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Encephale, 3:521, 1907

858

Stepanov, B. 1960 ON THE WAY TO THE STARS  
Krasnaya zvezda P. 3; 18 May 1960

859

Stevens, S.S. 1941 EFFECTS OF NOISE AND VIBRATION ON PSYCHOMOTOR  
EFFICIENCY-REPORT ON PRESENT STATUS. (Psycho-Acoustic Lab., Havard Univ.,  
Cambridge Mass.) ASTIA ATI- 27428, March 31, 1941

ABSTRACT: Work is being done to determine the effects of sound and vibration on psychomotor efficiency. In addition to a battery of psychomotor, physiological and psychological tests, equipment has been developed for the generation of sound fields similar to those encountered in aircraft. These sound fields are generated electronically. Variable speed motors driving eccentric loads are used to generate vibrations similar to those encountered in aircraft. These two interferences were shown to decrease the physiological and psychological efficiency of the individuals tested. Accomodation, visual acuity, marksmanship, and steadiness decreased; eye fatigue and lessened coordination resulted. The results were based upon the relative scores made on psychomotor tests with and without disturbances. hatched chicks. The subjecting of mature New Hampshire male chickens to sound levels of 112 decibels failed to affect the rate and nature of spermatogenesis when judged by both quantitative and differential sperm counts.

860

Stevens, S.S. 1941 THE EFFECTS OF NOISE AND VIBRATION ON PSYCHOMOTOR EFFICIENCY  
OSRD-32 (Department of Commerce, Washington, D.C.) 31 March 1941

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Stevens, S.S. 1943 THE EFFECT OF VIBRATION ON VISUAL ACUITY in C.E. Waring  
TRANSMISSION AND RECEPTION OF SOUNDS UNDER COMBAT CONDITIONS (NDRC, Wash.  
D.C.) NDRC Summary Technical Report Div. 17, Vol. 3, Ch. 2.

862

Stevens, S.S. 1946 THE EFFECTS OF NOISE AND VIBRATIONS ON PSYCHOMOTOR  
EFFICIENCY  
(Off. Sci. Res. Dev., Wash., D.C.) 1941 Publ. Bd. No. 8333, Dept. Commerce  
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Stone, Geraldine 1961  
(Psycho-Acoustic Lab., Harvard U., Cambridge, Mass.) Contract N50ri-7611  
and Nonr-186615, Proj. NR142-201, 31 Dec. 1961, ASTIA AD 277 839.

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Strakhov, A.B. 1962 ELECTROENCEPHALOGRAPHIC CHANGES IN PROLONGED  
ACTION OF NOISE. Byul Eksper Biol i Med, No. 7, 1962, Pp 11-13.  
Translation ACSI I-2340, ID 2229415

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Strughold, H. 1936 LUFTFAHRTMEDIZINISCHE FORSCHUNG (Aeronautical Medicine  
Research)  
Internationaler Sportarztes-Kongress, II. (Berlin) 2: 212-215

866

Strum, R.E. 1948 INSTRUMENT USEFUL IN THE ANALYSIS OF VIBRATIONS IN  
ORGANIZED LIVING TISSUE. U.S. Patent Office No. 2,457,744

867

Stýblová, V. 1956 VLIV MECHANICKÝCH OTRESU NA NERVOVÝ SYSTÉM. (EFFECT OF MECHANICAL VIBRATION ON THE NERVOUS SYSTEM) Pracovní lékařství (Praha) 8(4): 262-265, Aug. 1956

ABSTRACT: In workers exposed to mechanical vibrations, neurological changes of the neuritic, polyneuritic, or neuritic amyotrophic types were observed, especially in the arms. Mention is made of the participation of the nervous system in the development of occupational vasoneuroses. (AUTHOR)

868

Stýblová, V. 1959 NEUROLOGICAL PHENOMENA IN WORKERS EXPOSED TO VIBRATION  
Arch Gewerbepath 17:485-503

869

Stýblová V. 1962 NEUROLOGICAL PHENOMENON IN WORKERS SUBJECTED TO VIBRATIONS.  
(Foreign Tech. Div., Air Force Systems Command, Wright-Patterson Air Force Base, Ohio.) Trans. no. FTD-TT-62-536 from Arciv für Gewerbepathologie und Gewerbehygiene, no. 17, pp.485-503, 1959; ASTIA AD-290 103

ABSTRACT: In the present work the neurological conditions of 350 workers who have been subjected to shocks or vibrations are reviewed. In 74% of these workers the neurological condition was positive. In 65% of the cases the condition was insignificantly natural, 9% displayed signs of severe damage to the nervous system which could already endanger the subjects ability to work. The opinion is expressed that the positive neurological condition that is encountered is definitely connected with work in which dangerous vibrations are involved since a similar picture with so many disturbances of the nervous system could neither be found in examining the control group nor in general clinical practice. Functional and organic disturbances of the nervous system appeared in workers engaged in work where vibrations are encountered. A classification of these neurological changes are proposed in accordance with the following three symptom complexes: (1) The neuritic or polyneuritic syndrome with signs of organic changes in the nervous system; (2) The syndrome of a more or less developed amyotrophic lateral sclerosis with damage to the peripheral and central motor neurons; and (3) The polyfunicular neuralgic syndrome. The problem dealing with the pathophysiology of vibration diseases up to now is to be considered as unsolved and required additional clinical studies. In the work presented here the investigation is undertaken as a hypothetical interpretation of the pathophysiology of vibration diseases and these with the assumption of (a) an axon pseudoreflex (b) a reflex reaction in the sense of a physiopathological syndrome according to Froment-Babinski, and (c) a direct stimulation of the nerve fiber in connection with a continuous indication of an increased stationary excitation. Measures of a prophylactic and therapeutic nature are proposed.

Styblova, V. 1962 EFFECT OF MECHANICAL VIBRATION ON THE NERVOUS SYSTEM  
Procovni Lekaystvi 8(4):262-265, 1956  
(Translation Services Branch, Foreign Technology Div., Wright-Patterson AFB,  
Ohio) Translation FTD-TT-62-537/1; 20 April 1962; ASTIA AD-280 932

SUMMARY: We have presented the results of neurological investigations carried out on 150 laborers exposed to vibration. We have recorded a greater number of avident pathological findings. The neurological character showed however changes in the nature of neuritis and polyneuritis, or neuritic amyotrophy predominantly in the upper extremities, but (in a lesser percentage) more or less expressed syndrome amyotrophic lateral sclerosis. We have compared the neurological changes with rtg find of cervical spine. We assume that it is necessary to pay greater attention to the participation of the nervous system during pathophysiological interpretation of professional vasoneurosis. (AUTHOR)

871

Sueda, M. 1937 EXPERIMENTAL STUDY OF THE EFFECT OF VIBRATION UPON THE LIFE PERIOD OF SPERMATOOZOA TAKEN FROM LIVING ANIMALS. Mitt. Med. Akad. Kioto, 19:324-325

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Sueda, M. 1937 THE INFLUENCES OF VIBRATION. I. REPORT. THE EFFECT UPON THE BODY-WEIGHT AND LIFE PERIOD OF ANIMALS.  
Mitt. Med. Akad. Kioto, 21:1357-1370. English summary. pp. 1703-1704

873

Sueda, M. 1937 ON THE EFFECT OF VIBRATIONS UPON THE OESTROUS CYCLE OF WHITE RATS Mitteilungen aus der Medizinischen Akademie zu Kioto Kyoto-Ikagaigaku-Zasshi 21:1066-82

874

Sueda, M. 1938 (EXPERIMENTAL STUDY OF THE EFFECT OF SOME MEDICINES UPON THE GENERAL CONDITIONS, BODY-WEIGHT AND LIFE PERIOD OF ANIMALS SUBJECTED TO CONTINUOUS VIBRATIONS. V. REPORT. THE EFFECT OF THE INJECTION OF 1.6% GLUCOSE SOLUTION TOGETHER WITH VITAMIN A.)  
Mitt. med. Akad. Kioto 24:53-59. English Summary:269-270. 1938

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Sueda, M. 1938 EXPERIMENTAL STUDY OF THE EFFECT OF VIBRATIONS UPON THE BLOOD PRESSURE OF RABBITS. Mitt. med. Akad. Kioto, 24: 672-676

ABSTRACT: A group of male rabbits were placed in a box prepared to reproduce the lurching vibrations of trains and the box was moved for 24 hours continuously. At certain intervals during and after the shaking operation, the maximal blood pressure was examined. The results were as follows:

1. In the case of a large number of animals (a) the maximal pressure rises during the course of the shaking process. In the case of the remainder (b), the pressure falls. Following 24 hours of continuous shaking, the blood pressure returns essentially to its original point in both groups.

2. In the case of convalescent animals, the blood pressure rises slightly at the beginning of the process, then falls, a fall from which it does not recover even after 24 hours of repose.

876

Sueda, M. 1938 (EXPERIMENTAL STUDY OF THE EFFECT OF SOME MEDICINES UPON THE GENERAL CONDITIONS, BODY-WEIGHT AND LIFE PERIOD OF ANIMALS SUBJECTED TO CONTINUOUS VIBRATIONS. IV. REPORT. THE EFFECT OF THE INJECTION OF 1.6% GLUCOSE SOLUTION TOGETHER WITH CITAMIN C.) Mitt. med. Akad. Kioto 23:246-256. English summary:484. 1938.

877

Sueda, M. 1938 (EXPERIMENTAL STUDY OF THE EFFECT OF SOME MEDICINES UPON THE GENERAL CONDITIONS, BODY-WEIGHT AND LIFE PERIOD OF ANIMALS SUBJECTED TO CONTINUOUS VIBRATIONS. I. REPORT. THE EFFECT OF THE INJECTION OF PHYSIOLOGICAL SALINE SOLUTION AND 0.8% GLUCOSE SOLUTION. Mitt. med. Akad. Kioto 22:808-820. English summary:1077, 1938.

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Sueda, M. 1938 VIBRATION EFFECT ON BODY TEMPERATURE, QUANTITY OF FOOD, QUANTITY OF URINE, QUANTITY OF FECES, RATES OF RESPIRATION AND PULSE Mitt. med. Akad. Kioto 22:391-392

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Sueda, M. 1938 (EXPERIMENTAL STUDY OF THE EFFECT OF SOME MEDICINES UPON THE GENERAL CONDITIONS, BODY-WEIGHT AND LIFE PERIOD OF ANIMALS SUBJECTED TO CONTINUOUS VIBRATIONS. III. REPORT. THE EFFECT OF THE INJECTION OF GLUCOSE SOLUTION AND VITAMIN B<sub>1</sub>.)  
Mitt. med. Akad. Kioto 23:1-15. English summary:211. 1938

880

Sueda, M. 1938 THE INFLUENCES OF VIBRATION. II. REPORT. THE EFFECT UPON THE BODY TEMPERATURE, QUANTITY OF FOOD, QUANTITY OF URINE, QUANTITY OF FAECES, RATES OF RESPIRATION AND PULSE  
Mitt. med. Akad. Kioto. (Kyoto-Ikadaigaku-Zasshi) 22: 391-392

881

Sueda, M. 1938 THE BODY TEMPERATURE OF RABBITS DURING AND AFTER VIBRATION.  
Mitt. Med. Akad. Kioto, 25:231-234

882

Sueda, M. 1938 EXPERIMENTAL STUDY OF THE EFFECT OF ALTERNATE VIBRATION AND RESPONSE UPON THE BODY-WEIGHT OF ANIMALS. Mitt. Med Akad. Kioto, 25:30-34

883

Sueda, M. 1938 EXPERIMENTAL STUDY OF THE EFFECT OF SOME MEDICINES UPON THE GENERAL CONDITIONS, BODY-WEIGHT AND LIFE PERIOD OF ANIMALS SUBJECTED TO CONTINUOUS VIBRATIONS. VI. REPORT. AN EXAMINATION IN WHICH THE INJECTION OF SALINE SOLUTION WAS OMITTED Mitteilungen aus der Medizinischen Akademie zu Kioto 24:535-39 English Summary 615-616

884

Sueda, M. 1938 (EXPERIMENTAL STUDY OF THE EFFECT OF VIBRATIONS UPON THE HEALING OF WOUNDS.)  
Mitt. med. Akad. Kioto 24:1014-1016. English summary:1170. 1938

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Sueda, M. 1938 UPON THE EFFECTS OF CONTINUOUS VIBRATION ON THE LIFE  
PERIOD OF RABBITS DEPRIVED OF BOTH KIDNEYS  
Mitt. med. Akad. Kioto 23:874-880. English summary, pp. 1088-1089

886

Sueda, M. 1939 BODY-TEMPERATURE OF RABBITS DURING AND AFTER VIBRATION  
(Mitt. med. Acad. Kioto (Kyoto-Ikadaigaku Zasshi) 25, 397)

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Sueda, M. 1939 (EXPERIMENTAL STUDY OF THE EFFECT OF ALTERNATE VIBRATION  
AND REPOSE UPON THE BODY-WEIGHT OF ANIMALS.)  
Mitt. med. Akad. Kioto 25:30-34. English summary:209-210. 1939

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Tait, J. N. 1961 IN-FLIGHT SOUND LEVEL AND VIBRATION CONDITIONS IN NAVAL AIRCRAFT ELECTRONIC EQUIPMENT COMPARTMENTS. 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. 623-626

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Temkin, J. 1933 DAMAGE TO THE EAR CAUSED BY NOISE AND VIBRATION Monatsschr. ohrenheilk 67:257-299, 450417, 527-553, 705,736, 823-834

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Temkin, Ia S., 1960 THE PATHOGENESIS AND CLINICAL ASPECTS OF VIBRATORY COCHLEOVESTIBULAR DISORDERS. Vestn Otorinolaring 22:5-15, May-June 1960

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ten Cate, W., tr. Murray, R. C. 1953 VIBRATION NUISANCE (TRILLINGSHINDER). Instituut T. N. O. Voor Werktuigkundige Constructies, Delft, Rept. No. 147, May 1953 (Royal Aircraft Establishment, Great Britian, Library Trans. No. 693, Oct. 1957) ASTIA AD-159 701

ABSTRACT: A review of published information on the evaluation of the nuisance levels of vibration in houses, cars and aircraft for personnel, with proposals for better studies based on opinion sampling. (AUTHOR)



892

ten Cate, W. 1957 APPENDICES TO REPORT 147 (MAY, 1953) ON VIBRATION NUISANCE (Instituut T.N.O. Voor Werktuigkundige Constructies, Delft, Report No. 150) October, 1957, Royal Aircraft Establishment, Great Britian, Library Translation No. 694, ASTIA AD 161 477

ABSTRACT: Comments on various papers which have been published since the appearance of Report 147, in the form of three appendices.

893

Terent'ev, V. G. 1959 CHANGES IN VASOMOTOR REFLEXES DURING EXPOSURE OF THE INDIVIDUAL TO GENERAL VIBRATIONS. Pavlov Journal of Higher Nervous Activity 9(5):570-577 May 1960 Translation of Zh. Vyss. Nerv. Deiat. Pavlov 9(5):649-656, 1959.

ABSTRACT: Vibrations of frequencies from 10 to 70 cps and amplitude of 0.4 mm did not generally produce any changes in conditioned or unconditioned vasomotor reflexes. Vibrations of frequencies from 10 to 40 cps and amplitude 0.8-1.2 mm. and of 50 cps and amplitude 0.8mm. produced moderate changes in conditioned vasomotor reflexes, (reduction in the vascular reaction, disinhibition of differentiation, and increase of spontaneous fluctuations in the plethysmogram), indicative of adaptation. Prolonged exposure of 4 hours induced fatigue. Vibrations of higher frequencies and larger amplitude caused inversion or abolition of the conditioned and unconditioned vascular reflexes. Injection of caffeine reduced the harmful effect of vibration and contributed to the more rapid restoration of conditioned and unconditioned vascular reflexes. Repeated exposure to tolerable ranges of general vibration results in adaptational changes. (Author)

894

Tereschovich, K. 1937 WIRKUNG DER BESCHLEUNIGUNG AUF DES ORGANISMS (Effects of Acceleration Upon the Organs) Vyestn. Vozd. Flota 19(4): 29-34.

895

Thiessen, G. J. and E. A. G. Shaw     1958     EAR DEFENDER FOR NOISE  
PROTECTION  
J. of Aviation Medicine 29(11):810-814, November 1958

SUMMARY: Vibration of the whole ear protector is the main mechanism by which low-frequency sound reaches the ear when a well-sealed protector is used. In the case of the cover type of ear defenders, this vibration can be minimized by means of a cushion which uses a high Young's modulus sheath to contain a high bulk modulus filler. In this way a cushion spring constant can be achieved which exceeds many times that of the flesh around the ear and at the same time the equalization of the pressure on the head contributes greatly to comfort. The spring constant of the flesh may be increased by pressure but to this the comfort requirements of the wearer will set a limit. Cup volume and enclosed head area also play their part. A suitably designed ear defender can easily provide 20 db. attenuation at 50 cps.

896

Thomas, C.E.     1961     FLIGHT VIBRATION SURVEY OF F-101A AIRCRAFT.  
(Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson  
AFB, Ohio)     ASD Technical Note No. 61-60, ASTIA AD- 400 231, May 1961

ABSTRACT: The F-101A aircraft was surveyed to determine the vibration environment existing throughout the vehicle under all flight conditions expected in service. Approximately 32,630 data points were obtained from 25 separate locations on the vehicle during 31 test flights. The data obtained in this survey were evaluated to determine the vibration test requirements which should be specified for items of equipment to be used on the F-101A aircraft. The data indicated that, in general, the vibration testing requirements listed in Specification MIL-E-5272 are more than adequate for F-101A equipment.

897

Thomas, C. E.     1962     FLIGHT VIBRATION SURVEY OF C-130A AIRCRAFT  
(Aeronautical Systems Division, Wright-Patterson AFB, Ohio)     ASD-TDR-62-267;  
ASTIA AD-274 904; March 1962

ABSTRACT: A C-130A aircraft, SN 53-3133, was surveyed at Wright-Patterson AFB, Ohio to determine the vibration environment existing throughout the vehicle under all flight conditions expected in service. Approximately 50,700 data points were obtained from 21 separate locations on the vehicle during five test flights. The

data obtained in this survey were evaluated to determine the adequacy of vibration test requirements for aircraft equipment as contained in Specification No. Mil-E-5272C. The data indicated that the vibration testing requirements of that specification were more than adequate with the exception of the very light pieces of equipment which are attached to the fuselage sidewalls in the vicinity of the prop plane. (AUTHOR)

898

Thomas, C. E. 1962 FLIGHT VIBRATION SURVEY OF XC-123D AIRCRAFT  
(Aeronautical Systems Division, Wright-Patterson AFB, Ohio) ASD-TDR 62-235;  
ASTIA AD-274 903; Feb. 1962

ABSTRACT: An XC-123D aircraft, SN 53-8068, was surveyed at Wright-Patterson AFB, Ohio to determine the vibration environment existing throughout the vehicle under all flight conditions expected in service. Approximately 24,300 data points were obtained from 23 separate locations on the vehicle during four test flights. The data obtained in this survey were evaluated to determine the adequacy of vibration test requirements for aircraft equipment as contained in Specification Nr. Mil-E-5272C. The data indicated that the vibration testing requirements of this specification were adequate with the exception of the very light pieces of equipment which were attached to the fuselage sidewalls in the vicinity of the prop plane. (AUTHOR)

899

Thompson, A.B. 1959 PHYSIOLOGICAL AND PSYCHOLOGICAL CONSIDERATIONS FOR  
MANNED SPACE FLIGHT. (Chance Vought Aircraft, Inc., Dallas, Texas)  
Rept. no. E9R-12349, July 7, 1959

ABSTRACT: An analysis of the various psychological and physiological stresses and deviations from earth environment has been programmed on a systematic basis. Definitions of specific requirements are presented in detail in the order of their occurrence on a typical orbital mission.

