BIOLOGICAL PROBLEMS OF SPACE FLIGHT
J. British Interplanetary Soc. (London) 10:154-58, July 1951

ABSTRACT: A report on an informal talk in which the speaker discussed how man would live in a spaceship and on another planet, and the kind of life to be expected on another planet.

304

Hammer, Lois R. 1961 AERONAUTICAL SYSTEMS DIVISION STUDIES IN WEIGHTLESSNESS: 1959-1960.
(USAF Aerospace Medical Lab., Wright-Patterson AFB, Ohio) Proj. 7184, Task 71585, WADD TR 60-715

ABSTRACT: This report documents the more informal, early observations on weightlessness which did not warrant separate publication because of their limited scope and summarizes data from the more rigorous investigations during this period. For each "study" the intent and method of investigation, findings, and references are given. The C-131B, KC-135, free-floating test capsules, camera technique, F-104B, frictionless devices, and water submersion tank are described. The topics of the two heading are: aerospace medical--physiological phenomena, stress, sensory processes, gross motor performance and locomotion, fine motor behavior; and aeromechanics --power generation and heat transfer problems, fluid orientation, Able-5 vehicle stability. (Tufts)

305

Hammer, L.R. 1962 PERCEPTION OF THE VISUAL VERTICAL UNDER REDUCED GRAVITY (Behavioral Sciences Lab., Aeronautical Systems Div., Wright-Patterson AFB, Ohio) MRL TDR 62-55, ASTIA AD 284 050.

ABSTRACT: Judgements of the vertical in an unstructured visual field were obtained in flight under four levels of gravity ranging from 0 G to 1 G. Reduced and zero-gravity conditions were produced in a cargo aircraft flying a parabolic trajectory. Each of 16 subjects made 6 judgments under each of the 4 G-conditions. Results indicate that, although error of judgment of the vertical is not large, it does increase as the G-level decreases, from 1.8 degrees at 1 G to 3.5 degrees at).G. (Author)

306

Hanrahan, J.S. 1958 HISTORY OF RESEARCH IN SUBGRAVITY AND ZERO-G AT THE AIR FORCE MISSILE DEVELOPMENT CENTER, HOLLOMAN AIR FORCE BASE, NEW MEXICO, 1948-1958 (AFMDC, Holloman AFB, N. Mex., 1958)

307

Hanrahan, J.S., & D. Bushnell 1960 SPACE BIOLOGY: THE HUMAN FACTORS IN SPACE FLIGHT. (New York: Basic Books, Inc., 1960)

ABSTRACT: The book is a survey of the research accomplishments in the field of space biology. Included in the survey are the following topics: (1) man's motivation for space travel; (2) the development of a suitable vehicle; (3) the hazards of acceleration and weightlessness; (4) potentially dangerous Van Allen and cosmic radiation. The social, religious, and political implications of space travel are also included

308

Hardy, J.D. and C.C. Clark 1960 GRAVITY PROBLEMS IN MANNED SPACE STATIONS Aerospace Engineering 19:36-39

ABSTRACT: It is shown that more human experience at zero g must be available before one can conclude whether it is better while in space to stay at zero g, or, by rotation, to maintain certain centrifugal acceleration, or to have alternate periods at zero g and at higher g; table showing animal and man ascents above 100,000 feet.

309

Harrower-Erickson, M.R. 1941 PSYCHOLOGICAL FACTORS IN AVIATION. Canad. med. Ass. J., 44:348-352

310

Hart, E. M. 1961 EFFECTS OF OUTER-SPACE ENVIRONMENT IMPORTANT TO SIMULATION OF SPACE VEHICLES
(USAF Behavioral Sciences Lab., Wright-Patterson AFB, Ohio)
Contract AF 33(616) 6858, Proj. 6114, Task 60806, ASD TR 61 201, Aug. 1961. ASTIA AD 269 014.

ABSTRACT: The results of a literature survey undertaken to define the effects of the outer space environment important to the simulation of space vehicles are presented. Specific vehicles and trajectories are not included. Only the natural environment of space is considered and the survey is limited to the solar system with particular emphasis on the region in the near vicinity of the earth-moon system at heights greater than 80 kilometers above the earth's surface. To specify those effects that need to be incorporated into a space training simulator, the exterior environment, its effect on vehicle and crew, and the malfunctions that may result are considered. Recommendations for further study are made. (Tufts)

311

Hartman, B., R.E. McKenzie, and D.E. Graveline 1960 AN EXPLORATORY STUDY OF CHANGES IN PROFICIENCY IN A HYPODYNAMIC ENVIRONMENT.
(School of Aviation Medicine, Brooks Air Force Base, Texas)
Report No. 60-72 July 1960. ASTIA AD 244 121

ABSTRACT: Simulated weightlessness for a prolonged period was produced by the body immersion technic. Changes in psychomotor efficiency was assessed during immersion and after return to the normal environment of 1 G. Systematic changes in a relatively si ple task were obtained during immersion. Gross disruptions in psychomotor behavior on return to the normal environment were observed. Accompanying this were increased response times on three different kinds of tasks in a systems operator simulator. These results suggest that the functional capabilities of a man, while adequate during prolonged weightlessness, will be seriously impaired during the reentry phase of space flight.

312

Hartman, B.O. 1961 EXPERIMENTAL APPROACH TO THE PSYCHOPHYSIOLOGICAL PROBLEM OF MANNED SPACE VEHICLE. In (School of Aviation Medicine, Brooks AFB, Texas) Lectures in Aerospace Medicine, 16-20 January 1961.

313

Hauty, G. T., & R. B. Payne 1958 FATIGUE, CONFINEMENT, AND PROFICIENCY DECREMENT. In Alperin, M., M. Stern, & H. Wooster, eds., Vistas in Astronautics: Proceedings of the First Annual AFOSR Astronautics Symposium (New York: Pergamon Press, 1958) pp. 304-309
See also In (Air University, School of Aviation Medicine, Randolph AFB, Texas) Reports on Space Medicine - 1958 Feb. 1958 (F)

ABSTRACT: Beginning at 0800, different experimental groups of volunteers were required to perform for 30 consecutive hrs. a task which consisted of monitoring several simulated aircraft indicators and, upon the detection of departures from null, executing corrective action. With the exception of short and infrequent periods for lunch, relief, and exercise, they remained confined to this task situation and were not permitted to sleep.
While urinalyses revealed little or no temporal change in physiological function, task proficiency followed a highly regular pattern of change. Initial proficiency levels were maintained up to 2400 at which time decline set in and progressed until 0600. At this point proficiency began to increase until from 1200 to the termination of work, it was one-half that of initial levels. Dextro-amphetamine (5 mg) was found to exert a substantial restoration of proficiency and with no evidence of a 'letdown' effect. Nearly all subjects reported perceptual disturbances ranging widely in degree of bizarreness and presumed adverse effect upon proficiency.
Since these aberrations occurred within a normal sensory environment, it may be that such will occur to a greater degree in the closed ecological system of a space vehicle.

314

Hauty, G. T. 1958 HUMAN PERFORMANCE IN THE SPACE TRAVEL ENVIRONMENT (Air University, Maxwell AFB, Ala.) Air University Quarterly Review 10(2):

See also In (Air University, School of Aviation Medicine, Randolph AFB, Texas Reports on Space Medicine - 1958, Feb. 1958 (F)

ABSTRACT: By necessity, man will have to be incorporated as an integral component in systems designed for extended space operations. Together with the other principal components, he will be subjected to extensive and systematic testing for reliability determinations. The need for such testing is occasioned not so much by a lack of information on human limitations as by the lack of information on the interactions of these inherent limitations with the conditions man will experience in space. Since these interactions are somewhat unique, a brief discussion of the presently obvious conditions peculiar to a closed ecological system in space and of certain relevant human limitations will serve to indicate what man's performance will have to tolerate.

315

Hauty, G. T. 1959 HUMAN PERFORMANCE IN SPACE
In Gantz, K. J., ed., Man in Space
(New York: Duell, Sloan, & Pierce, 1959) Chap. 7

316

Hauty, G.T. 1960 PSYCHO-PHYSIOLOGICAL PROBLEMS OF MANNED SPACE VEHICLES. In (School of Aviation Medicine, Brooks AFB, Texas) Lectures in Aerospace Medicine, 11-15 January 1960

317

Hawkes, R. 1958 WEIGHTLESSNESS CRUCIAL SPACEMAN FACTOR. Aviation Week 68(5):50-51, 53, 55, 57; Feb. 3, 1958

ABSTRACT: Describes work being done at the Aero Medical Field Laboratory's Biodynamics Branch - Holloman AFB, New Mexico.

318

Hawkes, R. 1958 WEIGHTLESSNESS CRUCIAL SPACEMAN FACTOR Space Technology 1:8-10, April 1958

319

Hawkins, W.R. 1960 SPACE FLIGHT DYNAMICS -II. ZERO "G". In (USAF School of Aviation Medicine, Brooks AFB, Texas) Lectures in Aerospace Medicine, 11-15 January 1960

320

Hellebrandt, F. A., & E. Brogdon 1938 THE HYDROSTATIC EFFECT OF GRAVITY ON THE CIRCULATION IN SUPPORTED, UNSUPPORTED AND SUSPENDED POSTURES. Amer. J. Physiol. 123:95-96

321

Helvey, T. C. 1959 PROBLEMS OF GROUND SIMULATION OF LONG-RANGE SPACE FLIGHT ENVIRONMENTAL CONDITIONS. IRE Trans. Space Electronics and Telemetry SET-5 (2):57-60, June, 1959

322

Helvey, T.C. 1960 MOON BASE, TECHNICAL AND PHYSIOLOGICAL ASPECTS (New York: John F. Rider, Inc.)

323

Hendler, E. & L.J. SantaMaria 1961 RESPONSE OF SUBJECTS TO SOME CONDITIONS OF A SIMULATED ORBITAL FLIGHT PATTERN
Aerospace Medicine 32(2): 126-133

ABSTRACT: Some of the physiological responses of subjects wearing ventilated full pressure suits and exposed to pressure and thermal profiles characteristic of extreme conditions of orbital flight patterns were presented. No significant physiological stress was evidenced in subjects exposed to a modified thermal profile, except for the sweating response of one subject. Exposure of experienced subjects to long duration thermal loads simulating relatively severe post-landing and full thermal profiles resulted in premature test termination when ventilating air temperature was more than a few degrees above initial mean skin temperature. (Author)

324

Henry, John 1948 SPECULATIONS ON SPACE TRAVEL: PART A
Rocket News Ltr. 2:6-9, Oct. 1948

ABSTRACT: Discusses the problems of acceleration, oxygen, gravity, cosmic rays, ultra-violet rays, food and water.

325

Henry, J. P., E. R. Ballinger, P. J. Maher & D. G. Simons 1952 ANIMAL STUDIES OF THE SUBGRAVITY STATE DURING ROCKET FLIGHT.
J. Aviation Med. 23:421-432, Oct. 1952.

SUMMARY: 1. Pulse, respiration, electrocardiogram and arterial and venous pressures have each been telemetered from one or more of seven anaesthetized primates in four V_2 and three Aerobee rockets during subgravity periods lasting for two to three minutes. There was no evidence of a significant disturbance of the cardiovascular or respiratory systems.

2. Photographic records of the performance of five mice have been made through two to three minute periods of subgravity. As long as a foothold was available to the animals they did not appear seriously disturbed. In all cases the animals ran and jumped normally immediately following resumption of an orienting gravity stress.

3. The weight of evidence suggests that in currently attainable durations of two to three minutes the subgravity state will not lead to any serious psychophysiological difficulties.

4. Investigation of the effects of subgravity states lasting for hours or days must await the development of orbital rockets

326

Henry, J.P. 1955 PHYSIOLOGICAL LABORATORIES IN ROCKETS.
Astronautics, 2:22-26
See also Bull. Med. Res. 10(3):2-4, 1956

ABSTRACT: Photos and descriptions of the equipment installation in an Aerobee rocket used for upper-air research with live monkeys and mice.

327

Henry, J. P. 1956 PHYSIOLOGICAL LABORATORIES IN ROCKETS
Bull. Med. Res. 10(3):2-4
See also Astronautics 2:22-26, 1955

328

Henry, J.P., G.A. Eckstrand, R.R. Hessberg, D.G. Simons, et al. 1957 HUMAN FACTORS RESEARCH AND DEVELOPMENT PROGRAM FOR A MANNED SATELLITE. (Air Research and Development Command, Baltimore, Md.) ARDC TR 57 160, Oct. 1957. ASTIA AD-136 410.

ABSTRACT: This report presents a brief summary of the "state-of-the-art" in human factors research and development in providing a functioning man in space flight. An estimate that man can now be sent out into space for two hours is based upon present knowledge of such factors as: habitable atmosphere; accelera tion; weightlessness; thermal radiation; escape; isolation and confinement; presentation and processing of information; work place layout; crew skills; selection and training; and motivation. In the above factors, areas of the unknown are indicated and estimates of time needed to achieve significant progress are made.

329

Henry, J. P. 1960 PROJECT MERCURY, STATUS OF THE ANIMAL TEST PROGRAM
NASA Project Mercury Working Paper No. 158, NASA Space Task Group, Langley Field, Va.

ABSTRACT: Outlines the origin and purposes of the animal test program, details of the Mercury capsule animal program underway at AMFL, HAFB, prelaunch facilities at Cape Canaveral, operational aspects, information anticipated from the animal flights, and future research possibilities of the program. Appendices contain the animal-monitoring and flight-data plans and list the personnel involved in the animal program

330

Henry, J.P. & J.D. Mosely 1961 THE MERCURY ANIMAL PROGRAM
(Paper, IAS-ARS Joint Natl. Meeting, June 13-16, 1961, Los Angeles, Calif.)
Paper no. 61-158-1852, 17 pp.

ABSTRACT: A report is presented on several aspects of the MR-2 flight. Included are the dynamic considerations and the physiological and psychological responses of the subject to flight stress.

331

Henry, J. P., W. S. Augerson, R. E. Belleville et al 1962 EFFECTS OF WEIGHTLESSNESS IN BALLISTIC AND ORBITAL FLIGHT.
Aerospace Medicine 33(9):1056-1068, Sept. 1962.

ABSTRACT: This is a statement of conclusions made by the authors after studying data on weightlessness. The weightless state was observed during aircraft and ballistic and orbiting rocket flights and related to the results of the Mercury MR-2, 3, 4, MA 5, 6, and 7 flights. The authors state the following conclusions: (1) Orientation is no problem if stationary objects can serve as references. (2) If a subject is attached to his work area, he can perform complex visual-motor coordination tasks for long periods of time. (3) The weightless state does not affect respiration, digestion, eating, and micturition. (4) The weightless state does not affect the circulation system to a very great degree.

332

Herrick, R.M. 1959 AMAL BIOPROBE PROJECT: EFFECT OF SIZE OF REINFORCEMENT UPON OPERANT RESPONSE RATE
U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR83 April 14, 1959

ABSTRACT: In order to study the physiological and psychological effects of prolonged exposures to the weightless state, the orbital and space flight project included plans for exposing small mammals (white rats) to zero gravity in an orbiting satellite. In working toward this goal, one of the principal areas of study is the evaluation of animal performance. This report presents a study undertaken to determine how the response rate of water-deprived rats varies as a function of the amount of water procured by each response. The data of this study will help in providing an estimate of the number of reinforcements of a given size that can be delivered to a rat in various operant conditioning experiments before the rat's response rate decreases as a result of approaching satiation.

.333

Herrick, R.M. 1959 AMAL BIOPROBE PROJECT: FEASIBILITY OF USING DAILY LONG-DURATION PERFORMANCE PERIODS FOR RATS IN BIOPROBE (U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR85 May 13, 1959

ABSTRACT: The bioprobe program is designed to evaluate the effects of the zero G condition of an orbiting satellite upon the behavior of two rats within the satellite. Because of the two-three week term of the proposed outer space experiment, it would be desirable to increase the daily experimental period in the satellite beyond that ordinarily used in animal behavior experiments on the earth and thereby obtain more data within the alloted time. Thus, instead of the usual daily experimental period of an hour or two, a daily period of six or eight hours would be preferable. The experiment described in this report was performed in order to (a) determine the feasibility of a six or eight-hour daily experimental session with positive reinforcement provided under a variable-interval limited-hold schedule of reinforcement and (b) to uncover the characteristics of such long-duration experimental sessions. The results imply (a) that it will be possible to require a rat to perform under a variable-interval limited-hold schedule for several hours daily and (b) that it would probably be desirable to space the performance periods to correspond as closely as possible to the "normal" cyclical periods of the rat.

334

Herrick, R.M., G.H. Kydd, & R.L. Fenichel 1959 BEHAVIORAL AND PHYSIOLOGICAL EFFECTS OF EXPOSURE TO A SIMULATED JUNO II ACCELERATION PATTERN. (Aviation Medical Acceleration Laboratory, Naval Air Development Center, Johnsville, Pa.) Rept. NADC-MA-5913, 21 Sept. 1959, ASTIA AD 230 005.

ABSTRACT: The purpose of the present experiment was to determine how exposure to a simulated acceleration pattern of the Juno II missile system affected the subsequent behavior of rats. The findings of the experiment indicate that, within the limits of the simulation, exposure to the acceleration pattern will not detrimentally affect rats either physiologically or behaviorally. This means that in an analysis of the results of a biosatellite study designed to evaluate the influence of zero G upon behavior the fact that the rats were exposed to the Juno II acceleration pattern may be ignored. (Author)

335

Herrick, R. M., & P. Karnow 1961 A DISPLACEMENT-SENSING CONSTANT-TORQUE RESPONSE LEVER DESIGNED FOR USE IN SATELLITES. (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-6105, 3 Apr. 1961. ASTIA AD 255 595.

ABSTRACT: This report describes an animal response lever mechanism which (a) senses the displacement of the lever resulting from each press, (b) requires a constant torque throughout the total excursion of the lever arm, and (c) maintains the same torque characteristics under G. Calibration devices and techniques developed to evaluate the lever mechanism indicate its usefulness as a tool for the study of the effects of acceleration -- including zero G -- on behavior.

Sample data on (a) lever-pressing rate, (b) frequency-displacement distributions, (c) characteristics of individual responses, and (d) the order of occurrence of different responses indicate the variety of data obtainable and the depth of analysis possible with the response mechanism.

336

Herrick, R.M. 1962 LEVER DISPLACEMENT DURING CONTINUOUS REINFORCEMENT AND DURING A "DISCRIMINATION"
(Naval Air Development Center, Aviation Medical Acceleration Lab., Johnsville, Pa. Rept. no. NADC-MA-6209, July 23, 1962

ABSTRACT: In order to evaluate the influence of zero g or above-normal g on motor behavior in an animal, the normal motor behavior is required as a basis for measurement. Measurement was taken by the displacement of the T-bar handle during continuous reinforcement and during a discrimination. Although decreased motivation reduced the rate of lever-pressing, it had negligible effects on the distance the lever was pressed.

337

Hersey, I. 1957 DOG IN SPACE.
Astronautics, 2(5):30-31,84. Dec. 1957

ABSTRACT: The launching of a 1120 pound Sputnik II satellite carrying a dog is discussed. Aside from the data which the satellite can accumulate at very high altitudes, studies of the dog may produce significant information about cosmic ray effects and weightlessness once it is successfully returned to earth. The experiments involving the dog are largely physiological, and directed toward learning the mechanics of protecting living beings in space.

338

Hersey, I. 1959 THEY FLOAT THROUGH THE AIR.
Astronautics 4(2):42, 7 Feb. 1959.

ABSTRACT: In studying the effects of short periods of zero gravity on human performance and behavior, the Air Force Aero Medical Laboratory, Wright-Patterson Air Force Base, Ohio, has used a Convair C-131B transport plane to permit human subjects to float freely, without restrain of any kind, for weightless periods lasting from 12 to 15 sec. The C-131B provides space a little over 6 feet high, 10 feet wide, and about 25 feet long, and permits study of such problems as human orientation and movement, as well as studies of manipulative performances, under zero-G conditions.

339

Hertzberg, H.T.E. 1960 THE BIOMECHANICS OF WEIGHTLESSNESS
Aircraft and Missiles 3:52-53, July 1960

340

Hess, W.H. & E. Konnecci 1961 APPROACH TO REDUCED GRAVITY STUDIES FOR HUMAN EXPERIMENTATION
In: Proceedings of the IAS Aerospace Support and Operations Meeting, p. 76. (Instit. of Aerospace Sciences, In. New York; Assisted by IAS Aerospace Technology on Support, Orlando, Fla.) Dec. 4-6, 1961

ABSTRACT: A series of tests was devised to measure performance in some areas in which the effects of reduced gravity could be most realistically simulated by balloon suspension. These tests required the positioning of the arm and hand with limited visual feedback and the application of force in a variety of body positions in which traction between feet and floor was a limiting factor on the amount of force that could be applied. The tests were administered to a variety of subjects under both simulated reduced gravity and normal gravity conditions.

The feasibility of the approach described was clearly demonstrated. Because the studies covered were of a pilot nature based upon a limited number of subjects and a restricted sampling of tasks, further studies using these techniques should yield broadened-base data for comparison with the data already obtained by this and other techniques.

341

Hess, W. H., & E. B. Konecci 1961 APPROACH TO REDUCED GRAVITY STUDIES FOR HUMAN EXPERIMENTATION. (Douglas Aircraft Co., Inc., Santa Monica, Calif.) Engineering Paper No. 1189, Sept. 14, 1961

ABSTRACT: An apparatus for simulating reduced gravity is described. The subjects were attached by a harness and suspended from three helium-filled balloons. This effectively reduced the force of the subject against the floor. Tests that were given are as follows: (1) marking a target by blind positioning, (2) pulling against reduced traction, (3) pushing against reduced traction, (4) pulling with the body against reduced traction, and (5) applying torque against reduced traction. Results showed that in marking a target the mean positioning error increased with the number of trials under simulated reduced gravity. The results of the force and torque tests show a decrease in efficiency under simulated reduced gravity, and it appears that the results under normal conditions may be useful to predict performance under reduced gravity. The significance of these results to extraterrestrial activities is discussed. (Aerospace Medicine 33(11):1397-1398, Nov. 1962)

342

Hill, P.R. & E. Schnitzer 1962 ROTATING MANNED SPACE STATIONS
Astronautics, 7 (9): 14-18. Sept. 1962.

ABSTRACT: There are many potential uses of manned space stations, including the following: (1) gravity research, (2) launch-platform experiments, (3) space-systems environmental research, (4) communications, (5) earth observation, and (6) astronomical observation. This list shows that few applications involve a requirement for artificial gravity. Presented is a graph defining the rotational characteristics needed in conjunction with interpretation of physiological responses (comfort zone). Elementary forms (cross, rim, flywheel, cylinder, axial modules, in plane modules) considered for space stations are evaluated and diagrammed.

343

Hillaby, J. 1957 FLYERS DESCRIBE FLOATING IN AIR
Sci. Digest, Vol. 41, Feb. 1957

344

Hitchcock, F.A. 1956 PRESENT STATUS OF SPACE MEDICINE.
J. Astronautics 3(2):41-42, 51-52

ABSTRACT: In addition to suitable environment in cabin of space ships, there are certain unavoidable physiologic stresses which must be tolerated, including accelerative forces incident to take-off from earth, effects of gravity free state, hazards involved in exposure to cosmic radiation and possibility of collision between space ship and meteorite; from physiologic and medical standpoints there seems to be no insuperable obstacles to space flight

345

Hitchcock, F. A. 1956 SOME CONSIDERATIONS IN REGARD TO THE PHYSIOLOGY OF SPACE FLIGHT. Astronautica Acta 2:20-24

ABSTRACT: The physiological stresses that will be encountered in space flight are considered. Exposure to barometric pressures lower than 47 mm Hg (63,000 feet) will produce all of the harmful effects that would occur in a vacuum. Therefore from a physiological viewpoint any flight above 63,000 feet may be considered as space flight. In such flights sealed-cabins provided with an air conditioned artificial atmosphere must be used. While compressed, liquid or chemical oxygen might be satisfactory for flights of short duration the biological method of providing such atmospheres is probably the best. Thermal stresses, Accelerative forces and cosmic radiation are some of the other factors which must be considered. The physiological responses of living animals to a vacuum are discussed. It is concluded that none of these physiological problems is unsurmountable. (Literatuuroverzicht (Over Ruimtevaartgeneeskunke) (Space Medicine Bibliography) (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

346

Hitchcock, F. A. 1959 SPACE MEDICINE
Modern Med., 27(18):210-218,222,226-228. 15 Sept 1959.

ABSTRACT: A brief historical survey of early research of space medicine in the United States is presented. The engineer and the physiologist will both have an important function in the development of space travel. The engineer must develop three distinct types of space craft, all of which will be different in structure and function. The physiologist must concentrate his efforts on the ypes of stress that passengers and crew will experience. These stresses include: excessive acceleration, weightlessness, extreme heat, explosive decompression, supply problems, and composition and pressure of atmosphere.

347

Holden, G.R., J.R. Smith, & H.A. Smedal 1961 PHYSIOLOGICAL INSTRUMENTATION SYSTEMS FOR MEASURING PILOT RESPONSE TO STRESS AT HIGH G AND ZERO G. (Paper, 32nd Annual Meeting, Aerospace Medical Assoc., 24-27 April 1961, Chicago, Ill.)

ABSTRACT: An airborne physiological instrument system reported in NASA TN D-351 has been modified and additional tests have been made in the University of Southern California and AMAL centrifuges and in an F-104B airplane. These tests covered various levels of acceleration from zero to 8 g. The measurements made were, in part: ECG, blood pressure, pulse wave, respiration rate and volume, and carbon dioxide content of expired air. The data from a three-lead electrocardiograph were recorded, using a unique balance transistor amplifier. Systolic and diastolic blood pressures were measured using an automatic sequencing occluding arm cuff and microphone stethoscope. Pulse wave on the wrist was obtained with a vasochromograph and a.c. amplifier. Several methods were used to measure respiration rate, and respiration volume was measured with a wedge spirometer. The expired air was analyzed for CO2 content with a very much modified Bechman LB-1 gas analyzer. The quanitative effects of short term periods of zero g on pilot control performance were determined by measuring the tracking accuracy, the equivalent analytical transfer function and the physiological condition of a subject in the rear seat of an F-104B airplane being flown in a 60-80 second zero g trajectory. A tracking task played back from a tape recorder was presented to the subject on an oscilloscope. The subject used a sidearm controller to attempt to wipe out his tracking error. A small airborne analog computer computed the simulated airplane's response to the control motion and changed the tracking display accordingly. The experiment was repeated and thus affords a direct comparison with a study of pilot control behavior previously conducted on ground-based simulator and centrifuge. (Aerospace Med. 32(3):235, March 1961)

348

Holden, G. R. et al 1962 PHYSIOLOGICAL INSTRUMENTATION SYSTEMS FOR MONITORING PILOT RESPONSE TO STRESS AT ZERO AND HIGH G
Aerospace Medicine 33(4):420-427, April 1962.

SUMMARY: A physiological instrumentation system capable of recording the electrocardiogram, pulse rate, respiration rate, and systolic and diastolic blood pressures during flight has been developed. The recording of respiration volume and exhaled carbon-dioxide percentages as well as the nitrogen content of the expired breathing air has been added for centrifuge use. This instrumentation was designed for use during control studies at varied levels of acceleration in order to monitor the well-being of the pilot and at the same time to obtain data for study of the relationship between his various physiological functions and his performance capability.

349

Holmes, B. 1962 MANNED SPACE FLIGHT
AIBS Bulletin 12(5):56-59, Oct. 1962

ABSTRACT: Four National Aeronautics and Space Administration programs, Mercury one-day missions, Gemini, and Apollo, are discussed together with expected problem areas. The final phases of the Mercury program (orbital flight of short duration) are intended to amplify and expand the basic data obtained during the Glenn and Carpenter flights. The one-day missions program will extend the time of weightlessness and allow further assessment of the physiological effects of this phenomenon. This extension is of prime importance since during the lunar mission the astronauts will be weightless for some five days. The Gemini program will extend capability to orbital flight for two men for approximately 10 days. Aims of this program are to develop rendezvous techniques and gain further insight on the effect of prolonged weightlessness. The fourth major program, Project Apollo, will be the logical culmination of the previous three programs. It is aimed at landing men on the Moon and returning them to Earth. The problems raised by these programs are not insurmountable and many of them can be recognized far enough in advance to perform the research and development necessary to solve them.

350

Horak, J. 1960 RECENT DEVELOPMENTS IN AVIATION MEDICINE
South Africian Med. J. 34(28):582. July 9, 1960.

ABSTRACT: This is a summary of a paper presented at the Staff Scientific Meeting of the South African Institute for Medical Research. The meeting was held at Johannesburg on March 8, 1960. The three important factors affecting space ships are presented and discussed. Those three factors are as follows: the physical environment of space; speed of space craft in relation to linear, anbular, and radial acceleration; and distance space craft will travel over and away from the earth. There is also a discussion of medical problems during a flight including weightlessness, orientation, and the "break-off" phenomenon.

351

Horak, J. 1960 SPACE MEDICINE.
South African Med. J. (Cape Town) 34(53):1117-1122, 31 Dec 1960

ABSTRACT: Current space travel may be classified as being in a phase of global space-equivalent flight, as defined by the combined factors of the physiological and mechanical properties of the space environment, the speeds attained in space flight, and the distances rockets travel over and away from the earth. The attendant medical problems are basically those of high altitude flight as we know it today, and most of the problems involved in true space flight are encountered in the stage of global space-equivalent flight.

352

Houbolt, J. C. 1960 CONSIDERATIONS OF THE RENDEZVOUS PROBLEMS FOR SPACE VEHICLES. (Preprint No. 175A, Soc. Automotive Eng., Apr. 1960)

353

Howard, P. 1961 PHYSIOLOGICAL PROBLEMS OF SPACE FLIGHT
New Scientist (London) 10(231):106-108. April 1961.

ABSTRACT: This is a presentation of the problems of acceleration, deceleration and weightlessness during space flight. Centrifuge studies have been the source of most acceleration studies. Controlled parabolic flight studies in which the weightless state was sustained for about forty seconds have yielded information on feeding, drinking and excreting waste products during weightless ness and the effects of the weightless state on the nervous system. Because deceleration and acceleration have the same properties, the same precautions must be taken to avoid exceeding the limits of tolerance. Deceleration limits during re-entry is discussed.

354

Humphries, J. 1957 SOME IDEAS IN ASTRONAUTICS
Aeronautics, 35:41-42, Jan. 1957

ABSTRACT: Summaries of papers presented at the 1956 Congress of the IAF in Rome. The papers were concerned with solar power for propulsion, biological hazards of space flight, and effects of weightlessness

WEIGHTLESSNESS

I

355

Iazdovskii, V. I., E. M. Iuganov and I. I. Kasian 1960 USTANOVOCHNYI REFLEKS INTAKTNYKH ZHIVOTHYKH V USLOVIIAKH NEVESOMOSTI (Postural Reflexes of Intact Animals Under Conditions of Weightlessness) Izvest. Akad. Nauk S.S.S.R. Ser. Biol. (Moscow) 25(5):762-767, Sept. - Oct. 1960. (In Russian).