900

Thompson, S.P. 1954 ORIGINS OF PROPOSED SHOCK AND VIBRATION TERMINOLOGY.  
Magazine of Standards, 25:384-386

901

Thomson, G.R. 1958 FINAL REPORT ON VIBRATION TEST OF E36 COLLECTIVE PROTECTOR  
Development and Proof Services, Aberdeen Proving Ground, Maryland OCO Project  
Number 65 ASTIA AD 155 263

ABSTRACT: The purpose of the test was to determine if the E36 Collective Protector would be damaged when subjected to vibration such as might be encountered during transportation and handling. The collective protector was vibrated along each of its three major axes as stated in Specification MIL-T-4807 (USAF), reference test method 1A, for equipment without shock isolators. Drawings of the test setups are shown in Figures 1 and 2, Appendix A, and the test results are presented in Table 1, Appendix B. No apparent damage was sustained by the E36 Collective Protector as a result of this test.

902

Tinker, M. A. 1948 EFFECT OF VIBRATION UPON READING  
American J. Psychology 61:386-390, Jan. 1948  
NOTE: Reel 7, Flash 6, Item 34

SUMMARY AND CONCLUSIONS: (1) The purpose of this experiment is to study the effect of vibration of textual material on speed of perception in reading. (2) A control group and an experimental group of 69 readers each read Form I and Form II of a speed-of-reading test with 10-min. time limits. For the experimental group, Form II was read while the copy vibrated. (3) Vibration of the copy reduced speed of perception in reading by significant amounts, about 5%. (4) The speed-of-reading technique, when standardized tests are used in an adequate experimental design, may be employed to advantage to measure readability of print. (AUTHOR)

903

Titov, G. 1961 TITOV ADDRESSES 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)

904

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, D.C. Various aspects of his 17-orbit flight of August 6-7, 1961, discussed included launching, entering orbit, actual flight, re-entering the atmosphere, and landing. The basic physiological functions conformed well to flight loads and stresses. The flight indicated that man can withstand the effect of weightlessness for 24 hours. Some motion sickness was encountered which later abated, but eating, drinking, muscle coordination, and task performance remained good. The flight was preceded by two preparatory stages, a training program consisting of theoretical, special physical, medico-biological, technical, and flight factors; and an immediate preflight period.

905

Tobias, C.A. & J.V. Slater 1962 OUR VIEW OF SPACE BIOLOGY WIDENS  
Astronautics 7(1): 20-22, 47-52, Jan. 1962

ABSTRACT: Biological research in the space program is important. Knowledge of man's ability to withstand acceleration, deceleration, temperature changes, weightlessness, vibration and radiation, is necessary to safely put a man in space. Various phenomena both observed and considered for future research are listed.

906

Togart 1957 A GUIDE TO THE SOLUTION OF VIBRATION AND SHOCK PROBLEMS. Library of Congress no. KAPL-M-SWT-1

907

Tolle, E.A. 1960 SIMULATED COMBINED VIBRATION, SUSTAINED ACCELERATION AND EXTREME TEMPERATURE ENVIRONMENTS. (Aeronautical Accessories Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio) WADC TN 59-351. Feb. 1960. ASTIA AD 236 057

ABSTRACT: A simulator believed to be the first of its kind to produce simultaneous steady acceleration, vibratory acceleration, and extreme temperature is described. It comprises a 450 pound force electro-dynamic vibrator and temperature box installed on a large-mass centrifuge. The combination of environments produced by this simulator makes possible more realistic testing of certain ballistic missile components than otherwise would be possible. Design and performance characteristics are presented, and component testing results are discussed. (Author)

908

Travers, P. R., & J. C. Guignard 1959 EFFECT OF VIBRATION OF THE HEAD AND OF THE WHOLE BODY ON THE ACTIVITY OF POSTURAL MUSCLES IN MAN: SOME QUALITATIVE OBSERVATIONS. (RAF, Institute of Aviation Medicine, Farnborough) FPRC Rept. 1063

909

Tschermak-Seysenegg, A. 1932 PHYSIOLOGISCH-OPTISCHE BEOBACHTUNGEN IM FLUGZEUG UND IM ROTATORIUM (Physiological-Optical Observations in the Aircraft and in the Rotarium) Forsch. Fortschr. dtsh. Wiss. (Berlin) 8: 72-73

910

Turner, L. 1962 A REVIEW OF THE EFFECTS OF VIBRATION ON PERFORMANCE AMRL Memo. Report P-18, October 1962

911

Tuszkiewicz, A.R. and W. Szewczykowski. 1953 WYNIKI KLINICZNYCH BADAN TRAKTORZYSTOW. (Clinical results of examination of tractor workers.) Ann. Univ. Lubin, sec. D 8:213-230

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Ugnow, W., A. Martischenja, and A. Goldberg. 1936 UBER DIE WIRKUNG VON LARM UND ERSCHUTTERUNG AUF DEN GAS AUSTAUSCH. (Effect of noise and vibration on gaseous exchange.) Arbeits physiol. 9:387-391

913

Ugnow, W., A. Martischenja & A. Goldberg 1936 EFFECT OF NOISE AND VIBRATION ON BASAL METABOLISM. Arbeits physiol. 9:387-391

914

U.S. Aerospace Information Division 1961 SOVIET LITERATURE ON LIFE SUPPORT SYSTEMS  
Science and Technology Branch, Aerospace Information Division AID Rept. 61-156;  
Nov. 30, 1961 ASTIA AD 269 ,94

ABSTRACT: This publication contains material on the following subjects: ecological system; stress factors - acceleration, noise, and vibration; weightlessness; radiation effects; training and biotelemetry.

915

Aeronautical Systems Division 1962 A STUDY OF TANDEM HELICOPTER FUSELAGE VIBRATION. (Aeronautical Systems Division, Dir/Aeromechanics, Flight Dynamics Lab., Wright-Patterson AFB, Ohio) Report No. ASD-TDR-62-284, September 1962, ASTIA AD- 290317

ABSTRACT: A comprehensive research program covering many facets of tandem rotor helicopter fuselage vibration was conducted. Analytical portions consisted of the development of methods for the prediction of fuselage natural and forced modes; test portions of the program determined fuselage stiffness properties, rotor shaft vibratory loads and in-flight natural frequencies, modes and vibration levels. The results have proven to be of considerable value in the design of the present generation of helicopters.

916

USAF. Air Dev. Div. 1960 BIBLIOGRAPHY OF RESEARCH REPORTS AND PUBLICATIONS  
ISSUED BY THE BIO-ACOUSTICS BRANCH. (Wright Air Development Division,  
Wright-Patterson AFB, Ohio) Dec., 1960

ABSTRACT: Lists publications considered to be of lasting interest which have resulted from the research activities of the Bio-Acoustics Branch, Aero-space Medical Laboratory, Wright-Patterson Air Force Base. Items are listed, without abstracts under the headings: Sound sources and noise fields; Sound propagation; Acoustic instrumentation; Noise control-general; Noise control structures; Hearing and physiology of the ear; Speech; Biological and psychological effects of noise; Ear protection; Mechanical characteristics of the human body, effects of vibration and shock; General noise guides and criteria; Bionics; Miscellaneous. An author index is given.

917

U.S.A.F. Aerospace Medical Division 1962 CUMULATIVE AUDITORY EFFECTS  
RESULTING FROM MULTIPLE EXPOSURE TO INTENSE ACOUSTIC STIMULATION.  
PART I. DEAFENING EFFECTS OF NOISE ON THE CAT. (6570th Aerospace Medical  
Research Laboratories, Aerospace Medical Div., Wright-Patterson AFB, Ohio)  
Report No. AMRL-TDR-62-99(1). Dec. 1962. ASTIA AD 404 761

ABSTRACT: Aural effects of exposure to intense noise were investigated by measurements of the auditory sensitivity of cats, as determined by their behavior, before and after exposures and by histological examination of their cochleas. Exposures to 115 db for 1/8 hour or 105 db for 1/4 hour result in temporary threshold shift (TTS) with the same general features and course of recovery as for man. However, 1/4-hour exposures require 18 db less sound to produce the same magnitude of shift in the cat. Noise of 115 db for 1/4, 1/2, 2, or 8 hours without interruption produced permanent threshold shift (PTS) in which magnitude depended on the duration of the exposure, the test tone frequency, and the susceptibility of the individual cat. When the 2-hour exposure was divided into 16 doses of 1/8 hour each and four different inter-exposure intervals of 0, 1, 6, and 24 hours were used, PTS declined as inter-exposure interval increased. The pattern of injury ratings along the basilar membrane is highly similar to the pattern of the behavioral audiograms, if both are placed on anatomical-frequency scale.

918

U. S. Air Force 1953 PHYSIOLOGY OF FLIGHT. USAF Manual 160-30.  
(Wash., D. C.: U. S. Govt. Printing Office, 1953).



919

Armed Services Technical Information Agency 1957 SHOCK AND VIBRATION. ENTRIES  
SELECTED BY DR. J. NORTON BRENNAN; PENNSYLVANIA STATE UNIVERSITY, IN CONJUNC-  
TION WITH CONTRACT DA 19-129-qm-804. REPORT BIBLIOGRAPHY (Document Service  
Center, Armed Services Technical Information Agency, Dayton, Ohio) 26 Aug. 1957  
ASTIA AD 138 776

920

Armed Services Technical Information Agency 1959 BIO-ASTRONAUTICS:  
AN ASTIA REPORT BIBLIOGRAPHY (U) (Armed Services Technical Information  
Agency, Arlington, Va.) Feb. 1959 ASTIA AD 306 007

(Secret Report)

ABSTRACT: This bibliography covers the subject matter from 1952 through 1958  
insofar as report literature, represented by ASTIA holdings is concerned.  
(Unclassified Abstract)

921

Armed Services Technical Information Agency 1961 UNDERSEA WARFARE.  
A REPORT BIBLIOGRAPHY. (Armed Services Technical Information Agency,  
Arlington, Va.) ASTIA AD-264 000, 1 October 1961

ABSTRACT: This bibliography was prepared by ASTIA in response to frequent  
requests for information concerning Undersea Warfare and related topics. A  
confidential and secret section of the bibliography appear separately as  
AD-325 700 and AD-325 701 respectively. Citations are included for documents  
cataloged by ASTIA from 1953 through 1 October 1961. Entries are arranged  
in alphabetical sequence by subject areas pertaining to problems in detection,  
navigation, ordnance, propulsion, and underwater sound. Within each category  
and its subdivisions, reports published by Department of Defense contractors  
are listed alphabetically by source and contract number, and then by date;  
military reports are arranged by source and title. (Author)

922

U.S. Army Signal Corp. 1945 ROAD VIBRATIONS IN MILITARY TRUCKS.  
(Army Signal Corp., Ft. Monmouth, N.J.) Reports #3 & #5, July 1945.

923

U. S. Dept. of the Navy 1962 BIBLIOGRAPHY ON THE EFFECTS OF SHOCK AND VIBRATION ON MEN. (Structural Mechanics Laboratory, Ship Protection Div., David Taylor Model Basin, Washington). Tech. Note SML-740-8

924

U.S.A.F., Foreign Tech. Div. 1962 EARTH-SPACE-EARTH (SELECTED ARTICLES)  
(Foreign Tech. Div., Air Force Systems Command, Wright-Patterson AFB, Ohio)  
Trans. No. FTD-TT-62-1416 Oct. 11, 1962 ASTIA AD 292 224  
Original Source: Zemlya-Zosmos-Zemlya, (Sbornik Materialov, Opublikovannykh V Gazete "Pravda" Izdatel'stvo "Pravda", (Moskva), 24, Pp. 10, 13, 14, 27, 30, 31, 45-47, 51, 52, 56, 57 and 61. 16 Aug. 1962

ABSTRACT: This publication contains articles by the following titles: "Vostok-3 in Outer Space"; "News from Outer Space"; "Vostok-4 in Orbit"; "News from Outer Space"; "Research Program is Being Executed Successfully"; "Conversation in Outer Space"; "Food of Gods"; "Precisely According to Program"; "Before the Completion of a Historical Flight"; "and "Good Wishes to Nations of the World."

925

U.S. Frankford Arsenal 1946 INTERNAL VIBRATIONS EXCITED IN THE OPERATION OF PERSONNEL EMERGENCY ESCAPE CATAPULTS  
(Frankford Arsenal Lab. Div., Philadelphia, Pa.) Memo. Rept. MR-340  
26 November 1946 ASTIA AD 51 792

ABSTRACT: Studies of the catapults, T2 and T4, emergency escape personnel show that the accelerations transmitted throughout the body by the catapult differ in magnitude and phase from the acceleration applied to the center of gravity of the system. Typical acceleration measurements on dummy and human subjects taken from Air Corps reports are given in this report. Comparisons of these records with independent measurements of pressure-time data show that strong internal vibrations of the several massive components of the ejected system are superimposed upon the motion of its center of gravity. As a consequence of these vibratory components, the internal elastic stresses in the body, depending on the phase of the vibration, at their peaks will exceed the values which would be required for the acceleration of an equivalent rigid body to the required terminal velocity under action of the same applied forces. Since the estimated safe limit for these elastic stresses is not very high compared with the stress level to obtain the required center of gravity acceleration, the excitation of such internal vibratory motion imposes a distinct limitation in the application of the catapult to personnel escape. It is the purpose of this report to consider: (a) the general theory of such mechanical transients and their excitation, and (b) application to the problem of catapult and ammunition design.

926

U.S. Joint Publications Research Service 1962 THE QUESTION OF PHYSICAL  
HYGIENIC EVALUATION OF PULSE OSCILLATIONS  
(Joint Publications Research Service, Washington, D.C.) JPRS-14974,  
27 Aug. 1962. NASA N 62-17969

ABSTRACT: The study of physical-hygienic evaluation of pulse oscillations in the human organism is discussed. The most important factors in such studies is the establishment of indices which do not cause pathologic changes in the organism and their quantitative expression. For the accomplishment of this task, it is necessary on the widest scale to set up experimental models, primarily using sinusoidal oscillations. It is also necessary to carry out clinical studies using physiological and biochemical methods for the establishment of the early changes which cannot be detected by ordinary clinical methods. The hardness, the duration, the number of shocks per second, and the amplitude of the pulse oscillations should be obtained. It is especially necessary to determine the changes of acceleration with respect to time, since this is a combined index of hardness and is the most stable index.

927

U S. Naval Medical Research Institute 1945 EVALUATION OF CREPE SHOES AND  
HEELS TO ABSORB SHOCK ON STEEL DECKS.  
(Naval Medical Research Institute.) Rept. NH6/ALL-X-517, 30 Apr. 1945.

928

U.S. Navy 1957 ENGINEERING REPORTS ON SHIPBOARD VIBRATION PROBLEMS DURING 1957  
Mare Island Naval Shipyard, Vallejo, California ASTIA AD 217 665

ABSTRACT: This publication is composed of a series of engineering reports on shipboard vibration. Tests were conducted to determine main engine vibration, propulsion machinery and port turbo generator set noise and vibration, turbo-generator vibration, hull and machinery vibration, and radio and electronic set vibration

929

U.S. Navy 1958 ENGINEERING REPORTS ON SHIPBOARD VIBRATION PROBLEMS DURING 1958  
Mare Island Naval Shipyard, Vallejo, California ASTIA AD 217 666

ABSTRACT: This publication is composed of a series of engineering reports on shipboard vibration. Tests were conducted to determine main condenser pump vibration, deck vibration, generator vibration, cooling pumps vibration, and vibration of the No. 2 main diesel engine.

930

U.S. Navy 1959 ENGINEERING REPORTS ON SHIPBOARD VIBRATION SURVEYS - 1957-1958  
Portsmouth Naval Shipyard, U.S. Navy ASTIA AD 225 969

ABSTRACT: This report contains the measurement techniques used in shipboard vibration tests and the results of those tests.

931

U.S. Office of Naval Research 1946 MONTHLY REPORT OF THE SPECIAL DEVICES  
CENTER, DECEMBER 1946  
Office of Naval Research, Special Devices Center, Port Washington, L.I., N.Y.  
ASTIA ATI 28590

ABSTRACT: Synthetic training devices, teaching aids, human engineering, tactical evaluators, research tools, and training methods are the fields for which special devices have been developed. In order to familiarize the operator with his duties, new training techniques include assessing dry aircraft rocket and bombing runs, remote scoring target, projector smoke generator, coordination of navigation devices, and contact-flight simulator. A discussion is given of the pilot ejection seat which is necessary for escape from high-speed aircraft. New developments in sighting for aircraft and anti-aircraft gun systems are automatic sighting systems combining radar information, a gyro unit, a computer, and servos. It is suggested that television be used for mass training of personnel which is an important factor in emergencies.

932

U.S. Office of Sec. of Def. Res. & Engng. 1957 SHOCK AND VIBRATION BULLETIN,  
PART II. (Office of Sec. Res. & Engng., Washington, D.C.) Dec. 1957.  
ASTIA AD 247 148.

CONTENTS: Includes papers on saw-tooth shock equipment, drop-test facilities, instrumentation, and cumulative vibration effects.

933

Assistant Secretary of Defense (Research and Development) 1955 SHOCK AND VIBRATION BULLETIN NO. 22 SUPPLEMENT. (Assistant Secretary of Defense, Research and Development, Washington, D.C.) ASTIA AD-94 697

CONTENTS:

Motion sickness, by J.E. Steele  
The mechanics of vibration in the human body, by E.K. Franke  
Damage to animals due to vibration, by R.C. Fowler  
Hydrostatic effects of combined tumbling and deceleration, by R. Edelberg  
Vibration tolerance levels in military aircraft, by G.L. Getline  
Downward ejections at high speeds and high altitudes, by E.G. Sperry, H.P. Nielsen, and I.M. Barash  
Acceleration problems in ejection-seat design, by G.P. Santi

934

U.S. Assistant Secretary of Defense 1957 INDEX TO SHOCK AND VIBRATION BULLETINS. NO. 1 THROUGH 24. A SUBJECT INDEX AND AUTHOR INDEX (U) (Assistant Secretary of Defense (Research and Engineering), Washington, D.C.) Oct. 1957. ASTIA AD 320 436.

935

U.S. Assistant Secretary of Defense 1957 SHOCK AND VIBRATION. BULLETIN, PART I. (Assistant Secretary of Defense (Research and Development) Washington, D.C.) Dec. 1957. ASTIA AD 320 435.

936

U.S. Assistant Secretary of Defense 1959 SHOCK, VIBRATION AND ASSOCIATED ENVIRONMENTS PART III. (Assistant Secretary of Defense, Research and Engineering, Washington D.C.) Bull. no. 27. Pt. 3, ASTIA AD 212 976.

ABSTRACT: Test facilities: Vibration environment of supersonic track sleds; Missile component testing on rocket sleds at the Air Force Missile Development Center; Pneumatic vibration isolators in rocket-sled simulation of missile accelerations; NOTS controlled-vibration track test vehicle; System testing

on dynamic restraints at Lockheed SCTB; low-cost complex-wave machine for quality control vibration tests; Device for vibration (or shock) testing in 3 mutually perpendicular planes simultaneously; Evaluation of the Hyge Shock Tester for water-entry shock simulation; Heavy-equipment vibrator using a toggle mechanism. Combined environments; Combined environment testing; Simulating combined vibration, sustained acceleration, and extreme temperature environments; Investigation of a novel approach to combined environments testing for small components; Environmental test program for components of guided missiles; Destructive testing of missile components under simultaneous high-intensity vibratory, thermal, and electrical stresses; Redstone missile factory-to-impact simulation in the laboratory; Orbital simulations; Facility for space simulation studies. Instrumentation: Low-impedance vibration coupler for missile use; Pick-up to read-out calibrator for vibration channels. See also ASTIA AD-212 975, ASTIA AD 212 977, ASTIA AD 306 004.

937

U.S. Assistant Secretary of Defense 1960 SHOCK, VIBRATION AND ASSOCIATED ENVIRONMENTS PART I. (Assistant Secretary of Defense, Research and Engineering, Washington, D.C.) July 1960. ASTIA AD 318 006.

938

U.S. Assistant Secretary of Defense 1959 SHOCK, VIBRATION AND ASSOCIATED ENVIRONMENTS. PART III. (Assistant Secretary of Defense, Research and Engineering, Washington, D.C.) Bull. No. 27, pt. 4, June 1959. ASTIA AD 212 977.