ABSTRACT: The postural reflexes were studied in two white rats and two white mice during a rocket flight involving a sevenfold increase in gravity and a nine-minute period of weightlessness. The animals were enclosed in a sealed cabin of the regenerative type with normal atmospheric conditions. Food and drink were freely accessible. Individual and species differences were shown for motor activity during weightlessness. Within 40-45 seconds of weightlessness the movements of the animals became less discoordinated, slower, and smoother. Although the length of time necessary for full adaptation of postural reflexes to weightlessness cannot be estimated at this time, the first signs of adaptation are manifested after 40-45 seconds

356

IGY Satellite Panel 1958 IGY SATELLITE PANEL PROPOSES NATIONAL SPACE FLIGHT PROGRAM
Astronautics 3:132, May 1958

ABSTRACT: Recommendations for a five-year program costing about $150 million annually include projects "centering on biological experiments crucial to the eventual attainment of space flight; investigations of lunar gravity or mass, magnetic field and atmosphere; planetary and interplanetary probes; determination of the astronomical unit (A.U.) now estimination of planetary masses and their effects of the path of nearby space vehicles; and observation of an instrumented re-entry body as it plunged into the planet's atmosphere."

357

Ingram, W. T. 1957 ENVIRONMENTAL PROBLEMS CONNECTED WITH SPACE SHIP OCCUPANCY In The Proceedings of the 3rd Annual Meeting of The Society of the American Astronautical Society, New York

358

Ingram, W. T. 1958 ORIENTATION OF RESEARCH NEEDS ASSOCIATED WITH ENVIRONMENT OF CLOSED SPACES. (New York University College of Engineering, N. Y.) Rept. No. AFOSR TN-58-106; Contract AF 18(603)71; ASTIA AD-152 015 (Paper, American Astronautical Society in New York, Jan. 30, 1958)

ABSTRACT: A study is being made of closed ecological systems and the engineering techniques requisite to the handling, treatment, and disposal or recycling of materials appearing as wastes and by-products of human occupancy of the closed space. The study indicates that temperature control, air motion development, removal of particulate matter, elimination of odors and control of microorganism populations may be feasible with modifications of present day commercial equipment. A train of materials can be established such that turbulent air from the confined cabin would be drawn through an activated carbon filter, a millipore, or deep bed filter, and chemical train for specific materials such as CH_4, H_2S, etc. By the time the air has passed through the train most of the gross impurities will have been removed. This leads to the assumption that the room air may provide the purest source of water available in the confined ecological system. The human body itself, may act as a purification plant and receive these materials through inhalation, skin, or oral intake, and detoxify them, if necessary, passing them out as waste products.

359

Isakov, P. K. 1955 PROBLEMS OF WEIGHTLESSNESS. Nauka i Zhizn 22:17-20 Translated in Krieger, F. J., ed., A Casebook on Soviet Astronautics, Appendix XX, pp. 229-239, RAND Research Memo RM-1760, ASTIA AD 108 750, June 1956

360

Isakov, P. 1958 ON LAUNCHING A SINGLE-STAGE GEOPHYSICAL ROCKET TO AN ALTITUDE OF 450 KM ON AUGUST 27, 1958 Kr. Zvezda (USSR) Sept. 2, 1958 (Air Technical Intelligence ctr., Wright-Patterson AFB, Ohio, Rept. No. IR-1612-58, 1958)

ABSTRACT: This paper discusses the flights of dogs in non-hermetic chambers up to altitudes of 110 km, and in hermetically sealed cabins to an altitude of 212 km.

361

Isakov, P. 1958 LIFE IN SPUTNIK Astronautics 3(2):38-39, 49-50

ABSTRACT: Problems involved in keeping living organisms in space-examined by Soviet biologist, preventing escape of gases from liquids in organisms by combination of two methods-namely maintaining necessary barometric pressure in chamber and use of specially designed clothing or space suits. Solar and cosmic radiation studied; effects of acceleration on organisms of animals and humans.

362

Isakov, P. I. 1959 LIVING CONDITIONS ON ARTIFICIAL SATELLITES OF THE EARTH. Iskusstvenn'vye sputniki Zemli (Artificial Earth Satellites). Chap. IV:44-59. Moskva. (translation)

ABSTRACT: This chapter of the monograph presents in the form of questions and answers information on biological data of space flight. Under discussion of the medical and biological problems of man in space flight a basic problem is that of acceleration and weightlessness

363

Isakov, P. 1961 PROBLEM OF WEIGHTLESSNESS (USSR)
Meditsinskiy rabotnik, 15 Aug. 1961, p. 3, cols. 1-4

ABSTRACT: Subjected to weightlessness, mice were found to suffer loss of coordination in movement. However, with the vestibular nerve removed, the animals showed no disruption of movement while in a state of weightlessness. The role played by vestibular stimulation "indicated what form the training of astronauts should take to lessen the effect of disorientation."

364

Iuganov, E. M., I. I..Kasian and V. I. Iazdovskii 1960 O MYSCHECHNOM TONUSE V USLOVIIAKH NEVESOMOSTI (Muscle Tone During Conditions of Weightlessness)
Izvest. Akad. Nauk S.S.S.R. Ser. Biol. (Moscow) 25(4):601-606, July - Aug. 1960. (In Russian with English Summary).

ABSTRACT: The nature and degree of change in the eye muscle tone of a rabbit was investigated during alternating super- and sub-gravitational conditions. Movements of the left eye were filmed during rocket flight (with accelerations up to 6.5 g. and a weightless period of 5 minutes) from the moment of take-off throughout the flight. Control experiments were done under laboratory conditions employing a centrifuge, whereby the acceleration forces attained were analogous to those in flight. The vertical displacement of the eyeball during flight suggests a decrease of the tonic tension of eye muscles during weightlessness. Displacement of the projection of the visual after-image into distance during alternating super- and subgravitational states (oculogravic and agravic illusion) is apparently caused by the vertical displacement of the eyes, brought about by reflex stimuli from the otolith apparatus.

365

Iuganov, E. M., P. K. Isakov et al 1962 MOTOR ACTIVITY IN INTACT ANIMALS IN CONDITIONS OF ARTIFICIAL GRAVITY.
In Izv. Akad. Nauk. SSSR (Biol) 3:455-460, May-June 1962 (Russian)

366

Ivanova, M. P. and A. S. Barer 1962 SOVIET STUDIES IN THE EFFECTS OF WEIGHTLESS AND PHYSICAL EXERTION
(Joint Publications Research Service, Office of Technical Services, Dept. of Commerce, Washington, D. C., 10 Aug. 1962) Rept. No. JPRS-14796.

ABSTRACT: Ivanova, M. R., "Changes in the Biopotentials of the Human Brain in Connection with Physical Work," pp. 1-15.
Barer, A. S., "The After-Effect of Singly and Repeatedly Acting Antripetal Accelerations on the Higher Nervous Activity of Animals,"pp. 15-30.

WEIGHTLESSNESS

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367

Jacobs, H.L. 1960 THE LACK OF BEARING CONTACT AND THE PROBLEM OF WEIGHTLESSNESS: THE EFFECT OF PAST EXPERIENCES ON HUMAN PERFORMANCE ON A FREE-ROTATING, LOW-FRICTION TURNTABLE
Ann. N.Y. Acad. Sci., v. 84, Art. 9, Sept. 30, 1960, pp. 308-328

ABSTRACT: Investigations were conducted on the performance of liberal art students, swimmers, and engineers in the absence of bearing contact was investigated on a low-friction, oil-bearing turntable. Selection of the subjects was made on the basis of differences in past experiences and training considered relevant to the performance of the tasks. Consequently, the liberal arts students were considered naive because they had not had any college or high school physics courses. The swimmers also had no training in physics but had experience with the type of arm and leg control of body movements generally applicable to the no bearing contact situation. Because the engineering students had completed one year of college physics plus courses in statics and dynamics, they were classified as conceptually sophisticated. During the test, each subject was required to perform the following tasks: (1) in the standing position with the turntable stationary, but free to rotate, make one complete turn without shifting the feet or jumping; (2) in the standing position with the turntable spinning, to stop the rotation as quickly as possible. A hand-held gyroscope was available for use by the students. After observing the performance of the students, it was concluded that (a) college students learned to perform equally well in this situation; (b) engineering students were not able to make efficient use of their familiarity with mechanics to aid in the performance or understanding of the tasks; and (c) engineering students were able to use their knowledge of mechanics to understand the use of a hand-held gyroscope as a tool in these tasks

368

Jacobs, H.L. & E. Burgess, eds. 1960 ADVANCES IN THE ASTRONAUTICAL SCIENCES Vol. VI (New York: Macmillan, 1961)

ABSTRACT: Proceedings, AAS Sixth Annual Meeting, New York, Jan. 18-21, 1960. Contents include: White, S.,D.D. Flickinger, T.V. Helvey, A. Mayo and B. Rowen, "Panel Discussion: Man in Space, When?", Pp. 37-69.

369

Jakubski, Z. 1962 THE WORLD'S FIRST TANDEM FLIGHT IN SPACE (BASIC RESULTS) (PERVYI V MIRE GRUPPOVOI POLET V KISMICHESKOE PROSTRANSTVO ((OSNOVNYE ITOGI)))
(Space Technology Laboratories, Inc., Redondo Beach, Calif., Trans. no. 70, Nov. 1962)
In: Pravda, no. 295(16151), Oct. 22, 1962, pp. 1-3

ABSTRACT: During the Vostok 3 and 4 space flights, experiments in weightlessness were conducted. Nikolaev floated in the capsule for a total of 3.5 hours and Popovich for about 3 hours. During that time, they felt fine, conducted observations, and communicated with the ground by means of microphones. They also conducted several experiments within the capsule.

370

Johns,T. R. and S. Thesleff 1960
EFFECTS OF MOTOR INACTIVATION ON THE CHEMICAL SENSITIVITY OF SKELETAL MUSCLE

Acta physiol. scand., 51:136-141, 1961
ASTIA AD 262 290

ABSTRACT: In order to determine whether the lack of motor nerve impulses without denervation per se, alters the chemically sensitive area in skeletal muscle, the size of the ACh-sensitive areas in muscle fibres of cat tenuissimus were measured after isolation of the motor neurones by severence of the dorsal roots below a lower lumbar cord transection. The sensitivity of the individual muscle fibre to ACh was determined by iontophoretic micro-application of the drug, and by intracellular recording of the potential charge. The frequency of miniature end-plate potentials, their amplitude, and their time course, were unaffected by the isolation procedure. The procedure also caused little increase in the size of the ACh-sensitive surface. Therefore, inactivation per se did not alter the chemically sensitive area. (AUTHOR)

371

Johnson, G.E., J. Serrano, and E.Z. Levy 1959 APPLICATION OF SKIN RESISTANCE IN PSYCHOPHYSIOLOGICAL STUDIES. (Wright Air Development Center, Aerospace Medical Lab., Wright-Patterson AFB, Ohio)
WADC TR 59-688, Dec. 1959.

ABSTRACT: The usefulness of measuring changes in skin resistance as a device to detect the impairment of consciousness in personnel whose work requires maximum alertness was investigated during isolation, in flight, under acceleration, under the influence of drugs, and other conditions. These experiments have determined that the use of skin resistance for monitoring of consciousness is promising, however, further studies are necessary before this method may be used as an operational tool. The effects of temperature and environmental changes must be eliminated, and the patterns of skin resistance must have better quantification.

372

Johnson, S.P. 1960 PLANT GROWTH UNDER NEAR-ZERO GRAVITY
Paper: 31st Annual Meeting of the Aerospace Medical Association, Americana Hotel, Bal Harbour, Miami Beach, Fla., May 9-11, 1960

ABSTRACT: Closed ecological systems of space vehicles or stations will probably make use of algae or broadleaf plants for food and oxygen production. Apparently, plants in general do not have a special requirement for a gravitational field. The algae are largely oriented by the light source. The broadleaf plant above ground is oriented by light in the blue end of the spectrum. Root systems seem to respond more to oxygen tension and moisture levels in the soil than to gravitational fields. Several cabinets have been designed to study the plant requirements for gravity. Germinating seeds and plants are illuminated with blue, red and white light from below. Results of these experiments are presented. The problem of moisture supply appears to be a major one. A cabinet has been designed to study this problem. Preliminary studies have shown that pressurized aerosol feeding of the root system overcame the problem of supplying moisture to the root system. However, return of the aerosol spray to the system has not been solved.

373

Jones, D.C., J.H. Shaw, et al 1961 PRELIMINARY INVESTIGATION OF INTERPLANETARY LUNAR AND NEAR PLANET ENVIRONMENTS AND METHODS OF SIMULATION
(Aeronautical Systems Division, Wright-Patterson AFB, Ohio) ASD TR 61-267 July 1961 ASTIA AD 268 791

ABSTRACT: Summaries of the natural environments of Mars, Venus, the Moon and interplanetary space are presented. The primary induced environmental stresses associated with thermal radiation, cosmic atomic and subatomic radiation, meteoroid particles, vibration, shock, acceleration, and low pressure are described for operation near the above bodies including range of anticipated values and methods of simulation. Additional simulation techniques associated with temperature, heat flux and atmospheric composition are discussed. An environmental test philosophy and a summary of heat transfer characteristics of high speed vehicles are included. Important areas not covered in this report are combined, induced environments associated with atmospheric entry and biological effects and nuclear reaction radiations. (Author)

374

Jones, E. W. 1962 WHAT DOES "WEIGHTLESSNESS" REALLY MEAN
Space Aeronautics 38(5):65-67, Oct. 1962

ABSTRACT: A discussion is presented of the dynamic aspects of suborbital, orbital and escape flight in relation to weightlessness and gravity, with detailed calculations and formulas. When a body is exposed to the gravitational acceleration towards the Earth's center, and the rate of change of the velocity of fall is equal to g, the body is in free fall and in a state of null gravity. In a suborbital flight during re-entry, the body of a 161 pound astronaut may reach a weight of 1760.9 pounds. If the rate of change of velocity exceeds acceleration due to gravity the astronaut may take on negative weight. In an orbital on a

true spherical path there is a weightless state because there is no net stress or strain on the body in respect to the Earth's center or a point along the orbit path. Zero gravity can not occur in these circumstances, but can only be found at a point where the gravitational field of one body cancels that of another such as between the Moon and Earth. Problems of orientation of the astronaut in relation to gravitational forces are discussed. (Aerospace Medicine 34(3):276, March 1963)

375

Jongbloed, J. 1963 MEDICAL PROBLEMS RELATED TO SPACE TRAVEL. V. WEIGHTLESSNESS.
Nederl T. Geneesk 107:1086-1087, 15 June 1963 (Dut)

WEIGHTLESSNESS

K

376

Kalitinsky, A. 1963 NOVA LAUNCH VEHICLE DESIGN STUDIES
(Paper, American Astronautical Society Symposium on the Exploration of Mars, Denver, Colorado, June 6-7, 1963) Preprint No. 5.

ABSTRACT: The NOVA design studies currently being conducted under the direction of the Marshall Space Flight Center are aimed at defining the most desirable launch vehicle for the heavy space missions of the 1970's. To help make these missions technically and economically feasible, NOVA must achieve a big step forward in payload capability and cost effectiveness. The task of assembling, in Earth orbit, manned Mars expeditions weighing several thousand tons favors launch vehicles in the million pound payload class. Significant cost reductions can be achieved by recovery and re-use of high cost components or complete stages. Representative NOVA configurations developed by General Dynamics/ Astronautics and Martin/Baltimore, the NOVA Study contractors, are described in this paper.

377

Kama, W. N. 1961 SPEED AND ACCURACY OF POSITIONING WEIGHTLESS OBJECTS AS A FUNCTION OF MASS, DISTANCE, AND DIRECTION. (Wright Air Development Division, Wright-Patterson AFB, Ohio) WADD TR 61-182; ASTIA AD-260 131; March 1961

ABSTRACT: Human performance in positioning weightless objects was investigated experimentally using an air-bearing frictionless table. The subjects moved each four masses (1000, 3000, 5000, and 7000 gram) various distances (10,20, and 40 cm) in each of two directions over this frictionless table in response to paired light stimuli. The responses were accomplished in complete darkness after the lights were extinguished. Results were analyzed in terms of constant and absolute errors of positioning, and response time. From the investigation, we concluded that:
(1) Mass has little effect on the accuracy of positioning. There is some evidence, however, that response time increases with increase in mass.
(2) Distance is a significant variable affecting the direction of error, accuracy, and speed of positioning responses. Response time increases, and accuracy decreases with distance.
(3) Direction of movement is a significant variable affecting constant error, absolute error, and speed of positioning responses. Subjects tend to undershoot the mark in near to far movements. (AUTHOR)

378

Kama, W.N. 1961 EFFECTS OF SIMULATED WEIGHTLESSNESS UPON POSITIONING RESPONSES (Aerospace Medical Labs., Wright-Patterson AFB, Ohio) Proj. no. 7184, Task no. 718406. ASD Techn. Rept. no. 61-555, Dec. 1961. ASTIA AD 277 288.

ABSTRACT: The speed and accuracy of positioning movements as functions of distance, direction, and mass were investigated under simulated weightless conditions. Subjects seated on a frictionless device made blind positioning movements by sliding each of two frictionless masses (1000 to 7000 grams) various distances (10, 20, and 40 cm.) either left to right or near to far. Both speed and accuracy decrease with distance; left to right movements decreases with increased mass. With minor exceptions, the effects are similar to those noted when fixed subjects position weightless objects. The responses of fixed subjects were slower, but more accurate, and were not affected by the variable of mass.

379

Kas'ian, I. I. 1962 SOME PHYSIOLOGICAL REACTIONS IN MAN UNDER CONDITIONS OF THE ALTERNATING EFFECT OF OVERLOADING AND WEIGHTLESSNESS.
Izv. Akad Nauk SSSR (Biol.) 6:896-908, Nov.-Dec. 1962 (Russian).

380

Kasten, D. F. 1962 ANALYSES OF HUMAN MOTIONS IN ORBITAL SPACE.
(Paper, 33rd Annual Meeting of the Aerospace Medical Assoc., Chalfonte-Haddon Hall, Atlantic City, N. J., April 9-12, 1962)

ABSTRACT: A qualitative review is made of some seldom considered human factors problems which may confront a weightless worker in a space environment. Discussion is based on inflight zero gravity research, mathematical analyses of human motion in earth orbits, and computer simulation studies of orbital rendezvous. Topics covered include: human locomotion and rotation in a weightless, frictionless environment; human factors and engineering considerations for the design of rotating space stations; problems involved in tethering a space worker to his vehicle; and some misconceptions about the weightless state. Some implications are suggested for future space efforts.

381

Katzberg, A.A. & L.H. Mori 1962 ORGAN AND TISSUE CULTURES. I. EMBRYONIC CHICK HEART AND HUMAN CELL CULTURES.
In Prince, J.E., ed., Biologic Systems of Discoverer Satellites XXIX and XXX. (School of Aerospace Medicine, Brooks AFB, Texas)

ABSTRACT: Living embryonic chick hearts were placed aboard Discoverer satellite to observe the effect that exposure to stress factors of a flight in space

could have on a whole organ. Human cell cultures were also studied during the flight of the Discoverer satellites. It was concluded that the viability and the physiologic function of these hearts were not impaired by any of the stress factors that were encountered in space flight. Human cell cultures for both Discoverer satellites XXXIX and XXX showed no obvious degeneration. On being subcultered, those from Discoverer XXX showed normal proliferation. (STAR)

382

Kester, S.G. 1959 SR-183 LUNAR OBSERVATORY. HUMAN FACTORS LUNAR STUDIES. II. INITIAL PARAMETRIC ANALYSIS. (Boeing Airplane Co., Seattle, Wash.) Rept. no. D7-2444, Astia AD-232 322L, 30 Sept. 1959

ABSTRACT: Presents working charts for an initial study of human factors engineering problems associated with space exploration. Qualitative relationships are developed for parameters considered necessary for study in support of a manned extraterrestrial station. The moon serves as an example. Although the parameters emphasize human factors, the charts are intended for general utilization and will be useful for equipment and facilities design for manned extraterrestrial systems.

383

King, A. L. 1962 WEIGHT AND WEIGHTLESSNESS
Amer. Jour. Phys. 30:387, May 1962.

384

King, B. G. 1960 PHYSIOLOGICAL EFFECTS OF POSTURAL DISORIENTATION BY TILTING DURING WEIGHTLESSNESS. (Paper, 31st Annual Meeting of the Aerospace Medical Association, Americana Hotel, Bal Harbour, Miami Beach, Fla., May 9-11, 1960)

ABSTRACT: Decerebrate pigeons are useful experimental preparations for studying both static and dynamic postural reflexes. The principal advantage of the decerebrate is that it is less readily distracted than the normal pigeon and gives clean-cut reflex responses appropriate to the stimulus. When postural orientation in relation to the gravitational field is disturbed by tilting, the pigeon reacts by a compensatory movement and position so that the head is normally oriented in relation to gravity, regardless of the position of the body. If the head is fixed, compensatory eye movements and positions result. The semicircular canals do not participate in eliciting postural compensatory poses. This presentation reports results of experimental observations on the effects of postural disorientation during short periods of weightlessness. Advantage was taken of the suitability of the tonic postural reflexes in decerebrate pigeons for study of the functioning of the utricular otolith during weightless flights. Observations were made on normal pigeons and on four decerebrates approximately three weeks following operation. Responses to tilting were noted and were recorded photographically during the control and weightless phases of the flights. These responses are compared and interpreted, and illustrative sequences of the motion picture records presented.

385

King, B.G., C.T. Patch, & P.G. Shinkman 1961 WEIGHTLESSNESS. TRAINING REQUIREMENTS AND SOLUTIONS. (U.S. Naval Training Devices Center, Port Wash, N.Y.) Contract N61339-560, NAVTRADEVCEN 560-1, March 1961. ASTIA AD 259 512.

ABSTRACT: Physical principles and biological mechanisms relevant to human performance under conditions of weightlessness have been explained in order that the trainee can develop an appreciation of how the unaccustomed environment will affect his behavior. Special emphasis has been given to (a) changes of man's center of mass as various parts of the body are moved with respect to each other, and the significance of CM of body movement, (b) the mechanisms of postural reflexes, including experimental observations of response of pigeons to postural disorientation by tilting during weightlessness, and (c) anticipated changes in the sensory input spectrum and implications of such changes. Models have been proposed as visual aids in providing for cognitive learning aspects of training. The different effects of weightlessness on motor-perceptual and perceptual factors have been identified and solutions proposed for separately training each of these effects. (Author).

.386

King, B. G. 1961 PHYSIOLOGICAL EFFECTS OF POSTURAL DISORIENTATION BY TILTING DURING WEIGHTLESSNESS
Aerospace Medicine 32(2):137-140, Feb. 1961.

ABSTRACT: In a study of the labyrinthine function, observations on compensatory poses were made on pigeons (both normal and decerebrate) in a C-131 airplane during normal and weightless flights. Both motion and still picture records were made of responses to tilting, following rotation around the various body axes, and were compared with responses made under normal gravity conditions. The results were discussed in terms of the contribution of the utricular otolith in maintaining static posture of the body during conditions of weightlessness. (Tufts)

387

King, B.G. & M.C. Mans 1962 THE FEASIBILITY OF ESTIMATING THE ENERGY EXPENDITURE OF ASTRONAUTS THROUGH PARTIAL SIMULATION OF WEIGHTLESSNESS (Operations Research, Inc.) NASA contract NASr-170, Tech. Rept. 170, 28 Feb. 1962.

388

Kislik, M.D. 1960 THE MOTION OF AN ARTIFICIAL SATELLITE IN THE NORMAL GRAVITATIONAL FIELD OF THE EARTH.
In Kurnosova, L.V., ed., Artificial Earth Satellites
(New York: Plenum Press) IV, 183-201

ABSTRACT: This paper considers the problem of motion of an artificial satellite

in the earth's normal gravitational field without taking into account the effect of air resistance or anomalies in the force of gravity. The results can be utilized in calculating the orbits of high-altitude satellites and for qualitative analysis of the effect of the earth's oblateness on satellite motion. (CARI)

389

Kitzes, G. 1959 OCCUPATIONAL HEALTH PROBLEMS IN SPACE FLIGHT: IMPORTANT HEALTH PROBLEMS IN THE MAN-IN-SPACE STUDIES AT THE AERO MEDICAL LABORATORY Military Medicine 124(10): 717-719, Oct. 1959

ABSTRACT: Problems related to man's survival in space are briefly reviewed and categorized. The primary objectives of space-medical research are to provide an environment, workspace, and sustenance for the space traveller that will allow him to carry out his mission with maximum efficiency and protect him from irreversible injurious body changes. Basic requirements -- physiologic (metabolic environmental), psychologic (isolation, weightlessness, workspace, reduced sensory environment), and requirements pertaining to protection (from radiation, toxic chemicals and odors, noise and vibration, acceleration, natural infection, disorientation) are outlined.

390

Knight, L. A. 1958 AN APPROACH TO THE PHYSIOLOGIC SIMULATION OF THE NULL-GRAVITY STATE. J. Avia. Med. 29(4):283-286, Apr. 1958

ABSTRACT: While studying the physiological effects of prolonged weightlessness the similarities between the condition of a body floating in space and that of a body floating in water were noted, and the conclusion was drawn that weightlessness is the absence of external forces acting on the body. It was assumed that a physiologic condition approaching that observed in the null-gravity state could be simulated by obscuring vision, immersing the subject in water to eliminate tactile and proprioceptive cues, and positioning him in the supine, head-down orientation. A preliminary experiment (three subjects acquaint ed with conditions of null-gravity) was conducted to investigate the matter of spatial orientation during immersion in water, and to establish values for the threshold of sensitivity of the otolith organ to change in position.

391

Koelle, H.H. ed. 1951 HANDBOOK OF ASTRONAUTICAL ENGINEERING (New York: McGraw-Hill Book Company, Inc.)

392

Konecci, E. B. 1958 HUMAN FACTORS IN SPACE FLIGHT.
Aero/Space Engng. 17(6):34-48, June 1958

ABSTRACT: This paper lists possible human factor problem areas in space flight under three headings: physiological, human engineering, and psychological-social. Space cabin requirements for the human operator are also listed with discussion of the following: cabin environment, decompression, cosmic radiation and weightlessness.

393

Konecci, E. B. 1959 MANNED SPACE CABIN SYSTEMS, ADVANCES IN SPACE SCIENCE, VOL. I (New York: Academic Press, 1959)

ABSTRACT: Discusses the fundamental requirements for manned space flight, including the human factors involved. Reviews the possible physiological, psychological and human engineering problems to be encountered in space flight Under psychological factors emphasizes crew selection, confinement, isolation, and performance. Outlines the examinations and psychological tests given to selected Project Mercury astronauts.

394

Koshtoyants, Kh. 1960 TESTING SPACE SHIP CABIN
Pravda, May 19, 1960, p. 4, cols. 1-5

ABSTRACT: The pressurized cabin is the most important feature of the space ship satellite. Successful results have already been obtained in the regeneration of atmosphere. Biologists are solving the metabolic problem by transforming the pressurized cabin into a closed system with constant temperature, moisture, and atmospheric regeneration. Acceleration and weightlessness affect the nervous system, particularly its perceptive or receptory functions, which can cause the coordination of an organism's physiological functions to break down. (CARI)

395

Kositskiy, G. I. 1959 MAN IN COSMIC FLIGHT
Zdorov'ye (Moscow) 10:4-6, Oct. 1959

ABSTRACT: The first section, entitled "How the Weight of the Body Changes," deals with the physiological effects of weightlessness and high G forces, and means of counteracting them with centrifugal force and special anti-G suits. Sechenov's theory that brain activity is impossible without a continuous flow of nerve impulses from the sensory organs is reviewed; the author states that centrifugal force would provide the necessary vigorous stimulation of the

sensory organs. According to recently obtained data on respiration and heart function in experimental animals, the absence of gravity alone does not seem to affect these functions in any special way; however, it is not yet clear how the activity of the higher branches of the brain would be affected under similar conditions. The second section, entitled "Insidious Dangers", discusses the oxygen-carbon dioxide balance necessary for the smooth functioning of the human organism. The third section, "In the Zone of Cosmic Radiation" discusses the possible effects of cosmic rays on the human organism. (CARI)

396

Kositskii, G.I. 1960 CHELOVEK V KOSMICHESKOM POLETE (MAN IN SPACE FLIGHT) Zdorov'e (USSR) 10:4-6, 1959 (Air Technical Intelligence Ctr., Wright-Patterson AFB, Ohio) Rept. No. ATIC-1419621, 17 June 1960.

ABSTRACT: The article deals with accelerative stress and other ecological problems of Space flight.

397

Kositsky, G. 1961 NOTES ON THE PHYSIOLOGY OF FLIGHT Moscow News, May 20, 1961

ABSTRACT: The author discusses severla problems of man during space flight. First among them is excess strain on the organism starting with acceleration. The most effective protection is a special anti-excess-strain suit and an adoption of the correct position. Weightlessness is a problem in space flight. However, Gagarin's flight proved that man adapts quickly to weightlessness and does not experience any particular inconveniences. An important problem is the maintenance of necessary living conditions in the cabin of a spaceship. Short flights have simply used a chemical process but longer flights will use biological methods such as a closed-cycle system. The problem of protection from radiation - hard x-rays and above all cosmic rays - is also difficult. (CARI)

398

Kousnetzov, A. G. 1958 SOME RESULTS OF BIOLOGICAL EXPERIMENTS IN ROCKETS AND SPUTNIK II. J. Aviation Med., 29(11):781-784.

ABSTRACT: This is a review of Russian biological experimentation in space flight as presented by A. G. Kousnetzov, Chief of the Physiology Department of the Soviet Air Force Scientific Research Experimental Institute of Aviation in Moscow, in a paper delivered at the Third European Congress of Aviation Medicine, Louvain, Belgium, in September 1958. Since 1949, Soviets have been investigating the effects of space flight on animals

The first and second phases of the study involved catapult launching and parachute descent. The third phase culminated in animal-rocket launchings to a height of 473 km. No major physiologic changes resulting from the experiments were observed in the animals. The launching of Sputnik II carrying the dog, Laika, was a biological experiment to observe all of the conditions of space flight. Data concerning the condition and behavior of the animal were successfully transmitted and received. No physiologic manifestations of the effects of cosmic radiation on the animal were discovered.

399

Krivetsky, A., W. H. Bauer and others 1962 RESEARCH ON ZERO-GRAVITY EXPULSION TECHNIQUES. (Bell Aerosystems Co.) Rept. no. 7129-933003; ASTIA AD 274 044.

ABSTRACT: Synthesis of Expulsion Devices: Morphological approach and expulsion device methods. Expulsion Device Configuration: Diaphragm-type configuration, Bladder-type configuration, Mechanical systems, Surface forces, Orientation systems, Controlled deformation or folding configuration, Hybrid or miscellaneous systems, Electric and magnetic expulsion devices, and chemical. Space Environment: Temperature, High vacuum, Radiation, Extraterrestrial Environments, Accelerations, and Sonic fatigue. Material Considerations: Material-propellant compatibility, Permeability, Radiation, Elongation and ductility, Temperature, Yield strength, Ultimate Metal-to-metal compatibility, and Vacuum effects. Slosh and Vibration Characteristics: Bladder considerations, Cavitation and fuel spray, Elastic tank breathing mode, and Acoustic modes.

400

Kuehnel, H.A., W.O. Armstrong, J.J. Van Bockel & H.I. Johnson 1962 PILOT PERFORMANCE. In Results of the Second United States Manned Orbital Space Flight, May 24, 1962 (National Aeronautics and Space Administration, Washington, D.C.) pp. 63-68, NASA N 62 14691

ABSTRACT: The results of the MA-7 orbital flight of astronaut M. Scott Carpenter indicate that man can function effectively in a space environment for periods up to 4½ hours. The pilot demonstrated his ability to operate scientific apparatus successfully in a space environment and to obtain useful data for the analysis of scientific problems associated with a terrestrial space environment. The results of the flight provide additional evidence that man is ready for a more extended mission in a weightless environment. Flight difficulties occurring during the mission served to emphasize that the primary attention of the pilot be devoted to management of spacecraft systems and detailed attention to operational functions.

401

Kulwicki, P.V., E.J. Schlei and P.L. Vergamini 1962 WEIGHTLESS MAN: SELF - ROTATION TECHNIQUES. (Behavioral Sciences Lab., Aerospace Medical Div., Wright-Patterson AFB, Ohio) AMRL TDR 62-129, ASTIA AD-400 354

ABSTRACT: To be an effective weightless work, an individual must be able to achieve and maintain a stable attitude with respect to his vehicle. If the work is to have this capability, he must be able to control both translation and rotation. Translation may not be controlled without hardware, whereas rotation may. The purpose of this study was to investigate the possibility of body rotation by limb manipulation. This self-rotation is analyzed by the application of theoretical mechanics to a rigid mathematical model composed of six cylindrical segments. A quantitative of six cylindrical segments. A Quantitative evaluation, based on the mathematical model, is made for one maneuver to determine the expected degree of rotation. As a result of this analysis, a series of selected maneuvers are proposed to give man the capability for rotation about three mutually perpendicular axes. The nine maneuvers are intended to provide an effective rotation, while reducing undesirable coupled rotations. In addition, the stability of rotation of various geometrical shapes is investigated to determine if man can expect a self rotation maneuver to be stable. (Author)

402

Kulwicki, P. V. and Peoples, G. 1962 CONTROL ROTATION AND STABILIZATION FOR THE ORBITAL WORKER (Behavioral Sciences Lab., Aerospace Medical Div., Wright-Patterson, AFB, Ohio) AMRL Memorandum Report P-21, December 1962.

403

Kuznetzov, A.G. 1958 SOME RESULTS OF BIOLOGICAL EXPERIMENTS IN ROCKET AND SPUTNIK II. J. Aviation Med. 29:781-784

ABSTRACT: Scientific research work investigating the effect of space flight upon living organisms has been carried on in the Soviet Union since 1949. Penetration of the upper air layers by animals is achieved with the help of rockets. The first thing was to place the animals in specially equipped and hermetically-sealed cabins which were supplied with an air-conditioning system allowing to keep up the gas composition of the air, the temperature, and humidity at the required level so as to make the normal vital activity of the organism possible. The next task was to find out the possibility of separation from the rocket, with the help of a catapult, with a subsequent descent of the animals by parachute. The third stage of the experiments was started in 1958. The launching of animals into space with the help of rockets was effected at the height of 473 (294 miles). Changes noticed in the physiological functions of the animal were brought about by the sudden effect upon the latter of external irritants: acceleration, noise and vibration which appeared at the start and continued when the rocket was placed in orbit. The return to normal of the blood circulation and breathing during the zero-gravity state, when the Sputnik is in orbit, seems to prove that this factor caused no considerable changes nor any stable changes in the physiological functions of the animal.

WEIGHTLESSNESS

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404

Lamb, L.E. 1960 INFLUENCE OF AEROSPACE FLIGHT ON THE NORMAL CARDIO-VASCULAR SYSTEM: STRESSES AND EFFECTS.
Am. J. Cardiol. 6(1):8-18, July 1960.

ABSTRACT: A discussion of the adjustments and alterations of cardiovascular functions in response to certain flight stresses. Those flight stresses discussed include hypoxia, acute anoxia, acceleration, positive pressure breathing, relative immobility, decreased barometric pressure, and weightlessness.

405

Langenecker, B. 1954 ZUR FRAGE DER ORIENTIERUNG IM SCHWEREFREIEN ZUSTAND (THE PROBLEM OF ORIENTATION IN THE GRAVITY-FREE STATE) In International Astronautical Federation, Space Flight Problems: Being a Complete Collection of All Lectures Held at the 4th Astronautical Congress, Zurich 1953 (Biel, Switzerland: Switzerland, Laubscher & Cie, 1954)

406

Lansberg, M.P. 1958 THE FUNCTION OF THE VESTIBULAR SENSE ORGAN AND THE CONSTRUCTION OF A SATELLITE
(Paper, 9th International Astronautical Congress, August 25-30, 1958, Amsterdam, Holland)

ABSTRACT: The paper discusses the problem of weightlessness during space flight. More specifically, the problem is putting an object with weight into a weightless satellite. By making the satellite rotate around its own axis, an acceleration will result acting in a radial direction.

407

Lansberg, M. P. 1958 SOME CONSEQUENCES OF WEIGHTLESSNESS AND ARTIFICIAL WEIGHT. (Symposium on Space Medicine, British Interplanetary Society, London, 16-17 October 1958)
J. British Interplanetary Society 17(9):285-288, May-June 1960

ABSTRACT: Physiological consequences of weightlessness are discussed. Artificial

ventilation will be necessary, because of the absence of convection. In the absence of gravitational clues to position, some disorientation may occur and motor activities may have to be relearned, but muscular atrophy is not likely to be a real hazard. It would be unwise to extrapolate from what is experienced during parabolic flights to what can be expected during semipermanent weightlessness.

408

Lansberg, M.P. 1959 COCKPIT OF FIRST SPACESHIP MAY BE LIKE A PADDED CELL (Symposium, Brit. Interplanetary Soc., London 1958) Reprint Space Jan-Mar. 1959, p. 25-27

ABSTRACT: Discussion of problems arising from continual weightlessness. These include (1) Air circulation can no longer be induced by convection; (2) body perception will lack gravitational clues and (3) all muscular activity intended to move an object will have to be relearned.

409

Lansberg, M.P. 1960 A PRIMER OF SPACE MEDICINE
(Amsterdam: Elsevier Publishing Co., 1960)

ABSTRACT: Specific physical, physiological, and psychological problems of manned space flight are presented. Also included is a description of the dynamic conditions of life in a space cabin and man's acceleration tolerance during passage to and from the space station.

410

Lansberg, M.P. 1962 THE PHYSIOLOGIC ACCELEROMETERS
In Impact Acceleration Stress: Proceedings of a Symposium With a Comprehensive Chronological Bibliography (National Academy of Sciences, National Research Council) Publication No. 977, Pp. 27-34

ABSTRACT; Physiological accelerometers under conditions of weightlessness were investigated. Three inherent contradictions existing are that (a) the head is held in an inclined position relative to the vertical, (b) the head is rotating around a horizontal axis, and (c) the head is moved along a horizontal path. During weightlessness, it will be man's visual framework that will induce his spatial orientation. Against this background, the three contradictions arise. In the situation where the head is held in an inclined position relative to the vertical, the otoliths signal a symmetric status, albeit a symmetry of zero gravity, and for the higher centers a symmetry means perpendicularity, which is denied by the visual reference. Probably the voice of the otoliths will not be very strong in this instance, and the visual clue will dominate. The reason is that the otoliths respond to change in acceleration rather than to acceleration. In the situation where the head is rotating around a horizontal axis, matters become worse.

There is not only a conflict between otolithic information and visual framework but, worse still, the semicircular canals report a change in attitude which should be corroborated by the message from the otoliths which, however, may default. A disagreement now develops between the two parts of the labyrinth. This disagreement would not arise if the head movement had occurred around a vertical axis, vertical in the man's subjective framework of orientation. The situation where the head is moved along a horizontal path will probably be of less importance because such linear movements do not seem likely to occur.

411

Lanton, R. W. 1962 PHYSIOLOGICAL CONSIDERATIONS RELEVANT TO THE PROBLEM OF PROLONGED WEIGHTLESSNESS: A REVIEW. Astronautical Sci. Rev. 4:11-18, January-March 1962.

412

Lawden, D.F. 1957 THE SIMULATION OF GRAVITY
Brit. Interplan. Soc. J. 16:134-140, Jly./Sept. 1957

ABSTRACT: The artificial gravitational field produced by rotating a spaceship or artificial satellite about its axis is compared and contrasted with normal gravity at the Earth's surface.

413

Lawton, R. W., et al 1960 BIO-ENGINEERING PROBLEMS IN EARLY MANNED SPACE FLIGHT. In St. Whitelock, O. V., ed. Annals of the New York Academy of Sciences 84:29-74, Feb. 1960.

ABSTRACT: This article describes problems to be encountered during early manned spaceflight and offers solutions to those problems.

414

Lawton, R. W. 1962 PHYSIOLOGICAL CONSIDERATIONS RELEVANT TO THE PROBLEM OF PROLONGED WEIGHTLESSNESS. (Paper, 13th International Astronautical Congress, Varna, Bulgaria, September 23-29, 1962)
See also Astronaut. Sci. Rev. 4(1):11-18,31-38.

415

Lawton, R.W. 1962 PHYSIOLOGICAL CONSIDERATIONS RELEVANT TO THE PROBLEM OF PROLONGED WEIGHTLESSNESS: A Review. Astronaut. Sci. Rev. 4(1):11-18, 31-38 Jan-Mar 1962

ABSTRACT: The problems of weightlessness and methods of avoiding its ill-effects are the main subjects of this paper. The following subjects are briefly discussed: general metabolic effects, immobilization and bed rest, submersion, cardiovascular effects, bone demineralization, muscle atrophy, otolith functions, semicircular canal phenomena, the slow rotation room, adaptation, selection and training.

416

Lawton, R.W. 1963 THE PATHOPHYSIOLOGY OF DISUSE AND THE PROBLEM OF PROLONGED WEIGHTLESSNESS: A REVIEW
(6570th Aerospace Medical Research Laboratories, Air Force Systems Command, Wright-Patterson AFB, Ohio) Report No. AMRL-TDR 63-3 June 1963

ABSTRACT: The physiological implications of zero-G as encountered in space flight are discussed and the available research concerning the physiological effects of weightlessness is reviewed. The purpose of this review is to proceed from the present state of knowledge of normal human physiological systems, particularly as their structure and function are affected by gravity, to a consideration of the possible physiological consequences of prolonged human exposure to zero-G. Methods used to produce and to simulate zero-G are briefly reviewed. The data suggesting that prolonged weightlessness will be a deconditioning environment is presented. This data is considered for possible untoward effects of prolonged exposure to weightlessness, and for methods of prevention of undesired effects. The problem of artificial gravity by rotation of a space vehicle is briefly considered.

417

Leavitt, W. 1959 THE WEIRD WORLD OF WEIGHTLESSNESS
Air Force 42:109-110, April 1959

418

Leiderman, P. H. & R. Stern 1961 SELECTED BIBLIOGRAPHY OF SENSORY DEPRIVATION AND RELATED SUBJECTS
(USAF Biomedical Lab., Wright-Patterson AFB, Ohio)
Contract AF 33(616), 6110, Proj. 7220, ASD TR 61 259, July 1961.

ABSTRACT: This bibliography compiles and classifies the available articles and books relevant to the field of sensory deprivation. Included are

review articles; theoretical publications; anecdotal reports; experiemental, clinical, developmental, and social accounts; sleep deprivation; vigilance; level of activation and arousal; animal and physiological studies. American and British publications are reasonably well covered. No references specific to sensory deprivation are found in the literature of other countries. (Tufts)

419

Lelievre, J. 1958 LE VOL A PESANTEUR APPARENTE NULLE (A FLIGHT WITH APPARENT ZERO GRAVITY)
Information Air, March 20, 1958, pp. 7-10

420

Lepper, R. 1960 ZERO G FACILITY.
(Norair Div., Northrop Corp.) Rept. ASRL-TM-60-18Z-3

421

Lerine, R.B. 1960 NULL-GRAVITY SIMULATION
(Paper 1960 Meeting of the Aerospace Medical Assoc., March 9-11, 1960, Miami Beach, Fla.)

ABSTRACT: ' In a true state of free-fall, cancellation of gravitational and inertial fields results in no tendency for a body to accelerate with respect to its surroundings and in no tendency for the components of the body to accelerate with respect to each other. Although it is not possible to attain such a state in a laboratory at rest with respect to the earth, it is possible to duplicate the effects of weightlessness to varying degrees, and for extended time spans, on a large number of the body functions and sense orgnas. Success of such simulation depends especially on nullification of visual, mechanoreceptor, and vestibular cues to the gravitational vertical, and also on substantial reduction of any work required of the organism by virtue of its being in an uncompensated gravitational field. An artificial environment for simulation of the null-gravity state, based on the concept of Muller (Science 128: 772, 1958), will be discussed; and a comparison of the physiological and psychological effects of such a simulator with corresponding effects to be expected in true null-gravity will be made for several of the important body senses and functions.

422

Levering, B. 1956 THE CASE OF THE CURIOUS CAT: "LUCKY" FLOATS IN WEIGHTLESS REPOSE AT RANDOLPH'S SCHOOL OF AVIATION MEDICINE.
Skyline 14(4):10-13. Dec. 1956.

Experiments on weightlessness are becoming increasingly important to aviation as man approaches space flight. Detailed discussions are made of S. J.

Gerathewohl's investigations with the cat (Lucky) which are a part of a three-fold research project on weightlessness which he is conducting at the USAF School of Aviation Medicine. Other portions of the program include studies of human tolerance to weightlessness(wherein volunteer subjects experience weightlessness during parabola flights) and visual illusions during zero gravity (wherein subjects are requested to place a pencil dot on targets.) Mention is made of several other investigations monitored by Dr. Gerathewohl particularly the "sealed cabin simulator" studies (under the immediate direction of H. Strughold) wherein living conditions during space flights are reproduced as closely as possible

423

Levine, R.B. 1960 NULL-GRAVITY SIMULATION.
(Paper, 1960 Meeting of Aerospace Medical Association, Miami Beach, May 9-11)

ABSTRACT: In a true state of free-fall, cancellation of gravitational and inertial fields results in no tendency for a body to accelerate with respect to its surroundings and in no tendency for the components of the body to accelerate with respect to each other. Although it is not possible to attain such a state in a laboratory at rest with respect to the earth, it is possible to duplicate the effects of weightlessness to varying degrees, and for extended time spans, on a large number of the body functions and sense organs. Success of such simulation depends especially on nullification of visual, mechanoreceptor, and vestibular cues to the gravitational vertical, and also on substantial reduction of any work required of the organism by virtue of its being in an uncompensated gravitational field. An artificial environment for the simulation of the null-gravity state, based on the concept of Muller (Science 128:772, 1958), will be discussed; and a comparison of the physiological and psychological effects of such a simulator with corresponding effects to be expected in true null gravity will be made for several of the important body senses and functions. (Aerospace Med. 31(4):312, April 1960)

424

Levine, R.B. 1961 NEW APPROACH TO ZERO GRAVITY TESTS.
Aircraft & Missiles 4:26-29, June 1961.

ABSTRACT: In order to simulate the environment, Lockheed's Null-Gravity Simulator utilizes the process of immersing a man in water. Water immersion gives the following desired effects: (1) the subject loses the ability to detect gravitational support, (2) muscular effort for maintaining posture is reduced, (3) previously stretched, soft tissues no longer perceive the direction and magnitude of the gravitational field, (4) the force of friction between the vessel walls and the subject decreases to zero, and (5) hydrostatic pressures in the circulatory system are nearly equaled by the water pressure. Also included is a physical description of the simulator.

425

Lewis, C. 1958 U. S. AIR FORCE SCHOOL SIMULATES LIVING IN SPACE
Aviation Week 68(4):49, 51, 53, 55, 57, 59, 61, Ja. 27, 1958

ABSTRACT: Space research projects conducted by SAM in the following areas: space cabin simulation, psychological testing, weightlessness, and photosynthesis

426

Ley, Willy 1928 DIE MÖGLICHKEIT DER WELTRAUMFAHRT: ALGEMINVERSTANDLICHE BEITRAGE ZUM RAUMSCHIFFAHRTS-PROBLEM (The Possibility of Space Flight: General Agreement of Contributions to the Space Travel Problem) (Leipzig: Hachmeister und Tahl, 1928)

427

Lindberg, R. G. & D. F. Mitchell 1962 BIOLOGICAL AND PHYSIOLOGICAL STUDIES OF PEROGNATHUS (POCKET MICE) (Northrop Space Labs., Hawthorne, Calif.) NASA Contract NASr-91; NSL-62-125, NASA N62-15597.

ABSTRACT: The pocket mice (genus Perognathus), native to arid regions in Western U. S. and Mexico, are adaptable to experimentation in space capsules because they have no requirement for intake of drinking water, weigh only 6 to 10 grams as adults, and can readily be induced to hibernate. These hibernating mice can be used in inexpensive, lightweight space experiments to determine the biologic effects of cosmic radiation and prolonged weightless ness. Since cytogenetic effects are one of the principla indices of radiation damage, the Karyotypes of all available species of pocket mice are described. This information will also be useful in the difficult taxonomy of the genus and in potential studies of persistent chromosomal damage in natural populations in the Nevada test stie. The total chromosome sets of Perognathus formosus mohavensis Huey and P. Longimembris panamintinus Merrian are described. Comparisons of the 16 pairs of chromosomes of P. formosus with the 24 pairs of chromosomes of P. Longimembris show striking differences; all of the metacentrics of P. formosus are longer than those of P. longimembris, and the latter species has a large series of small median to submedian metacentrics which are completely absent in P. formosus. For radiation damage analysis purposes, the karyotype of P. formosus may prove quite useful; however, this species is one of the largest of the genus, weighing about 25 grams. One other small species (P. flavus), which may also prove useful and which weighs less than P. formosus, remains to be investigated.

428

Lippisch, A.M. 1963 VEHICLE DESIGNS FOR EXPLORATION OF MARS
Paper: American Astronautical Society Sympoisum on the Exploration of Mars, Denver, Colorado, June 6-7, 1963 Preprint (24)

ABSTRACT: As a result of experiments and studying, the author has drawn the

following conclusions: (a) The atmospheric conditions on Mars will make it possible to use a flying vehicle for exploration of the planet. (b) Flight near the surface of the planet is similar to flight in the Earth atmosphere at altitudes of 18 km or 60000 ft. (c) Power requirement in flight is reduced to 70 percent of the power required to fly the same vehicle on Earth at ground level (d) For flight of longer duration a power plant with a mass ratio of 50 lb/kw would be required under optimum conditions. (e) The development of ultra light weight structures for a high performance aircraft layout should be considered.

429

Lister, W., Jr. 1962 SOVIET PLAN: ARTIFICIAL GRAVITY FOR SPACE SHIPS Herald Tribune (New York), Thursday, April 5, 1962.

ABSTRACT: Soviet scientists will create artificial gravity in future spaceships if a new training program ordered for cosmonauts does not eliminate nausea during prolonged weightlessness. The program, consisting of increased concentration on spinning and springing, is intended to increase the stability of a cosmonaut's inner ear so as to withstand the nausea experienced by Maj. Gherman Titov during his 17-orbit flight last August. If future orbital flights show that space nausea occurs regularly and ground whirling cannot condition a man to withstand it, some artificial gravity--about one-fourth to one-tenth of the force of gravity on earth--will be provided in Soviet spaceships. (CARI)

430

Livshits, G. SH. 1956 O VOZMOSHNOSTI MEZHPLANETNYKH POLETOV. (On the Feasibility of Interplanetary Flight) (Alma-Ata: Kazakhskoe gosudarstvennoe izdatel'stvo, 1956)

ABSTRACT: Space travel and problems connected with its realization are depicted in popular language to acquaint the layman with the tremendous difficulties of achieving space flight. A chapter entitled "Preparation for the Realization of Interplanetary Flight" reviews historical progress of astronautics from the first rocket flights to modern animal rocket experiments and sputniks. It also summarized the findings related to overcoming effects of acceleration and deceleration forces, weightlessness, creation of cabin atmosphere, solar and cosmic radiation, etc.

431

Loftus, J.P. 1960 MOTION SICKNESS DURING A WEIGHTLESS STATE (Paper, Symposium on Motion Sickness in Weightlessness Research, March 1960 Wright-Patterson AFB, Ohio)

432

Loftus, J. P., & L. R. Hammer 1961 WEIGHTLESSNESS AND PERFORMANCE. A REVIEW OF THE LITERATURE. (Behavioral Sciences Lab., Aerospace Medical Div., Wright-Patterson AFB, Ohio) Proj. 7184; ASD TR 61-166; ASTIA AD-267 041; June 1961

ABSTRACT: The implications of weightlessness as encountered in space flight are discussed, and the known research dealing with the psychological and physiological effects of zero gravity is critically reviewed. Topics are grouped under the headings of orientation, psychomotor performance, and physiological functions, with a special section on methods of research. The major problem area indicated is the effect of weightlessness on gravity oriented sensory mechanisms, particularly the vestibular apparatus, and consequently on both physiological functions and psychomotor performance. An extensive bibliography is included. (AUTHOR)

433

LoMonaco, T. 1948 L'ORGANISMO UMANO RESISTERA ALLE VARIAZIONI AMBIENTALI DI UN VIAGGIO INTERPLANETARIO? (Will the Human Organism Be Able to Withstand the Environmental Changes of an Interplanetary Journey?) Riv. med. aeronaut. 11:84-87

434

LoMonaco, T. 1952 ALCUNI PROBABILI FENOMENI FISIO-PATOLOGICI DELL 'UOMO DURANTE I FUTURI VOLI SIDERALI (Some Probable Physiopathological Phenomena In Man During Future Interplanetary Flights) Riv. med. aeronaut. (Roma), 15(1):3-12

ABSTRACT: Physiopathological aspects of interplanetary flight are discussed, falling in three main categories: (1) changes in speed or direction of a moving body exert forces on the organism which are tolerated best if they are of short duration; (2) reduction of the apparent weight beyond the zone of gravitation would affect the labyrinthic rather than the cardiovascular system and would interfere with muscular coordination; and (3) problems of the environment include maintenance of air supply, temperature, and food, and avoidance of cosmic radiation. Space medicine cannot, at present, give any assurance as to the survival of humans in a space ship.

435

Lo Monaco (Croce), T. 1952 PRIMI STUDI SUGLI EFFECTTI FISIOPATOLOGICI CAUSATI DALLA SUB-GRAVITA IN ANIMALI LANCIATI, DENTRO MISSILI, NELL'ALTO ATMOSFERA (First Studies on the Physiopathological Effects Caused by the "Sub-Gravitation" in Animals Propelled in Rockets into the Upper Atmosphere) Rivista di Medicina Aeronautica (Rome) 16(2): 192-199

436

LoMonaco, T., M. Strollo, & L. Fabris 1956 COMPORTAMENTO DELLA COORDINAZIONE MOTORIA IN SOGGETTI SOTTOPOSTI A VALORI DI ACCELERAZIONE VARIANTI DA 3 A 0 G. (Behavior of Motor Coordination in Subjects Exposed to Acceleration Values Varying From 3 to 0 G) Proc. International Astronautical Congress, VIIth, (Rome), Pp. 825-839, Sept. 12-22, 1956.

ABSTRACT: Thirty subjects with normal labyrinthine function were exposed, by means of a subgravity tower, to accelerations varying from 3 to 0 G for a total of 8 seconds, of which 4 were spent in subgravity. Under these conditions, studies were made of eye-hand coordination and body equilibrium. During the experiment the subjects showed motor incoordination. Under subgravity conditions there was evidenced an increase of muscle tonus, a sense of levitation, bewilderment and distraction, and various unpleasant sansations. Twenty of the thirty subjects exposed to various consecutive tests demonstrated improvement in the coordination test and a decrease in unpleasant sensations, indicating possible adaptation to experimental conditions.

437

Lomonaco, T., M. Strollo, & L. Fabris, 1957 SULLA FISIOPATOLOGIA DURANTE IL VOLO NELLO SPAZIO: COMPARTOMENTO DELLA COORDINAZIONE MOTORIA IN SOGGETTI SATIOPOSTI A VALORI DI ACCELERAZIANA VARIANTE DA 3 A ZERO G (Physiopathology During Space Flight: Behavior of Motor Coordination in Subjects Exposed to Acceleration Values Varying From 3 G to 0 G) (Presented at Seventh International Astronautical Congress, Rome, 1956) Rivista di Medicina Aeronautica 20(1):76-96 (Suppl. to No. 1, Jan.-Mar.)

438

LoMonaco, T., A Scano, M. Strollo, and F. Rossanigo 1957 ALCUNI DATI SPERIMENTALI FISIOPSICHICI SUGLI EFFETTI DELLE ACCELERAZIONI E DELLA SUB-GRAVITA PREVISTI NELL 'UOMO LANCIATO NELLO SPACIO. (Some Physio-psychic Experimental Data On the Effects of Accelerations and Gravity Predicted for Man Launched Into Space) Riv. med. aeronaut. (Roma), 20(3):363-390. July-Sept 1957.

ABSTRACT: Thirty subjects with normal labyrinthine functions were exposed to accelerations ranging from +3 g (for fractions of a second) to zero g (4 seconds) in a 14-meter-high subgravity tower. The eye-hand coordination was studied by means of an aiming test. Slight but well defined motor incoordination was observed. During weightlessness the majority of subjects experienced a lifting sensation or a feeling of levitation, an increase in muscle tonus, and various unpleasant sensations. Five subjects exposed to several consecutive runs showed an improvement in coordination performance and less severe subjective sensations, indicating an adaptation to the experimental conditions. In 10 subjects, most of whom had already been exposed to the latter experiment, the CF and CF5 leads of the electro-cardiogram during controlled apnea before, during, and after gravity variations showed a marked increase in heart rate which rapidly returned to normal. The coordination test was repeated on five deaf mute subjects whose labyrinthine function was completely failing, and demonstrated good eye-hand coordination during the tower experiments

439

Lomonaco, T., A. Scano, M. Strollo & F. Rossanigo 1958 ALCUNI DATI SPERIMENTALI FISIC-PSICHICI SUGLI EFFETTI DELLE ACCELERAZIONI E DELLA SUBGRAVITA PREVISTI NELL'UOMO LANCIATO NELLO SPAZIO (Some Physio-psychic Experimental Data on the Effects of Accelerations and Sub-gravity Predictable for Man in Space)
Minerva medica (Torino) 49: 61-62, 4 Aug. 1958
See also: Riv. Med. Aero. (Rome) 20(3): 363-390, July-Sept. 1957.

440

LoMonaco, T.C., A. Scano, & F. Rossanigo 1958 VARIATIONS OF PSYCHO-PHYSIOLOGICAL DATA IN MAN SUBJECTED TO CHANGES IN ACCELERATIONS BETWEEN 3 AND ZERO G. Riv. di Med. Aero. 21(4):691-704
(In Italian with English summary)

ABSTRACT: Studies were carried out concerning psychophysiologic effects of weightlessness on human subjects (zero G, after an initial acceleration of 3 G) States of subgravity were achieved by drops from a tower 14-m high, which is described in detail. The authors made radiograms of the thorax and electro-nystagmographic recordings during the zero G state. Sensations experienced during the experiment were described by the test subjects upon termination of the experiments. The results show that weightlessness is accompanied by displacement of the heart and the diaphragm. Zero gravity, however, does not induce nystagmus or modify previously induced nystagmus. Among the sensations reported, the feeling of being lifted and of falling into the void was considered unpleasant; some subjects reported loss of the sensation of being tied to the seat. Two subjects who had kept their eyes shut reported that they felt like taking successive upward jumps after the actual fall, which was not perceived as such.

441

LoMonaco, T., A. Scano & F. Rossanigo 1960 COMPORTAMENTO DI ALCUNE FUNZIONI PERCETTIVO-MOTORIE DURANTE IL PASSAGGIO DA CIRCA 2 A O G ED INFLUENZA DELL ALLENAMENTO: ESPERIMENTI ESEGUITI CON LA TORRE DI SUBGRAVITA. (Behavior of Some Perceptual-Motor Functions During the Transition from About Two to Zero G and the Effect of Training: Experiments Executed with the Subgravity Tower) Riv. med. aeronaut. (Rome), 23(4):439-456 Oct-Dec. 1960. (In Italian).

ABSTRACT: Tests were conducted on a group of six subjects in order to establish the degree of performance during hyper-and zero gravity. The subjects were required to execute a repetitive task with electrical switches following a pre-established pattern while at rest and when launched on a subgravity tower to various states of gravity. Film was taken during the test for observation at a later time. After mild rectilinear acceleration, the normal subjects could tolerate several short and frequent exposures during weightlessness. Moreover, the subjects could perform simple perceptual-motor tasks. The subjects with restraint devices performed with greater ease and were more accurate than those without restraint devices. Repetition of the task during launches also led to greater accuracy in performance. Although the greater part of the test was only slightly affected provided that the relation between his body and the surrounding objects remained fixed.