ABSTRACT: Design and use of vibration test jigs and fixtures: Nature of the vibration testing problem; Design criteria for vibration test jigs and fixtures; Scope of the vibration fixture problem; Vibration fixtures for large test items; Multi-purpose environmental test fixtures; A critical look at vibration fixture performance; Investigation of vibration fixture materials; Comments on seminar on jigs and fixtures; Experimental and theoretical study of an oil film slider; Improved version of the fluid film method of stabilizing an auxiliary vibration table; Oil-film supported table for vibrating large components; Building an inertial guidance facility. Correlation of the effects of laboratory vs service environments on hardware: Real and simulated environment; A specification writer's viewpoint; Damage accumulation in relation to environmental testing; Method of equating long duration-low intensity and short duration-high intensity random vibration; Evaluating the effects of logistic environments on missile reliability; Reliability and mechanical design. Information exchange: National Bureau of standards calibration service for vibration pickups; Ad Hoc Committee on transportation hazards; Research program on random vibration. (See also ASTIA AD 212 976)

939

U.S. Office of the Secretary of Defense 1960 SHOCK, VIBRATION AND ASSOCIATED ENVIRONMENTS, PART IV. (U.S. Office of the Secretary of Defense, Research and Engineering, Washington, D.C.) Bulletin No. 28. ASTIA AD 244 857.

ABSTRACT: This publication contains some of the papers presented at the 28th Symposium on Shock, Vibration and Associated Environments held in the Departmental and Commerce Auditoriums, Washington, D.C., on February 9-11, 1960. The Department of the Air Force was host. This section of the Bulletin contains unclassified papers discussing design, test methods, instrumentation and data analysis. The material discussed at the panel session on the Collection, Analysis and Presentation of Shock and Vibration Data is also included. A Table of Contents for all four Parts of the Bulletin and an attendance list for the 28th Symposium may be found in Part I.

940

U.S. Assistant Secretary of Defense 1962 SHOCK, VIBRATION AND ASSOCIATED ENVIRONMENTS PART II. (Assistant Secretary of Defense, Research and Engineering, Washington, D.C.) Bulletin No. 30, pt. 2, Jan. 1962. ASTIA AD 273 514.

CONTENTS:

Analytical determination of mechanical impedance  
Instruments and methods for measuring mechanical impedance  
Applications of impedance information  
Application of mechanical admittance data to the solution of a practical problem  
Structural response to dynamic load.

941

U.S. Assistant Secretary of Defense 1962 SHOCK, VIBRATION AND ASSOCIATED ENVIRONMENTS. PART V. (Assistant Secretary of Defense, Research and Engineering, Washington, D.C.) May 1962. ASTIA AD 276 199

CONTENTS: Includes data on advanced test and simulation facilities, development of a combined environment chamber for physiological testing, measurement and simulation of space environments, vibration testing of the Mercury capsule, simulation problems in futuristic space environmental chambers, vibration at altitude, vibrational environment of the Mercury-Redstone vehicle, and simulation of air drops for the Mercury landing system controller utility of isolators for protection of equipment.

942

U.S. Assistant Secretary of Defense 1957 SHOCK AND VIBRATION BULLETIN.  
TEN YEARS OF PROGRESS. (Assistant Secretary of Defense, Research and  
Development, Washington, D.C.) Bull. No. 24, Feb. 1957. ASTIA AD 320 434

943

U.S. War Dept. n.d. PHYSIOLOGICAL EFFECTS OF ULTRA-SONIC VIBRATIONS  
(War Dept., Combined Intelligence Objectives Subcomm.) Report #45

944

Usenko, V. R. 1961 EFFECT OF GENERAL VERTICAL VIBRATIONS ON THE VESTIBULAR  
APPARATUS.  
In Tr. Leningrad Sanitarnogig Med. Inst. 71:9-15, 1961, (Russian).



VIBRATION

V

945

Vars, H. M. 1961 A STUDY OF METHODS OF EQUILIBRATING TISSUE OXYGEN REQUIREMENTS AND TISSUE OXYGEN SUPPLY IN SHOCK AND SHOCK-LIKE STATES. Annual Progress Report, 31 July 60 - 31 July 1961. (Pennsylvania University, Philadelphia) (Contract DA 49-007-md-511) ASTIA Doc. No. AD-265 277.

ABSTRACT: The secretion (microgram/min) and peripheral blood concentration of epinephrine (E), norepinephrine (N), 17-hydroxycorticosteroids (17-OHCS) and adrenal vein blood flow were measured in hemorrhagic shock: (1) bled to 60 mm Hg, maintained for 1 hr., then bled to 30 mm Hg and maintained for 1 hr; and (2) bled directly to 30 mm Hg, and maintained for 2 hr. In other experiments peripheral blood levels of E and N were followed during hypotension at 30, 45 and 60 mm Hg, maintained for 1.5, 2, 3, 4 and 6 hr. The adrenal response to shed blood replacement was also observed. With varying degrees and duration of hypotension a prompt increase in E, followed by a lesser and more variable increase in N, occurred in all groups. Blood reinfusion resulted in a sharp decrease to somewhat above control values of E and N when high secretion and blood levels were obtained at the time of transfusion. The adrenal vein blood 17-OHCS concentration usually increased at moderate levels of hypotension (60 mm Hg) although the microgram/min secretion may have decreased due to the reduction in blood flow. When the blood pressure was reduced to 30 mm Hg adrenal blood flow and corticoid secretion were markedly reduced to much lower levels. (Author)

946

van Galen, J. 1957 GERUIS- EN SCHOKBEVEILIGING VAN ONDERZEEBOTEN 1949: BIBLIOGRAFIE NOISE AND SHOCK SAFEGUARDING FOR SUBMARINES 1949: BIBLIOGRAPHY (Technisch Documentatie Centrum voor de Krijgsmacht (Netherlands) 10 Nov. 1957, Rept. no. TDCK 2911-S2, ASTIA AD-156 155

947

Vernon, J.A. 1952 CUTANEOUS INTERACTION RESULTING FROM SIMULTANEOUS ELECTRICAL AND MECHANICAL VIBRATORY STIMULATION (Virginia U., Charlottesville) 2 Sept. 1952; Contract N7onr-372, T.O. 2; ASTIA AD-13 860

948

Vernon, J.A. 1953 CUTANEOUS INTERACTION RESULTING FROM SIMULTANEOUS ELECTRICAL AND MECHANICAL VIBRATORY STIMULATION. J. Experimental Psychology 45(5):283-287. May, 1953

ABSTRACT: The simultaneous application of electrical and mechanical vibratory forces to a common locus on the finger-tip was demonstrated to produce a cutaneous interaction. This interaction, as indicated by the detection of cutaneous beats, was best produced in the narrow frequency range of about 280 cycles to 310 cycles per second.

The magnitude of the cutaneous interaction was measured by determining the effect of simultaneous subliminal electrical stimuli upon mechanical vibratory thresholds. When the two forces were presented in one phase relation (the absolute value was unknown), the mechanical vibratory thresholds were greatly lowered as compared with normal mechanical vibratory thresholds, but when the two forces were presented in a phase relation  $180^{\circ}$  different from the first, there was little or no departure from normal thresholds.

The evidence shows that electrical stimuli do not stimulate the skin by first producing mechanical movements in the skin.

In that an interaction between electrical and mechanical vibratory stimuli has been demonstrated. even under limited conditions, it now appears fruitful to plan future work. The investigation is being extended by the use of continuous phase variation.

949

Verrillo, R.T. 1962 INVESTIGATION OF SOME PARAMETERS OF THE CUTANEOUS THRESHOLD FOR VIBRATION. J. of the Acoustical Society of America 34(11):1768-1773, Nov. 1962.

ABSTRACT: Sensitivity to vibration on the hand was determined as a function of frequency, contactor dimensions, contactor configuration, and distance of the contactor from a rigid support. It was found that each of these parameters affects the threshold in a different way. In the frequency between 25 and 640 cps, the absolute threshold as a function of frequency yields a u-shaped curve that reaches a maximum of sensitivity in the region of 250 cps. The effect of the geometric parameters appears to be highly complex. (Author)

950

Voight, H., tr. E.N. Labouvie 1958 EINIGE NEUERE ERKENNTNISSE UND  
ERFAHRUNGEN BEI-SCHIFFSVIBRATIONEN (RECENT FINDINGS AND EMPIRICAL DATA  
OBTAINED IN THE FIELD OF SHIP VIBRATIONS) Jahrbuch Schiffbautechnische  
Gesellschaft vol. 47, Translation 268, ASTIA AD-202 516, Feb. 1958

ABSTRACT: The status of German research on causes of vibration in ship hulls  
appendages, and power plants is described, with examples drawn from the work  
of the Germanische Lloyd and the STG Technical Committee on Ship Vibration.  
Various devices for measuring vibration are reviewed. Also included is a  
discussion of the paper by several specialists in the field. (Author)

951

Vokac, Zdenek 1957 KINETOSY -- NEMOCI POHYBU (KINETOSES -- DISEASES CAUSED  
BY MOVEMENT)  
(Veda Zivot (Czech.) 1957 (3): 153-155, March 1957)

952

Volkov, A.M., and V. Chirkov 1960 OSCILLATIONS OF THE HUMAN BODY UNDER  
THE EFFECT OF VIBRATION. Gigiena truda i professional'nye zabolevaniia  
(Moskva), 4 (5): 8-12, May 1960

ABSTRACT: The physiological effects of vibration in the frequency range of  
1-70 cps were investigated on humans with the aid of a vibration table and a  
vibration stand. A method of simultaneous recording of the oscillatory movement  
of the human body was employed. The results confirm the resonance nature of  
oscillations in the frequency range of 5-8 cps and 17-25 cps for the human body.

953

von Békésy, G. 1939 SENSATIONS OF VIBRATION. (Über die Vibration-semfindung)  
Akustische Zeit. 4:316-334.

ABSTRACT: The diffusion of mechanical vibration and the isolation of resonance  
in the human body are investigated. From the sensation of pressure and vibration  
it becomes evident that they occur through two different nerve types which have  
separated themselves spatially in the vicinity of the fibrous root. The fre-  
quency dependence of the vibration threshold is continuously measured and it  
appears, through impedance measurements of the surface of the skin, that the  
sensation of vibration is not determined by the alternating pressure, but by  
the magnitude of deformation. Finally, an arrangement for the subjective  
measuring of vibration force is given.

954

von Bekesy, G. 1939 THE SENSITIVITY OF STANDING AND SITTING MAN TO  
SINUSODIAL VIBRATION. (Über die Empfindlichkeit des stehenden und  
sitzenden Menschen gegen sinusformige Erschütterungen)  
Akustische Zeit. 4:360-369.

ABSTRACT: A shake table for vertical vibration was made from a decimal balance which held a load of 100 Kg. With this arrangement the threshold of sinusoidal vibration stimulation of normal standing and sitting man was measured by its frequency relationship. The frequency range investigated was from 0.1 to 100.0 cps. The displacement of the hand or foot against the resting body which were noticed were also investigated.

With special large-faced quartz microphones the pressure threshold of vibration sensation for standing man could be determined, which as anticipated is independent of frequency in a wide frequency range. With resting, standing or sitting man periodic variations became evident which partly coincided with pulsation.

In order to be able to calculate the vibration transmission over man, the mechanical impedance of man was ascertained by two distinct methods. The frequency dependence of impedance showed that with increasing vibration frequency even smaller masses of the body were displaced in vibration.

By means of a horizontal pendulum the threshold of horizontal vibration were also investigated. At the same time the appearance of the vertebral column could be observed.

955

von Bekesy, G. 1940 UBER DIE STÄRKE DER VIBRATIONSEMPFINDUNG UND IHRE OBJEKTIVE  
MESSUNG (Concerning the Strength of the Vibration Experience and Its  
Objective Measurements)  
Akustische Zeitschrift 5: 113-124

956

Von Bekesy, G. 1940 THE NEURAL TERMINATIONS RESPONDING TO STIMULATION OF PRESSURE  
AND VIBRATION. J. Exp. Psychol. 26:514-519.

957

von Bekesy, G. 1948 VIBRATION OF THE HEAD  
J. Acoustical Society of America 20(6):749-760, Nov. 1948

958

von Bekesy, G. 1959 NEURAL FUNNELING ALONG THE SKIN AND BETWEEN THE INNER AND OUTER HAIR CELLS OF THE COCHLEA. (Psycho-Acoustic Lab., Harvard Univ., Cambridge, Mass.) Contract No. 186615; ASTIA AD-229 246; 1 June 1959  
See also Reprint J. of the Acoustical Society of America 31:1236-1249

ABSTRACT: An attempt has been made to show that (1) the rotating tones in hearing, (2) the rotating vibrations on the skin, (3) the difference limen for the smallest perceptible distance on the skin, and (4) Mach's law of contrast are all consequence of the same funneling action of the nervous system. In many situations the role of the funneling action can be better understood if a neural funneling unit is proposed, taking into account that a local stimulus produces both an area of activity and, around it, an area of decreased sensitivity. Since the inner and outer hair cells in the cochlea show a difference in sensitivity, the funneling action between these areas of different sensitivity has been investigated. It has been found that, between such areas, the locus of the sensation is continuously displaced as the intensity of the stimulus is increased. This suggests that along the organ of Corti there is a longitudinal displacement produced by variations in frequency, and a radial displacement between the outer and inner hair cells produced by variations in sound pressure. Thus there seems to be a pitch-loudness coordinate system in the ear. The cochlear model (J. Acoust. Soc. Am. 27:830-841, 1955) with nerve supply was therefore further developed into a cochlear model with more and less sensitive nerve supplies, in order to represent the outer and inner hair cells in the organ of Corti. (AUTHOR)

959

von Diringshofen, H. 1935 LOS MAS IMPORTANTES PROBLEMS DE LA MEDICINA AERONAUTICA (The Most Important Problems of Aviation Medicine)  
Revista médica germano-ibero-americana (Leipzig) 8: 418-438

960

von Diringshofen, H. 1935 DIE WICHTIGSTEN AUFGABEN DES FLIEGERARZTES UND DER LUFTFAHRTMEDIZIN (The Most Important Tasks of the Flight Surgeon and the Aviation Medicine)  
Deutsche Medizinische Wochenschrift (Stuttgart) 61: 461-464 & 545-547

961

von Diringshofen, H. 1938 FÜR DEN TRUPPENARZT PRAKTISCH WICHTIG FRAGEN DER LUFTFAHRTMEDIZIN (Practical, Important Questions of Aeromedicine for the Company Doctor)  
Luftfahrtmedizinische Abhandlungen (Leipzig) 2: 252-253.

962

von Diringshofen, H. 1950 BESCHLEUNIGUNGSWIRKUNGEN IM RONTGENBILD (Acceleration Effects in the X-ray Pictures)  
Weltraumfahrt 1: 135-137

963

von Gierke, H. E. 1949 SOUND ABSORPTION AT THE SURFACE OF THE BODY OF MAN AND ANIMALS. J. of the Acoustical Soc. of Amer. 21:55.

964

von Gierke, H.E. 1950 MEASUREMENT OF THE ACOUSTIC IMPEDANCE AND THE ACOUSTIC ABSORPTION COEFFICIENT OF THE SURFACE OF THE HUMAN BODY.  
(Wright Air Development Center, Wright-Patterson AFB, Ohio)  
AF Technical Rept. No. 6010, March 1950.

ABSTRACT: Measurements were made of the mechanical impedance and the acoustical absorption coefficient of the human body surface. The measurements were carried out over soft areas ( $1-18 \text{ cm}^2$ ) of the body surface for the frequency range 100 to 18,000 cps. For the lower frequencies the data were obtained from the resonance and damping characteristics of an air filled tube closed at one end by the body. At higher frequencies an aluminum rod pressed against the body was employed instead of the air column. These measuring devices are described and for each device two different measuring methods are treated theoretically.

The experimental results show for the body surface the absorption coefficient and the impedance (amplitude and phase) as functions of frequency and measured area. From this data the vibratory energy absorbed by the body surface may be calculated. A theoretical explanation for the measured behavior of the body surface is given.

965

von Gierke, H.E. 1950 THE EFFECTS OF SHOCK AND VIBRATION ON MAN  
USAF Technical Report 6010, 1950

966

von Gierke, H. E., H. O. Parrack, & D. H. Eldredge 1950 HEATING OF ANIMALS BY ABSORBED SOUND ENERGY (Air Materiel Command, Wright-Patterson AFB, Ohio) AF TR 6240; Oct. 1950

ABSTRACT: In order to explain the observed heating and killing of small animals in sound fields above about 150db ref. .0002 dyne/cm<sup>2</sup>, the sound absorption coefficient of rat's body surface is measured as a function of frequency. The absorption coefficient decreases up to about 1500 cps and then increases up to 6000 cps. The behavior below 1500 cps is determined largely by the tissue beneath the skin while the increased absorption above 1500 cps is the result of the presence of the fur. These absorption coefficients permit the estimation of the sound energy absorbed by a whole animal. By calculating the heat balance of the animal in a sound field, the sound intensity and the time required to cause heat death can be calculated approximately. These calculated results agree with the old as well as with new experimental data on the heat death of rats and establish overheating as the agent responsible for death. (Man's situation with respect to overheating in intense sound fields is considered in an appendix.) (AUTHOR)

967

Gierke, H.E. von, H.O. Parrack, and D.H. Eldredge 1952 HEATING OF ANIMALS BY ABSORBED SOUND ENERGY Jour. Cellular and Compar. Physiol. 39(3): 487-505 DLC(QP1.W533, v. 39)

ABSTRACT: The sound absorption of anesthetized rats with normal fur or with the fur shorn, and of the furred rat skin removed from the body was studied. Sound fields above 150 decibels and frequencies up to 6000 c.p.s. were employed. On the intact fur, the sound absorption coefficient decreased up to 1500 c.p.s. the coefficient increased again, being about 12% at 6000 c.p.s. On the bare skin, the absorption coefficient decreased with increasing frequency, and on the isolated furry skin it increased with increasing frequency throughout the tested. - The behavior below 1500 c.p.s. it is dependent on the physical properties of the fur. This coefficient permits the calculation of sound vibration absorbed by the whole animal. The duration of survival of the animal in a sound field is related to its heat balance.

968

vonGierke, Henning, Hans L. Oestreicher, Ernst K. Franke, Horace O. Parrack and Wolf W. vonWittern 1952 PHYSICS OF VIBRATIONS IN LIVING TISSUES (Journal of Applied Physiology, Vol. 4, No. 1, June 1952, pp. 886-900)

ABSTRACT: Experimental data about the behavior of vibrating body tissue in the frequency range from 0 to 20 kcps are given and the experimental techniques

described. The results show that the vibratory energy is absorbed by the body surface in several ways and that for the distribution of the energy inside the body tissue in the different frequency ranges different types of wave propagation are important. The results suggested a theory wherein the propagation of vibratory energy in soft human body tissue is compared to the wave propagation in an elastic viscous compressible medium. The general physical conclusions of this theory are briefly outlined and the three types of wave propagation that we must expect, the shear waves, the compression waves, and the surface waves are characterized. By applying this theory specifically to the experimentally investigated case that the vibrating force is applied perpendicularly to the body surface overlying soft tissue, it is shown that the simplified model of a vibrating sphere in an elastic viscous compressible medium describes entirely the mechanical behavior of the body tissue. The qualitative agreement between the calculated and measured characteristics in terms of impedances was found to be sufficiently good, that it is possible to determine approximate values for the shear elasticity and the viscosity of the body tissue, the most important of the unknown physical constants of the four quantities involved in the theory. With these constants known, the mechanical behavior of the body surface can be calculated for the whole frequency range from 0 to about  $10^5$  cps in the ultrasound range. The theory is in good agreement with all available measurements by different authors and should apply also in ranges where measurements are still missing. Theoretical explanations or models given in earlier investigations for the low frequency case and for the middle frequency range are special cases of the general theory. The theory enables us also to estimate, from the impedance characteristic measured on the body surface, the kind of wave propagation inside the body. That is, it shows how much of the total energy entering the body is distributed in the body in the form of shear waves and how much as compression waves.

969

von Gierke, H E., H. Davis, D.H. Eldredge and J.D. Hardy      1953    AURAL PAIN  
PRODUCED BY SOUND. BENOX Report, Contract N6-ori-020, ONR Project NR 144079  
December 1953

970

von Gierke, H. E., & D. R. Warren    1953    PROTECTION OF THE EAR FROM NOISE.  
(Office of Naval Research & University of Chicago) Contract N6 ori-020,  
Task Order 44, ONR Project NR 144079, Dec. 1953



971

von Gierke, H. E., H. Davis, D. H. Eldredge, & J. D. Hardy 1953 AURAL PAIN  
PRODUCED BY SOUND (Office of Naval Research & University of Chicago)  
Contract N6 ori-020, Task Order 44, ONR Project NR 144079, Dec. 1953

972

von Gierke, H. E. 1957 TRANSMISSION OF VIBRATORY ENERGY THROUGH  
HUMAN BODY TISSUE  
Proceedings of the First National Biophysics Conference, 1957  
(New Haven, Yale University Press, 1959)

973

Von Gierke, H. E. 1958 VIBRATION AND NOISE ENVIRONMENT OF MISSILES AND  
SPACECRAFT. WADC TR 59-732  
See also Proceedings of the Wright Air Development Center Space Technology  
Lecture Series, Section 5, "Space Medicine", Dec. 1958

974

von Gierke, H.E. 1959 VIBRATION AND NOISE PROBLEMS EXPECTED IN  
MANNED SPACE CRAFT. Noise Control 5(3):8-16

ABSTRACT: Noise and vibration problems in space vehicles will be most severe during launch and re-entry. The order of magnitude of the noise levels can be reasonably well predicted for the launch phase; estimates of the noise during hypersonic re-entry are considered less accurate. With proper cabin and personal equipment design, adequate speech communication should be possible during both phases.

Vibration levels are harder to predict. But it is concluded that major vibration problems with regard to human occupants of the rocket craft may be confined to the low-frequency oscillations and transient accelerations expected at rocket burn-out and during re-entry, respectively. The frequency range which requires special attention in this connection through-out the system planning and design phases is from 0.5 to 20 cps. Vibrations in this frequency range are particularly critical for the seated subjects.

Accurate measurements of noise and vibration levels during launch and re-entry should be obtained as soon as possible to insure the optimum design of cabin and personal protection equipment and to direct the course of basic studies on tolerance and performance. In the new and complex stress environment posed by space missions, even noise and vibration levels not affecting human behavior and performance when presented as individual stimuli must be considered as significant compounds of the overall physical and psychological stress picture.

975

von Gierke, H. E. 1959 VIBRATION AND NOISE ENVIRONMENTS OF MISSILES  
AND SPACECRAFT  
Space Medicine, Section 5  
Proceedings of the WADC Space Technology Lecture Series, WADC Technical  
Rep. 59-732, Vol. I 1959

976

von Gierke, H. E. 1960 VIBRATION AND NOISE ENVIRONMENT OF MISSILES AND SPACE-  
CRAFT. 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. 145-161

ABSTRACT: Noise, vibration, and transient accelerations have been with aviation from its inception. The noise and vibration problems will be most severe during launch and re-entry. The magnitude of noise levels can be reasonably predicted for the launch phase but noise estimates during hypersonic re-entry are less accurate. Critical and major vibration problems affecting crewmen may be confined to low-frequency oscillations at rocket burnout and transient accelerations during re-entry. Bio-acoustic problem areas should form no serious obstacle to manned flight. However, meager existing data must be supplemented soon by measurements of noise and vibration during launch and re-entry to permit optimum design of cabin and personal protection equipment and to direct a course of basic studies in tolerance and performance of humans. Noise and vibration levels which do not affect human behavior when presented as individual stimuli must be considered significant in the over-all physical and psychological stress picture. (AUTHOR)

977

von Gierke, H.E. 1959 VIBRATION AND NOISE PROBLEMS EXPECTED IN MANNED  
SPACE CRAFT. Noise Control, 5(3): 8-16, May 1959

ABSTRACT: The present information on noise, vibration and transient accelerations of space craft during launch and re-entry is reviewed and discussed with regard to human physiologic and psychologic tolerances and performance. Using general knowledge of noise and vibration sources, estimations and predictions are made of noise and vibration levels which may be experienced inside and outside a manned space craft. The order of magnitude of the noise levels can be reasonably predicted for the launch phase; estimates of the noise during hypersonic re-entry are considered less accurately. It is concluded that vibration problems with regard to human occupants may be confined to the low frequency oscillations and transient acceleration expected at rocket burn-out and during re-entry respectively.

978

von Gierke, H. E. 1960 TRANSMISSION OF VIBRATORY ENERGY THROUGH HUMAN BODY  
TISSUE. In Glasser, Otto, ed., Medical Physics (Chicago, Ill.: The Year  
Book Publishers, Inc., 1960) 3:647-668

SUMMARY: This survey is by no means exhaustive and only touches on the most important data available on the mechanical properties of body tissue. Phenomena such as nonlinearity and hysteresis are not included at all. The main purpose was to stress the fact that regardless of the frequency range and the application for which the measurements were made, all data should fit together into one general picture of the dynamic mechanical properties of human body tissue.  
(AUTHOR)

979

Von Gierke, H. 1960 REPORT TO THE ACCELERATION PANEL, ARMED FORCES-NRC  
COMMITTEE ON BIO-ASTRONAUTICS, WOODS HOLE, MASS., AUG. 1960. (Aerospace  
Med. Lab., WPAFB, Ohio)

980

von Gierke, H. E., et al. 1960 THE EFFECTS OF SHOCK AND VIBRATION ON MAN  
(Naval Medical Research Institute, Bethesda, Md.) No. 60-3, 8 Jan. 1960

981

von Gierke, H.E. 1961 BIOMECHANICS OF IMPACT INJURY.  
(Aerospace Medical Lab., Wright-Patterson AFB, Ohio)

ABSTRACT: A review of the biomechanics of impact injury indicates that (1) Steady-state vibration studies are very helpful for interpreting impact tolerance data. The mechanical models for the human body derived from such studies are useful as a basis for theoretical analysis and prediction of impact response. (2) Theoretical analysis of the response of the complex human system to impact loads shows clearly that a complete description of the force-time function of the impact load is necessary to define response or tolerance uniquely. Only in very limited impact-duration ranges can a single parameter such as peak acceleration, impulse, or rate-of-onset be considered primary to the response.

982

Von Gierke, H. E. & R. R. Coermann 1961 THE BIODYNAMICS OF HUMAN RESPONSE  
TO VIBRATION AND IMPACT.  
Rev. Med. Aero (Paris) 2:201-203, Dec. 1961

983

Von Gierke, H. E. & R. R. Coermann 1963 THE BIODYNAMICS OF HUMAN  
RESPONSE TO VIBRATION AND IMPACT.  
Industr. Med. Surg. 32:30-32, Jan. 1963.

984

von Gierke, H. E. and D. E. Goldman 1961 SHOCK AND VIBRATION: LIMITS  
OF COMFORT AND SAFETY  
Handbook of Shock and Vibration .  
(New York, N. Y., McGraw-Hill Book Co., 1961)

985

Von Gierke, Cole & Grob 1961 NOISE AND VIBRATION OF PERSONNEL IN AERO-  
SPACE SYSTEMS, AND THE SIMULATION OF THE ENVIRONMENT IN AEROSPACE  
MEDICAL RESEARCH. (1961 Proceedings of the Institute of Environmental  
Sciences;; Paper not available at publication).

986

- von Gierke, H. E. and R. R. Coermann 1961 THE BIODYNAMICS OF HUMAN  
RESPONSE TO VIBRATION AND IMPACT  
In Proceedings of the International Congress of Aviation and  
Cosmonautical Medicine, Paris, September 1961  
In Revue de Medicine Aeronautique, Vol 2, 1962  
See also Industrial Medicine and Surgery 32:30-32, 1963

987

- von Gierke, H. E. and E. P. Hiatt 1962 BIODYNAMICS OF SPACE FLIGHT  
In S.F. Singer, Ed. Progress in Astronautical Sciences, Vol I.  
(Voorburgwal, Amsterdam, North Holland Publishing Company) 1962  
See also WADD - Q-1

988

- van Liere, E. J. 1957 SPACE MEDICINE  
West Virginia Med. J. 53(8): 297-301 Aug. 1957

ABSTRACT: An outline is made of some of the physiologic problems encountered in space flight, including those arising from accelerations, weightlessness, rapid decompression, and hypoxia. As a result of such flights physicians will have to treat such things as radiation sickness, ultraviolet and thermal burns, cosmic ray damage, sterility, accidents due to meteors, and fractures sustained by assuming incorrect position when acceleration begins. Mention is made of the emotional strain and physical and mental fatigue which are conducive to bringing about neuroses in spacemen.

989

- von Wittern, W. W. 1952 FORCE BALLISTOCARDIOGRAPHY  
WADC TR 52-340, November 1952

990

- von Wittern, W.W. 1953 BALLISTOCARDIOGRAPHY WITH ELIMINATION OF THE  
INFLUENCE OF THE VIBRATION PROPERTIES OF THE BODY.  
American Heart Journal, 46(5):705-714, November 1953

VIBRATION

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991

Wacholder, B.V. & E. Fayer 1960 STUDY OF INSTRUMENTATION AND TECHNIQUES FOR MONITORING VEHICLE AND EQUIPMENT ENVIRONMENTS AT HIGH ALTITUDE INSTRUMENTATION AND MONITORING TECHNIQUES  
Wright Air Development Division, Air Research and Development Command, Wright-Patterson AFB, Ohio WADC TN-59-30/, Vol. III June 1960  
ASTIA AD 268 090

ABSTRACT: Instrumentation techniques are presented which are available within the state-of-the-art; an instrumentation system is proposed for the monitoring of high-altitude environments encountered by typical vehicles. The high altitude environmental effects on typical vehicles and equipment is summarized. The present airborne-instrumentation state-of-the art is presented for measuring temperature, pressure, strain, vibration, acceleration, radiation, meteorite detection, and acoustic noise. A feasible instrumentation system is discussed for monitoring these deleterious environments. In addition, recommendations are made for an extension of this study to cover environments that are outside the scope of the present program, such as the environments created by nuclear and other advanced propulsion systems. Another recommendation is the continuation of the instrumentation study to effect a complete design specification for an environmental monitoring system for a particular vehicle.

992

Walcott, Charles, & W. G. van der Klott 1959 THE PHYSIOLOGY OF THE SPIDER VIBRATION RECEPTOR. Journal of Experimental Zoology 41:191-244, July 1959  
See also (Cornell University, Ithaca, N. Y.) Contract Nonr-40128, Proj. NR 140-117; ASTIA AD-244 182

993

Walcott, Charles, & W. G. van der Klott 1959 THE PHYSIOLOGY OF THE SPIDER VIBRATION RECEPTOR. (Cornell University, Ithaca, N.Y.) Contract Nonr-40128, Proj. NR 140-117; ASTIA AD-244 182  
See also Reprint Journal of Experimental Zoology 41:191-244, July 1959

ABSTRACT: Much of the information that web-spinning spiders receive about the outside world can come only from vibrations--simple observation bears this out. Both in the capture of insects for food and in the elaborate courtship, vibration is an important stimulus for behavior.

By using electrophysiological techniques, we have been able to locate an extremely sensitive vibration receptor on the leg of the spider. This paper includes data on the threshold, frequency response, frequency discrimination, and other properties of the receptor as well as experiments designed to uncover the mechanism by which the receptor operates.

994

Waldron, D. L., & R. C. McNee 1961 INTRA-AURAL TEMPORARY THRESHOLD SHIFT DIFFERENCES (School of Aerospace Medicine, Brooks AFB, Texas) Rept. 61-95; Aug. 1961

995

Walsh, James E. 1948 VIBRATION PROBLEMS IN AIRCRAFT  
In: Marcus, Henri et al, Shock and Vibration Bulletin No. 7, Naval Research Lab. Rept. No. S-3229 ASTIA ATI 75 153 pp. 13-15

ABSTRACT: The method of vibration isolation of reciprocating engine-propeller combination is described. Present specifications for allowable cockpit vibrations are discussed critically. Finally, a brief comment on the problems of turbo-jet and prop-jet engine vibration isolation is presented.

996

Webb Associates 1962 FORCE FIELDS  
In: NASA Life Sciences Data Book (National Aeronautics and Space Administration, Washington, D.C.) Contract NASr-89. June 1962

ABSTRACT: This handbook provides 28 pages of charts and summaries from the various force fields. Areas covered include: Acceleration (experience, impact, transverse G limits, acceleration terminology, variations in G tolerance, G vector and consciousness, direction of force, maximum tolerable acceleration profiles, G protection by water immersion); tolerance to tumbling; deceleration (abrupt transverse, positive and negative G decelerations, tolerance to vertical impact, human impact sensitivity, impact tolerance); G fields in rotating space vehicles; vibration, (response, tolerances, physiological effects, psychophysical factors, performance functions, transmission, oxygen consumption, respiratory ventilation, and tracking performance); resonance of the abdominal wall; oscillations; high dynamic pressures; blast injury.

997

Weber, M. 1951 A NEW VIBRATION MEASURING APPARATUS AND ITS APPLICATIONS  
Schweiz Arch Angew Wiss Tech (German) v. 17, pp. 129-139

ABSTRACT: The mathematical design of a vibration recording apparatus is given briefly with special reference to the measurement of shock waves. Details are given of a piezoelectric accelerometer. The natural frequency of the equipment is 3500 c/s, and its output is linear up to 400 c/s.

998

Weber, M. and U.A. Corti. 1951 VORVERSUCHE ZUR ENERGETISCHEN ANALYSE BIO-DYNAMISCHER PHÄNOMENE AUF ERSCHÜTTERUNGSMES-STECHNISCHER GRUNDLAGE.  
(Preliminary experiments in the energetic analysis of biodynamic phenomena by measurement of vibration.) Schweiz. med. Wchnschr. 81:194-195

999

Webster, W. C., & J. D. Lin 1962 DYNAMIC HEAVING MOTION OF GROUND EFFECT MACHINES. (Hydronautics, Incorporated, Washington, D. C.) Technical Rept. 011-3; ASTIA AD-274 546; March 1962

ABSTRACT: The dynamics of simple ground effect machines undergoing heaving motion over a wavy surface is formulated here. The equation of motion is a third order ordinary differential equation with the coefficients depending essentially on the mass flow into or out of the cavity under the machine and on the geometric characteristics of the machine. The response of machines traveling over a sinusoidal surface is derived as a function of the encounter frequency and mass flow coefficients. Then, mass flow coefficients are obtained for different types of machines. Peripheral jet machines without an exceptionally large volume of concave bottom are found to be stable in the heave mode. The responses of both a peripheral jet machine and a plenum chamber machine are computed. The peak response of plenum chamber machines is generally higher than that of peripheral jet machines. (AUTHOR)

1,000

Weidmann, F. 1940 PHENOMENA OCCURRING WHEN TRANSMITTING MECHANICAL ENERGY FOR SHORT PERIODS OF TIME (VORGANENGE BEI MECHANISCHER ENERGIEUEBERTRAGUNG IN KURZEN ZEITRAEUMEN)  
ASTIA ATI 55423

ABSTRACT: A theoretical discussion is given on the phenomena occurring during the mechanical transmission of energy for short periods of time, using a catapult



...illation as an example. Three possible means to assure constant acceleration  
...lying models over the entire length of the catapult are discussed, and the  
...using a spring as a means for damping the acceleration shock is considered.  
...substitute for this system is a double pendulum, whose equations are derived  
...the general solution. The course of acceleration is purely sinusoidal  
...le the velocity is composed of a constant and a cosine term. The application  
...the spring for shock absorption is also considered.

01

...ert, C. E. 1950 VIBRATION ISOLATOR (DWG. NO. 4391419) LABORATORY STATIC,  
DYNAMIC AND TEMPERATURE TESTS. (Douglas Aircraft Co., Santa Monica, Calif.)  
Rept. No. DEV-542, 26 Dec. 1950

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...tz, J. 1939 VIBRATORY SENSITIVITY AS AFFECTED BY LOCAL ANESTHESIA.  
J. Experimental Psychology 25:48-64

003

...itz, J. 1941 VIBRATORY SENSITIVITY AS A FUNCTION OF SKIN TEMPERATURE.  
J. Exp. Psychol. 28:421-436.

1,004

Wendell, G.H. & S.B. Cummings 1938 FATIGUE OF THE VIBRATORY SENSE.  
J. Exp. Psychol. 22:429-438

1,005

Wendt, G.R. 1958 PHYSIOLOGICAL EFFECTS OF LOW FREQUENCY, HIGH-AMPLITUDE  
VIBRATION ON THE HUMAN ORGANISM. ( Paper read at the 29th Annual Meeting  
of the Aero Medical Association, Wash., D.C. March 1958)

1,006

Wendt, H.W., E.A. Stark, G.B. Simon, and E. Cohen 1961 THE VALUE OF COCKPIT MOTION IN FLIGHT SIMULATION (Link Division, General Precision Corporation, Presented at American Psychological Association Convention, New York, New York) 4 Sept. 1961

1,007

White, D.C. & M.M. Mozell 1957 WHOLE BODY OSCILLATION; PRELIMINARY REPORT U.S. Naval Air Development Center, Johnsville, Pa. NADC-MA-LR23 April 1, 1957

ABSTRACT: In a study to set the upper limit of endurance to sinusoidal whole body oscillation, two subjects were studied on a vibration table while strapped securely in an A4D seat at 0.34-inch double amplitude and frequency of 10 cps (2-3 G). An intolerable precordial pain radiating to the left shoulder developed in both subjects. At frequency levels of 20-25 cps and the same double amplitude (6-10 G), a lower bowel disturbance was observed which was characterized by discomfort, followed later by bloody, mucoid discharge.

1,008

White, G. H., Jr., K. O. Lange & R. R. Coermann 1962 THE EFFECTS OF SIMULATED BUFFETING ON THE INTERNAL PRESSURE OF MAN.  
Hum. Factors 4:275-290, Oct. 1962

1,009

White, S.Y. 1948 APPLICATIONS OF ULTRASONICS TO BIOLOGY Audio Eng. 32:42-45

1,010

Whittingham, P. D. G. V. 1962 THE MEASUREMENT OF TISSUE THICKNESS BY ULTRASOUND (Paper, 33rd Annual Meeting of the Aerospace Medical Assoc., Chalfonte-Haddon Hall, Atlantic City, N. J., April 9-12, 1962)

1,011

Wiercinski, F.J. and C.M. Child 1936 DIFFERENTIAL SUSCEPTIBILITY OF LIVING ORGANISMS TO SUPERSONIC VIBRATION Science 83:604-605

1,012

Wilcox, H. H. & W. F. Windle 1950 A CONTROLLED STUDY OF THE EFFECTS UPON THE BRAINS OF GUINEA PIGS OF ULTRASONIC WAVES GENERATED BY TURBO-JET ENGINES. J. Aviation Med. 21:85.

ABSTRACT: A pilot experiment was performed with eight guinea pigs to determine whether exposure to repeated bouts of "noise" generated by turbo-jet engines results in brain damage or impairment of retention of memory of a learned maze problem. No statistically significant alterations in retention were observed. No neuropathological changes were seen. Except for the destruction of the organ of Corti, leading to deafness, results were negative.

1,013

Wilcoxon, H.C., and E. Davy 1954 FIDELITY OF SIMULATION IN OPERATIONAL FLIGHT TRAINERS, PART I: EFFECTIVENESS OF ROUGH AIR SIMULATION (Special Devices Center, Port Washington, New York) SDC Technical Report 999-2-3, 24 January 1954.

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Wilson, W.Ker 1943 VIBRATION IN AIRCRAFT (Oscillation Sub-Committee of the Aeronautical Research Committee, DeHavilland Aircraft Co., Ltd., Hartfield, Herts, England) June 1943

1,015

Winchester, C. F., L. E. Campbell, & J. Bond 1959 EFFECTS OF AIRCRAFT SOUND ON SWINE. (Wright Air Development Division, Wright-Patterson AFB, Ohio) WADD TR 59-200; August 1959, ASTIA AD-233 449

ABSTRACT: To determine whether or not aircraft sounds affect swine unfavorably, a number of different lines of investigations have been carried out. Direct obser-

ventions and motion picture records have been made of animals exposed to reproduced aircraft sounds at high levels of intensity. Heart rate measurements have been made in an attempt to determine possible rate changes due to noise. Feeding trials in which pigs were exposed daily to the sound of random "fly-overs" have been carried out. Possible effects of noise on reproduction have been investigated. In addition, histological studies of the ears and adrenal and thyroid glands of swine after sound exposure have been made. None of these lines of investigation has yielded evidence indicating that swine are influenced significantly by noise.