442

Lomonaco, T. 1962 CONSIDERAZIONI BIOLOGICHE SUI VOLI SPAZIALI ESEGUITI FINO AD OGGI (BIOLOGICAL CONSIDERATIONS ON THE PRESENT STATE OF SPACE FLIGHT) Rivista di medicina aeronautica e spaziale (Roma) 25(3):431-449, July-Sept. 1962

ABSTRACT: A review is presented of the physiobiological data derived from Russian, American, and French suborbital and orbital flights utilizing animals and humans from 1949 to 1961. The experiments culminated in the orbital flights of the Soviet astronauts Gagarin and Titov in 1961. Neither showed any significant change in cardiovascular or respiratory function during the active phase of the flight. No changes were observed during the period of weightlessness, and no disorders of motion or muscle coordination were recorded. Only Titov suffered from nausea and vertigo for several moments. The first American suborbital flights (1961) were accomplished by Shepard and Grissom, and on February 20, 1962, Colonel John Glenn manned the first orbital flight. Telemetered biological parameters showed Glenn's cardiovascular functions in hyper- and zero-gravity to correspond to previously observed data. Sensory function underwent no change except for a reduction of twilight vision. No labyrinthine disorders were observed during zero-gravity although the astronaut attempted to elicit them by voluntary head movements. On May 24, 1962, the American pilot Carpenter was launched into orbit. During the weightlessness he exhibited tachycardia and great changes in blood pressure (Aerospace Medicine 34(3):271, March 1963)

443

Lomonaco, T., A. Scano & G. Meineri 1962 PHYSIOLOGICAL OBSERVATIONS ON THE MOVEMENT OF HUMANS WITH PARTIAL OR TOTAL ELIMINATION OF BODY WEIGHT. I. MECHANICS OF WALKING AND ITS ENERGY EXPENDITURE. Riv. Med. Aero. 25:623-635, Oct.-Dec. 1962 (It)

444

Loret, B. J. 1961 OPTIMIZATION OF MANNED ORBITAL SATELLITE VEHICLE DESIGN WITH RESPECT TO ARTIFICIAL GRAVITY. (Aeronautical Systems Division, Wright-Patterson AFB, Ohio) ASD TR 61-688; Dec. 1961

ABSTRACT: A design envelope is established as the result of a human factors analysis of the artificial gravity environment peculiar to rotating space vehicles. The envelope is prescribed by: an upper limit on vehicle angular velocity of 0.4 radian/second to minimize the occurrence of "canal sickness"; a basic upper limit on artificial gravity of 1 g; and a basic lower limit on artificial gravity of 0.2 g as the lowest value of g at which man can walk unaided. Both g-limits are modified to compensate for Coriolis forces which cause variation in g-level for tangential walking inside the rotating vehicle. An upper limit on vehicle radius of 180 feet is established on the basis of engineering practicality. The optimum vehicle configuration is established as a Modified Axially Expanded Dumbbell, characterized by a single, cylindrical, living-working compartment oriented parallel to the spin axis, counterbalanced by other vehicle components. The configuration is illustrated in the conceptual Pseudo-Geogravitational Vehicle, which has a radius of 180 feet and an operational angular velocity of 0.4 radian/second to produce 0.9 g in the living-working compartment. (AUTHOR)

445

Loret, B. J. 1962 OPTIMIZATION OF SPACE-VEHICLE DESIGN WITH RESPECT TO ARTIFICAL GRAVITY. (Paper, 33rd Annual Meeting of the Aerospace Medical Assoc., Chalfonte-Haddon Hall, Atlantic City, New Jersey, April 9-12, 1962)

ABSTRACT: A design envelope and the optimum vehicle configuration are established through a human-factors analysis of the artificial gravity environment peculiar to rotating space vehicles. The envelope is prescribed by: an upper limit on vehicle angular velocity of 0.4 radians/sec to minimize occurrence of "canal sickness"; an upper limit of one "g", and a lower limit of 0.2 g to permit unaided walking, both limits modified to compensate for Coriolis effects; and a practical upper limit on vehicle radius of 180 feet. The optimum configuration is character ized by a single cylindrical crew compartment oriented parallel to the spin axis, counterbalanced by other vehicle components. The configuration is illustrated in the conceptual Pseudo-Geogravitational Vehicle of 180-foot radius, rotated at 0.4 radians/sec to produce 0.9 g in the crew compartment.

446

Lovelace, II, W.R. & A.S. Crossfield 1959 BIOMEDICAL ASPECTS OF ORBITAL FLIGHT. Soc. exp. test Pilots, 3(3):41-56, Spring 1959.

ABSTRACT: The biomedical aspects of a manned space flight is the topic of this article. Four stages of performance are required as guides to tolerance needed to obtain an adequate level of functioning of man in the respective phases. The seven phases of an orbit mission and the medical problems of each phase are examined. Also included is a description of the three types of manned orbital vehicles available for use in biomedical research.

447

Lowi, B.H. & T.J. Gallagher 1961 BIO-ASTRONAUTICS RESEARCH: WHAT SHALL WE SIMULATE? In Bergeret, P., ed., Escape and Survival: Clinical & Biological Problems in Aero Space Medicine. (London; New York; Paris: Pergamon Press, 1961) AGARDograph 52. Pp. 108-114. ASTIA AD 261 881

448

Lowrey, R.O. 1960 SPACE FLIGHT SIMULATORS--DESIGN REQUIREMENTS AND CONCEPTS. Aerospace Engineering 19(10):50-56, Oct. 1960.

ABSTRACT: Man's experiences in spaceflight will be represented by the sum of the environmental factors which he perceives. The objective of spaceflight simulation is the representation of the total anticipated environment. Existing facilities are insufficient to provide the simulation capability for full exploitation of man's capabilities.

449

Lowry, R.H. 1960 CREW REQUIREMENTS FOR AN ORBITING SPACE STATION. In Proceedings of the Manned Space Station Symposium, (Sponsered by the Institute of Aeronautical Sciences with the cooperation of the NASA and Rand Corporation, Los Angeles, Calif, April 20-22)

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450

Mackworth, N.H. 1950 RESEARCHES ON THE MEASUREMENT OF HUMAN PERFORMANCE (His Majesty's Stationery Office, London) Med. Res. Council, Special Report Serial No. 268

451

Magnolia, L.R. & J.R. Trew 1961 THE LUNAR PROBLEM VOLUME I - BIBLIOGRAPHY (Space Technology Laboratories, Inc., P.O. Box 95001, Los Angeles 45, California STL 'AB 61-5110-40 ASTIA AD 268 706

ABSTRACT: This bibliography is issued in two volumes. Volume 1 is composed of annotated and abstracted references and is arranged alphabetically by main entry.

Volume 2, the index, provides additional coverage by author, source and fields of interest.

452

Magnolia, L.R. & J.R. Trew 1961 THE LUNAR PROBLEM VOLUME II -- INDEX (Space Technology Laboratories, Inc., P.O. Box 95001, Los Angeles, California) STL 'AB 61-5110-40 ASTIA AD 268 705

ABSTRACT: This index volume is designed to be used with The Lunar Problem, volume 1, Bibliography. Three areas are covered: author, source and fields of interest.

453

Makowski, J. 1958 APPARENT WEIGHTLESSNESS CALLS FOR NEW DESIGN APPROACH Aviation Age 30:196-203, Sept. 1958

454

Malcik, V. 1961 OTAZKY KOSMICKEHO LEKARSTVI (Problems of Space Medicine) Tvorba (Prague) 26(17): 387-388, April 27, 1961 (In Czech.)
See also: U.S. Joint Publ. Research Service, Washington, D.C., Trans. No. 4717 (1842-S), June 22, 1961

ABSTRACT: This is a review of the physiological problems encountered in space flight. A rotating anti-g capsule may be installed in the space ship in order to keep the astronaut transverse to the direction of acceleration. Although weightlessness does not affect vital functions, it does affect coordination and orientation in space. Vibration is another problem encountered in space flights. Vibrations of high amplitude cause general fatigue and disturb the nervous system, vision, and hearing. The cabin atmosphere may be composed of 60% oxygen, 20% helium, and 20% nitrogen. If so, the high oxygen content and helium will avert some of the consequences of explosive decompression by reduction of cabin pressure. Also included is a discussion of sanitation problems to be solved.

455

Malcik, V. 1961 THE STATE OF WEIGHTLESSNESS AND FLIGHT ILLUSIONS
Rude Pravo (Prague), 13 Aug. 1961, p. 3

ABSTRACT: The author points out that it is virtually impossible to simulate weightlessness and that thus, the actual experiences under this condition on the part of the Soviet astronauts yielded much valuable data. The article reviews some of the findings in experiments with animals during rocket flights and mentions some of the illusions experienced by space travelers, stating that some of these would be of great significance in cases in which the traveler made a forced landing with the space craft. The author stresses the importance of making astronauts aware of the illusions which they may encounter. Physicians and psychologists must cooperate in analyzing and explaining these phenomena to the astronaut. Above all, the astronaut must be taught to rely on the instruments in the space craft and to accept their indications even when his senses indicate that conditions are contrary to what the instruments show. Only thus can the astronaut protect himself and his craft, the author asserts.
An accurate study of the effects of weightlessness can be made only by human space travelers; no instruments or experimental animals can substitute in these experiments, the article states. The article briefly mentions statements made by Gagarin and Titov regarding their reaction to weightlessness.

456

Mallan, L. 1955 MEN, ROCKETS AND SPACE RATS
(New York: Julian Messner, 1955)

ABSTRACT: The accomplishments in rocket technology, which made possible the announcement of a planned earth satellite, are brought together in terms of the men who are pioneering in the design and testing of rocket ships and are risking their lives as the guinea pigs of space medicine to determine the effects of space flight upon human beings.

457

Mallan, L. 1956 SECRETS OF SPACE FLIGHT
(Greenwich, Conn.: Fawcett Publications, Inc., 1956) (Fawcett Book No. 298)

ABSTRACT: A photographic account is presented of rocketry and space flight. Subjects covered include studies in space medicine; escape capsules and rocket sleds; development of the space suit; launch into the stratosphere; training of space pilots, and research rocket takeoff.

458

Maloney, J.A., & F.G. Richardson 1961 TESTS OF A LIFE SUPPORT SYSTEM UNDER SIMULATED OPERATING CONDITIONS. In 1961 Proceedings of the Institute of Environmental Sciences National Meeting, April 5, 6, 7, 1961, Washington D.C. (Mt. Prospect, Ill.: Institute of Environmental Sciences) Pp. 379-394

ABSTRACT: As an initial step in man's exploration of space the McDonnell Aircraft Corporation under the sponsorship of NASA has developed a "space capsule" complete with all necessary controlling systems for orbital flights about the Earth. This project, known as Project Mercury, is to place a man in orbit approximately 100 miles above the earth and return him safely. Time required for one orbital revolution will be approximately 90 minutes and the first orbital flight will consist of three orbits making a total flight time of four and one half hours. A primary requirement for a successful orbiting mission is the satisfactory operation of a Life Support System. In addition to the basic requirement to sustain the Astronaut in this flight, there will be periods of "on-the-pad" time prior to launching and "in the ocean" time after re-entry during which the system must provide for the Astronaut's safety and comfort. The satisfactory operation of the life support system of spacecraft must be assured before man can safely venture beyond his normal environment. Complete system operation under conditions as nearly like those expected to be encountered is one means of evaluating design adequacy A program for evaluating and demonstrating operation of the Environmental Control System of the Mercury Capsule was conducted in McDonnell's Systems

The system test installation, instrumentation, methods of simulating essential capsule environments, test procedures, safety precautions, and medical monitoring instrumentation and methods are described. The basic program for system demonstration is outlined and a brief evaluation of the test installlation is presented. (Author)

459

Marfone, P. & D. Grady 1961 OUTER SPACE ENVIRONMENT SIMULATION. 1961 Proceedings of the Institute of Environmental Sciences, (Institute of Environmental Sciences, Mt Prospect, Ill.)

460

Margaria, R. 1950 ALCUNI IMPORTANTI DE URGENTI PROBLEMI DI MEDICINA AERONAUTICA (Important and Urgent Problems of Aeronautic Medicine) Minerva Medica. (Torino), 41:229-232, July 28, 1950

461

Margaria, R. 1953 THE CONDITION OF SUBGRAVITY AND THE ELIMINATION OF THE EFFECTS DERIVING FROM ACCELERATION (La condizione di subgravità e la sottrazione dall' effectto delle accelerazioni.) Rivista di medicina aeronautica (Roma), 16 (4): 469-474. 1953

ABSTRACT: A method of creating conditions of subgravity by immersion of the test subject in a fluid of equal specific gravity is discussed. Such an experimental procedure would make superfluous the considerably more complicated and costlier methods in which weightlessness is created by means of free falling bodies. Furthermore, a body immersed in a fluid of equal density does not under-go either gravitational or other types of acceleration. This phenomenon could be applied towards prevention of injuries in airplane crashes, by placing the pilot into a reinforced cockpit immersed in a fluid of a density equal to pilot's body.

462

Margaria, R. 1957 LE FORZE DI ACCELERAZIONE E LA CONDIZIONE DI SUBGRAVITA IN VOLO. (ACCELERATION FORCES AND THE SUBGRAVITY STATE DURING FLIGHT) Riv. Med. Aeronaut. (Rome) 20:(2):175-186

463

Margaria, R., T. Gualtierotti, and D. Spinelli 1958 PROTECTION AGAINST ACCELERATION FORCES IN ANIMALS BY IMMERSION IN WATER J. of Aviation Medicine 29(6):433-437, June 1958

ABSTRACT: Experimentally an animal immersed in water can stand acceleration forces more than ten times greater than in air, the probability of survival being very high even at 1,00 G. A limit to the resistance to acceleration forces is given by parts of the body having a specific weight different from that of the rest of the body, particularly the lungs for their air content, and the otoliths, Rat foetuses, having no air in their lungs, can survive impacts corresponding to accelerations higher than 10,000 G when the mother is floating in water.

464

Margaria, R. 1958 WIDE RANGE INVESTIGATIONS OF ACCELERATIONS IN MAN AND ANIMALS: FOURTH ANNUAL LOUIS H. BAUER LECTURE.
Riv. med. aeronaut. 21:655-690
See also J. Aviation Med. 29(12):855-871, Dec. 1958.
See also (Milan University, Italy) AFOSR TN-58-516, ASTIA AD 158 327

ABSTRACT: This article discusses many aspects of the problem of accelerative forces on man and animals. The viewpoint presented is that much more information can be gathered with less troublesome experimental situations that the gravity-free or free-fall situation. Several examples of simpler data-gathering circumstances are included. Discussion also considers protection from acceleration forces, disadvantages of a gravity-free condition, sensitivity of the labyrinth to gravitation, and effects of gravitation upon various animals. The author includes several experiments conducted under non-free-fall conditions, especially underwater studies.

465

Margaria, R. & T. Gualtierotti 1960 BODY SUSCEPTIBILITY TO HIGH ACCELERATIONS AND TO ZERO GRAVITY CONDITION. (Paper, Intern. Council. Aero. Sci. 2nd Intern. Congress, Sept. 12-16, 1960, Zurich)

ABSTRACT: Experiments were conducted on pigeons, birds and frogs in order to investigate possible effects of satellite flight on humans. This report gives the results of those experiments and observations.

466

Margaria, R., & T. Gualtierotti 1962 LA PERCEZIONE DEL MOTO, L'EQUILIBRIO E L'ORIENTAMENTO IN CONDIZIONI DI GRAVITAZIONE NULLA (PERCEPTION OF MOTION, EQUILIBRIUM, AND ORIENTATION IN CONDITIONS OF ZERO GRAVITY) Rivista di medicina aeronautica e spaziale (Roma) 25(3):450-465, July-Sept. 1962

ABSTRACT: The main systems (vestibular and visual systems and cutaneous exteroceptors) controlling body sensations in space are reviewed. All converge at the level of the cerebellar cortex which analyzes accelerations via labyrinthine connections and integrates visual, acoustic, and other data. The mechanism of action of vestibular receptors is discussed in relation to their anatomical position and to the constant stimulus of 1 g. Gravity receptors appear to follow the Weber-Fechner law, that for a sensation to increase by equal amounts (arithmetical progression), the stimulus must increase by geometrical progression. A hypothesis is presented that under zero gravity conditions responses to a given acceleration will be greater than when sense organs are already subjected to a constant stimulus of 1 g. It is also postulated that the otoliths work as a differential inertia meter. Experimental verification of these hypotheses is suggested by means of comparing the response to acceleration on Earth and during orbital flight in the same animal. (Aerospace Medicine 34(3):277, March 1963)

467

Martin Co., Denver, Colo. 1961 MTSS. GENERAL HUMAN FACTORS CONSIDERATIONS VOLUME III.
Aeronautical Systems Division, Wright-Patterson AFB, Ohio) ASD-CR-61-14 ASD-TR-61-211, July 1961 ASTIA AD 273 005L

ABSTRACT: Contents include material on the following subjects:
Acceleration
Weightlessness
Artificial Gravity
Labyrinthine Sensitivity in Space Flight
Vibration
Summary of Vibration Test Results
Summary of Literature Surveyed

468

Mathews, C.W. 1960 REVIEW OF THE OPERATIONAL PLANS FOR MERCURY ORBITAL MISSION. (Paper, 28th Annual Meeting of the Inst. Aero. Sci., New York, N.Y., 25 Jan. 1960)

469

Mayo, A.M. 1957 SOME SURVIVAL ASPECTS OF SPACE TRAVEL
Journal of Aviation Medicine 28(5): 498-503

ABSTRACT: In a space craft as in aircraft the over-all objectives must command first attention. Survival problems resulting from space environment will be so severe however, that a larger percentage of total space craft design time is likely to be spent in their solution than in airborne craft. The design of crew compartments will be dictated by the requirements of human operators not significantly different in basic physical and mental capabilities from those of the pilots of present aircraft. Automatic controls will be needed as greatly for actuation of safety equipment and environmental control of the crew quarters as in control of the craft and its propulsion and power systems. A major problem will be that of suitably linking the human operator to his "automatic" systems. Hermetically sealed crew quarters to provide a livable earth environment in space will be a prime survival requirement. The reconversion of liquid and food waste products to useful nutrients that are psychologically satisfactory might be approached by the use of secondary living organisms in the same manner as in nature. Temperature control will undoubtedly require specialized attention. The possibly dangerous stresses to be encountered during space flight include weightlessness and acceleration. The problems of surviving the effects of a wide variety of solar and cosmic radiation are other dangers. Careful consideration must be given to a proper balance of the fundamental moral, morale and economic factors to provide escape equipment justifiably on the basis of the total purpose of the craft involved.

470

Mayo, A. M. 1960 LIFE SCIENCES AND HYPER-ENVIRONMENTS 1960
Proceedings of the Institute of Environmental Sciences, 43-62.

ABSTRACT: If it is to meet the objectives for which it is created, the space cabin must be configured to function within the capabilities of its operators. In order to insure man-machine compatibility, a set of realistic requirements for the over-all operation should be reduced to the most fundamental terms practical by questioning each requirement until the objective is clearly outlined.

The fundamentals must be adequately considered in relation to the whole system before allowing compromise by utilizing existing devices. A feasibility study should then point to meeting each of the requirements.

471

Mayo, A.M. 1961 REQUIREMENTS FOR ARTIFICIAL GRAVITY DURING PROLONGED SPACE FLIGHT-IMPACT ON VEHICULAR DESIGN AND OPERATION
(Paper, AAS 7th Annual Meeting Jan. 16-18, 1961, Dallas, Texas) AAS preprint no. 61-13, 6 pp.

472

Meineri, G. 1962 GLI EFFETTI DELLA SUBGRAVITA E I METODI PER RIPRODURLA A TERRA E IN VOLO (Subgravity Effects and Simulation Methods in Laboratory Situations and In Flight)
In Antonio Ambrosini, Ed. RENDICONTI DEL CONGRESSO INTERNAZIONALE--L'UOMO E LA TECNICA NELL'ERA NUCLEARE E SPAZIALE, 18-21 APRILE 1962,
(Proceedings of the International Congress--Man and Technology in the Nuclear and Space Age, 40th Trade Fair, Milan, April, 18-21, 1962)
(Rome, Italy: Associazione Internazionale Uomo nello Spazio)
Pp. 593-609

ABSTRACT: A description is given of the chief methods and physical means used to simulate subgravity conditions; a distinction is made, in the first place, between ground methods (the use of which is recommended for readons of easy performance and greater security, while noting, however, that they usually permit investigation of only a few of the psychophysiological aspects occurring in spaceflight) and the much more cumbersome methods through which real and complete subgravity conditions can be attained (parabolic flight, suborbital, and orbital launching of missiles). The accomplishments and activities of the Center of Studies and Researches of Aerospace Medicine in Rome, by means of the Subgravity Tower designed and installed at the Center's own initiative, are reported. This tower permits the attainment of real, though short-lasting subgravity conditions, preceded and followed by periods of acceleration. Using the Subgravity Tower, it has been possible to tackle a few problems of spaceflight, particularly with respect to the transition between the active and passive stages of spaceflight. (Author)

473

Meineri, G. 1963 THE EFFECTS OF SUBGRAVITY AND METHODS FOR REPRODUCING IT ON EARTH AND DURING FLIGHT.
Riv. Med. Aero. 26:80-98, Jan.-Mar. 1963

474

Metlitskii, L. V. and I. I. Kas'yan 1962 BIOCHEMICAL ASPECTS OF THE RADIATION METHOD OF PRESERVING FOOD PRODUCTS (AND) SOME HUMAN PHYSIOLOGICAL REACTIONS UNDER CONDITIONS OF ALTERNATING OVERLOADS AND WEIGHTLESSNESS.
Trans. of Akademiya Nauk SSSR. Izvestiya (Seriya Biologicheskaya), 27(6):869-884 and 896-908, 1962.
(Joint Publications Research Service, San Francisco, Calif.)
Feb. 12, 1963 JPRS: 17591

475

Metzger, C.A. & A.B. Hearld 1962 CREW ACCOMMODATIONS FOR AEROSPACE MISSIONS (Paper, 1962 Meeting of the Aerospace Medical Assoc., April 9-12, 1962, Atlantic City, N.J.)

ABSTRACT: The results of research by the Aerospace Medical Laboratory on techniques and devices for crew accommodation for use in a weightless environment, which would exist in an earth-orbiting vehicle, are presented. New and unique methods for storing human wastes, with and without chemical treatment, in sealed containers are described. Specialized techniques for bathing, shaving, oral cleansing, laundering and nail and hair care are reviewed. Gravity-independent procedures for storing, preparing, preserving, and dispensing of foods are presented. The problems of weightlessness and the integration of the accommodations are discussed. Laboratory models of components required for food storage and serving, refrigeration, waste collection and disposal, and personal hygiene and sanitation are described. Feasibility of the techniques and experimental devices will be studied in a 3-man 14-day test in a laboratory life support system evaluator.

476

Metzger, C. A. and A. B. Hearld 1962 CREW ACCOMMODATIONS FOR AEROSPACE MISSIONS (6570th Aerospace Medical Research Labs., Aerospace Medical Div., Wright-Patterson Air Force Base, Ohio) MRL memo. no. V-6; May 1962, ASTIA AD-276 203

ABSTRACT: Techniques and laboratory models of equipment to demonstrate the required capabilities of crew accomodations were developed. These models are not engineered for installation in a planned vehicle. They are intended to demonstrate the feasibility of principles and designs that can be adapted for use during an aerospace mission. Reductions in basic requirements, increases in available power, and advances in methods and materials will permit the design of more sophisticated equipment. (AUTHOR)

477

Mickelwait, A.B. 1962 LUNAR MISSIONS - LAUNCH TO RENDEZVOUS
(Space Technology Labs., Inc., Redondo Beach, Calif.)
ARS 2456-62, 17-19 July 1962.

478

Miller, J.W., ed. 1962 VISUAL PROBLEMS OF SPACE TRAVEL
(National Academy of Sciences, National Research Council, Washington, D.C.)
June 18, 1962 ASTIA AD 276 513

ABSTRACT: The problems of space flight as they relate to the visual mechanism are discussed. Substantial portions of the Brown report are quoted in the present report. This report, in addition to updating the Brown report presents a considerable amount of additional information regarding specific critical visual problems, as well as a recently compiled, extensive bibliography of research in this field. (Author)

479

Miller, S.U. and A. Stephenson April 1960 CREW STATIONS OF THE FUTURE
(1960 Proceedings of the Institute of Environmental Sciences, C-24--C-25)

ABSTRACT: This is a commentary on a paper presented by John Bowring to the Institute of Environmental Sciences in April of 1960. The title of the paper was "Crew Stations of the Future."

480

Milliron, J. R. 1960 SPACE ENVIRONMENTAL EFFECTS.
In (Wright Air Development Ctr., Wright-Patterson AFB, Ohio) PROCEEDINGS OF WADC SPACE TECHNOLOGY LECTURE SERIES, VOLUME 1 TECHNICAL AREAS. WADC TR 59-732; ASTIA AD-235 424; pp. 61-74

ABSTRACT: The environments described may occur individually or in combination, and certain combinations cause more significant effects than others. The effects are a function of many variables including the components, the characteristics of the component materials, and the environmental conditions. To achieve reliable performance the designers of systems will need to acquire an understanding of the associated environments and their combined effects. Test conditions should relate directly to the actual conditions encountered in space. (AUTHOR)

481

Minkewitzova, D. 1959 FIVE SECONDS IN A WEIGHTLESS STATE
Central Intelligence Agency Scient. Inform. Rep., Sept. 18, 1959, pp. 50-51
from: Zapisnik (Prague) 3 (14): 16-17, July 1959. (In Czech)

ABSTRACT: In a zero-gravity experiment conducted by the Czechoslovak Institute of Aviation Medicine (Ustav leteckeho zdravi), two physicians of the Institute were used as subjects. Electrocardiograms were taken on one of the subjects. Several consecutive zero-gravity experiments, each lasting 5 seconds, were performed from 2,000-meter altitude, using IL-14 aircraft of Czechoslovak make. Normal drinking from a cup or a bottle was impossible in a weightless state. After approximately 30 minutes the aircraft landed and the experiment was completed. Almost all of the members of the test crew were ill and nauseated, including the reporter, who also suffered an extremely severe headache subsequently. The headache was so severe, the reporter asserts, that three different types of headache powders and pills were completely ineffective; in fact she felt as though "someone hand scrambled my brains."

482

Minners, H.A., S.C. White, W.K. Douglas, E.C. Knoblock & A. Graybiel 1962
AEROMEDICAL STUDIES: CLINICAL MEDICAL OBSERVATIONS
(In: Results of the Second United States Manned Orbital Space Flight, May 24, 1962, Rept. No. NASA SP-6, Govt. Printing Office, Washington, D.C., 1962)

ABSTRACT: This is a report of medical examinations of two astronauts after each had spend 4½ hours in weightless space flight. Generally, there was no evidence of detrimental physical or biochemical effects. Specifically, no abnormal vestibular nor related gastrointestinal symptoms have occurred. Moreover, no pulmonary atelectasis has been found, no cosmic-ray damage has occurred, and no psychiatric abnormalities have been produced. Water survival and heat stress are two problems not yet solved in manned space flights.

483

Montgomery, Jr., A.V. 1962 EFFECT OF SPACE ON MAN
In: National Symposium on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 (St. Louis Aircraft Corporation)

ABSTRACT: A few principles involved in the definition of a spacecraft environment are outlined and exemplified. These principles involve individual variations, duration of stimulus, discrete range of acceptability, and interactive effects between simultaneously applied environmental factors. (Author)

484

Moore, W.L., Jr. & B. Rowen 1963 DYNA-SOAR (X-20) AND AEROSPACE PLANE
Paper: Lectures in Aerospace Medicine, School of Aviation Medicine, Brooks AFB, Texas, 4-8 February 1963

485

Mueller, D. D. 1962 THE CORIOLIS EFFECT IN ZERO-GRAVITY RESEARCH AIRCRAFT
(Aerospace Medical Div. Aerospace Medical Research Labs. Wright-Patterson AFB, Ohio)
MRL-MEMO-P-9 June 1962 ASTIA AD 248 049

ABSTRACT: The purpose of this paper is to define and discuss the nature and extent of the Coriolis effect as it exists on board the ASD zero gravity research airplanes during a weightless parabola and to suggest improvements in the pilot's instruments which are used to fly the maneuver. Considered are: Coriolis forces, aircraft rotation during weightless maneuver, and pilot techniques. (N63-19010)

486

Mueller, D.D. & J.C. Simons 1962 WEIGHTLESS MAN: SINGLE-IMPULSE TRAJECTORIES FOR ORBITAL WORKERS
(Aerospace Medical Division. Behavioral Sciences Lab., Aerospace Medical Research Labs. (6570th), Wright-Patterson Air Force Base, Ohio)
Project no. 7184, Task no. 718405. Technical Documentary Report No. AMRL-TDR-62-103, Sept. 1962. ASTIA AD 289 257

ABSTRACT: While performing maintenance and assembly tasks outside of space vehicles under weightless conditions, a worker may accidentally propel himself away from his vehicle. To determine the speed of such a single-impulse launch, subjects under weightless conditions in a zero-g KC-135 aircraft propelled themselves away from a surface with their legs. They attained maximum velocities of approximately 10 m.p.h. Using various launch speeds and directions, theoretical trajectories were projected for both coplanar and noncoplanar launches. These trajectories indicate that any launch having a velocity component parallel to the direction of orbital motion will result in a trajectory such that the worker will never return to his vehicle. (Author)

487

Mueller, Donald D. 1963 ZERO GRAVITY INDOCTRINATION FOR THE GE MINI/APOLLO ASTRONAUTS
(6570th Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio)
AMRL Memo P-31, March 1963. ASTIA AD 402 786

ABSTRACT: This brochure describes the activities to be performed during weightless flight aboard the ASD zero-G aircraft for indoctrinating and training the Gemini/Apollo astronauts. The activities were chosen because they illustrate motions or behavior patterns that are significantly different during weightlessness from those under normal gravity conditions. The particular significance of each activity as it pertains to orbital flight is discussed. The number preceding the title of each acitivity refers to the corresponding activity on the schedule sheet included as the last page of this brochure. The schedule sheet is used to indicate the activity to be performed by each trainee on each weightless parabola.

488

Muller, B. 1956 FLUGMEDIZINE: KOMPENDIUM DER LUFTFAHRTMEDIZIN (Aviation Medicine: Compendium of Aviation Medicine)
(Dusseldorf: Droste, 1956) Nordrhein-Westfalen. Ministerium fur Wirtschaft und Verkehr. Verkehrswissenschaftliche Veroffentlichungen. Heft 34.

ABSTRACT: This monograph surveys the field of aviation medicine and is intended for use by medical students, students of aerotechnology, physicians, engineers, and fliers interested in aeromedical problems. The chapters deal with the historical development of aviation and aviation medicine, high-altitude flight and the effects of altitude, acceleration and centrifugal forces, motion sickness sensory organs and sensory illusions in flight, orientation as to the position in space and movement, psychophysiology of fliers, flight hygiene, flight accidents, physical and psychological examination of fliers, flying fatigue -- symptoms and therapy, and some problems of space medicine

489

Muller, H. J. 1958 APPROXIMATION TO A GRAVITY-FREE SITUATION FOR THE HUMAN ORGANISM ACHIEVABLE AT MODERATE EXPENSE.
Science 128(327):772. Oct. 1958.

ABSTRACT: This brief report describes in some detail relatively simple equipment which can be constructed to permit studies of the effects of weightlessness on the human organism. The relatively small cost of the apparatus recommends it for pilot studies in this area. The author suggests other questions which would be opened for investigations such as effects on free-fall tolerance.