1,016

Winter, R. S. 1947 PASSENGER SEAT, STRUCTURAL AND VIBRATORY TESTS, MODEL 240 AIRPLANE. (Consolidated Vultee Aircraft Corp., San Diego, Calif.)  
Rept. 4939, 22 May 1947

1,017

Wolfers, F. 1931 ULTRASONICS AND BIOLOGY (Paris: A. Blanchard)  
See Also: Biol. Abstr. 8:19647

1,018

Wood, R.W., & A.L. Loomis 1932 THE PHYSICAL AND BIOLOGICAL EFFECTS OF HIGH FREQUENCY SOUND WAVES OF GREAT INTENSITY Biol. Abstr. 6:24736

See Also: London, Edinburgh & Dublin Philosophical Magazine and Journal of Science 4:417-436 (7th Series)

1,019

Wuff, V.J., Fry, W.J. D. Tucker, F.J. Fry & C. Nalton 1951 EFFECTS OF ULTRASONIC VIBRATIONS ON NERVE TISSUES  
(Proc. Soc. of Biol. Med., 1951, 76, 361)

1,020

Wulfeck, J.W., Weisz, A., and Raben, M.W. 1958 EFFECTS OF VIBRATION ON VISUAL PERFORMANCE. In; Wulfeck, J.W., Weisz, J.W., & Raben, M.W., editors, Vision In Military Aviation. (Wright Air Development Center, Wright-Patterson AFB, Ohio) WDAC Technical Rept. 58-399, ASTIA AD-207780, Nov. 1958

ABSTRACT: Vibration has been recognized to impair visual performance in reciprocating aircraft of all kinds. When vibration cannot be avoided, its effects upon visual performance may be reduced by proper design of the visual display and printed materials which must be viewed. However, effective design depends upon an understanding of how vibration influences vision. Research on the effects of vibration on visual performance have taken two directions. On the one hand, the effects of certain kinds of vibration impressed upon the operator's body, through his feet or seat, have been explored. On the other hand, the effects of certain kinds of vibration in the visual-field have been determined. Early research on the effects of vibration imposed upon the body measured human sensitivity to vibration. After bodily sensitivity to vibration was measured and discomfort thresholds were determined, efforts were made to discover the physiological effects upon which judgments of discomfort are based. Results of experiments on visual sensitivity to vibration are reported in this chapter.

VIBRATION

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VIBRATION

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1,021

Yacorzynski, G.K. & M. Brown 1941 STUDIES OF THE SENSATION OF VIBRATION  
VARIABILITY OF THE VIBRATORY THRESHOLD AS A FUNCTION OF AMPLITUDE AND  
FREQUENCY OF MECHANICAL VIBRATION. J. Exper. Psychol. 28:509-516

1,022

Yamasaki, S. & R.F. Karls 1962 AN ACCURATE METHOD OF AUTOMATICALLY  
PLOTTING "g" LEVELS OF VIBRATION SIGNALS. ( Institute of Environmental  
Sciences, Mt Prospect, Ill.) Reprint 62-620

ABSTRACT: This is a report on the development of the vibration Data Reduction  
System. This new process provides the same quality of reduced data as the  
previous system. However, UDRS requires a much shorter time period.

1,023

Yarcho, W.B. 1957 ENVIRONMENT TEST FACILITIES OF WRIGHT AIR DEVELOPMENT  
CENTER. WADC TN-57-27, Jan. 1957. ASTIA AD-110 740

ABSTRACT: The purpose of this report is to provide a compilation of the  
major environmental test facilities available at Wright Air Development  
Center for effective utilization. It is concluded that test facilities to  
meet most environmental conditions are available within Wright Air Develop-  
ment Center and their utilization is limited only by the size or weight of  
the test specimen.

1,024

Yerg, R.A. 1962 OCCUPATIONAL MEDICINE AT THE LAUNCH SITE  
In (School of Aerospace Medicine) Lectures in Aerospace Medicine, 1962,  
pp. 21-44.

ABSTRACT: Much of the success of a manned space flight depends on the individuals who are operating the ground launch equipment. Human exposure is limited to exposure of fuels used in the vehicles. Therefore, safety rules and alarm systems must be developed to protect ground crew from the hazards of explosion. Moreover, the SCAPE suit (Self Contained Atmospheric Breathing Ensemble) has been designed for the same type of protection. Other sources of medical concern at the launch site is protection from radiation, noise at the hydraulic servicing unit and in the powerhouse.

1,025

Yevskiy, A.A. Arkad 1962 COMBINED EFFECT ON MAN OF VIBRATION AND NOISE  
Gig i San, No. 10, 1962, pp. 25-29 FTD-TT-63-292

1,026

Young, W. A., D. B. Shaw et al 1963 EFFECT OF CO2 ON HYPERVENTILATION  
PRODUCED BY VIBRATION.  
J. Appl. Physiol. 18:349-352, March 1963.

1,027

Young, W. R. 1959 WHAT IT'S LIKE TO FLY INTO SPACE. Life  
46(15):132-149. 13 April.

ABSTRACT: A description of various research and training for space flight is provided with photographs including weightlessness, vibration, and acceleration studies. He describes Shake table vibration tests at Navy's Bethesda, Md. Laboratories. He was informed that "test animals sometimes die after 10 minutes on this table". "The vibration seems to make various organs hemorrhage." He notes his reactions at 180 and 600 vibrations per minute. A description of the Wright-Patterson equilibrium chair, and the Pensacola, Fla. Human Disorientation Device is also given. (CARI)



1,028

Yudkofsky, P. L. n.d. PRIMATE RESPONSES TO PROLONGED LOW MAGNITUDE ACCELERATIONS AND TO SUDDEN WITHDRAWAL OF THESE ACCELERATIONS. (Wright Air Development Ctr., Wright-Patterson AFB, Ohio) Technical Report in preparation

VIBRATION

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1,029

Zeller, W. 1932 EIN BEITRAG ZUR UNTERSUCHUNG DER MECHANISCHEN ERCHUTTERUNGEN IN IHRER AUSWIRKUNG AUF DEN MENSCHLICHEN ORGANISMUS. (Contribution to the investigation of mechanical vibration and its effect on the human body) Schalltechnik. 5:24-35

1,030

Ziegenruecker, G.H., & E.B. Magid 1959 SHORT TIME HUMAN TOLERANCE TO SINUSOIDAL VIBRATIONS. (Wright Air Development Center, Wright-Patterson AFB, Ohio) WADC TR 59-391, July 1959. ASTIA AD 227 341.

ABSTRACT: Short time human tolerance criteria for sinusoidal vibration from 1 to 15 cps were determined using 10 healthy male subjects ranging in age from 23 to 34 years. At each frequency, the amplitude was increased at a constant rate from zero to the point where the subject stopped the run because he thought that further increase might cause actual bodily harm. The lower levels of tolerance were found to be between 1 and 2 g at 3-4 cps and at 7-8 cps. The highest tolerance level of 7-8 g was found at 15 cps. Subjective tolerance limits were found to be caused by one or more of seven specific sensations or symptoms. Physiological observations during vibration exposure were also made.

1,031

Ziegenruecker, Gerd H. & Edward B. Magid 1960 SHORT TIME HUMAN TOLERANCE TO SINUSOIDAL VIBRATIONS  
Paper: 31st Annual Meeting of the Aerospace Medical Association, Americana Hotel, Bal Harbour, Miami Beach, Fla., May 9-11, 1960

ABSTRACT: Short time human tolerance criteria for sinusoidal vibration from 1 to 15 cps were determined using ten healthy male subjects ranging in age from twenty-three to thirty-four years. At each frequency, the amplitude was increased at a constant rate from zero to the point where the subject stopped the run because

he thought that further increase might cause actual bodily harm. The lower levels of tolerance were found to be between 1 and 2 G at 3-4 cps and at 7-8 cps. The highest tolerance level of 7-8 G was found at 15 cps. Subjective tolerance limits were found to be caused by one or more of seven specific sensations or symptoms. Physiological observations during vibration exposure were also made.

1,031

Ziengenruecker, G.H. and E.B. Magid. 1960 SHORT TIME HUMAN TOLERANCE TO SINUSOIDAL VIBRATIONS. Aerospace Med. 31 (4): 325-6

ABSTRACT: Short time human tolerance criteria for sinusoidal vibration from 1-15 cps were determined using ten healthy male subjects ranging in age from 23 to 34 years. At each frequency the amplitude was increased at a constant rate from 0 to the point where the subject stopped the run because the thought that further increase might actual cause bodily harm. The lower levels of tolerance were found to the between 1 and 2 G at 3-4 cps and at 7-8 cps. The highest tolerance level of 7-8 G was found at 15 cps. Subjective tolerance limits were found to be caused by one or more of 7 specific symptoms. Physiological observations during vibration exposure were also made.

VIBRATION

ANONYMOUS

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Anon. 1945 AERO-MEDICAL RESEARCH: BASIC STUDIES ON VIBRATION. (Rept. Air Techn Intelligence, U.S. Tokyo No. 111 pp. 1-7)

1,033

Anon. 1946 INTERNAL VIBRATIONS EXCITED IN THE OPERATION OF PERSONNEL EMERGENCY ESCAPE CATAPULTS (Frankford Arsenal, Philadelphia, Pa.) Memo. rept. no. MR-340 26 Nov 1946, ASTIA AD-51 792

1,034

Anon. 1947 CONFERENCE ON ULTRASONICS AND EXPLOSIVE DECOMPRESSION.  
(Comm. on Aviation Med., Div. of Med. Sci., Nat'l Research Council,  
Washington, D. C. ) 17 Dec. 1947

1,035

Anonymous, 1947 PHILIPS VIBRATION MEASURING APPARATUS  
(Philips, Endhoven, Holland ) Undated, translated 1947  
R.A.E. Translation No. 148

1,036

Anon. 1948 LANDING IMPACT VIBRATION STUDIED  
Aviation Week, 48:26-27

ABSTRACT: An extensive investigation of vibration of airplane structure as a result of landing impact is in progress at the National Bureau of Standards under the direction of Dr. Walter Ramberg. Craft of earlier and more rigid types were designed for landing condition by treating the airplane as a rigid body subjected to an impact force. Large transport planes designed on this assumption showed a tendency to develop failures in the wing or tail, which could be ascribed only to transient vibration of the structure excited by landing impact. A comparison showed that the values obtained from the theory were 15 to 140 per cent greater than the measured values. It was concluded from the tests that the theory would give a fair estimate for the transient vibration in an airplane subjected to symmetrical landing impact leading to flexural vibration of the wing. Measurements on actual landings of large transport airplanes have failed to substantiate this conclusion.

1,037

ANON 1948 A REVIEW OF SUBJECTIVE RESPONSES TO VIBRATORY MOTION OF THE HUMAN BODY IN THE FREQUENCY RANGE 1 TO 70 CYCLES PER SECOND  
Project NM 004 001, Report No.1, 16 March 1948.

1,038

Anon. 1949 SYNOPSIS OF THE AERO MEDICAL ASPECTS OF JET PROPELLED AIRCRAFT  
(Aero Medical Lab., Air Materiel Command) January 1949. ASTIA ATI 56134

ABSTRACT: Brief reviews of recent developments and current practices are presented on the following subjects: requirements and equipment, decompression sickness, cabin pressurization, explosive decompression, long term positive and negative acceleration, pilot's pneumatic suit for positive acceleration, cockpit design and temperatures, flight instruments, psychological limitations, sound problems, the ejection seat, protective helmets, wind-blast protection, and vision. Future research will be concerned with protection under emergency conditions in a vacuum, etc.

1,039

Anon. 1951 GENERAL SYSTEMIC ACUTE AND CHRONIC DISORDERS RESULTING FROM TRACTOR RIDING.  
(A complete survey among 1,800 general practioners in Iowa, unpublished ms.)

1,040

Anon. 1954 INJURIES IN AIR CARRIER ACCIDENTS IN TURBULENT AIR  
Air Carrier Safety Bulletin, No. 39, 16 March 1954.

1,041

Anon. 1957 GERUIS-EN SCHOKBEVEILIGING VAN ONDERZEEBOTEN 1949: BIBLIOGRAFIE (NOISE AND SHOCK SAFEGUARDING FOR SUBMARINES 1949: BIBLIOGRAPHY) (Technisch Documentatie Centrum voor de Krijgsmacht (Netherlands). 10 Nov. 1957, ASTIA AD-156 155

1,042

Anon. 1958 SOVIETS RECOVER RESEARCH ROCKET DOGS  
Aviation Week 69: 61-63, 3 Nov. 1958

ABSTRACT: Izvestia reports two dogs, Belyanka and Pestraya, were recovered from 280 miles altitude in a single-stage research rocket launches from the "middle

latitudes of Soviet European territory" on Aug. 21, 1958, with a 3,726-lb. payload. This is reported as being the second launching of such a rocket. The felt-lined cabin, which landed "in a selected area," contained "a generation system, a self-contained system for recording the biological functions of the animals, and a special motion picture camera." The rocket was stabilized "during the entire flight, including the inertial part of its flight," to ensure the necessary conditions for the experiment. The rocket also carried instruments for measuring concentration of free electrons, ion composition of the atmosphere, concentration of positive ions, electron temperature, air pressure, micro-meteorite impingement, ultraviolet region of the solar spectrum, infrared radiation of the earth, and the earth's atmosphere.

1,043

Anon. 1958 SPUTNIK II THROUGH RUSSIAN EYES  
Astronautics 3: 48-49, '62.

ABSTRACT: Although silent on launching vehicle and means of propulsion, these translations from the Soviet press offer hitherto unreleased data on structure of the satellite and the biological experiments performed.

1,044

Anon. 1960 ROCKET INSTRUMENTATION BIBLIOGRAPHY NO. 8 SECOND SERIES  
(U) (ITEMS 786-1000 AND INDEX) (Ministry of Aviation, Gt. Britain.  
Rept. No. T11/BIB/9, March 1960. ASTIA AD 318 395L

CONTENTS:

- General instrumentation
- Accelerometers
- Bearings
- Combustion
- Computing and data reduction
- Displacement measurement
- Flow and pressure measurement
- Recording instruments
- Safety and protection
- Shock and vibration measurements
- Strain gauge techniques
- Temperature measurement and control
- Velocity measurement

(Unclassified Contents Note) See also ASTIA AD 315 418L

1,045

Anon. 1960 VIBRATION AND NOISE SURVEY REPORTS ISSUED FOR 1960 (Pearl Harbor Naval Shipyard, T.H.) 21 Feb 1961

1,046

Anon. 1960 NONTITLED

Discovery 21:482-486, 1960

**ABSTRACT:** A concise summary with illustrations of the experiments carried out in Sputnik V, launched Aug. 19, 1960, based on information from official Russian sources. The bio-medical experiments carried out in the 10,000 lb. satellite were designed to provide data on specific features of the vital activity of different animal and plant organisms during a space flight, the biological action of space-flight conditions on living organisms (overstrain, prolonged weightlessness, the transition to and from weightlessness), the action of cosmic rays on the vital activity and heredity of animal and plant organisms, systems for maintaining life and well-being during space flight (air regeneration, temperature, regulations, food and water supply, sanitation, etc.). In addition to dogs, Belka and Strelka, the biological payload included 21 black and 19 white mice, the seeds of different varieties of onions, peas, wheat, and maize, Nigella, actinomycete fungi, Chlorella in liquid and solid nutritive media, sealed ampules of cultures of intestinal bacteria (type KK-12, B, "aerogenes"), butyric fermentation bacteria, a culture of staphylococci, two varieties of phages (T-2 and 13-21), DNA, HeLa cells, and pieces of preserved human and rabbit skin. Also the container carried four automatic bioelements with a culture of butyric fermentation bacteria, two enclosed in a spherical thermostat and two in an unheated container. The various microbiological and cytological specimens were intended to provide data on the effect of space-flight conditions on growth and genetic change. The oxygen concentration was to be maintained at 20 to 25 percent, with a carbon dioxide concentration no higher than 1 percent; the temperature was to be between 15° and 25° C, the relative humidity at 39 to 70 percent, and the pressure at one atmosphere. The feeding method was similar to that used with Laika. The physiological information recorded during the flight included arterial blood pressure, electrocardiograms, frequency of respiration, body temperature, and movements. Data transmitted to earth stations by radio-telemetry included cabin temperature, pressure, humidity, and control data on the functioning of the life-support system. Television was employed to study the motor activity of the dogs, and transducers mounted on each cradle provided additional data on their movements. Ionizing radiation dosimeters placed near the dogs and on their suits measured radiation dose from cosmic rays. Pre- and post-flight studies included metabolism, blood and urine, cardiovascular, immunological, and (for the rats only) nervous activity and their typological peculiarities. The postflight examination showed that the rats, like the dogs, took the trip well. The arknik also investigated cosmic radiation and short-wave solar radiation. Measurement techniques and some experimental results are given

1,047

Anon. 1960 IN THE EARTH'S ATMOSPHERE

Vozdushnogo flota 11:95

1,048

Anon. 1961 DETAILS OF VOSTOK CONSTRUCTION GIVEN  
Pravda (Moscow), September 8, 1961

ABSTRACT: With the development of spaceships of the Vostok type, there began the program of regular studies designed to perfect methods for putting man into orbital flight and returning him to earth, studies of the effects of space flight conditions on the human body, for the possibility of maintaining man's work capacity during prolonged weightlessness, and perfection of systems to sustain man's life during space flight. PRAVDA notes that the two Soviet manned spaceflights were preceded by thorough preparations to establish, in particular, the physiological effects of weightlessness. The first special experiments to study the effect of weightlessness on the human body were conducted on a ground test installation in which weightlessness was induced for one or two seconds. An attempt was also made to simulate weightlessness by immersing a man in a special suit into a liquid with specific gravity equal to that of the human body. A substantial step forward in the study of weightlessness was made in plane flight experiments. During high-speed flights, the centrifugal force developing along a parabola compensates the force of gravity. In these conditions it is possible to obtain weightlessness for periods of 40 to 50 seconds. The next phase in the study of the effects of zero gravity were flights of mice, rats, and dogs in sputniks. Positive results obtained in these experiments warranted the conclusion that weightlessness lasting 24 hours would not endanger man's life or health. (CARI)

1,049

Anon. 1961 FLIGHT OF THE SECOND COSMIC SHIP  
Vestnik Akademii Nauk SSSR, 10: 10-17

ABSTRACT: On August 19, 1960, the second Soviet cosmic ship, on board which was a group of experimental animals and other living organisms, went into orbit around the earth. On August 20, they all returned safely to earth. A press conference was held on August 24 by the Presidium of the USSR Academy of Sciences devoted to the new, outstanding achievement in conquering outer space. A.V. Topchiyev related about how the planned program on the second cosmic ship was carried out and described its passengers. He also cited preliminary results of the flight. Academician N.M. Sisakyan described the biological program of the second cosmic ship. V.V. Parin, active member of the Academy of Medical Sciences, U.S.S.R., described the medico-biological part of the program. Then O.G. Gazenko, senior scientific co-worker of the U.S.S.R. Academy of Medical Sciences showed the first cosmonauts who returned to earth -- Belka and Strelka. The rats and mice were also shown. S.N. Vernov and L.V. Kurnosova told about the investigations of cosmic rays which were carried out during the flight.

1,050

Anon. 1961 EL HOMBRE EN EL ESPACIO EXTERIOR (MAN IN OUTER SPACE)  
Revista de Aeronautica (Spain) 21(245): 275-282, April 1961

ABSTRACT: A resume of the man-in-space projects being conducted by the U.S. and U.S.S.R. is presented. (JPL)



1,051

Anon. 1961 VOSTOK DETAILS  
Flight 79(2721):586, May 4, 1961

ABSTRACT: The Soviet satellite Vostok and Major Gagarin's flight of April 12, 1961 are described. (JPL)

1,052

Anon. 1961 PARIN ON COSMONAUTS, SPACE DOGS  
FBIS USSR & East Europe, Nr. 81, April 27, 1961

ABSTRACT: Moscow--The dogs which have taken part in space flights are still in excellent health and their journey into space has had no harmful aftereffects on them, said Soviet medical scientist Vasil Parin today, appearing on Moscow television program devoted to the conquest of space. Parin stressed that Soviet technology had created vehicles capable of placing living creatures into orbital flight and that both the stages of acceleration and deceleration had caused no harmful aftereffects.