490

Mur Vilaseca, Tomas 1953 LA ASTRONAUTICA. QUE DEBEMOS PENSAT ACERCA DE LA POSIBILIDAD DE LOS VIAJES POR EL ESPACIO? (Astronautics. What Ought We to Know About the Possibility of Voyages Through Space?)
Rev. Obras Publicas 101: 269-279, June 1953

ABSTRACT: Survey of astronautics, including propulsion of a space vehicle, historical outline, fundamental equations of the rocket, the space station, and the trip to the moon.

WEIGHTLESSNESS

N

491

Nadel, A.B. 1958 HUMAN FACTORS REQUIREMENTS OF A MANNED SPACE VEHICLE (General Electric Co., Santa Barbara, Calif.) Rept. RM 58TMP 10 April 1958

ABSTRACT: This report presents an analysis of human factors requirements of a manned space vehicle in light of present knowledge. One section deals with the physical environment of the operator, covering the effects of physical stimuli from space external to the craft, their possible effects on the operator and protective measures needed. Another section is concerned primarily witn inputs from space received via the sensory system of the operator. Phenomena apprehended through the perceptual system are described together with their possible effects and practices recommended to avoid undesirable effects. The information processing function (information items needed, displays, and display-control relations) is discussed at length

492

Nadel, A.B. 1959 SUPPORTING MAN IN SPACE: 1970-1975 (General Electric Co., Santa Barbara, Calif.) RM 59 TMP-85. 30 Nov. 1959

ABSTRACT: This report discusses progress in space technology that is expected to take place by 1970 and anticipates several bold adventures into space during the period 1970-1975, such as successful trips to the moon and the beginning of interplanetary travel (Mars, Venus, etc.). Needed requirements and capabilities for such accomplishments are discussed in the following areas: (1) the physical environment - atmosphere, gravitational forces (acceleration and zero g), temperature, and radiation; and (2) acoustic noise and vibration.

493

Nagoya U. Research Inst. of Environmental Medicine 1962 ANNUAL REPORT, 1961 (Nagoya U. Research Institute of Environmental Medicine, Japan) In Japanese.

ABSTRACT: Contents include:

1. "Annual Review of Progress in the Aeromedical Department" Fushiro Motobayashi, p. 1-2.
2. "Preliminary Study on the Biological Phenomena In Rocket Flight" Shigeru Ando and Sadaharu Takagi, p. 2-4.
3. "How is the Mento-Physical Condition Measured? (1. Preliminary Study)" Fushiro Motobayashi, Sukeo Sugimoto, Tamotsu Somiya, and Sadaharu Takagi, p. 5-12.

4. "Neuroglial Response and a Theory of Neuroglialneuronal Interaction" Genyo Mitarai, p. 12-17.
5. "Adient Reaction Potential and Abient Reaction Potential as a Function of the Fistance (From the Object (3) Tamotsu Somiya, p. 17-21.
6. "Experimental and Theoretical Studies on Behavior in Space" Tamotsu Somiya, p. 21-31.

494

Neiner, J. J. 1959 THE EFFECT OF ZERO GRAVITY ON FLUID BEHAVIOR AND SYSTEM DESIGN. (Wright Air Development Ctr., Wright-Patterson AFB, Ohio) WADC TN-59-149; ASTIA AD-228 810; April 1959

ABSTRACT: The results are given of a test program which shows the behavior of fluids under the method of obtaining this environment is described. The effect of this environment on fluids of different densities and viscosities is presented as well as a discussion of the behavior of air bubbles released in the fluid and methods of fluid transfer under this condition.

495

Neuman, W. F. 1963 POSSIBLE EFFECTS OF WEIGHTLESSNESS ON CALCIUM METABOLISM IN MAN.
(U.S. Atom Energy Comm., Univ. Rochester, Rochester, N. Y.) 622:1-13, 18 Jan. 1963.

496

New, G. W. 1955 YOU'RE IN SPACE
Air Training, 4(6):24-25, Jan. 1955.

ABSTRACT: A test pilot's subjective experiences in ascending to higher than 85,000 ft. altitude are described. The sensations during a brief period of weightlessness included falling, difficulty in orienting and spinning.

497

Newbauer, J.A. 1959 KEEPING YOUR FEET ON THE GROUND IN SPACE.
Astronautics. 4: 28, June 1959

ABSTRACT: A brief note given on current and projected experiments with magnetic shoes which will allow man to walk in normal fashion in spacecraft during periods of weightlessness.

498

Nicholson, J. F., & D. W. Naas 1960 MAGNETIC SHOES FOR HUMAN ORIENTATION IN SPACE. (Wright Air Development Ctr., Wright-Patterson AFB, Ohio) WADC TN 59-352; ASTIA AD-236 362; Feb. 1960

ABSTRACT: Both permanent and electromagnetic shoes for human orientation in a weightless environment are described. The electromagnetic shoes operate on a low voltage power source which may be adjusted to the individual requirements of the wearer. A microswitch which interrupts the magnetic circuit each time the heel is raised reduces walking fatigue and increases the operational life of the batteries. An inertia switch is included in the magnetic circuit as a safety device. When the switch senses any sudden acceleration or deceleration, it shunts the potentiometer and allows additional current to flow to the electromagnet thereby increasing the holding force. (AUTHOR)

499

Nicoll, N.R. 1954 DESIGN OF THE LIFE COMPARTMENT NECESSARY FOR SPACE TRAVEL Brit. Interplan. Soc. J. 13:277-282, Sept. 1954

ABSTRACT: The composition of the life compartment of a spaceship is dealt with and an overall weight of under one ton is developed as being realistic. The compartment is of double-wall construction, containing equipment for atmosphere control, variations in g and other necessities for the survival of a crew of thirteen for 15 days.

500

Niehuss, O. 1959 A PRELIMINARY INVESTIGATION OF THE SPECIFIC PERFORMANCE CAPABILITIES OF THE KC-135 AIRPLANE FOR PROVIDING EXPERIMENTAL ZERO-GRAVITY ENVIRONMENT (Boeing Airplane Company, Renton, Washington) Document D6-3885, September 1959

501

Nieto Boque M. 1961 GRAVITY AND ITS REPERCUSSIONS ON MAN. STUDY OF ITS PHYSIOLOGICAL ACTION IN "TERRESTRIAL MAN" FOR THE PURPOSE OF UNDERSTANDING ITS ACTION ON "PLANETARY MAN".
Bol. Cons. Gen. Coleg. Med. Esp. 24:11-32, April 1961 (Spain)

502

Nikolaev, A.G. & P.R. Popovich 1962 MY ZHILI I RABOTALI V KOSMOSE (We Lived and Worked in Space) Priroda (Moskva), (9): 10-16, Sept. 1962.

ABSTRACT: The authors relate their experiences on the orbital flights of

Vostok-3 and Vostok-4. While in flight they did not experience vestibular disturbances, lack of appetite, or insomnia. No unpleasant sensations resulted when moving in the cabin. They regard a six-hour sleep as adequate. Psychologically the most unpleasant moment during the flight was the re-entry. In the opinion of both cosmonauts, a prolonged space flight does not impair the physical capacity of the human organism. (Aerospace Med. 34 (8): 769, Aug. 196β

503

Nixon, C.W. and C.E. Waggoner 1962 SPEECH DURING WEIGHTLESSNESS (Aerospace Medical Div., Air Force Systems Command, Wright-Patterson AFB, Ohio) Proj. 7231; MRL TDR 62-45, May 1962. ASTIA AD 284 688.

ABSTRACT: Certain characteristics of human speech exhibited under 1-g conditions may be different under weightless conditions. If such differences exist, they might interfere with satisfactory speech communication under conditions of zero gravity. Standard speech materials recorded under conditions of 0 g, 1 g, and 2-1/2 g's were evaluated by both objective and subjective methods. Results indicate that speech production is not significantly altered by brief periods of zero gravity. Reception of speech also seems to be unaffected. Both speakers and listeners indicate good speech intelligibility under conditions of weightlessness. (Author)

504

North American Aviation, Inc. 1961 WEIGHTLESSNESS: MAN IN SPACE, A LITERATURE SURVEY. (Space and Information Systems Division, North American Aviation, Inc., Los Angeles, Calif.) Rept. No. SID 61-447; ASTIA AD-282 469; 12 Dec. 1961

ABSTRACT: Covered in this partially annotated bibliography is a review of literature from 1957 to August 1961 on the state of weightlessness with primary emphasis on the physiological aspect with some engineering documentation included. The 131 references are listed alphabetically by periodical title and corporate author in one alphabet. Both an author and subject index follows the bibliography (AUTHOR)

505

North American Aviation, Inc. 1961 PROJECT APOLLO; PRE-CONTRACTURAL DOCUMENTATION AND ORBITAL RENDEZVOUS: A LITERATURE SURVEY (North American Aviation, Inc., Downey, Calif.) Rept. No. SID 61-470 Dec. 29, 1961

ABSTRACT: A review of literature on Project Apollo and Orbital Rendezvous, in two parts, from August 1959 to December 4, 1961 is given. The references are listed alphabetically by corporate author and periodical title in one alphabet. Following the bibliography are both author and subject index. (Author)

506

Novotny, Z. 1960 THE EFFECT OF FULL OR PARTIAL WEIGHTLESSNESS ON LIVING ORGANISMS. (Paper, First Czechoslovak Conference on Rockets and Astronautics, Liblice, April 22-23, 1960)

ABSTRACT: The influence is considered of a reduced number of excitations due to the effect of partial or complete cessation of the sensation of weight from the periphery to the central nervous system. In the surface skin and in the internal receptors and the receptors of the inner ear less impulses are generated than under the effect of normal gravity so that the brain crust does not have sufficient information to gain an impression of the location and movement in space; vision cannot always substitute fully these sensations and, as a result of this, illusory impressions are gained on the location in space. Exclusion of the factor of weight of the extremities leads to a relative over-dosage of nerve impulses to the appropriate muscles leading to excessive movement. The state of weightlessness preceding the state of excessive gravitational effects leads to a reduced resistance of the body to high g-loads. The author also dealt with the further possible effects of the state of partial and complete weightlessness over long periods, on the reduction of the quantity of muscle substance (muscle atrophy), on the vegetative reaction in the blood circulation and breathing, on the basic food consumption, on the level of nervous activity, etc. A short 16 mm film on the state of weightlessness for short durations was projected

WEIGHTLESSNESS

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507

Oberth, H. 1929 FRACTIONAL G AND WEIGHTLESSNESS
In Wege zur Raumschiffahrt (Munich: Oldenburg, 1929) pp. 100-106

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Ogle, D.C. 1957 MAN IN SPACE VEHICLE
U.S. Armed Forces Med. J. 8(11): 1561-1570, Nov. 1957

509

Osakov, P.K. 1958 LIFE IN SPUTNIK
Astronautics, Vol. E, No. 2, Feb. 1958. Pp. 38-39, 49-50

ABSTRACT: A Russian biologist examines problems involved in keeping a living organism alive in Space and reveals Soviet approaches.

510

Otto, E. & T. R. ThorKelson 1960 SIMULATION OF ZERO-G AIRCRAFT CONTROL
Instrum. Control Syst. 33(9):1564-1567, Sept. 1960.

WEIGHTLESSNESS

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511

Pace, N. 1958 PROBLEMS IN SPACE PHYSIOLOGY
Publ. Astronaut. Soc. Pacific, 70(415):349-359. August 1958.

ABSTRACT: A review of problems encountered in space flight including air content and pressure, waste disposal, food and water, radiation, g tolerance and weightlessness.

512

Page, W. 1962 CAN SPACE PROLONG YOUR LIFE?
Space World, 2(4):56-58, March 1962.

ABSTRACT: This article deals with conditions in outer space which may prove beneficial in the treatment of disease and provide new cures. The author suggests the use of weightlessness and certain radiations in the treatment of specific diseases and comments on the possibility of a 100 per cent germ free hospital in outer space.

513

Pando, M. Velasco 1958 ARTIFICIAL SATELLITES AND INTERPLANETARY TRAVEL PHYSIOLOGICAL EFFECTS OF CHANGE IN GRAVITY.
Revista De La Real Academia De Ciencias De Medris. 52(2):141-145

ABSTRACT: A corrected and extended version of an analytical study on the launching of space rockets. Attempts to correlate a mathematically basic physiological and physical parameter.

514

Parin, V. V. 1960 MAN IN SPACE
Tekhnika molodezhi 1960(11):19

ABSTRACT: The author describes the problems still to be solved before man can expect to set out on space travels. These problems include environmental effects upon the organism and the elaboration of methods and means to ensure its normal functioning. In the first place it is necessary to study, in all details, the factors of the means intended to safeguard the vital action of the organism and general flying safety. The knowledge of acceleration effects if also of importance. Seclusion over a long time in an isolated and narrow room, as is the flyers' cabin, is apt to cause severe psychological complications. The absence of habitual stimuli, the complete silence, darkness, weightlessness, perturbation in the normal alternation of day and night, work and rest, may cause disturbances in the psychic sphere and in blood circulation as well. Food and water supplies are one of the main problems, and so is the study of nutritive conditions. The conquest of space has to go through three stages: instruments, animals, man. The first two stages are being pushed on by powerful efforts, and have already yielded abundant and valuable material While man has not yet launched on space travels himself, he has nevertheless succeeded in gaining insight into the mystery of space thanks to the latest complicated trials.

515

Parin, V. 1961 BIOLOGY, TECHNIQUES AND SPACE
Przeglad techniczny 1961(31):6-7

ABSTRACT: The article describes and praises Soviet space achievements, broadly outlines the need for close cooperation between the various scientific fields participating in the space program and the training of cosmonauts. After mentioning the April 12, 1961 flight of Gagarin, the author points out that a new science has been created as a result of the exacting demands of cosmic flight-space biology and medicine. In contradistinction to the former concepts of biology, space biology and medicine are closely related and combine a number of other fields. A number of factors may influence the living organism in space. These were first determined in animals by the radiotelemetering method. The results of these first investigations in space physiology showed that during flight, right up to peak velocity and again during the space vehicle's deceleration period, the living organism is subjected to great strains on the heart and blood vessels. During training, the cosmonaut was sjbjected to a gradual and careful increase in acceleration; careful medical control was carried out during all training stages, assuring the perfect health of the cosmonaut. (CARI)

516

Parin, V.V. & V.I. Iazdovskii 1961 PUT' SOVETSKOI KOSMICHESKOI FIZIOLOGII (ADVANCES IN SPACE PHYSIOLOGY IN THE SOVIET UNION)
Fiziologicheskii zhurnal SSSR (Moskva) 47(10): 1217-1226, Oct. 1961

ABSTRACT: The first and second stages of animal experiments in Soviet space medicine and biology were carried out with rocket flights. Satisfactory data were obtained on physiology and behavior under space-equivalent stresses and on the adequacy of hermetic cabins, cabin equipment, space suits, and recovery equipment. The orbital flight of the dog, Laika, confirmed that a highly organized organism can survive space flight in a satisfactory condition. Other satellite flights with different types of animals allowed continuous observations of their condition throughout the flight and during landing. The final stage was preceded by the selection and training of cosmonauts. The training program subjected the cosmonauts to simulated stresses gradually increasing in intensity until the levels expected in space were exceeded. Careful medical observations were made throughout the training. The results of this preparation were seen in the successful flight of Gagarin. In Titov's flight prolonged weightlessness affected his vestibular sense organs but not his efficiency. Recovery after the flight was rapid.

517

Parin, V.V., O.G. Gazenko, & V.I. Yazdavkiy 1962 THE POSSIBILITY OF PROTECTIVE ADAPTATIONS OF THE ORGANISM AND LIMITS OF ADAPTATION UNDER CONDITIONS OF MAXIMUM OVERSTRAIN AND WEIGHTLESSNESS.
Vestnik Adad. Med. Nauk SSR (Moscow), JPRS-15187, NASA N 62-17962, 10 Sept. 1962.

ABSTRACT: A study is made of the possibility of protective adaptations and limits of adaptation of an organism under conditions of maximum overstrain and weightlessness. A study of the rate of blood circulation and oxygen content in arterial blood shows a direct dependence of the degree of blood oxygenation on the rate of circulation. This can serve as evidence of the active participation of the hemodynamics of the lesser pulmonary circulation in blood oxygenation during transverse overloads. As a result of ground experiments and human space flights, the limits of admissible values of prolonged accelerations have been established; and preliminary results on the possibility of raising the physiological tolerance of man to the action of accelerations by the training exercise method have been obtained. An alteration of afferentation was observed under conditions of weightlessness after prolonged space flight. (STAR)

518

Parin, V.V. & O.G. Gazenko 1962 SOVIET EXPERIMENTS AIMED AT INVESTIGATING THE INFLUENCE OF THE SPACE FLIGHT FACTORS ON THE ORGANISM OF ANIMALS AND MAN. (Paper, 3rd International Space Science Symposium and Fifth COSPAR Plenary Meeting, April 30 - May 9, 1962, Washington, D.C.) NASA N 62-15217.

ABSTRACT: This is a presentation of the results of the biological experiments conducted on Space ship-satellites II, III, IV, and V and of scientific observations made during Gargarin and Titov's flights aboard space ships Vostok I and II. The physiological reactions to various flight stresses were not fatal. Neither the cosmonauts nor the animals had any observable change in health. The most important task is the study of the influence on the human organism of the various flight stress factors, including emotion strain.

519

Parin, V.V., & O.C. Gazenko 1962 SOVIETS GIVE VOSTOK PHYSIOLOGICAL DETAILS Aviation Week and Space Technology, May 28, pp. 67, 71.

ABSTRACT: The first flights of the astronauts were made in paths already tested in launchings of space ships with animals aboard. Animals in this case were specific indicators of danger. Close investigation of animals during flight and after recovery to Earth enabled us to conclude that there are no considerable changes dangerous for life and health of cosmonauts. A combination of physiological methods and the corresponding medical research apparatus was used in order to make studies of the influence of space flight factors on the cosmonaut's organism. During Gagarin's and Titov's flights physiological methods were used chiefly for the purposes of physician's control. Before the launch, at all the portions of the flight trajectory and after, Gagarin's health was satisfactory. After lift-off during the gradual increase of velocity of the ship the heart rate increased to 140-158 beats per minute, the respiration rate was 20-26. At the end of the powered period the heart rate decreased to 109 beats and the respiration rate reduced to 18 per minute. Gagarin pointed out some unusual sensations under conditions of zero-gravity, though no disorders of functions were observed, he felt and performed his program well. When he approached the Earth his respiration became not frequent, smooth and calm. In three hours after landing indices were fixed characteristic of the normal, calm condition of the space pilot. (CARI)

520

Parin, V., V. Yazdovskiy, & O. Gazengko 1962 SPACE MEDICINE REPORT
FBIS USSR & East Europe, No. 23, Feb. 1, 1962.

ABSTRACT: The effects of space flight factors and man's potential defensive adaptation mechanisms under the conditions of maximum acceleration and weightlessness were the subject of a paper presented to a current session of the USSR Academy of Medical Sciences in Moscow.

Three groups of factors encountered in outer space are discussed in this paper. The first group of physical factors includes extremely low barometric pressures, ionizing radiations, meteorites, and so on. The second group of factors, depending on the rocket flight itself, include noise, vibration, acceleration, and weightlessness. The third group of factors affecting the cosmonaut depend on conditions inside the spaceship and safety facilities for the crew in flight. Scientists believe that the strongest operating factors of space flight are acceleration, weightlessness, cosmic radiation, and emotional tension. (CARI)

521

Parin, V. 1962 CAPACITIES OF THE HUMAN ORGANISM: DEFENSE MECHANISMS AND ADAPTATIONS IN CONDITIONS OF MAXIMUM OVERLOAD AND THE STATE OF WEIGHTLESSNESS.
Perspect Biol. Med. 5:527-533, Summer 1962

522

Parin, V.V. et al 1962 DEVICES TO PROTECT THE ORGANISM FROM G-FORCES AND IN THE WEIGHTLESS STATE
(Office of Technical Services, Washington, D.C.) 62-24377 March 21, 1962
Trans. from Meditsinskli Rabotnik (USSR) 25:3. 6 Feb. 1962

523

Parin, V.V. 1963 COSMOS, MEDICINE, MAN
Komosomol'skaya Pravda, 10 March 1961, 1 p.
(Translation Services Branch, Foreign Technology Division, Wright-Patterson AFB, Ohio) FTD-TT-52-1603/1, Jan. 17, 1963. ASTIA AD 295801

ABSTRACT: Four questions were directed to Prof. active member of the Academy of Medical Sciences USSR, V.V. Parin. His answers to the following four

questions are contained in this report: (1) What is the characteristic trait of cosmic investigations, carried out in our country? (2) Has the analysis of data obtained during the flight of the second ship-satellite been completed? What new facts have these investigations given to medicine? (3) What is the effect of cosmic flight conditions on the higher nervous activity? (4) Why are dogs employed in the role of experimental animals in cosmic investigations?

524

Parin, V.V. 1963 IT HAS BEEN ACCOMPLISHED
Smena, No. 7, 1961. pp. 3-4
(Translation Services Branch, Foreign Technology Division, Wright-Patterson AFB, Ohio) FTD-TT-62-1607/1, 18 Jan. 1963. ASTIA AD 295 805.

ABSTRACT: Behind the flight of Communist Yuriy Alekseyevich Gagarin are years of scientific achievements in the field of space flight. An unforgettable day was when the first soviet satellite weighing 83.6 kg made a round trip around our planet. From that memorable day, more than three years have passed. The flight of the Dog Layka and later, the first trip of the Zoo-Botanical Garden headed by dogs Byelka and Strelka. Dogs were used instead of monkeys because it is difficult to train a monkey to calm behavior under flight conditions. The blast off of dogs can be carried out without chemically doping their nervous system. After the flights of various dogs, came photography of the reverse side of the moon. Finally, flights of the third, fourth, and fifth cosmic ships. All of these flights brought about the conclusion by scientists that mans flight into the cosmos on board a soviet space ship is connected with no danger to his health or life.

525

Parin, V.V. 1963 THE COSMONAUT IS FEELING FINE, SAID A SOVIET SCIENTIST
Literaturnaya Gazeta, Aug. 15, 1961, p. 1
(Translation Services Branch, Foreign Technology Division, Wright-Patterson AFB, Ohio) FTD-TT-62-1602/1, Jan. 17, 1963. ASTIA AD 295 798

ABSTRACT: A discussion of the good physical condition of both Yuriy Gagarin and German Titov during and following their space flights provides scientists with a good outlook for future space flights. After the flights, scientists concluded that weightlessness does not interfere with normal activities. Moreover, it does not appear to be a hindrance in manual control of the ship. Furthermore, Titov spent 24 hours in the cabin of the Vostok-2 in which time, day and night changed 17 times. This change in the customary time period had no effect on the health of the cosmonaut. Titov's flight also proved that weightlessness has no adverse effect on the functions of man's organism. Finally, the flight proved that man can without greater strain and without harm live under conditions of cosmos--for a time necessary to carry out such flight.

526

Parin, V.V. 1963 MAN IN COSMOS
Smena, No. 13, 1961, pp. 22-23
(Translation Services Branch, Foreign Technology Division, Wright-Patterson AFB, Ohio) FTD-TT-62-1606/1, 17 Jan. 1963. ASTIA AD 295 806

ABSTRACT: Overload is one of the serious problems faced by a cosmonaut during space flight. Scientists are now trying to solve the problem by placing the cosmonaut dressed in an airtight suit into a special chamber filled with liquid In it, he will be situated in a suspended state. It is hoped that the specific weight of the liquid will become equalized with the specific weight of the cosmonaut and thus, make it possible for him to endure overloads. Observations of animals on board cosmic ships explained that the vital activity of the organism under conditions of weightlessness is normal. One of the yet unsolved problems of space flight is that of radiation. One method under investigation to increase the stability of the organism to radiation is by artificially slowing down the vital processes in the organism. This would be done by cooling the living organism.

527

Pavlok, Jan 1958 BIOLOGICKE ZABEZPENCENI MEZIPLANETARNICH LETU (Biological Safety in Interplanetary Flights)
Vojenske zdravotnicke listy (Prague) 27(6): 257-262, 1958

528

Peterson, N. V., & H. Jacobs, eds. 1958 PROCEEDINGS WESTERN REGIONAL MEETING AMERICAN ASTRONAUTICAL SOCIETY, 18-19 AUGUST 1958, PALO ALTO, CALIF.

CONTENTS:

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Peterson, N.V., ed. 1958 PROCEEDINGS, FOURTH ANNUAL MEETING, AMERICAN ASTRONAUTICAL SOCIETY, 29-31 JAN. 1958, NEW YORK

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Petrovich, G.V. 1961 SOVETSKIE KISMONAVTY V BLIZHNEM KOSMOSE (SOVIET COSMONAUTS IN NEAR-SPACE)
(Vestnik Akad. Nauk S.S.S.R. (Moscow), v. 31, no. 5 May 1961, pp. 13-22, in Russian)
Also in: U.S. Joint Publ. Research Serv., Washington, D.C., Trans. no. 8897 (CSO:66-D), Sept 19, 1961

ABSTRACT: The Soviet space program culminated with the orbiting flight and return of Yu. A. Gargarin. His physiological reactions to weightlessness showed that the human body could tolerate the weightless state for a much longer duration. However, cosmic radiation is a source of danger and presented a major problem to space travelers.

531

Phoebus, C.P. 1958 ACCOMMODATING THE SPACE MAN.
Research Reviews, Pp. 6-12, June 1958.

ABSTRACT: This article discusses problems which must be solved before space ships can be built which accommodate man's needs sufficiently to permit weeks or months of flight. These problems arise primarily because of the continuously closed environment, hence are discussed in the light of experience with submarine design. Problem areas include: respiratory mechanisms, food and waste, radiation, psychological factors, information from human engineering studies, the crew, acceleration and deceleration, environmental temperature, waste disposal and weightlessness.

532

Pigg, L. D. 1961 HUMAN ENGINEERING PRINCIPLES OF DESIGN FOR IN-SPACE MAINTENANCE. (Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson AFB, Ohio) ASD TR 61-629; ASTIA AD-271 066; Nov. 1961

ABSTRACT: Results of research on problems related to human performance of maintenance actions in space systems are reviewed. The interactions of sensory, psychomotor and motor functions are discussed, along with problems of remote-handling applications in the space environment. (AUTHOR)

533

Pigg, L.D., & W.N. Kama 1961 THE EFFECT OF TRANSIENT WEIGHTLESSNESS ON VISUAL ACUITY. (Behavioral Science Lab., Aerospace Medical Division, Wright-Patterson AFB, Ohio) WADD TR 61-184, March 1961. ASTIA AD 261 906

ABSTRACT: Visual acuity was measured on subjects while they were exposed to short periods of weightlessness aboard an aircraft flown through zero-g trajectories involving transition from 1 g to 2-1/2 g to zero g. Monocular and binocular acuity of near and far vision were measured on both Snellen and checkerboard targets. Control measurements were made on the ground and inflight at 1 g in counter-balanced sequence with the zero-g measurements. Results show that the weightless environment produced from this study has a detrimental effect on visual acuity as measured. The decrement is not considered to have practical significance. (Author)

534

Piolett, L. 1960 LE VOYAGE TERRE LUNE-SERA-T-IL UN JOUR UN VOYAGE D'AGREMENT? (THE EARTH-MOON TRIP - WILL IT ONE DAY BE A PLEASURE TRIP?)
L'air, May 1960, pp. 16-18, in French

ABSTRACT: The author presents the following hazards which must be solved before man has a 90% chance of survival of a space flight: (1) the accelerations of launching and landing, (2) extreme temperature variations, (3) the noise and vibration of the rocket, (4) the state of weightlessness, (5) ionizing and nonionizing radiation, and (6) meteoritic impact.

535

Platonov, K. K. 1959 PSIKHOLOGICHESKIE PROBLEMY KOSMICHESKOGO POLETA (PSYCHOLOGICAL PROBLEMS OF SPACE FLIGHT) Vosprosy Psikhologii (Moskva) 5(3):56-65
German Translation: Psycholgische Probleme des Raumfluges Sowjetwissenschaft: Naturwissenschaftliche Beitrage (Berlin) 1959(12):1213-1222, 1960

ABSTRACT: The psychologic effects of the conditions of space flight are reviewed with reference to published reports on the reactions of experimental subjects to these conditions. It is concluded that the adverse effects of acceleration, weightlessness, confinement, isolation, and exposure to danger may satisfactorily be counteracted by the proper conditioning and motivation of space pilots.

536

Pogrund, R.S. 1962 PHYSIOLOGICAL ASPECTS OF THE SPACEMAN
In: Brown, K., and L.D. Ely, eds., Space Logistics Engineering (New York: John Wiley and Sons, 1962) pp. 55-135

ABSTRACT: The complexity of space logistics engineering for the comfort of the astronaut in a space vehicle is described as a function of mission duration and of the operational requirements and performance capabilities expected. The following physiological parameters are reviewed: (1) vehicle-induced stresses (propulsion, noise, vibration, accelerations, zero gravity, re-entry, emergency escape); (2) internal environment of the space capsule (sources of oxygen supply, handling food, biological photosynthesis systems, methods of carbon dioxide elimination, water and waste control, toxicological considerations, temperature and humidity regulation); (3) radiation hazard shielding requirements, (low-level chronic exposure hazard); and (4) psychological stress (isolation, confinement, and sensory deprivation).

537

Pokorovski, A.V. 1956 STUDY OF THE VITAL ACTIVITY OF ANIMALS DURING ROCKET FLIGHTS INTO THE UPPER ATMOSPHERE
(Report presented at the Congres Internationale des fusees et engins guides Paris, Dec. 3-8, 1956) In Etudes Sovietiques (Paris) 106:65-70, Jan. 1957. R.A.E. Translation No. 625, ASTIA AD 124191

ABSTRACT: In the first stage of this work, vital activity of the body at high altitudes has been observed in dogs, carried in a hermetically sealed compartment in the nose of a rocket. Equipment carried in the compartment allowed observations to be made on conditions, and on the behaviour of the animals during flight, and during the free fall of the cabin from the rocket.

The second stage involved the placing of the dogs, in space suits, in a compartment not hermetically sealed. In one case the animal was ejected at about 75 to 85 km, its parachute opened, and it was subjected to all the external influences of the upper atmospheric layers during 50-65 min.