Academician Parin said that apparently for some time to come cosmonauts would be selected from among pilots. Outlining the requirements to be met by a cosmonaut, the scientists said that he must possess the same qualities as those possessed by Yuriy Gagarin.

Speaking about Yuriy Gagarin's preparation for the flight, Academician Parin said that it had been carried out according to a big program, and all the tests were carried out with "large endurance margins" exceeding in severity those conditions which Gagarin was likely to encounter during the flight. Parin said that Gagarin's space suit incorporated special transmitters with the help of which all the data on the condition of his body during the flight were transmitted to earth.

Academician Parin said that in future flights into unexplored cosmic regions the first explorers would apparently again be man's four-legged friends - dogs.

1,053

Anon. 1961 INSTRUMENTATION BIBLIOGRAPHY  
(Ministry of Aviation, Gt. Brit.) Rept. No. TIL/BIB/50; Jan. 1961;  
ASTIA AD 253 346

ABSTRACT: This bibliography contains material on the following subjects: general instrumentation; calibration; combustion; electrical and electronic devices; test facilities; accelerometers; computers; displacement measurements; flow measurement and control; pressure and thrust measurement; recording; shock and vibration; strain gauge measurements; temperature measurement; and time measurement.

1,054

Anon. 1961 DETAILS OF THE LEGENDARY FLIGHT  
(Aerospace Technical Intelligence Center, Wright-Patterson AFB, Ohio)  
Trans. No. MCL-1035, July 27, 1961, ASTIA AD 261 805  
Original Source: Komsomol'skaya Pravda, 91(11031): 1-3, April 16, 1961

1,055

Anon. 1961 SOVIETS INDICATE BIG PROBLEMS IN SPACEMAN'S WAY  
Columbus Dispatch March 10, 1961

ABSTRACT: Two Russian scientists indicated that despite Soviet recovery of another space ship with a dog inside, major problems remain to be solved before a Soviet man is shot into space. Ivan Maisky, director for the Experimental Biology Institute, and Vasil Parin of the Soviet Academy of Medical Sciences agreed that weightlessness is a major problem of manned space flight. Parin said Russian scientists have been getting "interesting data" on how living organisms are affected by such unusual irritants as vibration, stress, and the extreme noise of rocket engines. (CARI)

1,056

Anon. 1961 PERIODICAL REPORT ON AEROMEDICINE IN THE USSR: 61-24  
(1126th USAF FAG, Arlington Hall Station, Arlington 12, Va.) Rept. 1452577

ABSTRACT: This is a report dealing with: (a) Contents of a book on the psychology of the flying profession, (b) Comparative physiological study of tolerance to radial acceleration, (3) The Sixth Congress of the Ukr. Society of Physiologists, and (d) Astronaut training and manned space flights. (CARI)

1,057

Anon. 1962 SURVEY OF FACILITIES FOR SPACE ENVIRONMENT SIMULATION  
(Aerospace Research and Testing Committee, Washington, D.C.)  
ARTC Project No. 6-60; ATC Report No. ARTC-30; April 1962.

ABSTRACT: The main body of the report is separated into 11 sections including acoustic test facilities, vibration test facilities, human factors facilities, and general environmental test facilities. These sections explain the function of specific equipment for space environmental simulation. When practical a summary table has been added to the section giving general characteristics of the equipment.

1,058

Anon. 1962 SPACE SIMULATION FACILITIES

J. Environmental Science 5(2): 23-24, April 1962

ABSTRACT: The world's largest combined environmental test facility being built at Edwards Air Force Base, California, features a 30 g centrifuge with a load capacity of 30,000 pounds. The environmental complex is designed to assume any combination of acceleration, vibration, temperature, humidity, and altitude. It integrates in one test system a large centrifuge acceleration test machine, vibration exciter, and temperature and vacuum chamber. Vibration stresses and g forces encountered by missiles and spacecraft during take-off and flight will be simulated by a shaker integrally mounted to the test chamber. A tabulated comparison of thermal vacuum test facilities and the space environment simulator is presented. (Aerospace Medicine 33(10): 1280, Oct. 1962)

# **WEIGHTLESSNESS**

WEIGHTLESSNESS

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Abelson, P.H.        1962        THE VENUS MISSION.  
Science, 138(3545):1069, 7 Dec. 1962.

ABSTRACT: The article contains a description of Mariner II including the launching, mission, and future prospects.

2

Adams, C. C.        1958        HUMAN FACTORS IN SPACE FLYING  
In: Space Flight (New York, McGraw-Hill).    Chapt. 10

ABSTRACT: A review of work being done in Space Medicine with sections on Radiation, Vision, Respiration, Acceleration, Weightlessness, Heat Problems, Space suits and meteors.

3

Adams, C.        1960        ASTRONAUT SUPPORT PROBLEM.  
Ground Support Equipment. 2(4):83-85, August-September 1960

ABSTRACT: A study of man's water requirements in space and an analysis of eating and drinking experiments conducted under zero gravity conditions are presented.

4

Adamson, D.            1962        THE GRAVITATIONAL FIELD ENVIRONMENT OF AN EARTH  
                         SATELLITE.  
                         NASA-TN-D 1270        August 1962

5

Adey, W.R., J.D. French, R.T. Kado, D.F. Lindsley, D.O. Walter, et al. 1961  
EEG RECORDS FROM CORTICAL AND DEEP BRAIN STRUCTURES DURING CENTRIFUGAL AND  
VIBRATIONAL ACCELERATIONS IN CATS AND MONKEYS  
IRE Trans. Military Electronics BME-8(3): 183-188. July 1961.

ABSTRACT: Electroencephalographic records have been taken from deep regions of the brains of cats and monkeys with chronically implanted electrodes during centrifugal and shaking acceleration comparable to booster forces. Histological and x-ray controls have indicated that displacement of the electrodes does not occur, and that damage to brain tissue is comparable with nonaccelerated animals. A transistorized EEG amplifier suitable for recording in satellite biopack environments has been developed. In centrifuge tests, transverse accelerations up to 8 g were associated with rhythmic "arousal" patterns of slow waves in hippocampal regions of the temporal lobe during increasing or decreasing acceleration. Longitudinal accelerations between 5 and 6 g produced blackouts after 30 to 40 seconds, with flattening of EEG records, and frequently with induction of epileptic seizure activity in temporal-lobe leads. Shaking tests suggested that vibrational acceleration may be associated with the intermittent "driving" of the cerebral rhythms, in a fashion resembling photic driving, at shaking rates from 11 to 15 c.p.s., and from 22 to 30 c.p.s. (Author)

6

Aero Medical Assoc.        1958        AVIATION MEDICINE ON THE THRESHOLD OF SPACE:  
                         A SYMPOSIUM. J. Aviation Med. 29(7):485-539, July 1958

ABSTRACT: This issue deals with:

- 1) New knowledge of the extra-atmospheric radiation field;
- 2) Potentialities and ramifications of life under extreme environmental conditions;
- 3) Experiments during weightlessness: A study of the oculo-aural illusion;
- 4) Design considerations of a balloon-borne pressurized capsule for high altitude bailout study;
- 5) The feasibility of recycling human urine for utilization in a closed ecological system
- 6) A closed food cycle atomic conservation for space flight

(Literatuuroverzicht (Over Ruimtevaartgeneeskunde) (Space Medicine Bibliography (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

7

Aerospace Information Div. 1962 PRINCIPLES OF LIFE SUPPORT IN SPACE BASED ON  
SOVIET OPEN LITERATURE PUBLISHED IN CONNECTION WITH THE VOSTOK-3 AND  
VOSTOK-4 LAUNCHINGS  
(Aerospace Information Div., Washington, D.C.) 5 Dec. 1962 ASTIA AD 291 910

ABSTRACT: Descriptions of the principles of life support in space used by Soviet specialists at the present time for orbital flights, and those which are being discussed and developed for future long-range missions have been extracted from more than two hundred articles and TASS reports published predominantly in Soviet newspapers in connection with the launching of the Vostok-3 and Vostok-4 spaceships. The articles were written by various specialists in the field of space technology, including academicians, corresponding members of the Academy of Sciences, professors, doctors of biological sciences, doctors of medical sciences, candidates of medical and technical sciences and physics and mathematics, engineers, science reporters, and cosmonauts. Primary emphasis was placed on discussions of data which describe the design elements of equipment used in space application, including the spaceship cabin, automatic devices, equipment used in the cosmonaut training program. Psychological and physiological conditioning and responses and safety factors are included. (Author)

.8

Aerospace Information Div. 1962 SOVIET MANNED SPACE FLIGHT LIFE SUPPORT  
SYSTEMS: MEDICAL AND BIOLOGICAL ASPECTS OF THE VOSTOK-3 AND VOSTOK-4  
FLIGHTS  
(Aerospace Information Div., Washington, D.C.) AID Rept. No. 62-191; Nov. 1962  
ASTIA AD 291 911

ABSTRACT: The medical and biological aspects of the Vostok-3 and Vostok-4 flight, including selections of orbits, physical and psychological preparation, medical monitoring, radiation protection, diet, cabin ecology, and projected problems for interplanetary flight, were reviewed. The sources are from Soviet open-literature, chiefly newspapers, published in the period from August thru October, 1962.

9

Akulininichev, I. 1962 PROGRESS IN SPACE MEDICINE

(In: "Medical and Biological Aspects of USSR Space Flights", Joint Publications Research Service Translation No. 16,277 ASTIA AD 400 411  
Original Source: Russian newspaper, Meditssinskiy rabotnik 17 August 1962, P. 3

ABSTRACT: Experience accumulated in manned space flight permits the conclusion that weightlessness is completely tolerable and has no substantial effect on blood circulation or the motor functions of the gastrointestinal tract. However conclusions and generalizations applicable to mass space flights must be drawn with caution since these flights have been relatively short and the cosmonauts have been most highly trained athletes. They have been distinguished for great volitional qualities and great functional reserves, particularly of the cardiovascular system.

10

Aleksandrov, A. 1960 MAN AND THE COSMOS

Trans. of Meditssinskii Rabotnik (USSR) 20(105):3, 1957  
(Office of Technical Services, Washington, D.C.) 61-27432

11

Aleksandrov, S.G. & R. Ye. Federov 1962 SOVIET SATELLITES AND SPACE SHIPS (SELECTED ARTICLES). (Wright-Patterson Air Force Base), Trans. No. FTD-TT-62-121. From Sovetskiye Sputniki i Kosmicheskiye Korabli, 2nd Edition. (Moscow: Akademiya Nauk SSSR, 1962). Pp. 24-82, 117-124, 144-147, 182-184, 217-242, 256-394, 427-456. ASTIA AD 273 888.

PERTINENT ARTICLES:

The Problem of Descent to the Surface of the Earth and Planets  
Biological Investigations  
Second Soviet Ship-Satellite  
Arrangement of Ship-Satellite  
Flight of Ship and its Return to Earth  
Medical-Biological Problems of Man's Flight into Cosmic Space  
Training of Cosmonauts  
First Cosmic Flight  
Conclusion



12

Alexander, G., & R. Barany 1905 PSYCHOPHYSIOLOGISCHE UNTERSUCHUNGEN UBER DIE BEDEUTUNG DES STATOLITHENAPPARATES FUR DIE ORIENTIERUNG IM RAUME AN NORMALEN UND TAUBSTUMMEN. (PSYCHOPHYSIOLOGICAL INVESTIGATIONS CONCERNING THE IMPORTANCE OF THE APPARATUS OF THE STATOLITHS FOR ORIENTATION IN SPACE ON NORMALS AND DEAF-MUTES.) Arch. ohr., Nas., u. Kehlkopfheilk. 65:187-192

13

Alexander, G. 1961 FLIGHT PROVES MAN CAN FUNCTION IN SPACE  
Aviation Week 70(20): 31-32. 15 May 1961.

ABSTRACT: A description is given of the pilot functions performed and the stresses and loads (weightlessness, peak gravity and re-entry loads) to which pilot and capsule were subjected during the 15 minute Mercury-Redstone flight on May 5, 1961.

14

Alexander, H.S. 1960 BIO-MAGNETICS  
1960 Proceedings of the Institute of Environmental Sciences  
(Institute of Environment Sciences, Mt Prospect, Ill.) pp. 119-126

15

Annenskii, F. D. 1961 KOSMICHESKAIA PSIKHOLOGIIA (SPACE PSYCHOLOGY)  
Nauka i zhizn' (Moskva) 28(2):33-39, Feb. 1961  
English Translation:  
(U. S. Joint Pub. Research Service, Washington) JPRS 9916.  
Aug. 10, 1961

ABSTRACT: Psychological problems that confront the astronaut in space are reviewed. Absence of the usual environmental timers, lack of gravity, and the enormous rate of speed of his vehicle may create a disorientation in time. Lack of direct information feedback of the outcome of his actions forces the astronaut to evaluate his actions by instrument readings. Lack of support due to zero gravity poses special problems which, however, can be overcome by proper training. Isolation and confinement in the space cabin are not anticipated to have the same effects as sensory deprivation, since the astronaut will take an active part in the flight and therefore his mental set will differ. Neuropharmacologic agents may be used to control sleepiness, anxiety, or fatigue. (Aerospace Med. 33(8):1029, Aug. 1962)

.16

Armstrong, C. R. 1953 SPACE PHYSIOLOGY  
J. British Interplanetary Society 12:172-175

ABSTRACT: The sensory-motor system of a man living in a gravity-free state is subjected to abnormal handicaps. The muscle and skin pressure senses are gravireceptors and would be useless in a gravity-free state. However, the Vater-Pacini corpuscles, being deep pressure receptors in the hands, feet, and joints, would probably continue to function and partially compensate for the loss of the other two receptors. The vestibular apparatus, which controls posture, and is stimulated by gravity, respiration, and circulation, is felt to present lesser problems. Under zero-gravity conditions, oxygen consumption would be low—approximately 500 litres per day per person. By utilizing the upper physiological limit of increased oxygen pressure, which is 415 mm hg, this problem can be minimized. (CARI)

.17

Arnoult, M. D. 1959 PERCEPTUAL PROBLEMS OF A SPACE TRAVELER  
(Paper, Annual Meeting of the Southern Society of Philosophy and Psychology, 1959)

18

Askren, W.B. 1959 MAN FUNCTIONS IN SPACE FLIGHT  
Paper: Panel on Psychology, of the Armed Forces - MRC Committee on Bio-Astronautics, Washington, D.C. December 2, 1959 ASTIA AD 238 480

ABSTRACT: Duties typical of those to be assigned to future space crews are described. The duties of a three-man crew for a hypothetical seventy-two hour moon flight are presented on a logarithmic time-line. The duties are analyzed to determine the major activities of space crews such as navigation, flight control energy management, etc. The activity of in-flight maintenance is stressed as an essential duty. Finally, the duties are analyzed to determine the criteria that should be used in selecting personnel for a space flight of this type.

19

Augerson, W.S. & C.P. Laughlin 1961 PHYSIOLOGICAL RESPONSES OF THE  
ASTRONAUT IN THE MR-3 FLIGHT.

In NASA, Results of the First U.S. Manned Suborbital Space Flight  
National Aeronautics and Space Administration, pp. 45-51

ABSTRACT: Astronaut Shepard (on his suborbital flight on May 5, 1961)  
demonstrated physiological responses to 5 minute weightless flight (interrupted  
by 23 seconds of retrofire) were uneventful. Acceleration-weightlessness  
transition period produced physiological responses within the limits of intact  
function. The relative change in pulse rate in going from weightlessness to  
reentry acceleration was comparable to that in going from 1 g to reentry  
acceleration on the centrifuge. Special senses, that is, vision, semicircular  
canal function, and hearing, appeared intact throughout the flight. (Author)

20

Ax, P. 1960 PACAF BASIC BIBLIOGRAPHIES: EXPLORATION OF SPACE  
Misawa Air Force Base, Japan Feb. 1, 1960

ABSTRACT: This is a bibliography on the exploration of space, with annotations  
from various sources, which supersedes the bibliography dated 1 February 1959.  
Included are 85 references, published between 1953 and 1959, and classified as  
follows: Rocket History and Research; Space Flight; Satellites; International  
Geophysical Year Space Programs; Space Medicine; and the Moon and Interplanetary  
Travel.

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Bakh, I., Gorlov, O. et al 1958 MEDICAL-BIOLOGICAL PROBLEMS IN SPACE FLIGHTS  
(Office of Technical Services, Washington, D.C.) Trans. No. 59-22143 7 Oct. 1959  
Trans. from: Chelovek v Kosmose (Moscow) Ser. 8, Vol. 1, No. 20. 1958

ABSTRACT: This popular pamphlet indicates the problems raised by the g effect, weightlessness, cosmic radiation etc. It concludes with the statement that man will eventually adapt himself to space flight.

22

Bakulev, A. 1960 DESTINATION --- SPACE  
Meditsinsky Rabotnik (Medical Worker) 1(40):34-36, Jan. 1960

ABSTRACT: Experimental research has shown that man can tolerate acceleration 12 to 15 times greater than the force of the earth's gravity for seven minutes without ill effects if he is conditioned by systematic training, equipped with a special anti-gravity suit to prevent disturbances in cerebral blood circulation and seated in the rocket so that the mechanical forces act perpendicularly to the longitudinal axis of his body. Other experiments have shown that the human organism can easily endure a state of weightlessness lasting 30 to 45 seconds. It has been ascertained that with recurrence of weightlessness man adjusts himself to this state, retains orientation in space and may coordinate his movements accurately. The author also discusses the sealed cabin, oxygen supply, and radiation encountered during a space flight. (CARI)

23

Baker, D. F. 1962 SURVEY OF REMOTE HANDLING IN SPACE  
(6570th Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio)  
AMRL-TDR-62-100. ASTIA AD-288 863

ABSTRACT: A survey of industrial opinion on remote handling in space was undertaken to document early concepts and to identify areas of agreement, areas of

conflict, and unique ideas relating to the subject. Seven industrial concerns and one military agency provided papers on the role of remote handling in space. These papers are discussed in terms of: (a) remote operations of which there are five major categories---maintenance, assembly, experimentation, transfer operations, and emergency operations; (b) space vehicle design---the manned lightweight capsule, with anthropomorphic gloves, stabilization arms, window ports, and two to three manipulator arms, being representative; (c) manipulator design---concerning actuation, configuration, control, and feedback systems; and (d) space environment factors---vision, weightlessness, temperature fluctuations, high-energy radiation, and micrometeorite collisions. (Author)

24

Balakhovskii, I.S., & V.B. Malkin 1956 BIOLOGICHESKIE PROBLEMY  
METZHPLANETNYKH PLOETOV. (Biological Problems of Interplanetary Flight)  
Priroda 1956(8):15-21

**ABSTRACT:** Numerous experimental investigations, carried out in the USSR and abroad, have established that the influence on the human organism of the mechanical forces resulting from accelerations depend, on one hand, on their magnitude, time of action, rate of increase, and direction relative to the longitudinal axis of the body, and on the other hand, on the functional condition of the organism, i.e., on the state of health. It has been established that the disturbance of a circulation of the blood during acceleration is caused by the displacement of a great mass of blood into the lower half of the body; also, because of the vertical position of the body, the blood pressure is so great that the heart cannot send it into the upper organs, particularly the brain. Furthermore, because of the significant increase in the "weight" of the internal organs, their connective apparatus is subjected to great strain, and the irritation of the receptors of the internal organs caused by this can become a source of pathological reflexes. In order to avoid this, an "anti-overload" costume consisting of a system of rubber chambers connected by some solid material, has been designed. With the appearance of over-loading compressed air is supplied automatically to the chambers of the costume. This costume prevents the accumulation of blood and thus maintains the circulation of the blood to the brain. The stability of the organism can be raised also by systematic training. Investigation carried out with people on centrifugal machines have shown that, in the vertical position, a man can withstand the action of 4 to 5 times the force of gravity, but only for a few minutes. Overloads are withstood best when they are directed perpendicular to the longitudinal axis of the body. In such a position a man can withstand, for a few minutes, forces that exceed his "earth"weight 10 to 12 times. Most investigators consider that life is possible under conditions of "nongravity" and that the human organism will be able to adapt itself to new conditions of existence. (CARI)

25

Balakhovskii, I.S. & V.B. Malkin 1957 BIOLOGICAL PROBLEMS OF INTERPLANETARY FLIGHTS

(USAF Proj. Rand, Santa Monica, Calif.) Res. Memo. RM-1922, 21 June 1957. Pp. 81-86.

Original Source: Priroda 45: 15-21, Aug. 1956

German Translation in Naturwissenschaft Rundschau 10: 173-177, 1957

26

Ballinger, E.R. 1952 HUMAN EXPERIMENTS IN SUBGRAVITY AND PROLONGED ACCELERATION J. of Aviation Medicine 23(4): 319-321, 372. August 1952.

ABSTRACT: Tests were conducted on human subjects at the Aero Medical Laboratory at Wright-Patterson Air Force Base, Ohio. Results of the zero gravity tests showed that thirty zero gravity runs averaging 15 seconds each gave no suggestion of motion sickness, vertigo or in-coordination attributable to the sub-gravity state. During acceleration tests on the centrifuge, it was observed that vertigo seems to be the result of head motion rather than from any particular position of the head during the accelerations. Second, the dizziness following each run was related more to the duration of the acceleration than to its intensity. Lastly, escape velocities can be tolerated at accelerations at least as high as 10 g in the semi-supine position. However, from the physiological point of view an accelerating thrust below 8 g probably represents the more acceptable acceleration.

27

Banghart, F. and E. Pattishall 1960 HUMAN FACTORS AT EXTREME ALTITUDES: SYNOPSIS AND BIBLIOGRAPHY. (Air Research and Development Command, Wright Air Development Center, Wright-Patterson AFB, Ohio) ARDC-TR 60-7. March 1960. ASTIA AD-242 348.

ABSTRACT: 135 references to 1959 cited and discussed in: space medicine, ecology, behavior and performance, acceleration and deceleration, weightlessness, radiation effects, instrumentation, monitoring and communication, selection and training. Chapters include the following:

- Synopsis
- Behavior and performance
- Acceleration and deceleration
- Weightlessness
- Radiation
- Instrumentation
- Bibliography

28

Barker, C. L., Jr. 1959 SPACE FLIGHT SIMULATOR  
(Army Ballistic Missile Agency, Redstone Arsenal, Ala.) Rept. No. DSP-TR-1-59; 16 March 1959

ABSTRACT: Objectives of this report are two fold: to examine the problem of rocket flight simulation and possible users of a simulation facility; and to describe a system which is capable of producing repeatable acceleration time histories of any desired booster flight including weightlessness and re-entry. Propulsion calculations for the sled are discussed, and the El Capitan in Yosemite Natl. Park is described as a possible site for this apparatus. A table of characteristics of flight trajectories to produce weightlessness of maximum duration for 8 vehicles is included.

29

Barker, C. L., Jr. 1961 SPACE FLIGHT ACCELERATION SIMULATOR  
Planet. Space Sci. 7:335-344. July 1961

ABSTRACT: Discussion of a proposal for a space flight acceleration simulator, a ground-based training and research facility, which produces the acceleration-time history of rocket flight and the gravitational fields of the Moon and planets. The track captured capsule carries several trainers or hundreds of pounds of equipment through programed "flights" which duplicate the conditions of boost, zero-g, and re-entry, or any combination thereof. The track consists of a horizontal circular track of 1,000-ft. diameter connected to a vertical track with a total height of about one mile.

30

Barshev, P. & V. Peskov 1961 FIVE HOURS WITH YURIY GAGARIN  
Komsomol'skaya Pravda (Aerospace Technical Intelligence Center,  
Wright-Patterson AFB, Ohio) Trans. no. MCL-1151 27, July 1961.  
ASTIA AD 261 825.

31

Bayevskiy, R. 1961 TITOV FLIGHT BODILY EFFECTS VIEWED  
FBIS USSR & East Europe, Nr. 168, August 30, 1961

ABSTRACT: Yuriy Gagarin's safe return to earth provided an affirmative answer to the question of the possibility of manned space flights. Highly important

was the question of how the cosmonaut would be able to stand up to the overloads on the downward phase of his flight after prolonged weightlessness. Major Titov's flight demonstrated that the stability of the human body to the effects of such adverse factors is high enough with special preliminary training. The reduced pulse characteristic during sleep was characteristic of the space traveler. This, the scientist stressed, indicates that the complex functioning of the central nervous system was not disturbed during the flight. It was also established that the problem of eating in space was not as serious as previously supposed. (CARI)

32

Beckman, E.L., K.R. Coburn, R.M. Chambers, R.E. DeForest, V.G. Benson, & W.S. Augerson 1961 SOME PHYSIOLOGICAL CHANGES OBSERVED IN HUMAN SUBJECTS DURING ZERO G SIMULATION BY IMMERSION IN WATER UP TO NECK LEVEL. (Naval Air Development Ctr., Johnsville, Pa.) NADC MA 6107. ASTIA AD 256 727.

ABSTRACT: Knowledge relative to the effects of prolonged weightlessness is needed in preparing man for space flight. The buoyant force exerted upon immersed bodies effectively simulates the weightless state with respect to proprioceptive sensory responses and perhaps in other ways. An investigation into the physiological effects of immersing subjects in water up to neck level was undertaken. A series of experiments involving 7 subjects immersed in water up to neck level for periods of 5 to 23 hours (5 subjects for 12 hours) showed a significant weight loss during the period of immersion, which was explained by the diuresis which occurred. Pulmonary volume measurements showed a decrease in the expiratory reserve volume and in the respiratory minute volume during immersion. There was no significant decrement in the performance of a tracking task, attributable to the water immersion, during exposure to a simulated space vehicle reentry deceleration profile. Exposure to 4.5 positive G for 15 seconds following water immersion revealed a decrement in tolerance in most subjects. (Author)

33

Beckman, E.L., R.M. Chambers, K.R. Coburn, R.E. Deforest, W.S. Augerson and V.G. Benson 1961 PHYSIOLOGIC CHANGES OBSERVED IN HUMAN SUBJECTS DURING ZERO G SIMULATION BY IMMERSION IN WATER UP TO NECK LEVEL. Aerospace Medicine 32(11):1031-1041.

ABSTRACT: To ascertain some of the effects of prolonged weightlessness on man, a series of experiments involving seven Ss immersed in water (an effective simulation of the weightless state with respect to proprioceptive responses) up to the neck level for periods of 5 to 23 hours was conducted. Weight changes on a tracking task, during exposure to a simulated space vehicle re-entry deceleration profile, attributable to water immersion were determined. Changes in tolerance to accelerative forces were also measured. (Tufts)



34

Beischer, D.E., & W.C. Hixon 1963 TRIAXIAL HUMAN BALLISTOCARDIOGRAM IN  
ZERO G ENVIRONMENT. (Naval School of Aviation Medicine, Pensacola, Fla.)

ABSTRACT: The linear and angular accelerations in three perpendicular axes of a free floating man have been telemetered and recorded. The flights were performed on a KC-135 with cooperation of the Aerospace Medical Research Laboratory at Wright-Patterson AFB, Ohio.

The spatial relationship of the cardiovascular forces will be demonstrated and the significance of the results for cardiovascular performance in the gravity free state discussed. The equipment used in this study will be on exhibit and vector-ballistocardiograms demonstrated. (Aerospace Medicine 34(3):248, March 1963)

35

Beletskii, V.V. 1960 MOTION OF AN ARTIFICIAL EARTH SATELLITE  
ABOUT ITS CENTER OF MASS  
In L.V. Kurnosova, ed., Artificial Earth Satellites  
(New York: Plenum Press, 1960) Vol. 1, pp. 30-54

ABSTRACT: The motion of an artificial earth satellite about its center of mass under the action of aerodynamic and gravitational perturbations has been investigated taking into account the regression of the orbit due to the oblateness of the earth. It has been assumed that the satellite possesses dynamic symmetry. It has been shown that the motion of the satellite is a combination of the unperturbed motion about the angular-momentum vector and a secular precessional-nutational motion of the angular-momentum itself. This secular motion of the angular-momentum vector takes place about an axis which moves as the result of the regression of the orbit and which lies close to the tangent of the perigee if the influence of aerodynamic perturbations is more important than that of the gravitational perturbations. In all cases the motion is stable with respect to the orbit. The moments of the gravitational forces will be greater than the moments of aerodynamic forces for altitudes above 500 km. In the case of satellites whose altitude at perigee is 200-500 km. the relative importance of gravitational and aerodynamic perturbations will depend upon their construction. 4 refs. (CARI)

36

Belikov, V. 1963 PEOPLE OF RARE PROFESSIONS....PILOTS (NAVIGATORS) OF  
COSMONAUTS  
(Translation Division, Foreign Technology Div., Wright-Patterson AFB, Ohio)  
FTD-TT-63-419/1 26 April 1963 ASTIA AD 405 721  
Original Source: Russian Newspaper: Izvestiya, Nr. 59, 10 March 1963,  
P. 6

ABSTRACT: The author relates his observations and conversation with a Russian taking part in a simulated weightlessness test.

37

Benedikt, E.T., ed. 1961 WEIGHTLESSNESS - PHYSICAL PHENOMENA AND  
BIOLOGICAL EFFECTS. (New York: Plenum Press, 1961)

ABSTRACT: Contents include:

Levine, R.B. "Zero Gravity Simulation", pp. 135-153  
Simons, J.C. "Current WADD Weightless Research"  
Brown, E.L. "Human Performance and Behavior During Zero Gravity"

38

Benson, O.O., Jr. 1951 THE MEDICAL PROBLEMS OF FLYING  
Rivista di Medicina Aeronautica (Rome) 14: 706-753

39

Benson, V. G., E. L. Beckman, et al. 1961 EFFECTS OF WEIGHTLESSNESS AS  
SIMULATED BY TOTAL BODY IMMERSION UPON HUMAN RESPONSE TO POSITIVE  
ACCELERATION. (Naval Air Development Ctr., Johnsville, Pa.)  
NADC-MA-6132. ASTIA AD 262 329.  
See also Aerospace Medicine 33(2):198-203, Feb. 1962.

ABSTRACT: Twelve members of Underwater Demolition Team No. 21 used underwater breathing equipment while completely immersed in water for 18 hours. Their response to positive acceleration was determined by observing the G level at which the limitation of ocular motility under acceleration (LOMA) occurred. This G level is approximately the same as when loss of peripheral vision or greyout occurs when subjects are exposed to positive acceleration. The period of immersion was well-tolerated. A small but statistically significant decrease in the G level at which LOMA occurred was found following the period of immersion. (Author)

40

Benson, V. G., E. L. Beckman, et al. 1961 WEIGHTLESSNESS SIMULATION BY TOTAL BODY IMMERSION. PHYSIOLOGICAL EFFECTS. (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-6134. ASTIA AD-263 194.

ABSTRACT: Attempts have been made to simulate the weightless state by immersing subjects in water up to the neck level for varying periods of time. These subjects were exposed to acceleration forces on human centrifuges before and after immersion. A reduction in the ability to withstand these acceleration forces was noted following the immersion period. Immersion in water to the neck level produces a negative pressure breathing situation which in turn results in a profuse diuresis. An attempt was made to eliminate the negative pressure breathing and the diuresis by equipping the subject with a full face diving mask with a compensating regulator and completely immersing him in water for a period of twelve hours. Of the seven subjects tested, only three were able to tolerate the 12-hour period of water immersion. The remaining four terminated early in the study due to the stress of the underwater environment and were not exposed to acceleration forces following their immersion periods. (AUTHOR)

41

Bergeret, P. 1951 BIOLOGICAL PROBLEMS OF THE EARTH SATELLITE VEHICLE  
Brit. Interplanetary Soc. J. 10:301, Nov. 1951.

ABSTRACT: The problem of life in interplanetary flight or on an artificial satellite is an extension of the problem of life in high altitude flight. The provision of a breathable atmosphere and maintenance of a tolerable temperature is the same in both cases.

42

Bergeret, P. 1952 LA VIE DANS UN MILIEU SANS PESANTEUR (Life in the Weightless State) A. Tomes 7:219-224

43

Berry, C.A. 1958 THE ENVIRONMENT OF SPACE IN HUMAN FLIGHT  
Aeronaut. Eng. Rev. 17(3): 35-39. March 1958  
See also: USAF School of Aviation Medicine, Randolph AFB, Texas, Epitome of Space Medicine, Item No. 41

ABSTRACT: The problems presented by space as an environment for human travel

are extensions of those encountered in present day flight. This paper defines "space" as an environment for man. It discusses the problem of space equivalence, oxygen, dysbarism, embolism, ozone, cosmic radiation, and meteors. It also discusses the dangers of solar radiation, weightlessness, and the sealed cabin. (CARI)

44

Best, C. H. and N. B. Taylor 1963 EFFECT OF GRAVITY UPON CIRCULATION  
In The Human Body: It's Anatomy and Physiology Fourth ed. (New York:  
Holt, Rinehart and Winston) Pp. 273-275

ABSTRACT: A physiological description of fainting and "blackout" is provided, and the effect of centrifugal force upon the circulation is detailed. In the gravity-free state it is noted that the normal circulatory reflexes elicited by the stimulation of pressoreceptors in the carotid sinus and other vascular areas will be reduced or suspended. The blood will have no weight, so the work of the heart will be reduced and the skeletal muscles will not be called upon to expend energy upon ponderable objects. These will have no short time effects but would lead to atrophic changes if extended over long periods. (CARI)

45

Biget, P., & H. Boiteau 1957 QUELQUES ASPECTS PHYSIOLOGIQUES DU VOL "SANS  
PESANTEUR". Fusees (Paris) 161-165, May 1957

ABSTRACT: Review of the physiological aspects of interplanetary flight emphasizing problems of the gravity-free state

46

Boeing Airplane Company 1959 KC-135 MODIFICATION FOR ZERO-GRAVITY FLIGHT  
(Boeing Airplane Company, Aero Space Division, Seattle, Washington)  
Technical Proposal D2-5358, December 1959

47

Boeing Airplane Company 1959 HUMAN FACTORS LUNAR STUDIES:  
I. COMMENTS ON SELECTED PROBLEM AREAS. (Boeing Airplane Company,  
Seattle, Washington) AFBMD-TR-59-9, 30 Sept. 1959. ASTIA AD 232 321L

ABSTRACT: The human factors program supporting the lunar studies is concerned among other items, with the determination of implications of the lunar environment for the establishment of relatively normal human activity cycles in a moon station. Selected problem areas from the overall program are discussed, including lunar gravitational field, human energy requirements, human mechanical efficiency, perception on the moon and physiological reference data.

48

Boeing Airplane Company 1960 INITIAL SYSTEMS EVALUATION OF ZERO-G MODIFICATION (Boeing Airplane Company, Renton, Washington) Flight test report, Document No. D6-5159, 23 June 1960.

49

Boeing Airplane Company 1960 DIFFERENCE DOCUMENT, KC-135 ZERO GRAVITY MODIFICATION (Boeing Airplane Company, Renton, Washington) Document No. D6-5353, 1 April 1960

50

Bowring, J.I.R., and B.P. Ebert 1961 A HYPOTHETICAL MISSION TO SPACE IN A THREE-MAN SEALED CABIN. Planet. Space Sci., 7:309-323, 7 July 1961

ABSTRACT: Discusses a 30 day orbital mission: the accelerations during launch, weightless flight, cabin layout, high-acceleration crew seats, restraint systems, feeding devices and human elimination devices.

51

Brannan, P. 1960 DRML SCIENTISTS PROBE MAN'S SPACE LIMITATIONS  
Canadian Aviation 33(3): 8-11. March 1960

ABSTRACT: The work of the Defence Research Medical Laboratories at Downsview,

Ontario, Canada, towards the solution of the problems of weightlessness and motion sickness in space travel is discussed. Muscular deterioration, circulatory changes, and problems of movement, as results of the weightless conditions, are briefly considered. Experiments on motion sickness resulting from the utilization of angular acceleration to counteract weightlessness are also described

52

Brooks, P. M. 1963 AN ANALYTICAL TREATMENT OF THE FLUID SHIFT IN THE WEIGHTLESS STATE. (Paper, 34th Annual Meeting of the Aerospace Medical Association, Statler-Hilton Hotel, Los Angeles, Calif., April 29-May 2, 1963)

ABSTRACT: If it is assumed on the basis of the relationships,  $P = h\delta g$  and  $F = Mg$ , that part of the hydrostatic pressures in the vascular and extravascular compartments are due to gravity, then on the basis of the Starling osmotic-hydrostatic pressure equilibrium, a differential equation can be derived which will relate pressure changes and fluid movement to time in the gravity-free state. Such an equation was derived and was found to describe the fluid shifts of the Landis plethysmograph data in relation to time and pressure quite accurately. If the time-pressure-constants obtained from the Landis data are applied to man in the gravity-free state, it is found that a fluid shift, from the extravascular to the vascular compartment equivalent to about 20 per cent of the plasma volume occurs and that such a shift is 99 per cent completed within 110 minutes from start of exposure

53

#### MOTION PICTURE

Brown, E. n.d. ZERO GRAVITY RESEARCH AT WRIGHT AIR DEVELOPMENT CENTER.  
(Wright Air Development Center, Wright-Patterson AFB, Ohio)

ABSTRACT: Sequence of shots taken aloft during "Keplerian trajectories", aboard a C131B Aircraft; illustrates various problems associated with zero 'g' states.

54

Brown, E. L. 1958 ZERO GRAVITY TESTS SHOW MAN CAN ADJUST TO SPACE.  
Aviation Week 69(25):52-53, 55  
See also A. M. A. Proceedings, April 1959

ABSTRACT: Experiments conducted during the past six months both in the laboratory and in actual flight, in which short periods of zero gravity were

achieved, reveal that there is no serious decrement in man's performance under these conditions. The experiments indicated that special provisions such as wider spacing of switches and levers, or springs or other restraints to prevent the arm from overshooting when reaching for objects, need not be considered in future space cabins. Without exception, the subjects were able to adjust to zero gravity conditions within seconds. It may be that longer periods of zero gravity and further tests may upset the conclusions reached to date, but, as of now, weightlessness does not appear to create as serious a problem for crews as biomedical scientists had predicted. (J. Aviation Med. 30(4): 295, April 1959)

55

Brown, E. L. 1959 RESEARCH ON HUMAN PERFORMANCE DURING ZERO GRAVITY  
(Paper presented at the 1959 Meeting of the Aero Medical Assoc., Los Angeles, Calif., 27-29 April 1959).

ABSTRACT: This laboratory is conducting research on several aspects of human performance during zero gravity periods. The zero gravity condition is produced by flying a C 131B aircraft through a Keplerian trajectory. Periods of apparent weightlessness lasting from 12 to 15 seconds can be achieved. Several experiments on simple motor tasks are being conducted. One experiment is concerned with the speed and accuracy of humans making vertical, rotary switch, push button switch, toggle switch and horizontal motions. Motion pictures have been taken of human subjects during unrestrained free-floating in the cabin of the aircraft. The motion pictures demonstrate that nearly all subjects tend to use underwater-type swimming motions to assist in the control and locomotion of their bodies during zero gravity periods. These motion pictures will be shown at the presentation of this paper. The pilots on this experiment (including the author) report no greater difficulty in flying the airplane during zero gravity than during normal gravity. The subjects who have experienced free-floating in the cabin during the zero gravity periods report that the feeling of complete weightlessness, with no restraints on the body, is very exhilarating. In as much as the zero gravity experiments are continuing, it is expected that at the time this paper is presented the results of several controlled experiments on human performance during zero gravity will be reportable. (Aerospace Med., 30:177.)