538

Pokrovskiy, G. 1961 MAN GOES OUT INTO SPACE
Kryl'ya rodiny 6: 17-18

ABSTRACT: The article deals with the first cosmic flight of Major Yu. A. Gagarin in the spaceship "Vostok", which proved that man can exist and function normally in space. K.E. Tsiolkovskiy was amongst the first scientists to point out that man in a cosmic flight would experience two distinctly different states, i.e. overloads which would be felt during the acceleration and deceleration in the atmosphere before landing, and a state of weightlessness while the spaceship is in orbit. Insignificant "g" loads would be possible during change-over from one orbit into another or before landing. "g" loads have been known to high-speed pilots, and momentary weightlessness to aerobatic pilots. Checking of a prolonged state of weightlessness had to be carried out under conditions of a real cosmic flight. Three aspects of the phenomena were observed: (1) weightlessness reduces the load on blood vessels and facilitates the heart functions. It lowers the strain of the human body, and could be used as a treatment for heart diseases; (2) it affects the intake of food, which becomes weightless; further investigation as to the food's progress in the digestive system was required; (3) the force of gravity must play an important part in man's orientation in space as it acts on the body as a whole, and on the vestibular apparatus, which governs the sensation of "Top" and "Bottom". After Major Yu. A. Gagarin's flight in space it was found that the human body withstands all unexpected and unusual conditions quite well. (CARI)

539

Pokrovskiy, I. 1961 MIRACLE OF THE TWENTIETH CENTURY.
Ekonomicheskaya Gazeta 88(941):4
(Aerospace Technical Intelligence Center, Wright-Patterson AFB, Ohio)
Translation No. MCL-1150, 13 April 1961. ASTIA AD 261 824

ABSTRACT: This report is an evaluation on the individual and technical achievements of Soviet scientists, designers, and workers in the field of cosmic flights and other fields. It emphasizes the importance of sending a man into space to make it possible for him to work in this medium.

540

Potts, P. and J. I. Bowring 1960 EXERCISE IN A WEIGHTLESS ENVIRONMENT
Physical Therapy Rev. 40(8):584-587

541

Presnyakov, A. 1961 THE SECRET OF THE FORCES OF GRAVITY.
(Aerospace Technical Intelligence Center, Wright-Patterson AFB, Ohio)
Translation No. MCL-1057, 14 July 1961. ASTIA AD 261 810

ABSTRACT: The author gives a brief review of work done in the field of gravitation. He states that the interest in the problems of gravitation is due to the study of the nature of time and space, investigations of the cosmos and progress in learning of the elementary particles of matter. For research work carried out by Professor Dmitri Dmitriyevich Ivanenko is reviewed. Considerable interest was prompted by reports of this scientist concerning the so-called field quantization, new hypothesis of cosmology, a unified theory of matter and gravitation, and antigravitation.

542

Putt, D.L. 1952 TRENDS IN U.S. AIR FORCE RESEARCH AND DEVELOPMENT
Technical Data Digest 17(1):7-12
See also J. Aviation Med. 23(4):407-408, 1952.
See also WAE Journal 60(3):43-44, Mar. 1952.

ABSTRACT: Within the context of a review of the progress made in aviation industry and research, the author summarizes briefly the recent advances in aviation medicine. Research in space medicine is still in the beginning stage, covering such tasks as protection against solar and cosmic radiation, cabin pressurization and air conditioning, and adaptation to sub-g conditions as well as the exploration of unknown factors, e.g. the possible effects of the magnetic energy developed in cutting through the earth's magnetic field at high speed. (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD 227 817, Feb. 1959)

WEIGHTLESSNESS

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543

Quinnel, R.K. 1956 THE HUMAN COMPONENT IN EXTRATERRESTRIAL FLIGHT
TAC Surgeon's Bulletin (Langley AFB, Va.) 6(11): 1-24, Nov. 1956
See also: Medical Newsletter 29(4): 27-40 Feb. 15, 1957

ABSTRACT: A general discussion is presented on the physiological stresses to be encountered in extraterrestrial flight such as accelerations, vibrations, cosmic radiations, and weightlessness. Within the cabin, control of pressurization, temperature, oxygen, carbon dioxide, and body odors is required, as well as adequate illumination and presentation of the instrument panel. Vision outside the cockpit may be important only for psychological reasons.

544

Quinnell, R.K. 1957 THE HUMAN COMPONENT IN EXTRATERRESTRIAL FLIGHT
Canad. Serv. Med. J. 13(4): 245-258

WEIGHTLESSNESS

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545

Reed, W.S. 1962 SOVIET SCIENTISTS DISAGREE WITH TITOV ON EXTENT OF SPACE SICKNESS. Aviation Week and Space Technology, May 21, 1962.

ABSTRACT: Extent of Gherman Titov's sickness during his sixth orbit has become a matter of disagreement between the cosmonaut and the Soviet medical scientists who followed his flight. Dr. V.V. Parin, academician of bio-medical sciences at the National Academy of Science, Moscow, said that Titov began to have symptoms of dizziness, nausea and nervousness beginning in the sixth orbit. These symptoms became worse during the sixth orbit and were somewhat eased on the seventh. Titov moved his head carefully while so afflicted. Parin reported that Titov felt somewhat better after the sleep. The Soviet doctors reported that the orbiting dogs on earlier space experiments demonstrated instability of the cardio-vascular system-changes in blood pressure, pulse and electrocardiograph traces-plus confusion of the central nervous system pattern. Titov's condition could be similarly described. (CARI)

546

Rees, David W. and Nola K. Copeland 1960 DISCRIMINATION OF DIFFERENCES IN MASS OF WEIGHTLESS OBJECTS
(Wright Air Development Division, Aerospace Medical Division, Wright-Patterson Air Force Base, Ohio) WADD TR 60-601, Project 7184; Task 71586 December 1960 ASTIA AD 252 161.

ABSTRACT: Absence of gravity results in the loss of many familiar kinesthetic cues of weight and friction necessary to man for object discrimination and manipulation. Man's ability to discriminate small differences in mass as opposed to small differences in weight was studied. Four weight series were used, each consisting of a standard (1000, 3000, 5000, or 7000 grams) and nine comparison stimuli. Judgments for mass differences were made with the same weights supported by compressed air on an air-bearing table. Thus, the friction-less aspect of a weightless environment was simulated. Results show that the mean difference limen, mean standard deviation, and Weber ratio for each standard are much larger for mass than for weight. Thus, to be detected under a weightless condition, mass increments must be at least twice as large as the weight increments required for discrimination in a normal weight-lifting situation

547

RePass, E. 1962 A BIBLIOGRAPHY ON WEIGHTLESSNESS. (Martin-Marietta Corp., Denver, Colo.) Literature search no. 23, ASTIA AD-295 142,

548

Reynolds, S. R. M. 1961 SENSORY DEPRIVATION, WEIGHTLESSNESS AND ANTI-GRAVITY MECHANISMS. THE PROBLEM OF FETAL ADAPTATION TO A FLOATING EXISTENCE.
Aerospace Medicine 32(11):1061-1068, Nov. 1961.

ABSTRACT: Sensory deprivation in relation to effects of prolonged weightlessness is approached in this discussion by reviewing embryological studies. Specifically, the problem of fetal adaptation to a floating existence is discussed. The weightless fetus is then considered in relation to weightless man in terms of established cybernetic principles. (Tufts)

549

Ritter, O.L. & S.J. Gerathewohl 1959 THE CONCEPTS OF WEIGHT AND STRESS IN HUMAN FLIGHT. (School of Aviation Medicine, Aerospace Medical Center, ATC, Brooks AFB, Texas) Rept. No. 58-154, Jan. 1959.

ABSTRACT: The concepts of weight and stress in human flight are considered. The usage of terms and expressions is analyzed, their diverse meanings disentangled, and some of the physical facts are presented together with a simple and consistent set of concepts for their description.

550

Rohles, F. H., R. E. Belleville, and M. E. Grunzke 1960 THE MEASUREMENT OF CONCEPT FORMATION IN THE CHIMPANZEE AND ITS RELEVANCE TO THE STUDY OF BEHAVIOR IN SPACE ENVIRONMENTS (AFMDC, Holloman AFB, New Mexico) July 1960, AD 241 966.

551

Rohles, F.H., Jr. and H.H. Reynolds. 1962 A PROPOSED APPROACH TOWARD DETERMINING THE PSYCHOPHYSIOLOGICAL EFFECTS OF PROLONGED MANNED SPACE FLIGHT. (6571st Aeromedical Research Lab., Holloman AFB, New Mex.) ARL TDR Report No. 62-28, December 1962. ASTIA AD 293 881.

ABSTRACT: Orbital space flights are proposed to study the psychophysiological effects of prolonged weightlessness and cosmic radiation. The program presented will use animal subjects and attempts to eliminate weightlessness and cosmic radiation as deterrents to manned space flights of higher altitudes and longer duration. (Author)

552

Rohles, F.H., M.E. Grunzke & H.H. Reynolds 1962 A DETAILED ACCOUNT OF CHIMPANZEE PERFORMANCE DURING THE BALLISTIC AND ORBITAL PROJECT MERCURY FLIGHTS
(6571 st Aeromedical Research Lab., Holloman AFB, N. Mex.) ARL TDR 62-15; Proj. 6893 ASTIA AD 282 687

ABSTRACT: The insults of prolonged periods without sleep, the suturing of the physiological sensors, and the long period of restraint before launch, did not affect performance during flight; this also appeared true of the prolonged breathing of 100 per cent oxygen under reduced atmospheric pressures for the time periods of these flights. The noise and vibration accompanying launch did not affect performance during flight. Accelerations accompanying launch and re-entry in excess of 7 G's had an immediate effect upon performance; however, recovery to a prelaunch level appeared to be rapid. Adaptation to weightlessness took place during the long exposures to the weightless state, and re-entry accelerations did not have as severe effect upon performance as during the shorter flight. Eating and drinking were accomplished during weightlessness without difficulty. The visual processes, as measured, were unaffected by the rigors of space flight; this was also true of temporal response processes as well as continuous and discrete motor behavior. The pellet and water dispensers functioned properly during weightlessness. The chimpanzee appears to be a highly reliable subject for future space flights. (Author)

553

Roman, J. A. et. al. 1961 SCHOOL OF AEROSPACE MEDICINE PHYSIOLOGICAL STUDIES IN HIGH PERFORMANCE AIRCRAFT
Paper 1961 Meeting of Aerospace Medical Assoc., 27 Apr. 1961, Chicago, Ill
See also Aerospace Med. 33(4):412-419, April 1962

ABSTRACT: Survey of various studies made at the School ofAerospace Medicine, in which NF-100F aircraft are used for gathering physiological information in the following areas: (1) quantitative studies of physiological response of humans and animals to zero-gravity states of short duration (50 sec.); (2) development and testing of automatic physiological instrumentation for use in space vehicles; (3) development of monitoring and telemetering techniques for physiological information, and development of data reduction techniques for such information; (4) determination of physiological norms for human subjects in-flight under conditons of heightened alertness; and (5) screening of physiological parameters for suitability as indices of physiological functioning under in-flight conditions.

554

Roman, J.A. 1962 BIOMEDICAL MONITORING IN-FLIGHT
In (School of Aerospace Medicine, Brooks AFB, Texas) Lectures in Aerospace Medicine, 8-12 January 1962, ASTIA AD 281775

ABSTRACT: "Biomedical Monitoring" implies the automatic gathering of quantitative information relative to physiological functioning in the intact human or animal in a form suitable for evaluation, recording or storage.

Automatic monitoring of physiological parameters relies heavily on electronics techniques and has been with us for a relatively short time. The advent of semiconductors and the relative ease with which miniaturization may be accomplished in circuits employing them accounts only partly for the interest in biomedical monitoring and the strides which we have witnessed. Schemes for monitoring physio logical information in an operational situation were entirely possible with vacuum tube techniques. The impetus for the recent progress in monitoring techniques has been provided by the advent of manned space flight. This report is concerned largely with biomedical monitoring as it applies to space flight.

555

Roman, J. A., B. H. Warren, J. I Niven, & A. Graybiel 1962 SOME OBSERVATIONS ON THE BEHAVIOR OF A VISUAL TARGET AND A VISUAL AFTER-IMAGE DURING PARABOLIC FLIGHT MANEUVERS (School of Aerospace Medicine, Brooks AFB, Texas) AFSC Project 7930, Task 59615; Navy Project MR005. 13-6001, Subtask 1, Rept. 64, SAM-TDR-62-66, June 1962, ASTIA AD-287 083

ABSTRACT: The apparent displacement of a real target and a visual after-image were observed in the F-100F aircraft during periods of weightlessness averaging 45 seconds. The experimental results are used as a background from which to reconcile apparent discrepancies between the findings of different investigators.

556

Roman, J.A., B.R. Warren, J.I. Niven & A. Graybiel 1963 SOME OBSERVATIONS ON THE BEHAVIOR OF A VISUAL TARGET AND A VISUAL AFTERIMAGE DURING PARABOLIC FLIGHT MANEUVERS
Aerospace Medicine 34(9): 841-846

ABSTRACT: On the basis of short intermittent exposure to accelerations above and below 1 G in high-performance aircraft, the direction of apparent displacement of a real target and a visual after image is summarized. A real target appears to be displaced upward from center for accelerations greater than 1 G positive, and appears to be displaced downward for accelerations lwss than 1 G positive. A visual afterimage, when observed in the absence of a real target, appears to be displaced from center in a direction opposite to that observed for a real target. (From Author's Summary)

557

Roman, J.A., B.H. Warren, A. Graybiel 1963 THE SENSITIVITY TO STIMULATION OF THE SEMICIRCULAR CANALS DURING WEIGHTLESSNESS.
(School of Aero. Med., Brooks AFB, Texas, and Naval School of Aviation Med., Pensacola, Fla.) Proj. MR005.13-6001, Task no. 793002, Subtask 1, SAM-TDR 62-148, February 1963.

ABSTRACT: The sensitivity to stimulation of the semicircular canals during periods of weightlessness averaging 46 seconds was estimated by timing the duration of apparent rotation of a visual target and of the subject's perception of rotation after stimulation. Stimulation was accomplished by rolling the aircraft during periods of subgravity as well as during 1-G control maneuvers. Time intensity relationships of the stimulus were obtained by means of specialized instrumentation incorporated into the experimental subject's crash helmet.

558

Roman, J. A., B. H. Warren & A. Graybiel 1963 OBSERVATION OF THE ELEVATOR ILLUSION DURING SUBGRAVITY PRECEDED BY NEGATIVE ACCELERATIONS
(USAF School of Aerospace Medicine, Brooks AFB, Texas) SAM-TDR-62-141 February 1963

ABSTRACT: By observing apparent displacements of a real target, and visual afterimages during weightlessness preceded by positive or negative acceleration it was possible to identify these displacements as a special case of the "elevator illusion," as opposed to the oculogravic illusion. Positive and negative linear acceleration, as well as weightlessness, was obtained for this purpose in jet aircraft.

559

Roos, C.A. 1959 BIBLIOGRAPHY OF SPACE MEDICINE
U.S. Armed Forces Med. J. 10(2): 172-217, Feb. 1959
See also: National Library of Medicine, Washington, D.C., Public Health Service Publ. No. 617, 1958.

ABSTRACT: This compilation of 446 references covers aspects of space medicine such as sealed cabin problems, acceleration and deceleration, fractional and zero gravity, cosmic radiations, nutrition in space flight, survival problems, psychological and social problems, ground crew problems, and extraterrestrial aspects. Entries are arranged chronologically starting with 1958 and going back as far as 1928.

560

Roscoe, S.N. April 1960 PERFORMING MAN-SIZED TASKS IN SPACE
1960 Proceedings of the Institute of Environmental Sciences, 365-368

ABSTRACT: Within the near future the science of manned space travel will have advanced to the point of warranting the performance of man-sized tasks in space. The performance of such diverse will require the man to leave the protective environment of the ferry vehicle or space station and operate independently in free space.

Much study has been devoted to the problems of extra-vehicular protective devices for space operations. Less study has been directed toward making it possible to perform man-sized tasks while wearing such devices in space. Of particular interest are the problems of (1) providing prime power and converting it to useful forms, (2) controlling position and attitude relative to other objects, (3) performing complex discrimination, manipulation and decision functions which in turn will require, (4) special means of controlling illumination, particularly glare, and dark-light adaptation.

561

Roth, E.M. 1955 MEDICAL ASPECTS OF TRAVEL IN OUTER SPACE
Harvard Med. Alumni Bull. 20(4): 10-13, July 1955

562

Rozenblium, D. 1959 PERED POLETOM CHELOVEKA V KOSMOS (Prior to the Flight of Man into Outer Space)
Meditsinskii Rabotnik (Moskva), 38 (1786):2, May 12, 1959
See also: "Prior to Sending a Man in Outer Space Ships" Central Intelligence Agency Scient. Inform. Rep., Sept. 18, 1959, pp. 46-50. (PB 131891T30)

ABSTRACT: In any manned flight into space in a hermetically sealed cabin an artifically maintained microclimate is required. The selection of a system of air regeneration will present relatively few difficulties, since as early as the late 1930's four Soviet scientists successfully endured a period of 100 hours in a sealed cabin with a simulated environment. The inadequacy and unreliability of the sensory organs due to high speed, radial acceleration, and weightlessness will require automatic devices for navigation and piloting. Prolonged transverse accelerations are well tolerated. The observation of animals in rocket flights and of Laika in Sputnik shows that respiration and circulation are not substantially distrubed by the weightless state. It is supposed that the initial symptoms of vertigo, disruption of fine motor coordination, and illusions disappear as the organism becomes adjusted to weightlessness. Meteors and short-wave untraviolet radiation are not regarded as serious threats. Information on the intensity of cosmic radiation obtained

563

Ryabchikov, Ye. 1962 IN THE CITY OF "THE CELESTIAL BROTHERS"
(Translation Services, Branch, Foreign Technology Div., Wright-Patterson AFB, Ohio)
FTD-TT-62-1583/1+4 9 Nov. 1962 ASTIA AD 292 600
Original Source: Pravda August 7, 1962. P. 4.

ABSTRACT: This article gives a brief description of the temperature chamber, pressure chamber, and silence chamber used in the training of Russian cosmonauts. It also describes the cosmonauts' experiences in the centrifuge, weightless basin, and the training panel.

564

Kublowsky, J. 1960 MAN IN A TUB.
Space World. 1: 14-15, July 1960

565

Ryker, N.J. 1962 MANNED SPACE FLIGHT
(North American Aviation, Inc., Space and Information Systems Division, Downey, Calif.) July 17-19, 1962.

ABSTRACT: Herein is described the major difference between several manned space flight missions and their effect upon the hardward design of spacecraft sub-systems.

WEIGHTLESSNESS

S

566

Saenger, E. 1949 THE LAWS OF MOTION IN SPACE TRAVEL
Interavia, 4:416

567

Salaznev, V.P. 1958 ISKUSSTVENNYY SPUTNIK ZEMLI (ARTIFICIAL EARTH SATELLITE) (Moscow: Oborongis, 1958)

ABSTRACT: On the basis of domestic and foreign, chiefly American sources, the author discusses the theoretical problems involved in the construction and launching of Soviet artificial satellites, specifically Sputnik I, the world's first. He indicates the path to be followed by scientists in solving the problem of conquering space, mentioning past and future difficulties, and pointing out the main problems the artificial satellites will solve. He reviews the successive stage in the conquest of space, beginning with the launching of the unmanned earth satellite and ending with the establishment of inetrplanetary space stations and the use of space ships. Several models of the earth satellite, celestial rockets, and space stations are described. The principles of control and celestial orientation of the artificial satellite during its orbital flight are reviewed, and a description is given of the most important instruments installed in the satellite. (CARI)

568

Schaefer, H. J. 1959 A NOTE ON THE GRAVITY-FREE STATE ON A SPACE PLATFORM. (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.48 29 Jan. 1959

ABSTRACT: The gravity-free state in a satellite is fully realized only in its center of gravity. A few meters off center, forces of the order of 10^{-6} G are felt. Though they are not likely to affect physiological or sensory functions, they do influence the motion of freely floating objects twisting their trajectories into tortuous paths. The consequences of this phenomenon for intersatellite transportation are discussed for the case that an object (consort) is thrown by hand from a satellite. The apparent motion of the object in the satellite reference system is analysed. It is shown that any desired displacement can be accomplished with various widely different launching speeds and directions. If the latter parameter is properly chosen, launching speeds of centimeters per second will produce displacement of many kilometers.

569

Schaefer, K.E., ed. 1962 ENVIRONMENTAL EFFECTS ON CONSCIOUSNESS. (New York: The MacMillan Co., 1962)

ABSTRACT: Proceedings of the First International Symposium on Submarine and Space Medicine, U.S. Submarine Base, New London, Conn., Sept. 8-12, 1958. Contents include:
Noell, W.K., Effects of High and Low Oxygen Tension on the Visual System;
Wing, K.G., Effects of Certain Environmental Changes Upon the Cochlear Response of the Cat;
Therman, P.O., Neurophysiological Effects of Carbon Dioxide;
Stein, S.N., The Neurophysiological Effects of Oxygen Under High Pressure;
Taylor, H.J., Neurophysiological Effects of Nitrogen;
Davis, H., The Problem of Consciousness;
Graybiel, A., Orientation in Space, with Particular Reference to Vestibular Functions;
Gerathewohl, S.J., Effect of Gravity-Free State;
Simons, D.G., The Break-Off Phenomenon During Balloon Flight in the Stratosphere;
Lilly, J.C., The Effect of Sensory Deprivation on Consciousness;
Schaefer, K.E., Effects of Carbon Dioxide on Consciousness;
Pugh, L.G.C.E., The Effect of Acute and Chronic Exposure to Low Oxygen Supply on Consciousness;
Behnke, A.R., Effects of Nitrogen and Oxygen on Consciousness;
Panel Discussion.

570

Schechter, H.B. 1960 SOME WEIGHT CONSIDERATIONS FOR MANNED LUNAR MISSIONS. American Rocket Society J. 30(2):195-197, Feb. 1960.

ABSTRACT: The total weight requirements for three possible types of manned, round-trip, soft-landing lunar missions are investigated, all starting out from a space station circling the earth at an altitude of about 350 miles. The first and second missions follow direct hit flight trajectories and employ chemical and nuclear power plants, respectively. Thrust magnitudes needed are determined by imposing an initial landing deceleration load factor of 3 earth g. The third mission makes use of a nuclear power plant as a sort of "ferry boat" to reach a circular orbit around the moon, whereas for the landing and ascent portions at the moon, the final payload is propelled by chemical rockets. After rendezvous with and attachment to the orbiting ferry boat, the payload is returned to the earth space station.

571

Schlei, E. J., P. L. Vergamini, and J. C. Simons 1962 SOME MOTION CHARACTERISTICS OF TETHERED FREE-FLOATING WORKERS
(Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio)
AMRL MEMO P-13 Oct. 1962

ABSTRACT: The freedom of movement of a free-floating and weightless operator who is tethered to a spacecraft is described. The purpose is to determine how a lifeline limits his six-degrees-of-motion freedom and, if limitations do exist, to suggest schemes by which he can be tethered with minimum restrictions. The operator's motion behavior as he soars along a tether stretched between two weightless masses is also described. The worker is found to be limited only by the amount of tether slack, and can rotate about any axis without limitation, provided the tether is attached to the intended axis of rotation. (N63-19092)

572

Schmeck, H. M., Jr. 1961 RUSSIAN SUBJECT TO HEAVY STRESS; FIRST MAN TO BE EXPOSED TO PROLONGED WEIGHTLESSNESS, A VITAL FACTOR IN SPACE.
New York Times, August 7, 1961, pp. 1, 6

ABSTRACT: The second Soviet astronaut has endured one trial in particular unlike anything any human has experienced before. This is a state of weightlessness lasting many hours. While many of the experiences of space flight can be estimated or simulated on earth or in the air, this is not true of long-term weightlessness. Reports from Moscow indicated that Maj. Gherman S. Titov's mental and physiological functioning was normal. One particularly important question is the effect of the heavy forces of re-entry into the atmosphere and landing on a person who has become accustomed, over a period of hours, to "zero G" or the state of weightlessness. The success with which the vehicle protects its occupant and maintains comfortable conditions for life will also, no doubt, be studied closely. (CARI)

573

Schock, G.J.D., 1957 SOME OBSERVATIONS ON ORIENTATION AND ILLUSIONS WHEN EXPOSED TO SUB AND ZERO GRAVITY. (Ph.D. Thesis, University of Illinois, Champaigne, Illinois.)

574

Schock, G.J.D., & D.G. Simons 1957 A TECHNIQUE FOR INSTRUMENTING SUB-GRAVITY FLIGHTS. J. Aviation Med. 28(6):576-582, Dec. 1957.
See also AFMDC TN 58-4, Feb. 1958.

ABSTRACT: Reduced data from flights conducted during the past year emphasize that individual pilots vary in their skill in obtaining the maximum duration of zero G

from each ballistic trajectory flown. Repeated flights using the technique described greatly increases pilot skill. The longest consecutive period of zero G obtained has been seven seconds. Periods of less than + 0.025G last for as long as 22.5 seconds, with intermittent periods of zero gravity of four to five seconds. Complete trajectories of less than +0.1 G for thirty seconds or more can be easily realized.

Incidental problems arising in the use of F-94 jet aircraft as test platforms in sub-gravity research has been: (1) loss of engine oil pressure, (2) loss of hydraulic fluid from the resevoir, and (3) loss of trim tab action. The loss of engine oil pressure lasts only during the zero G trajectory and is not harmful to the engine. The oil rises in the chamber during reduced gravity conditions causing a loss of hydrostatic pressure at the oil sump located in the bottom of the reservoir. This loss of pressure is reflected in the oil pressure indicating needle dropping to zero and remaining there as long as the oil is floating in the chamber. The same conditions prevail for the hydraulic fluid, except in the F-94, with returned longitudinal acceleration the fluid tends to flow out the overflow vent located at the top of the reservoir and is dumped overboard. The loss of trim tab action is explained in the overheating of the trim tab actuator motor due to loss of air currents in the zero G state. With returned air currents the trim tab actuator motor cools and become operational.

The equipment designed to instrument sub-gravity flights is uncomplicated and has the advantages of light weight and compactness. The complete package weighs less than 15 pounds and can be fitted easily in the observer's compartment of an F-94C aircraft.

Some of the more interesting observations of recent flights have been an incident of extreme vertigo and disorientation in a pilot with more than 3,000 flying hours observations on the behavior of different fluids under sub and zero-gravity conditions, and a high incidence of motion sickness. Preliminary experiments indicate that a study of fluid behavior under extended periods of true zero G will be valuable in the planning and design of future space vehicles

575

Schock, G. J. D. 1958 SENSORY REACTIONS RELATED TO WEIGHTLESSNESS AND THEIR IMPLICATIONS TO SPACE FLIGHT. (Air Force Missile Development Ctr., Holloman AFB, N. Mex.) Proj. 7851, AFMDC TR 58-6, April 1958; ASTIA AD-135 012

ABSTRACT: The implications of a sensory-starved environment are reviewed and compared to conditions that will prevail in actual space flight. Recommendations for training for future space flight are presented. It is conjectured that in periods of weightlessness of several hours, the highly motivated space traveler would probably cope with sensory deprivation effects; but in longer periods, when rest would be a necessity, much heavier stress would be put on the individual. Ability to operate efficiently in spite of this stress can best be assured by psychiatric evaluation of experiments in simulated space cabins.

576

Schock, G. J. D. 1958 APPARENT MOTION OF A FIXED LUMINOUS TARGET DURING SUB-GRAVITY TRAJECTORIES. (Air Force Missile Development Ctr., Holloman AFB, N. Mex.) AFMDC TN-58-3; ASTIA AD-135 009; Feb. 1958

ABSTRACT: The purpose of this study was to determine the effects of linear acceleration and deceleration found in flying a ballistic trajectory on the visual perception of a target in the dark. Four subjects observed a fixed luminous target while the pilot of an F-94 aircraft executed the ballistic trajectory. During increased forward acceleration and vertical-g force, the target appeared to move downward. The reverse occurred with deceleration and decreased vertical-g-force values. During weightlessness the target appeared to stabilize and oscillate up and down as the subject made excursions into negative g and positive subgravity states, respectively. (AUTHOR)

577

Schock, G. J. D., & D. G. Simons 1958 A TECHNIQUE FOR INSTRUMENTING SUBGRAVITY FLIGHTS. (Air Force Missile Development Ctr., Holloman AFB, N. Mex.) AFMDC TN 58-4; ASTIA AD-135 008; Feb. 1958

ABSTRACT: Instrumentation was designed to achieve the maximum duration of weightlessness using F-94C aircraft. Observations on the behavior of different fluids under subgravity and weightless conditions indicate a study under extended periods of true weightlessness is worthwhile for planning and designing future space vehicles. (AUTHOR)

578

Schock, Grover J.D. 1959 A STUDY OF ANIMAL REFLEXES DURING EXPOSURE TO SUBGRAVITY AND WEIGHTLESSNESS. (Air Force Missile Development Center, Holloman Air Force Base, N. Mex.) Report no. AFMDC TN-59-12; ASTIA AD-215 463; June 1959
See also Aerospace Med. 32:336-340, April 1961.

ABSTRACT: Normal cats exposed to weightlessness display loss of labyrinthine reflexes, disorientation and confusion, with and without visual cues. Cats in which the vestibular cortical area of the brain had been removed bi-laterally seemed to be less disoriented and confused than normal animals, but also display loss of labyrinthine reflexes. Bi-labyrinthectomized cats, however, are relatively unaffected by exposure to weightlessness and display no symptoms of serious disorientation and confusion. (Author)

579

Shock, G. J. D. 1959 PERCEPTION OF THE HORIZONTAL AND VERTICAL IN SIMULATED SUBGRAVITY CONDITIONS. (Air Force Missile Development Ctr., Holloman AFB, N. Mex.) AFMDC-TN-59-13, June 1959; ASTIA AD-215 464

ABSTRACT: Quantitative experiments show that in simulated sub-gravity conditions

with decreased proprioceptive input, perception of the horizontal and vertical is greatly impaired. During actual space flight artificial gravity forces may be needed to insure adequate human orientation during weightlessness.

580

Schock, G.J.D. 1959 AIRBORNE GALVANIC SKIN RESPONSE STUDIES: A PRELIMINARY REPORT
(Air Force Missile Development Center, Holloman AFB, New Mexico) Report No. TN 59-14, June 1959, ASTIA AD 215 465
See also Aerospace Med. 31:543-546, July 1960.

ABSTRACT: Galvanic skin responses are not affected by weightlessness but instead may be attributed to emotional factors.

581

Schock, G.J.D. 1960 PERCEPTION OF THE HORIZONTAL AND VERTICAL IN SIMULATED SUBGRAVITY CONDITIONS. Reprint USAF Medical Journal 11(7):786-793.

ABSTRACT: This investigation was conduted with the aim of ascertaining the role played by the labyrinth in the perception of the body position in subgravity conditions. The subject was seated in a special rotating chair and had to orient a fluorescent rod in a dark room without any reference marks, according to his own evaluation of the true horizontal and vertical. The error relative to the real coordinates was measured with a special device. the tests were carried out under the following conditions: (1) head inclined to the left at 45° (upheld by a special support); (2) body inclined to the left at 42°; (3) body inclined to the left at 28°; (4) seated, with head and trunk erect. The tests were executed on the ground and in the water.

582

Schock, G.J.D. 1960 AIRBORNE GSR STUDIES; A PRELIMINARY REPORT
Aerospace Medicine 31(7): 543-546 June 1960

ABSTRACT: Evidence gained from subjects exposed to pre-weightlessness accelerations and weightlessness suggest changes in GSR and heart rate to be due to emotional factors rather than to weightless or positive G. Instrumentation techniques for high performance aircraft are presented for measuring GSR and heart rate of human subjects.

583

Schock, G. J. D. 1961 A STUDY OF ANIMAL REFLEXES DURING EXPOSURE TO SUBGRAVITY AND WEIGHTLESSNESS.
Aerospace Medicine 32(4):336-340, April 1961.

ABSTRACT: Several experiments were conducted to study the role of the vestibular apparatus during stakes of subgravity and weightlessness. Six cats were observed: two unoperated, two bilabyrinthectomized, and two with the vestibular cortical area of the brain removed bilaterally. Postural reflex activity of these animals was recorded on the ground and during straight and level flying (normal g conditions), and during ballistic trajectory flight (subgravity and weightless conditions). Comparisons of the responses to the various tests, with eyes open and eyes covered, were compared. (Tufts)

584

Schocken, K. 1959 THE ELECTROCARDIOGRAM IN THE ABSENCE OF GRAVITY.
(Thermodynamics Section, Research Projects Laboratory, DOD, Army Ballistic Missile Agency, Redstone Arsenal, Ala.) DV-TN-4-59; 13 Feb. 1959

585

Schocken, K., & S.J. Gerathewohl 1960 A QUANTITATIVE EVALUATION OF THE ELECTROCARDIOGRAMS OF TWO SQUIRREL MONKEYS UNDER CHANGING CONDITIONS.
(Army Ballistic Missile Agency, Redstone Arsenal, Alabama)
Rept. No. DV-TN-12-60.

ABSTRACT: The following cardiodynamic effects of changes of the gravitational force have been previously observed: (1) a marked increase in cardiac rate occurs in almost all subjects during acceleration and deceleration periods, (2) the electrocardiogram is generally normal in the zero-G state, (3) the heart rate is increased and unstable during post-acceleration weightlessness, (4) transient changes may occur in the electrocardiogram if the state of the gravitational field changes, (5) the steady cardiodynamic state seems to be the same for zero G as for the one G condition, (6) increased G loads lead to the condition of physiological stress, (7) the absence of G-forces is a mechanically stressless condition, (8) the stresses imposed by acceleration and the condition of weightlessness encountered in aircraft and missile flights are within the range of tolerance of the human and animal organism. These cardiodynamic effects are confirmed by the electrocardiographic findings of the 2 bioflights of monkeys. A rigorous statistical evaluation of the limits of normality, in a similar manner as was carried out previously in humans, is possible and can be performed as soon as sufficient statistical material is available

586

School of Aviation Medicine 1959 REPORTS ON SPACE MEDICINE - 1958
(School of Aviation Medicine, Randolph AFB, Texas)

ABSTRACT: A series of articles and reports by research scientists at the School of Aviation Medicine, USAF, including:

1. Human Performance in the Space Travel Environment, George T. Hauty
2. Supersonic and Hypersonic Human Flight, Julian E. Ward, Siegfried J. Gerathewohl and George R. Steinkamp
3. Human Engineering of the Sealed Space Cabin, Julian E. Ward and George R. Steinkamp
4. Fatigue, Confinement, and Proficiency Decrement, George T. Hauty and R.B. Payne
5. The Feasibility of Recycling Human Urine For Utilization in a Closed Ecological System, Willard P. [illegible]

587

Schubert, G. & H. Kolder 1961 FACTOR ANALYSIS OF SPACE ORIENTATION
Rev. Med. Aero (Paris) 2:179-180, Dec. 1961. (Fr)

588

Schubert, G. and H. Kolder 1962 FACTOR ANALYSIS OF SPACE ORIENTATION
In Riv. Med. Aero. 25:64-77, Jan.-March 1962. (Italy)

589

Schwartz, E. W. 1961 LIQUID BEHAVIOR INVESTIGATIONS UNDER ZERO AND LOW G CONDITIONS. In Benedikt, E. T., ed. Weightlessness-Physical Phenomena and Biological Effects. (New York: Plenum Press, 1961) pp. 102-110.

590

Schwichtenberg, A.H. 1960 SPACE MEDICINE AND ASTRONAUT SELECTION
Minnesota Med. 43(12): 797-812 Dec. 1960

ABSTRACT: In a manned space flight project, there is an interdependence in the fields of medicine, design engineering, and human engineering. The author describes the physical tests given during the selection of astronauts. He suggests that the knowledge and experience gained from research in aviation medicine be applied to the general medical practice.

591

Schwichtenberg, A.H. 1961 MEDICAL ASPECTS OF SPACE FLIGHT
Ann. Rev. Med. 12: 299-322, 1961

ABSTRACT: A great deal of research has been conducted in the field of space flight travel. However, the application of the knowledge gained from the research has been slow because of the lack of communication among the scientists engineers, and physicians. There are many medical implications that can be attributed to various flight stresses. The author discusses the flight stresses as well as commenting on selection of astronauts, function of man in space, and man-machine relationships.

592

Seale, L.M. & R.E. Flexman 1961 RESEARCH ON A SELF-MANEUVERING UNIT FOR ORBITAL WORKERS
In: Proceedings of the IAS Aerospace Support and Operations Meeting, Dec. 4-6, 1961 (Instit. of Aerospace Sciences, Inc., New York; assisted by IAS Aerospace Technology Panel of the I.A.S. Aerospace on Support, Orlando, Fla.)

ABSTRACT: Maintenance activities required of an orbital worker and the systems that are necessary to support him in the predicted environments are studied extensively.

Three major subsystems which comprise the orbital worker self-maneuvering system are: (1) life support systems (all equipments and structures required to sustain life), (2) support equipments (tools and other equipments necessary for the successful completion of orbital maintenance activities), and (3) propulsion, stability and control systems.

593

Segal, H. 1954 SPACE MEDICINE
J. South African Interplanetary Society 24-29, April-Sept. 1954

ABSTRACT: Medical problems under weightless conditions outside the earth's gravitational field in terms of selection of the crew, take-off, flight, landing, and life on the objective.

594

Sells, S. B., & C. A. Berry, eds. 1961 HUMAN FACTORS IN JET AND SPACE TRAVEL
(New York: Ronald, 1961)

CONTENTS:

Graybiel, A., Medical Aspects of Jet and Space Travel,
Hale, H. B., Natural Environment and the Environment of Flight,

Hekhuis, G. L., Radiobiology and the Environment of Flight,
Wilbanks, W. A., Basic Aspects of Skilled Performance,
Matheny, W. G., Human Operator Performance Under Non-normal Environmental Operating Conditions,
Sells, S. B., Group Behavior Problems in Flight,
Berry, C. A., Human Qualifications for and Reactions to Jet Flight,
Sells, S. B., & C. A. Berry, Human Requirements for Space Travel,
Norton, J. A., Protective Medicine in Jet and Space Flight,
Moseley, H. G., Air Craft Accidents and Flight Safety,
Hanks, T. G., Human Factors Related to Jet Aircraft,
Clamann, H. G., The Engineered Environment of the Space Vehicle,
Mayo, A. M., Operational Aspects of Space Flight,
Webb, H. B., Speculations on Space and Human Destiny.

595

Semotan, J. 1961 VYZAM DUSEVNI HYGIENY V ASTRONAUTICE (THE IMPORTANCE OF MENTAL HYGIENE IN ASTRONAUTICS)
Cekoslov. Psychiat. (Prague) 57(1): 61-69, Jan. 1961. In Czech, with English summary.

ABSTRACT: Possible damage to the mental facilities of astronauts during space flight is discussed in this article. The dangerous influences include weightlessness, acceleration and deceleration, noise, vibration and isolation. The author suggests a psychogenic approach to the selection of spacemen. He also describes the present and future research for the preservation and development of mental health in the space crew.

596

Sewall, H. 1946 THE CLINICAL RELATIONS OF GRAVITY AND CIRCULATION
Amer. J. Med. Science 151:491

597

Sharp, E. D. and C. W. Sears 1963 WALKING UNDER ZERO-GRAVITY CONDITIONS USING VELCRO MATERIAL
(Aersopace Medical Div. Aerospace Medical Research Labs. (6570th) Wright-Patterson AFB, Ohio)
AMRL MEMO P-23 Jan. 1963

ABSTRACT: The purpose of this study is to evaluate man's ability to walk under conditions of weightlessness while using Velcro materials as a means of maintaining surface contact. Velcro consists of two mating pieces of fabric: a hook portion containing many mylon hooks, and a mating material, pile, consisting of many small mylon eyes or loops. When the two materials are pressed together, the hooks engage in the eyes and the two portions

adhere. It was concluded from the study that: (1) Velcro material, applied to a maximum-area, flexible shoe with a resilient, flat sole, appears to hold some promise as an aid to weightless walking; (2) under the conditions of this study, the body posture that permitted the most successful walking gait was a crouched position, knees bent and the upper portion of the body bent forward. This posture apparently best enables the center of mass of the body to maintain a straight line path parallel to the walking surface; and (3) subject-induced motions appear to play a definite part in attaining a good walking gait. Swinging the arms, the velocity with which the legs are raised off the floor, and the technique that is used in separating the Velcro material on the shoes from that on the walkway all play a part in the success or failure of maintaining useful contact with the walking surface. (N63-19093)

598

Shaw, R.F. & N.B. Marple 1961 METHODS OF DETERMINING BLOOD FLOW THROUGH INTACT VESSELS OF EXPERIMENTAL ANIMALS UNDER CONDITIONS OF GRAVITATIONAL STRESS AND IN EXTRA TERRESTIAL SPACE CAPSULES. (Columbia Univ., College of Physicians and Surgeons: Electronics Research Labs., New York) Status rept. no. P-1/168, Rept. no. CU-1-61-NASA-112-PS/ERL, 1 May 1961

ABSTRACT: The following work is described: (1) technical development of blood flowmeter instrumentation; (2) surgical considerations related to special problems of chronic implantation of flowmeter probes; (3) study of the relationship between levels of blood flow and organ activity.

599

Shepard, A.B., Jr. 1961 PILOT'S FLIGHT REPORT, INCLUDING IN-FLIGHT FILMS (Paper, Conference on Results of the First U.S. Manned Suborbital Space Flight, June 6, 1961, NASA, Washington, D.C.) Pp. 109-116

600

Shternfel'd, A. 1958 ARTIFICIAL SATELLITES.
(Trans. of a book published by State Publishing House of Technical Literature, Moscow, 1958) LC or SLA PB 141351T.

601

Shternfeld, Ari. 1959 MAN IN COSMIC SPACE
Soviet Space Science (New York: Basic Books, 1959) pp. 163-189

ABSTRACT: Presents an excellent, simplified discussion of work and life under conditons of weightlesness. Defines G-force for the layman.

602

Shternfel'd A. 1959 OT ISKUSSTRENNYKH SPUTNIKOV K MEKHPLANETNYM POLETAM (FROM MAN-MADE SATELLITES TO INTERPLANETARY FLIGHTS) Gosudarstvennoye Izdatel'stvo Fiziko-Matematicheskoy Literatury (Moscow), 1959 (Aerospace Technical Intelligence Ctr., Wright-Patterson AFB, Ohio) Trans. No. MCL-1301, 18 Sept. 1961. ASTIA AD 264 626

ABSTRACT: The launching of an automatically controlled rocket to Venus will enable scientists to obtain valuable scientific data. But more data will be supplied by flights around Venus, especially the flight of a manned rocket. At a definite trajectory the cosmic rocket after flying around the celestial body will automatically return to the point of take-off, traveling on inertia without any fuel consumption. That is why flights of people around Venus will be easier and sooner than the flight with landing on the surface of Venus with return to Earth. But the flight around Venus is a considerably more difficult problem than the flight around the Moon. In the latter case, the rocket is preferably in the terrestrial field of gravitation. Having overtaken the Moon, it will come back to Earth. But when a cosmic rocket will fly in the direction of Venus then at a relatively short distance from the Earth it will fall into the field of gravitation of the Sun

603

Shurley, J. T. 1960 PROFOUND EXPERIMENTAL SENSORY ISOLATION Am. J. Psychiat. 117(6):539-545.

ABSTRACT: This is a description of the sensory deprivation experiments conducted at Oklahoma City Veterans Administration Hospital. In order to simulate weightlessness, the subject was placed in a large tank filled with water slowly flowing at a constant temperature. The rest of the system consisted of automatic controls and continuous tape recorders. The subjects were volunteers who had been pre-selected on the basis of capacity for memory, ability to communicate freely, and self-observation. Light, sound, vibration, odor, and taste inputs were highly restricted. The chronological report is based on tape recordings by a subject in isolation for 4 1/2 hours. The water immersion test was not perceived as unpleasant. The subjects feeling states varied during post-exposure.

604

Siegel, R. 1961 TRANSIENT CAPILLARY RISE IN REDUCED AND ZERO-GRAVITY FIELDS American Society of Mechanical Engineers Transactions, Series E 28:165-170 June 1961

ABSTRACT: Experimental information given on the transient "capillary" rise of water into vertical tubes subjected to reduced and zero-gravity fields. The response in a low-gravity environment is of interest in studying the behavior of liquid systems for space vehicles.

605

Simons, D. G. 1955 REVIEW OF BIOLOGICAL EFFECTS OF SUBGRAVITY AND WEIGHTLESSNESS. Jet Propulsion 25(5):209-211, May 1955

ABSTRACT: Disorientation and discoordination resulting from exposure to subgravity and weightlessness depend upon the response of the sensory modalities of equilibrium, vision, and kinesthesis. These modalities are influenced by altered stimulus-sensation responses, illusions, and sensory inconsistencies. Experimental evidence of disorientation and discoordination due to exposure to subgravity and weightlessness is cited from both animal and human experiments. It is concluded that the vestibular apparatus plays a critical role in the physiological and psychological responses to subgravity exposure. The experimental evidence available to date suggests that incapacitating disorientation may occur under specific conditions. (AUTHOR)

606

Simons, D. G. 1956 REVIEW OF BIOLOGICAL EFFECTS OF SUBGRAVITY AND ZERO-GRAVITY (American Rocket Society) ARS 139-54, Circa 1956

ABSTRACT: Disorientation and discoordination resulting from exposure to subgravity and zero-gravity depend upon the response of the sensory modalities of equilibrium, vision, and kinesthesis. These modalities are influenced by altered stimulus-sensation responses, illusions, and sensory inconsistencies. Experimental evidence of disorientation and discoordination due to exposure to subgravity and zero-gravity is cited from both animal and human experiments. It is concluded that the vestibular apparatus plays a critical role in the physiological and psychological responses to sub-gravity exposure. The experimental evidence available to date suggests that incapacitating disorientation may occur under specific conditions. (AUTHOR)

607

Simons, D. G. 1957 APPLICATIONS OF SATELORB (SATELLITE SIMULATING OBSERVATION AND RESEARCH BALLOON). (Presented under the auspices of The American Rocket Society at the 8th International Astronautical Congress, Barcelona, Spain, 6-12 October 1957)

608

Simons, D.G. 1958 AREAS OF CURRENT SPACE MEDICAL RESEARCH
In Alperin, M., M. Stern, & H. Wooster, eds, Vistas in Astronautics: Proceedings of the First Annual AFOSR Astronautics Symposium (New York: Pergamon Press, 1958) pp. 299-303, Part 6, Human Factors

ABSTRACT: Effects of heavy-ray particles, the design of sealed cabins, the effects of weightlessness, and the problems of reentry into the atmosphere are briefly discussed.

609

Simons, D. G. 1961 SUBGRAVITY AND WEIGHTLESSNESS. (In Gauer, O. H. and G. D. Zuidema, eds., Gravitational Stress in Aerospace Medicine) (Boston: Little, Brown, and Co., 1961). Pp. 189-201

610

Simons, J. C. 1959 PRELIMINARY FLIGHT TEST REPORT - IN-FLIGHT STUDY OF MAGNETIC SHOES FOR ORBITAL WORKERS. (WADC, Wright-Patterson AFB, Ohio) 9 Jan. 1959

611

Simons, J.C. 1959 PRELIMINARY FLIGHT TEST REPORT, PROJECT SKYHOOK. INFLIGHT STUDY OF STABILIZATION UNIT FOR ORBITAL WORKERS
(Wright Air Development Center, Aerospace Medical Lab., Wright-Patterson AFB, Ohio) June 29, 1959

612

Simons, J. C. 1959 WALKING UNDER ZERO-GRAVITY CONDITIONS
(Wright Air Development Ctr., Wright-Patterson AFB, Ohio)
WADC TN 59-327, Oct. 1959; ASTIA AD-232 469

ABSTRACT: This is the first report on experiments with permanent magnetic sandals which enable a man to walk with an approximately normal gait under weightless conditions. All four subjects reported an immediate spatial orientation of "down" being where their feet were, as soon as their body rotation stopped. A basic index was formulated to define magnetic requirements in terms of the inductive forces required to hold a subject stationary. A vector analysis of the 1 g walking gait is made.

613

Simons, J.C. & M.S. Gardner 1960 SELF-MANEUVERING FOR THE ORBITAL WORKER. (Wright Air Development Center, Wright-Patterson AFB, Ohio) WADD Tech. Report. 60-748. Dec. 1960. ASTIA AD 252 125.

SUMMARY (a): Various self-propulsion and stabilization systems have been flight-tested under weightless conditions. The capability of these systems is reviewed. After analyzing the basic motion and orientation problems of the orbital worker, requirements for an optimum propulsion and stabilization system are discussed.

614

Simons, J. C., & M. S. Gardner 1961 FREE FLOATING SENSATIONS AND PERFORMANCE In 1961 Proceedings of the Institute of Environmental Sciences National Meeting, April 5, 6, 7, 1961, Washington, D. C. (Mt. Prospect, Ill.: Institute of Environmental Sciences, P. O. Box 191) pp. 371-378

CONCLUSIONS: A general design criterion is proposed from the many conclusions found in the table: i.e. The orientation of the designer should be pointed toward the use of the gravity-free environment as a focus. Earth oriented, behavior should not be forced into the g-free state.
The first consideration for developing hardware and optimizing performance should be the appreciation, acknowledgment and USE of weightless behavior. Restrictions and control of motion will be required; however, the potentiality of a g-free man as the most intimate man-vehicle ever conceived should guide all of our applications. The freefloater is indeed both man and machine, vehicle and driver in one. (AUTHOR)

615

Simons, J.C. & W.Kama 1962 A REVIEW OF THE EFFECTS OF WEIGHTLESSNESS ON SELECTED HUMAN MOTIONS AND SENSATIONS.
(6570th Aerospace Medical Research Laboratories, Aerospace Medical Div., (AFSC) Wright-Patterson AFB, Ohio) April 1962. ASTIA AD 282 116

ABSTRACT: The motions of the weightless free-floating worker are discussed in terms of an operator performing maintenance and supply functions between, upon, and within space vehicles. A postural coordinate system is used as a basic reference and current USAF studies concerned with rotating and translating the system are reviewed. Study techniques include physical analyses of the motions, inflight validation of the analyses and mathematical projections of probable orbital motions. Sensations to these motions and the ability to handle inertial objects is also discussed.

The motion freedom of the unencumbered surface-free worker revealed many restraint requirements and such designs as lifelines, adhesive foot-gear and self-maneuvering units are introduced to limit and control his motions. These designs are being used to determine human factor criteria for space hardware and to suggest crew selection and training procedures.
The effects of transient weightlessness on sensory, psychomotor, and motor functions have revealed minor effects; however, the perception of the postural vertical and the response of the circulatory system to the return of positive gravity are considered as pertinent problems.

616

Simons, J. C. and M. S. Gardner 1963 WEIGHTLESS MAN: A SURVEY OF SENSATIONS AND PERFORMANCE WHILE FREE-FLOATING (FINAL REPORT, OCT. 1960-FEB. 1961).
(Aerospace Medical Div. Aerospace Medical Reserach Labs. (6570th). Wright-Patterson AFB, Ohio)
AMRL-TDR-62-114 March 1963

ABSTRACT: The effect of surface-free behavior on work performance in space

has been investigated to determine what techniques should be developed to aid the orbital workers. While they performed gross motor activities under weightless conditions, subjects reported their sensory and performance experiences during Keplerian parabolas in a C-131B aircraft, in both lighted and dark cabin conditions. Their experiences were categorized into sensation influences upon orientation and body-motion influences upon body attitude and position control. Unique examples of short-term weightless behaviors were found, and their causes are briefly discussed. Potential applications of these weightless responses to hardward development and to crew training and selection are discussed, and significant areas for future research are proposed. (Author)

617

Simons, J.D., Jr. April 1960 EFFECTS OF EXTREME ALTITUDES, AND THE NEED FOR SIMULATION
1960 Proceedings of the Institute of Environmental Sciences, 5-10

618

Sinnamon, E.G. & W.S. Wray 1962 BIBLIOGRAPHY OF AVIATION MEDICAL ACCELERATION LABORATORY PUBLICATIONS, 1950-1960
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-6211, Sept 27, 1962

ABSTRACT: A bibliography with abstracts and indices is presented which covers all of the published work of the Aviation Medical Acceleration Laboratory during its first decade, 1950-1960. The primary facility at this laboratory is the 50-foot radius human centrifuge with its gimbal-mounted gondola. This device is capable of producing acceleration levels up to 40 G and with computer control can realistically simulate flight profiles of air and space vehicles. The subject matter covered by the publications includes aviation and space medicine, the effects of acceleration on the animal and human organism, human performance under acceleration stress, dynamic stimulation of aircraft and space vehicles, biochemistry, physiology, psychology, and engineering. Included are formal reports, progress reports and articles which appeared in the open literature. The material is coded and grouped under subject headings and indexed by author, title and report number or journal citation. ASTIA numbers are given for all reports available under that system.

619

Sisakyan, N. 1961 MANNED SPACE FLIGHT PROBLEMS DESCRIBED
FBIS, USSR & East Europe, Nr. 145, July 28, 1961

ABSTRACT: Successful completion of a series of experiments with satellite ships made it possible to start preparing for man's flight into space. Results of research have shown that the limits of endurance could be considerably expanded,

620

Sisakyan, N. 1961 . MAN AND SPACE
Pravda 85(15575): 6, 26 March 1961
(Aerospace Technical Intelligence Center, Wright-Patterson AFB, Ohio)
Trans. No. MCL-1149, 27 July 1961 ASTIA AD 261 823

ABSTRACT: Soviet science and technology never ceases to amaze mankind with its ever increasing achievements in the study of space. On March 25 the fifth sputnik, weighing an impressive 4695 kilograms and carrying a four-legged cosmonaut -- the dog Zvezdochka -- and other biological specimens, was launched from the Soviet Union and returned again, on the same day, to a pre-selected landing site, by a command from the ground. The attention of the entire world is attracted to the flights of Soviet space ships, the outstanding results of our scientists when investigating outer space. This Soviet and world interest is due mainly to the fact that each such flight enriches science with new important facts on the rules that govern the influence of space conditions on living organisms, gives valuable information on the operation of the multitude of complex research instruments, automatic devices and the equipment of the spaceship. We are acquiring ever newer information on the unknown depths of space. Finally, we are getting a clear concept of the increasing power of our rocket systems, capable of sending increasingly heavier ships into space with unfailing accuracy

621

Sisakian, N.M., O.G. Gazenko & A.M. Genin 1961 NEKOTORYE PROBLEMY KOSMICHESKOI BIOLOGII (SOME PROBLEMS OF SPACE BIOLOGY)
Zhurnal obshchei biologii (Moskva) 22(5): 325-332, Sept.-Oct. 1961
English Translation: (Office of Technical Services, U.S. Dept. Commerce)
U.S. Joint Pub. Research Serv., Washington, No. 12097 (CSO:6503-N) Jan. 23, 1962

ABSTRACT: The field of space biology is reviewed in regard to three basic problems: (1) the effects of extreme conditions of space on terrestrial organisms, (2) the biological bases for support of space flights and life on other planets, and (3) extraterrestrial forms and conditions of life. Suggestions for partial or complete regenerative cycles in space ships include: regenerative cycle of water by physical or physico-chemical methods, oxygen regeneration by electrolysis of water or biochemical conversions by means of anaerobic bacteria, and food regeneration by chemical synthesis of basic biochemicals with subsequent biosynthesis. The more feasible method seems to be utilization of photosynthetic processes of unicellular algal suspensions. Speculations on exobiology discuss hypotheses of the ecosphere of the sun, and interstellar migration of microorganisms in light of some suggestive findings concerning the composition of meteorites. (Aerospace Medicine 33(8): 1029-1030, Aug. 1962)

622

Sisakyan, N.M. & V.I. Yazdovskiy 1962 PHYSIOLOGICAL RESPONSES OF COSMONAUTS DURING SPACE FLIGHT
(Aerospace Information Division, Washington, D.C.) AID Rept. No. 62-202
Dec. 19, 1962 ASTIA AD 294 572
Original source: Pervyye Kosmicheskiye Polety Cheloveka (First Space Flights of Man) Moskva, Ozd-vo AN SSSR, pp. 176-198

provided one makes intelligent use of the organism itself, and even moreso of the proper technical means. The state of weightlessness is considered one of the characteristic factors of space flight. Expériments carried out on animals which were returned to earth proved that their 24-hour period in a state of weightlessness had no negative effect on their main functions. When a very careful analysis was carried out, some slight changes in the activity of the blood circulation apparatus had been discovered. (CARI)

623

Sisakyan, N., V. Parin, V. Chernigovskiy & V. Yazdovskiy 1961 SPACE BIOLOGY MEETING
FBIS USSR & East Europe, Nr. 192, Oct. 4, 1961

ABSTRACT: This is a report on the general meeting of the biology department of the U.S.S.R. Academy of Sciences and of the papers presented at that meeting. The authors stress the fact that all of the studies of outer space conducted by Soviet scientists have been for peaceful purposes exclusively. They also state that the young science of space biology gives rise to its own specific methods of research, differing basically from conventional ones. These are methods of biological radiotelemetry and new techniques of experimentation, automatically affected by special instruments according to a predetermined program. The report furnished certain data obtained by Soviet scientists and lists some of the problems to be solved by space biology such as weightlessness and radiation effects. A new science, exobiology, examines the pecularities of extraterrestrial forms of life on the planets of the solar system. The author of another paper found that the physiological, biochemical, morphological, and immunological changes registered in experimental objects after space flights, proved to be of reversible nature. They did not show specific effects of cosmic radiation, weightlessness, and g-forces. The best explanation is that these changes were the organisms' generalized reaction to a complex irritant. (CARI)

624

Sisakyan, N.M. 1961 BIOLOGIIA I KOSMICHESKIE POLETY (BIOLOGY AND SPACE FLIGHT) Priroda (1): 7-16, 1961
See also: "Soviet Literature on Life Support Systems", Air Information Division, Wright-Patterson AFB, Ohio. AID Report 61-59 April 28, 1961 ASTIA AD 256 235

ABSTRACT: Soviet experiments with animal-bearing rockets show that at heights of 78-85 km and speeds of 2,000 km/hr or at 39-46 and 4,100 km/hr catapulting is the reliable emergency escape method and causes no great functional disturbances in the animal. It has also been found that 3-10 minutes of weightlessness causes no great functional lesions to the animals cardiovascular or respiratory system. Experiments indicate that the body can more easily withstand the transition from acceleration to weightlessness than the reverse. No changes, genetic or otherwise, have so far been noted in the bacteria and phages contained in the second Soviet space ship. (CARI)

625

Sisakyan, N.M. & V.I. Yazdovskiy 1962 METHODS AND TECHNIQUES OF BIOMEDICAL CONTROL IN SPACE FLIGHT
(Aerospace Information Division, Washington, D.C.) AID Report No. 62-201, Dec. 19, 1962. ASTIA AD 294 573
Original Source: Pervyye Kosmicheskiye Polety Cheloveka (First Space Flights of Man) Moskva, Izd-vo AN SSSR, pp. 167-174

ABSTRACT: Physiological measurements performed on Vostoks I and II included electrocardiography (with two sets of leads), pneumography, and registration of pulse rate. In addition, kinetocardiography was performed on Vostok II. The pulse rate was monitored continuously by means of a cardiophone which transformed the R peaks of electrocardiographs into rectilinear pulses of 0.1 to 0.2 sec duration. These were modulated by an auditory frequency of 3 kc and were transmitted continuously by a signal transmitter on a frequency of 19.95 mc. Other measurements were transmitted periodically. During reentry all physiological parameters were registered by means of a self-contained onboard system. After ejection of the cosmonaut, registration was carried on by means of a self-contained device located on his person. Transmitted data on pulse frequency was recorded on undulating and on magnetic tapes. (Author)

626

Sisakyan, N.M. & V.I. Yazdovskiy 1962 RESULTS OF POSTFLIGHT MEDICAL EXAMINATIONS OF G.S. TITOV
(Aerospace Information Division, Washington, D.C.) AID Report No. 62-204 Dec. 19, 1962 ASTIA AD 294 571
Original Source: Pervyye Kosmicheskiye Polety Cheloveka (First Space Flights of Man) Moskva, Izd-vo AN SSSR pp. 125-153

627

Sisakyan, N.M., V.V. Parin et al. 1962 PROBLEMS OF SPACE BIOLOGY AND PHYSIOLOGY
(Joint Publications Research Service, New York) JPRS-16083, Nov. 7, 1962 ASTIA AD 299 909

628

Sisakyan, N.M. 1963 PROBLEMS OF SPACE BIOLOGY (PROBLEMY KOSMICHESKOY BIOLOGII)
(Foreign Tech. Div., Air Force Systems Command, Wright-Patterson AFB, Ohio) Trans. No. FTD-MT-62-78 ASTIA AD 299 677
Original Source: Izadtel'stvo Akademii Nauk SSSR pp. 1-462

ABSTRACT: Experimental and theoretical works carried out chiefly within the last years, are presented. The first part includes theoretical and survey articles, encompassing the main problems of cosmic biology and giving general

presentation concerning results and perspective of researches. The second part is devoted to an account of the results of experimental researches conducted under the conditions of real space flights on ships-satellites in 1960-1961. The third part summarizes the results of the biological experiment on the second artificial satellite of the Earth with the dog Layka -- the experiment which searches in the cosmos. In the fourth part are entered experimental laboratory and methodic works. (Author)

629

Slager, U.T. 1962 SPACE MEDICINE
(Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1962)
Library of Congress Catalog Card No. 62-12491

ABSTRACT: Contents include papers on the following subjects: "The Concept of Space Flight"; "Development of the Space Vehicle"; "The Concept of Space Medicine" "Pressure and Oxygen in the Upper Atmosphere and Space"; "Meteoritic Material in the Upper Atmosphere and Space"; "Experimental Space Simulation"; "The Biological Effects of Low Pressure"; "The Temperature During Flight in the Atmosphere"; "The Temperature During Orbital Flight"; "Experimental Space Simulation"; "The Biological Effects of Temperature Variations"; "Radiation in Space"; "Experimental Space Simulation"; "Interaction of Electromagnetic Radiations With Matter"; "The Biological Effects of Non-Ionizing Radiation"; "Ionizing Radiations in Space"; "Experimental Space Simulation"; "Mode of Action of Ionizing Radiations"; "The Biological Effects of Ionizing Radiation"; "Dynamics of Space Flight"; "Experimental Simulation of Space Flight Acceleration"; "The Biological Effects of Acceleration"; "The Dynamics of Weightlessness"; "The Experimental Simulation of Weightlessness"; "The Biological Effects of Weightlessness"; "Noise and Vibration in Space Flight"; "Experimental Space Simulation"; "The Biological Effects of Sound and Vibration"; "Metabolic Requirements in Space"; "Experimental Space Simulation"; "The Biological Effects of Life Support Systems Imbalance"; "Life-Support Systems"; "Ionizing Radiation"; "Particulate Matter"; "Toxic Chemical Compounds"; "Psychological Stress in Space" "Experimental Space Simulation"; "Psychological Effects of Space Flight"; "The Space Environment"; and "Biology of Far Space".

630

Slater, A. E. 1950 THE BALANCING MECHANISM OF THE INNER EAR
J. Brit. Interpl. Soc. 9:18-23

631

Slater, A. E. 1952 SENSORY PERCEPTION OF THE WEIGHTLESS CONDITION
Ann. Report Brit. Interplanet. Soc. :342-348

632

Slater, A. E. 1952 SENSORY PERCEPTIONS OF THE WEIGHTLESS CONDITION
In Kölle, H. H., ed., Probleme aus der astronautischen Grundlagenforschung (Vortrage gehalten anlasslich des III Internationalen Astronautischen Kongresses in Stuttgart, vom 1 bis 6 September 1952) (Stuttgart: Gesellschaft fur Weltraumforschung, 1952) pp. 219-225
See also Brit. Interpl. Soc., 1952, pp. 342-348
See also In Carter, L. J., ed., Realities of Space Travel (London: Putnam, 1957) pp. 266-274

ABSTRACT: Human organisms can function without the three following sensations of gravity: (1) tension in the muscles used for balancing (2) sensation of pressure against any support, and (3) weight and pressure of internal organs. The fourth sensation of gravity is mediated by the otolith organs, which provides information of directions, changes in direction, of gravitational pull or any other linear acceleration. During weightlessness, it is possible that the message to the brain from the otoliths may result in contradictory messages. Many experiments had caused many investigators to believe that the real function of the otoliths is not the transmission of information but (a) the resulation of muscles for maintenance of equilibrium, and (b) the regulation of eye movements during changes in position of the head to facilitate continuous fixation of objects

633

Slater, A.E. 1957 THE PROBLEM OF WEIGHTLESSNESS
Spaceflight 1(3):109-113, April 1957.

ABSTRACT: Weightlessness is discussed as it relates to: (1) vision; (2) bodily sensations, including pressure on the skin where it takes the weight, tension of the muscles used in balancing, and pressure of internal tissues on each other due to weight; and (3) the balancing organs of the inner ear. Various experiments testing both animals and humans are described using both the upward and downward arcs flying the full parabola to produce the weightless state. Some of the periods of weightlessness have lasted up to 30 seconds. Subjective reports of sensations during weightlessness are given from one group of experiments. Eight subjects liked the sensation, three were indifferent to it, and five found it unpleasant and suffered from motion sickness. The answer to the problem of weightlessness, so far, is that it depends on who is being made weightless. But what will happen for longer much longer-periods than 30 seconds remains a problem still

634

Slater, A. E. 1957 SENSORY PERCEPTIONS OF THE WEIGHTLESS CONDITION. In L. J. Carter, ed., Realities of Space Travel (New York: McGraw-Hill, 1957) pp. 266-274.

635

Slater, E.T.O., A.E. Slater & H.E. Ross 1950 SYMPOSIUM OF MEDICAL PROBLEMS ASSOCIATED WITH SPACE FLIGHT
Brit. Interplanetary Soc. J. 9(1): 14-37 Jan. 1950

ABSTRACT: Three papers are presented: "Psychological Problems of Space-Flight" by E.T.O. Slater; "Balancing Mechanisms of Inner Ear" by A.E. Slater; and "Lunar Spacesuit" by H.E. Ross

636

Slater, J. V., ed. 1962 BIOLOGICAL SYSTEMS INTERPLANETARY ENVIRONMENT (Space Sciences Lab., University of California, Berkeley, Calif.) TR NASA Grant NsG-9460, Semiannual status rept., series 3, issue 3, NASA N62-12476, Feb. 1962.

ABSTRACT: In studies of weightlessness, theoretical analysis of particle flow during convection and diffusion indicates that flow rate in a difusion cell is proportional to the component of gravity in the direction of the linear part of the cell.
The influence of relative humidity and other environmental factors on embryonic development in Tribolium has been under investigation. Desiccation or high relative humidity (78 percent) had little influence on wing development at 30 degrees C (optimum temperature for minimal wing damage), although the total number of pupal deaths and molting failures rose considerably. Tempertures lower than 25 degrees C drastically affected development in the absence of atmospheric water. Pupae held in a head-down position are little affected as far as wing development, but the total number of molting failures increases sharply. This was not evident at 30 degrees but at 38 degrees was quite obvious. Over three times as many abnormalities occurred when the organisms were held in any position as compared with the controls. Pupal deaths rose sharply after 16 hours exposure to pure CO_2, although wing differentiation remained relatively unaffected. Phenotypes of known mutants were induced in Tribolium by the use of various agents, including boric acid, insulin, temperature changes, radiation, shaking, ether, and dietary changes. Post-irradiation incubation at 30 degrees C results in minimal abnormalities.

637

Slayton, D.K. & A.B. Shepard 1961 ASTRONAUTS DISCUSS MERCURY TRAINING
Aviation Week & Space Technol., 74(25):67, 71, 73-75, 77, 79

ABSTRACT: This article written by two astronauts describes the training program for Project Mercury. Various methods were used to simulate flight stresses. A weightless state was produced for 15-30 seconds in the interior of an aircraft. A human centrifuge was used to produce high acceleration and high altitude. A special chamber producing temperatures of 250° was used in training for working under heat loads. Survival training on water included exercises in distilling water and learning methods of sun protection. The overall psychological effect of the training period was to instill confidence in the astronauts.

638

Smith, A.H., C.M. Winget & C.F. Kelly 1959 PHYSIOLOGICAL EFFECTS OF ARTIFICIAL CHANGES IN WEIGHT. Naval Research Review, pp. 16-24, April 1959.

639

Smith, G.B., Jr., S.J. Gerathewohl et al. 1962 BIOASTRONAUTICS (National Aeronautics and Space Administration, Washington, D.C.) NASA-SP-18, NASA N63-11508

ABSTRACT: This publication contains papers presented at Session L of the NASA-University Conference on the Science and Technology of Space Exploration, at Chicago, Illinois on November 1-3, 1962. The following papers are presented: "Environmental Biology" by G.B. Smith, Jr. (NASA. Manned Spacecraft Center); "Physiological and Behavioral Sciences" by S.J. Gerathewohl and B.E. Gernandt (NASA. Ames Research Center); "Bioengineering" by Richard S. Johnston (NASA. Manned Spacecraft Center); "Exobiology" by R.S. Young (NASA. Ames Research Center)

640

Smith, G.B., 1962 ENVIRONMENTAL BIOLOGY.
In: Proceedings of the NASA-University Conference on the Sciences and Technology of Space Exploration, 1:395-398. NASA SP-18
Washington, D.C.: National Aeronautics and Space Administration, December 1962

ABSTRACT: Environmental factors in space flight and their effects on man are discussed as they relate to promoting and maintaining are included: (1) biodynamics, involving noise and vibrations, sustained accelerations and impacts, and the effects of weightlessness; (2) radiations from the sun, the stars, the Van Allen belt, and nuclear-reactor propulsion or power systems; (3) life support, consisting of providing food, water, oxygen, etc.; and (4) medical selection and maintenance. The National Aeronautics and Space Administration has used the skills of various federal agencies, the academic world, and industry, as well as its own centers in these endeavors.

641

Smith, R.W., & J.W. Altman 1961 SPACE PSYCHOLOGY: SOME CONSIDERATION IN THE STUDY OF ASTRONAUTS' BEHAVIOR.
(American Institute for Research, Pittsburg, Pa.) April 1961.

ABSTRACT: The following environmental factors and their potential implications for human behavior are discussed: altered atmospheric characteristics, high gravitational loads, weightlessness, temperature, radiation, noise and vibration, isolation and confinement, sexual deprivation, time, and encounters with alien factors.

642

Smith, W.G. 1958 TESTING TOMORROW'S SPACE PIONEERS.
Science Digest 43(3):10-16, March 1958.

ABSTRACT: A popularized account of the numerous and often grueling tests men now are undergoing in order to prepare for human flight into space: research in space medicine, increasingly long periods of time spent in simulated space flight conditions, studies in the effect of weightlessness on the human body, and so forth, is presented here. Partially solved and as yet unsolved problems are discussed.

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Sokolov, V.A. 1961 STAGES ON A GREAT ROAD
Air Information Division, Wright-Patterson AFB, Ohio AID Rept. No. 61-156
ASTIA AD 269 794
Original Source: Nauka i zizhn' April 1961. Pp. 5, 8ff.

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Solliday, R.E. 1961 EVALUATION OF PROJECT MERCURY SIMULATOR.
(Naval Air Test Center, Patuxent River, Md.) Proj. TED PTR RAAD-3058
FT 2123-68, Rept. No. 1, 21 Feb. 1961.

645

Stallings, Jr., H. D. & S. J. Gerathewohl 1957 PRODUCING THE WEIGHTLESS STATE Flying 61:33-34, 80-82. Nov. 1957.

ABSTRACT: This is a report of weightlessness studies conducted at S.A.M. in the T-33 and F-94C aircraft flying the "keplerian Trajectory."

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Stallings, H. D., & S. J. Gerathewohl 1959 THE WEIGHTLESS MAN
Space Journal 2(2):13-14, 41-45, Dec. 1959

ABSTRACT: The condition of zero gravity is discussed and its effects on man are described.

647

Stapp, J.P., 1958 BIODYNAMICS OF MANNED SPACE FLIGHT
Air University Quart. Rev., 10(2): 847-852

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Stapp, John P. 1962 MEDICAL PROBLEMS OF SPACE FLIGHT
(Presented at Symposium on Space Medicine, Miss. State Medical Ass'n Jackson, Miss. 8-10 May 1962)

649

Státni Lékařská Knihova (National Medical Library) 1959 THE ANNUAL OF CZECHOSLOVAK MEDICAL LITERATURE 1957
Praha, Czechoslovakia: Statni Zdravotnicke Nakladatelstvi (Prague 1, Czechoslovakia: State Health Publishing House)

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Statni Lékařská Knihovna (National Medical Library) 1961 THE ANNUAL OF CZECHOSLOVAK MEDICAL LITERATURE 1959
Praha, Czechoslovakia: Statni Zdravotnicke Nakladatelstvi (Prague 1, Czechoslovakia: State Health Publishing House)

651

Steinkamp, G. R. 1960 HUMAN FACTORS IN SPACE FLIGHT.
J. of the Arkansas Medical Society 56:338-342, Feb. 1960

ABSTRACT: Presents a discussion of the human factors to be considered in the planning of manned space flight, with reference to the work of the Department of Space Medicine of the USAF School of Aviation Medicine. Topics include the time element, weightlessness, and the psychologic selection and training of space crews

652

Steinkamp, G. R., & G. T. Hauty 1960 IMPLICATIONS DERIVED FROM SIMULATED SPACE FLIGHTS. (Unpublished manuscripts, 1960)

653

Steinkamp, G. R., G. T. Hauty 1961 SIMULATED SPACE FLIGHTS. In B. E. Flaherty, ed., Psychophysiological Aspects of Space Flight. (New York: Columbia Univ. Press, 1961) pp. 75-79

654

Still, E. W. 1960 EQUIPPING MAN FOR A FLIGHT TO THE MOON
Engineering, (London) 189(4907):634-635, May 6, 1960.

ABSTRACT: A review is presented of a paper read before the British Interplanetary Society on April 28, 1960. A resume of the United States Space Program was given, followed by a discussion of the environmental requirements for interplanetary travel and the engineering techniques being developed to meet these requirements. (Aerospace Medicine 31(10):869, Oct. 1960)

655

Stone, Irving 1954 MARTIN TEAM PUSHES ANTIGRAVITY STUDY Aviat, Wk. 61:42-44, 46, 48, 18 Oct. 1954

ABSTRACT: Among projects of the Advance Design Department are the space ship, and a satellite vehicle.

656

Strong, C.L. 1963 THE AMATEUR SCIENTIST: HOW TO REPEAT CAVENDISH'S EXPERIMENT FOR DETERMINING THE CONSTANT OF GRAVITY
Scientific American 209(3): 267-280

ABSTRACT: On 21 June, 1798, Henry Cavendish read a report before the Royal Society of London describing an experiment substantiating Newton's estimated value for G. This article shows how to construct the equipment to repeat this experiment, and provides calculations of the value of G from Newton's equation ($F=GMm/d^2$). (CARI)

657

Strughold, H., H. Schaefer & H. Strughold 1951 WIE WIRD SICH DER MENSCHLICHE ORGANISMUS VORAUSSICHTLICH IM SCHWEREFREIEN RAUM VERHALTEN? (What is the Probable Behavior of the Human Organism in Gravity Free Space?)
Weltraumfahrt 2:81-88

658

Strughold, H. 1952 FROM AVIATION MEDICINE TO SPACE MEDICINE
J. Avia. Med. 23(4):315-318, 329
See also Air University Quarterly Review, Summer 1958

ABSTRACT: A brief outline of the development of space medicine is given. The lower layer of the atmosphere supports propeller (up to 60,000 feet) and jet

(up to 80,000 feet) flight and is the realm of conventional aviation medicine. Space medicine is concerned with an additional dimension, vertical, and its province is rocket flight which has no vertical limit. The transition from lower atmosphere to space conditions is gradual and various physiological functions of the atmosphere cease at different altitudes. These 'space-equivalent' altitudes are: for anoxia, 52,000 feet; body fluids boil at 65,000 feet; heavy primaries of cosmic radiation penetrate to 120,000 feet; ultraviolet solar radiation, to 135,000 feet; optical appearance of the sky, 400,000 feet; and penetration of meteorites, 500,000 feet. The so-called upper atmosphere of physicists is, for all physiological purposes, equivalent to free space. Aviation at present is in an amphibious stage, in a transition between conventional flight and space flight. (Literatuuroverzicht (Over Ruimtevaartgeneeskunke) (Space Medicine Bibliography) (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

659

Strughold, H. 1955 SPACE EQUIVALENT CONDITIONS WITHIN THE EARTH'S ATMOSPHERE: PHYSIOLOGICAL ASPECTS. Astronautica Acta 1:32-40
German: Weltraumfahrt 6:2-5, 1955

ABSTRACT: Within the astronomically defined atmosphere conditions are found that are physiologically equivalent to those existing in free interplanetary space. Those that occur at certain topographically fixed levels of the atmosphere are termed static space equivalent conditions. These levels are identical with the 'functional borders' between atmosphere and space. Some of these space equivalent conditions are caused by the loss of certain vitally important atmospheric factors. The loss of these factors during flight results in anoxia, boiling of body fluids, and the impossibility of utilizing the ambient air for pressurization of the cabin.
Other static space equivalent conditions are caused by the appearance, in full force, of certain extraterrestrial factors such as cosmic rays, meteors, etc. These space equivalent conditions show variations in the vicinity of the earth, effected by the solid body of the earth and its magnetic field.
The state of zero-gravity as it is encountered in flight is defined as a dynamic space equivalent condition. This condition is not associated with any height or distance from the earth. Since some of the biologically significant space equivalent conditions are encountered in present manned rocket flight, space flight is now a reality. (Literatuuroverzicht (Over Ruimtevaartgeneeskunke) (Space Medicine Bibliography) (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

660

Strughold, H. 1956 MEDICAL PROBLEMS INVOLVED IN ORBITAL SPACE FLIGHT. Jet Propulsion 26:745-748, 756, 788, Sept. 1956
See also School of Aviation Medicine, Randolph AFB, Texas, Epitome of Space Medicine, Item 32

ABSTRACT: Discussion of medical problems involved in circumplanetary or orbital

space flight including: the state of weightlessness, its sensomotor effect, and its effect upon the general wellbeing of satellite-vehicle occupants; the optical properties of the environment and the visual appearance of light sources; physiological day-night cycling; and problems of human engineering of the space cabin involving pressurization, supply of oxygen, removal of carbon dioxide, photosynthetic gas exchange, and the event of sudden decompression of the cabin. (Literatuuroverzicht (Over Ruimtevaartgeneeskunke) (Space medicine Bibliography) (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

2nd ABSTRACT: Circumplanetary or orbital flight chosen for discussion of some of the most important medical problems involved in space operations with reference to state of weightlessness, optical properties of environment and visual appearance of light sources, physiological day-night cycling, and problems involved in human engineering of space cabin. Bibliography.

661

Strughold, H. 1956 A SIMPLE CLASSIFICATION OF THE PRESENT AND FUTURE STAGES OF MANNED FLIGHT. J. Avia. Med. 27:328-331, August 1956
See also School of Aviation Medicine, Randolph AFB, Texas, Epitome of Space Medicine, Item 31

ABSTRACT: The final achievement of a space flight to the moon or to Mars will be the end result of a gradual evolution. The stages of this evolution are examined under three main categories in this article: (1) the physiological and mechanical properties of the environment; (2) the speeds attained by rockets; (3) and distances they travel over and away from the earth. (CARI)

662

Strughold, H. 1957 MECHANORECEPTORS, GRAVIRECEPTORS
J. Astronautics 4:61-63, Winter 1957.
See also Air Force School of Aviation Medicine, Randolph AFB, Texas
Epitome of Space Medicine, Item 39.

ABSTRACT: Mechanoreceptors or gravireceptors are sensing devices located in the skin, in the skeletal muscles and in the connective tissue. These devices aid man's perception of the position and movement of his limbs and of the whole body. This article contains a discussion of the anatomy of these mechanoreceptors and their physiological function under normal gravitational and zero-gravity conditions.

663

Strughold, Hubertus. 1958 MAN-CARRYING SATELLITE?
Sci. Dig. 43:inside back cover, Feb. 1958

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Strughold, H. 1958 INTRODUCTION (In M. Alperin, M. Stern, and H. Wooster, Vistas in Astronautics: Proceedings of the First Annual AFOSR Astronautics Symposium) (New York: Pergamon Press, 1958) Part 6 Human Factors, Pp. 281-284.

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Strughold, H. 1958 STAYING ALIVE IN SPACE
Air Force 41(4):84-87, Apr. 1958

666

Strughold, H. & O. L. Ritter 1958 THE GRAVITATIONAL ENVIRONMENT IN SPACE. (Paper, Second International Symposium on the Physics and Medicine of the Atmosphere and Space, San Antonio, Texas, November 1958)

ABSTRACT: The gravitational field concept is and always will be the gravitational concept par excellence in astronomy, geophysics, and also in the fast developing field of astronautics.

667

Strughold, H. 1958 HUMAN FACTORS
In Alperin, M., M. Stern, & H. Wooster, eds., Vistas in Astronautics: Proceedings of the First Annual AFOSR Astronautics Symposium (New York Pergamon Press, 1958) pp. 281-284

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Strughold, H. 1959 THE MEDICAL ASPECTS OF MANNED SPACE FLIGHT
(In: H. Seifert, Ed., Space Technology (New York: John Wiley and Son, Inc., 1959) Chapt. 28.

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Strughold, H., & O. L. Ritter 1960 THE GRAVITATIONAL SITUATION IN SPACE. In. Benson, O. O., & H. Strughold, eds. Physics and Medicine of the Atmosphere and Space (New York: John Wiley & Sons, Inc., 1960) Chapter IX

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Strughold, H. 1960 LECTURES IN AEROSPACE MEDICINE SUMMATION
In Lectures in Aerospace Medicine, 11-15 January 1960 (School of Aviation Medicine, USAF Aerospace Medical Center, Brooks AFB, Texas)

671

Strughold, H. 1960 THE SPACE FLIGHT SITUATION: SENSORY PHYSIOLOGICAL ASPECT (Paper presented at the Symposium on the Psychophysiological Aspects of Space Flight, May 1960, School of Aviation Medicine, Aerospace Medical Center (ATC) Brooks AFB, Texas)

672

Strughold, H. 1961 SENSORY-PHYSIOLOGICAL ASPECTS OF THE SPACE FLIGHT SITUATION
In B. E. Flaherty, Ed. Psychophysiological Aspects of Space Flight (New York, N. Y., Columbia Univ. Press, 1961) Pp. 57-65).

ABSTRACT: A review of the physiological function of the peripheral, extra-labyrinthine, mechanical sense organs (skin pressure, muscle tension, and postural sense receptors) under normal gravitational conditions is followed by a discussion of their functions during conditions of zero gravity. Tests in parabolic flight maneuvers have confirmed the assumption that these predominantly proprioceptive senses are not affected by zero gravity. However, experimental data on man's tolerance to weightlessness over longer periods of time are not yet available, and provision of artificial gravitation (by rotation or slight continual linear acceleration) may become a necessity.

673

Strughold, H. 1961 BIOPHYSICS OF THE SPACE ENVIRONMENT. Lectures in Aerospace Medicine, 16-20 January 1961 (School of Aviation Medicine USAF Aerospace Medical Center, Brooks AFB, Texas)

674

Strughold, H. 1962 HOW BIOASTRONAUTICS LOOKS AT THE MOON
Jour. Mississippi State Med. Assoc., 3 (9): 397-403. Sept. 1962

ABSTRACT: To create artificially, as far as possible, an ecological optimum for terrestrial Moon visitors is a challenge to space medicine and bioastronautics. For example, the lunar atmospheric density is less than 10^{-10} of the terrestrial atmosphere. Exposed to this environment, the unprotected human body faces anoxia at zero altitude and symptoms of ebullism. Although the Earth is essentially a dense atmospheric environment with mild radiations, the lunar environment is essentially a radiation-vacuum environment. Lunar surface gravity is about 17% that on Earth, or 1/6 g, and will greatly affect human metabolism circulation, muscle activity, and blood pressure. A day-night cycle of 27.3 days' duration does not allow time for regulation of the selenonaut's sleep-wakefulness cycle, determined by the internal physiological clock inherited from Earth. The magnetic field intensity is less than 1/400 that on Earth, and full solar illumination (140,000 lux) is immediately felt. Consideration is given also to the problem of vision, photosynthetic regeneration, and macro- and microclimates.

675

Stubbs, R.A. 1960 SOME ENGINEERING CONSIDERATIONS FOR THE MANNED ORBITING VEHICLE. Can. Aeronaut. J. 6:375-379, Nov. 1960.

ABSTRACT: Cabin pressure, temperature, and constituent gases, along with man's tolerance to accelerations during launch, orbit, and reentry are discussed in this paper. (CARI)

676

Stutman, L. J. and R. N. Olson 1959 EFFECTS OF LIMITED PERIODS OF ZERO GRAVITY ON THE CARDIOVASCULAR SYSTEM. Circulation 20:776.

677

Stutman, L. J., & R. Olson 1960 EFFECTS OF ZERO GRAVITY UPON THE CARDIOVASCULAR SYSTEM. U. S. Armed Forces Medical J. 11:1162-1168, Oct. 1960

ABSTRACT: Some preliminary investigations of the effects of zero gravity upon the cardiovascular system. Position in zero gravity field does not seem to affect the cardiovascular system. Hypotheses are proposed for the potential circulatory difficulties that will hamper a person's return to earth.

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Stutman, L. J. & R. Olson 1961 EFFECTS OF ZERO GRAVITY UPON THE CARDIOVASCULAR SYSTEM. PRELIMINARY OBSERVATIONS.
Rev. Med. Aero (Paris) 2:171-172, Dec. 1961

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Sullivan, J. 1962 MAN AGAINST SPACE -HIGH G AND ZERO G
Science World, 4(5): 4 April 1962.

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Surosky, A.E., D.A. Hill, & J.S. di Rende 1952 GRAVITY-ZERO GRAVITY--ENVIRONMENTAL CONTINUUM. In 1959 Proceedings of the Institute of Environmental Sciences, Annual Technical Meeting, April 22-24, 1959, La Salle Hotel, Chicago, Illinois (Institute of Environmental Sciences, Mt Prospect, Ill.) Pp. 189-192

ABSTRACT: Gravity, a universal environment, is rapidly assuming a critical

role as an environmental parameter. Its decrease with increasing altitude and its rapid effective variation from zero to several g's leads to some unusual design problems. This paper conjectures on the nature of gravity and future utilization of its gradient. The effects of the gravity-zero gravity continuum on men and equipment are discussed. Some thoughts are presented concerning the "gravity" environment in the test laboratory. (Author)

681

Sutton, G. P. 1961 FUTURE EXTENDED SPACE OPERATIONS. Lectures in Aerospace Medicine, 16-20 January 1961. School of Aviation Medicine, Brooks AFB, Texas)

WEIGHTLESSNESS

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682

Taylor, A. A., B. Finkelstein and R. E. Hayes 1960 FOOD FOR SPACE TRAVEL AN EXAMINATION OF CURRENT CAPABILITIES AND FUTURE NEEDS (Air Research and Development Command, Andrews AFB, Washington, D.C.) ARDC-TR-60-8 Jul. 1960 ASTIA AD 241 869, Jul. 1960

ABSTRACT: The state of progress and present capabilities in nutrition, food technology; and food service supporting equipment for manned space flight are described and evaluated in terms of future needs.

The study is broad in scope. It describes feeding in very short to very long space missions. Preflight feeding provisions are described as well as partially regenerative systems and, finally, the requirements of a closed ecology are considered. A section is devoted to permissable preflights foods Varied menus are offered for flights of short, medium, and long duration in an ascending order of variety, consumer acceptance, and support equipment.

683

Thompson, A. B. 1959 PHYSIOLOGICAL AND PSYCHOLOGICAL CONSIDERATION FOR MANNED SPACE FLIGHT. (Vought Astronautics, Chance Vought Aircraft Inc., Dallas, Texas) 1 June 1959

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Thompson, A. B. August 1961 SELF MANEUVERING UNIT FOR ORBITAL MAINTENANCE WORKERS. (Life Sciences Sect., Vought Astronautics Div., Chance Vought Corp., Dallas, Texas) Contr. AF 33(616)-8197, Proj. 8119, Task 60900. Report AST/ElR-13566)

ABSTRACT: This report covers the Life Sciences portion of a study for the design of a device to provide self-propulsion and stabilization for an orbital maintenance worker. Specific items covered include an analysis

of typical tasks required of the worker, establishment of a reference axis system for the maneuvering unit design, tests on pressure suit mobility and areas for improvement, determination of moments of inertia of a 95th percentile man for establishment of stabilization force requirements, vision problems of the worker in space and how they affect rendezvous and rates of translation and rotation, establishment of limit rotation and translation rates, and control system and stabilization and propulsion unit design considerations and recommendations.

Least data was available on vision in empty space, hence, a series of experiments was conducted to better define the problems involved. These are included in the appendices. From the human factors standpoint it appears feasible to meet the requirements of an orbital worker within present technology.

685

Thompson, A. B. 1962 PHYSIOLOGICAL CONSIDERATION IN DESIGNING FOR ARTIFICIAL GRAVITY IN MANNED ROTATING SPACE SYSTEMS. (Paper, 33rd Annual Meeting of the Aerospace Medical Assoc., 9-12 April 1962, Atlantic City, N. J.)

ABSTRACT: If future manned orbital flights prove long term weightlessness to be an unacceptable physiological stress, one practical method of achieving simulated gravity will be to rotate the vehicle such that the resulting centrifugal force provides an apparent gravity vector. A few significant drawbacks to this technique will impose design restrictions on the vehicle if they are to be made physiologically acceptable to the crew. These parameters are discussed and physiologica design limits defined. An acceptable design enveloped is presented with limits as to radius of rotation, maximum angular velocity, minimum and maximum G, and limit coreolis accelerations in per cent of apparent gravity and rate of crew movement. (Aerospace Medicine 33(3):372, Mar. 1962)

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Thompson, L. N. 1952 MAN WITHOUT GRAVITY; THE PHYSIOLOGICAL AND PSYCHOLOGICAL PROBLEMS OF SPACE FLIGHT. Flight, London 61:298-300 , 14 March 1952

ABSTRACT: The principal physiological functions of the human body such as respiration, circulation, and digestion, are primarily muscular in action, and, therefore, independent of gravitational pull. The author summarizes other problems that will arise in actual space flight, such as the need for atmospheric circulation because of lack of convection currents, prevention of blackouts during high take-off accelerations, protection from radiation, the possibility of infection by alien viruses and germs encountered on other planets, and the need of proper preparation against psychological crises on extended flights.

687

Titov, G. 1961 TITOV ADRESSES SCIENTIFIC MEETING
(FBIS USSR & East Europe, No. 199, October 13, 1961)

ABSTRACT: Cosmonaut German Titov said he was confident that Soviet cosmonauts would be the first to fly to the moon. It would be happy to pilot a spaceship once more, he declared. German Titov was addressing a meeting of propagandists of scientific knowledge held at a polytechnical museum tonight.

It is possible to live and work in the state of weightlessness. This is the main conclusion which, in Titov's opinion,can be drawn from his 25-hour flight around the earth on 6 and 7 August. The cosmonaut added that the state of weightlessness proved somewhat different from what the scientists thought about it before the flight.

German Titov pointed out that the noise and vibrations in the cabin did not exceed admissible norms. The vibration, for instance, did not at all hamper him in following the instruments. Titov said that were he to fly again around the earth he would be able to distinguish one sea from another by the color of the water.

The cosmonaut regretted that he had failed to take good photographs of the earth from aboard the ship. "The boys who will fly after me are sure to get better photographs" he added.

Daniel Petrucci, an Italian doctor who spoke at the meeting, expressed admiration at the Soviet achievements in space exploration. (CARI)

688

Titov, Gherman S. 1962 GHERMAN TITOV FIRST MAN TO SPEND A DAY IN SPACE. (New York: Crosscurrents Press, 1962)

CONTENTS: The Soviet cosmonaut's autobiography as told to Pavel Barashev and Yuri Dokuchayev, Novosti Press Agency correspondents.

689

Titov, G. 1962 MY DAY IN SPACE
Spaceflight 4(5): 146-150 Sept. 1962

ABSTRACT: This is an abridged version of the speech made by the Russian astronaut German Titov on May 3, 1962, at the 3rd Space Science Symposium in Washington,