56

Brown, E. L. 1959 RESEARCH OF HUMAN PERFORMANCE DURING ZERO GRAVITY  
(American Society of Mechanical Engineers, New York) Report 59-AV-10

57

Brown, E. L., 1960 RESEARCH ON HUMAN PERFORMANCE DURING ZERO GRAVITY  
In Glen Finch, ed. Symposium on Air Force Human Engineering, Personnel,  
and Training Research (National Research Council, Washington, D. C.  
Pub. 783). pp. 204-217.

58

Brown, E. L. 1960 RESEARCH ON HUMAN PERFORMANCE DURING ZERO GRAVITY.  
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. 171-174.

ABSTRACT: The Aero Medical Laboratory, Wright Air Development Center, is conducting research on several aspects of human performance during periods of zero-gravity. The zero gravity condition is produced by flying a C-131B aircraft through a Keplerian trajectory. Apparent weightlessness lasting from 12 to 15 seconds can be achieved. Several experiments on simple motor tasks are being conducted. One is concerned with the speed and accuracy of humans making vertical, rotary switch, push-button switch, toggle switch, and horizontal motions. Motion pictures have been taken of unrestrained human subjects floating freely in the cabin of the aircraft. Nearly all subjects tend to use underwater type swimming motions to assist in the control and locomotion of their bodies during zero gravity periods. The pilots report no greater difficulty in flying the airplane during zero gravity than during normal gravity. The subjects who have experienced free-floating in the cabin during the zero gravity periods report that the feeling of complete weightlessness is very exhilarating. the zero gravity experiments are continuing and it is expected that results of several controlled experiments on human performance will be available.  
(Author)

A C-131B transport airplane was used to study human performance during zero G by flying a Keplerian trajectory. In this study no problems of human performance decrement were evident. Subjects were able to accommodate to the zero G condition in a very few seconds with accuracy similar to that under normal G. It is necessary, however, to have a solid position from which to work in order to maintain performance during zero gravity periods.

Photographs of the pilot's instrument panel, the C-131B, and subjects performing various maneuvers under zero gravity conditions are included.  
(DACO)



59

Brown, E. L. 1960 HUMAN AND SYSTEM PERFORMANCE DURING ZERO G  
(Paper, SAE-AFOSR, Astronautic Symposium, October 12-14, 1960, Los Angeles, Calif.)

ABSTRACT: Using a C-131 transport aircraft flying in a Keplerian trajectory, about fifteen seconds of zero g was produced. This is a report on the problems encountered during zero g which includes: human perceptive orientation; behavior of liquids; fluid transfer and heat transfer problems; human performance tasks; and locomotion inside and outside large space vehicles.

60

Brown, E. L. 1960 HUMAN AND SYSTEM PERFORMANCE DURING ZERO G.  
In Vistas in Astronautics--1960, Volume III. Proceedings of Third AFOSR Astronautics Symposium, Los Angeles, Calif., October 12-14, 1960.  
(Society of Automotive Engineers, Inc., New York, N. Y.) Pp. 85-88, October 1960.

ABSTRACT: A summary of work conducted on a research program on human and system performance during zero g was presented. These studies were made in a C-131B transport-type airplane while it was flying a Keplerian trajectory; about 15 sec. of zero g were produced in each trajectory. The areas investigated and discussed included 1) human performance on motor and mental tasks, 2) locomotion of individual humans inside large space vehicles, 3) locomotion outside space vehicles, 4) human perceptive orientation, 5) behavior of liquids, 6) fluid transfer problems, and 7) heat transfer problems. (Tufts)

61

Brown, E. L. 1961 MAN'S ANTICS DURING ZERO GRAVITY  
Society of Automotive Engineers J. 69:52-54, Feb. 1961

ABSTRACT: Description of sensations experienced during brief periods of zero g produced in a C-131B transport aircraft. The necessity of magnetic shoes, and of experiences with their use, are mentioned.

62

Brown, J. H. U., ed. 1963 PHYSIOLOGY OF MAN IN SPACE  
(New York, London: Academic Press, 1963)

ABSTRACT: Contents include the following papers: "Neuromuscular Aspects of Space Travel" by G. H. Bourne; "Acceleration" by E. F. Lindberg and E. H. Wood; "Stress" by C. E. Hall; "Human Tolerances" by B. Balke; "Psychological Aspects of Space Flight" by R. M. Chambers and R. Fried; "Biomedical Capsules" by C. D. Green; "Space Flight Dynamics-- Weightlessness" by W. R. Hawkins; and "Ecological Systems" by B. E. Welch.

63

Brown, J. L. 1961 ORIENTATION TO THE VERTICAL DURING WATER IMMERSION.  
J. Aerospace Medicine 32:209-217, Mar. 1961

ABSTRACT: Subjects were immersed in water at a depth of either 18 or 25 feet and then rotated in a tucked position on a rod through 3, 4, or 5 revolutions. Rotation was terminated with the head in one of 4 positions: upright, inclined forward, down, or back. Upon termination of rotation subjects were directed to point in the up direction, then to nod the head and correct the direction of pointing if necessary, and finally to swim toward the surface. There were errors in direction of initial pointing of as much as 180 degrees. Errors were greatest with the head down or back and least with the head up or forward. Nodding of the head was followed by consistent improvement in the direction of pointing. There was little indication of any difficulty in swimming in the upward direction. Greater density of the legs as compared to the trunk resulted in fairly rapid vertical orientation of the body upon release of the rod. The results are interpreted to reflect the relative inefficiency of the utricles as gravity sensors when the head is in certain positions. The simulation of zero gravity may be enhanced by utilizing these positions with water immersion. (AUTHOR)

64

Buchheim, R. W., and the RAND Research Staff 1959 SPACE HANDBOOK:  
ASTRONAUTICS AND ITS APPLICATIONS  
(New York: Random House Books, 1959.)

ABSTRACT: A review of astronautics, its technology and its applications, prepared at the request of the Select Committee on Astronautics and Space Exploration, House of Representatives, Eighty-fifth Congress.

65

Bugelski, B. R. 1957 THE BEHAVIORAL ASPECTS OF WEIGHTLESSNESS, PART I  
(Cornell Aeronautical Laboratory, Inc, Buffalo, New York) Contr.  
AF 29(600)1334, Rept. no. 0-1186-V-1, Nov. 1957

ABSTRACT: The present report is concerned with an evaluation of the literature pertaining to the capacities of organisms to adjust to space conditions, especially the factor of weightlessness, and its bearing upon behavior. Because of gaps in our knowledge revealed by this evaluation, an experimental program is proposed which would add substantially to the known data. Prior investigations and experience have indicated that various species and classes of animals (turtles, rats, monkeys, and man) can survive brief periods of weightlessness as these are approximated in current aircraft and rockets. Human pilots in aircraft have described varying degrees of effectiveness over periods of up to about 20 seconds of weightlessness. Animals have survived brief rocket journeys, but beyond the survival of anesthetized monkeys and some apparently successful "holding on" behavior in rats, we have no data relating to capacities for successful reactions to signals or displays. The experimental proposals describe a program which should establish the fact that monkeys and rats can cope with such signal situations while under weightless conditions.

66

Burch, G. E., and S. J. Gerathewohl 1959 SOME OBSERVATIONS ON HEART RATE AND CARDIODYNAMICS DURING WEIGHTLESSNESS. (U.S. Army Medical Services Research & Development Command, Bioastronautics Research Unit) Repts. Control Symbol CSCRD-16-5, 13 Nov. 1959, ASTIA AD-234 284.  
See also J. Aerospace Medicine 31:661-669, Aug. 1960

ABSTRACT: Considerable efforts were made during the last decade to determine the biomedical effects of subgravity and zero-G. Animals and men were exposed to short and moderate periods of weightlessness; and their behavior, respiration, and cardiovascular functions were recorded during aircraft and rocket trajectories. The electrocardiogram was also recorded from subjects during increased and decreased accelerations on the Subgravity Tower. By and large, a marked increase in cardiac rate occurred in almost all of the subjects during the acceleration and deceleration phase; this holds for aircraft trajectories as well as for the lift-off and re-entry maneuver of rockets. However, the EKG generally appeared normal during the free-flight periods and weightlessness, although some slight changes of its elements occasionally were observed. In several cases, the heart rate was somewhat increased and unstable during post-acceleration weightlessness; thereafter, it returned to normal. That psychological factors

entered into the physiological phenomena is clearly evident through an analysis of the data obtained in zero-G experiments. Nevertheless, the entire integrated responses resulted in subjects whose cardiological states remained sufficiently sustained to ensure normal and controlled behavior. (Author)

SECOND ABSTRACT: Experiments on the cardiodynamic effects of acceleration and weightlessness were carried out in the United States, Italy, and Russia. This is a review of the various experiments with special emphasis on tachycardia and changes in the EKG norman range. Throughout the experiments, prolonged and fluctuating tachycardia was observed in the early stage of weightlessness and decreased cardiac activity in later stages. The experiments proved that stresses and loads imposed on subjects during a space flight are well within human tolerance range.

67

Burch, G. E. and S. J. Gerathewohl 1960 OBSERVATIONS ON HEART RATE  
AND CARDIODYNAMICS DURING WEIGHTLESSNESS  
J. of Aerospace Medicine 31(8):661-669 August 1960

ABSTRACT: A generalized survey on the cardiodynamic effects of acceleration and weightlessness encountered in aircraft, rocket, and satellite flights is given in Table III. Tachycardia during radial and linear accelerations was observed in almost all of the human subjects and animals studied. Slight changes in the ECG were found in a few animals; but they seemed to be within the range of normal variations characteristic of their groups. There seems to be a tendency of prolonged and fluctuating tachycardia in the early state of weightlessness, and decreased cardiac activity was observed in its later states, which may be interpreted as the functional adaptation of the heart to the decreased mechanical load. No abnormal manifestations were found in the ECG. The entire series of experiments demonstrate that stresses imposed by acceleration and the episodes of weightlessness encountered in aircraft and biological missile flights are well within the range of tolerance of the human and animals.organism.

68

Burch, G.E., and S.J. Gerathewohl 1959 SOME OBSERVATIONS ON HEART RATE AND CARDIO-  
DYNAMICS DURING WEIGHTLESSNESS (Presented at 2nd World and 4th European  
Congress on Aviation and Space Medicine, Rome, Italy, 27-31 October 1959)

69

Burns, N.M., R.B. Ziegler, R. Noble & E.C. Gifford 1960 A BIBLIOGRAPHY OF PSYCHOPHYSIOLOGICAL STUDIES RELEVANT TO SPACE AND ORBITAL FLIGHT. (U.S. Naval Air Material Center, Air Crew Equipment Lab., Philadelphia Pa.) Report No. NAMC-ACEL-441, 26 Oct. 1960. ASTIA AD 246 414

ABSTRACT: This bibliography contains a total of 582 entries on standard bibliographic file card forms. The entries cover a variety of subjects, but place prime emphasis on the psychological and physiological problems of space flight. Sixteen categories ranging from applied problems to theoretical applications form the basic classification scheme.

70

Bushnell, D. 1948-58 HISTORY OF RESEARCH IN SUBGRAVITY AND ZERO-G AT THE AIR FORCE MISSILE DEVELOPMENT CENTER, HOLLOMAN AFB, NEW MEXICO 1948-1958. (Air Force Missile Development Center, Air Research and Development Command, Holloman AFB, New Mexico) May 1958. ASTIA AD 208 017

ABSTRACT: Weightlessness, the weird condition of subgravity which man has never before experienced and survived--except for the initial split-second of short-distance free fall -- has recently become a major field of serious scientific research. Much of the important basic research in subgravity and zero-g has been performed by men of the Space Biology Branch of the Aeromedical Field Laboratory at the Air Force Missile Development Center. In this monograph Dr. David Bushness, of the Center's Historical Office, has traced the history of local contributions to this field of study. He has also placed this effort into the broader context of subgravity research accomplished elsewhere, especially in the United States, Argentina and the Union of Soviet Socialist Republics. This forms the third of a series of monographic studies by Dr. Bushnell related to the historical evolution of space biology as a field of study.

72

Butz, J. S., Jr. 1961 ALL IN A WEIGHTLESS DAY'S WORK Air Force, 44(4):112-113.

ABSTRACT: The Air Force's increasing research into the problems of weightlessness has resulted in many aids to human performance during subgravity. More than five aids in the form of a separate stability and propulsion system have been the result of research in a modified C-131 aircraft at Wright Air Development Division, Wright-Patterson AFB, Ohio.

WEIGHTLESSNESS

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73

Cacioppe, A.J. & M.L. Joppesen 1961 EXPANDABLE SPACE STATIONS, IMPLICATIONS FOR PROLONGED MANNED SPACE FLIGHT. (Goodyear Aircraft Corp., Akron, Ohio) (Paper, 3rd International Symposium on Rockets and Astronautics, September 1, 1961)

ABSTRACT: The thesis of this paper is to develop the rationale for a manned space laboratory specifically conceived to acquire physical and biological data. The concept demands that the manned space laboratory be capable of being deployed in space for increasing periods of time.

74

Callaghan, E. E. 1962 WEIGHTLESSNESS  
Mach. Design 34:156-161, October 11, 1962.

75

Campbell, P. A. 1948 POSSIBLE EFFECTS OF STREPTOMYCIN UPON AN  
AIRMAN'S FUTURE. J. Aviat. Med. 19(5):393-396.

76

Campbell, P. A. 1957 AEROMEDICAL AND BIOLOGICAL CONSIDERATIONS OF FLIGHT ABOVE  
THE ATMOSPHERE. In Carter, L. J., ed., Realities of Space Travel  
(London: Putnam, 1957) pp. 251-265  
See also J. Brit. Interpl. Soc. 14:1-12, 1955

ABSTRACT: New altitude and speed records indicate everincreasing trends toward the possibility flight above the atmosphere. Basic biological problems group themselves into three primary categories; those associated with the attainment

of high speed and penetration of the atmosphere at those speeds; those resulting from loss of the life-sustaining qualities of the earth's atmosphere; and those resulting from loss of protection afforded by the filtration qualities of the atmosphere. These categories are discussed. (Literatuuroverzicht (Over Ruimtevaartgeneeskunde) (Space Medicine Bibliography) (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

77

Campbell, P. A. 1958 HUMAN PARAMETERS OF SPACE FLIGHT.  
USAF Med. Serv. Dig. 9(3):2-10

78

Campbell, P. 1958 HUMAN LOGISTICS FROM THE VIEWPOINT OF SPACE TRAVEL.  
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. 285-287

79

Campbell, P. A. 1959 MAN IN SPACE: WHERE WE STAND Air Force & Space Digest July 1959, pp. 65-67.

80

Campbell, P.A. 1959 THE PRESENT SPACE MEDICINE EFFORT AT THE SCHOOL OF AVIATION MEDICINE, USAF.  
In U.S. Armed Forces Med. J. 10(4):392-397

ABSTRACT: Describes the four departments of the Space Medicine Division of the School of Medicine. They are Astroecology; biogravics, which is concerned with studies of the effects of weightlessness on man; bioastrophysics; and bioastronautics.

81

Campbell, P. A., & S. J. Gerathewohl 1959 THE PRESENT STATUS OF THE PROBLEMS OF WEIGHTLESSNESS. Texas State Journal of Medicine 55(4):267-274, Apr. 1959

ABSTRACT: Reports weightless orientation studies made by immersing men in water. Man's ability to orient himself depends upon a variety of factors, and during weightless situations the eye becomes the only reliable organ.

82

Campbell, P. A. 1959 A PANEL DISCUSSION. THE UTILIZATION OF A SATELLITE LABORATORY FOR LIFE SCIENCE STUDIES. In Alperin, M., & H. F. Gregory, eds., Vistas in Astronautics II (New York, N. Y.: Pergamon Press, 1959)

83

Campbell, P. A. 1960 RESEARCH PROGRAMS -- II. THE LUNAR COLONY. Lectures in Aerospace Medicine, 11-15 January 1960 (Conducted at the School of Aviation Medicine USAF Aerospace Medical Center).

84

Campbell, P. A. 1961 HUMAN FACTORS: ASPECTS OF WEIGHTLESSNESS In R. I. Ordway, III, Ed., Advances In Space Science and Technology, Volume 3, (New York, N. Y., Academic Press, 1961). Pp. 443-464.

ABSTRACT: The material in this chapter is devoted primarily to considerations of weightlessness insofar as it affects human factors and life-support systems. However, it is not intended to detract from the importance of the phenomenon from the viewpoint of many other disciplines and technologies. Problems of direct interest to engineers undoubtedly are equally important as those of the physician, the psychologist, and the biologist, but are not discussed herein.



85

Campbell, P.A. 1962 THE HUNTING PHENOMENON DURING FLIGHT IN THE WEIGHTLESS STATE (School of Aerospace Medicine, Brooks AFB, Tex.) AF-SAM-Q-2, 6-10 July 1962

86

Cannizzaro, C 1958 OTONEUROLOGICAL ASPECTS OF VERTIGO AND PSEUDOVERTIGO  
Rass Studi Psichiat 47:445-74, Jul-Aug 1958

87

Caporale, R. 1961 BEHAVIOR OF SOME POSTURAL REFLEXES IN INTACT, DELABYRINTHIZED OR DECEREBRATED PIGEONS DURING VARIATIONS OF ACCELERATION IN WEIGHTLESSNESS IN SUB-GRAVITY ROTATION.  
Rev. Med. Aero (Paris) 2:165-170, Dec. 1961 (Fr)

88

Caporale, R. 1962 BEHAVIOR OF SOME POSTURAL REFLEXES IN INTACT, LABYRINTHECTOMIZED OR DECEREBRATE PIGEONS DURING ACCELERATION VARIATIONS BETWEEN 2 AND ZERO G'S.  
In Riv. Med. Aero. 25:243-256, April-June 1962

89

Carter, C.W. 1960 INTERNATIONAL LIST OF HUMAN FACTORS FILMS.  
Human Factors. 2(2): 62-69, May 1960

ABSTRACT: This annotated bibliography presents 54 references to films dealing with human factors problems in man-machine design. The subjects covered include emergency escape and survival systems, zero gravity studies, medical aspects of high intensity noise, illumination and dark adaptation, anthropometrical techniques, simulated decompression studies, aircrew fatigue problems, and the effects of whole body vibration on human performance. The references are categorized by source in order to facilitate procurement of certain films desired by the reader.

90

Cates, J.D. 1961 HIGH-CAPACITY TELEMETRY DIGITIZER AND VIBRATION ANALYZER.  
(Integrated Range Mission, White Sands Missile Range, N.Mex.)  
ASTIA AD-266 639L, 30 January 1961

ABSTRACT: The logical design, circuitry, and theory of operation is described of the Sub-System A (digitizer) portion of the high capacity telemetry digitizer and vibration analyzer. Sub-System B, a second digitizer, and Sub-System C, the vibration analyzer, will be covered in separate reports. The equipment described includes an Adage Voldicon analog-to-digital (A-D) converter and 5-channel multiplexer, an EPSCO Transicon analog-to-digital converter, a time-code reader, two digital-tape handlers, and the necessary record and control circuitry to program and record the digitized data. The sub-system will operate at sampling rates up to 1000 samples per second. It has a digitizing error of plus or minus 0.1 percent of full scale. The equipment, with the exception of the time-code reader, is transistorized. (Author)

91

Cawthorne, T., M. R. Dix, C. S. Hallpike, & J. D. Hood 1956 THE INVESTIGATION  
OF VESTIBULAR FUNCTION. Brit. Med. Bull. 12:131-142

ABSTRACT: The author first gives a short introduction to the vestibular function. The neuro-otologist's approach to the vestibular is stated along with its structure and function. The author then gives a detailed review of caloric tests and rotational tests. Other tests conducted were positional tests of otolith function. Tests for optokinetic nystagmus. A list of references follows the article. (CARI)

92

Chambers, R. M., D. A. Morway et al. 1961 THE EFFECTS OF WATER  
IMMERSION ON PERFORMANCE PROFICIENCY. (Aviation Medical Acceleration  
Lab., Naval Air Development Center, Johnsville, Pa.) NADC-MA-6133,  
22 August 1961. ASTIA Doc. No. AD-267 665.

ABSTRACT: In an attempt to study a wide range of human performance abilities associated with weightlessness and the transition from weightlessness to a high G reentry environment, the technique of water immersion and centrifugation was used to simulate these conditions. Six male subjects were immersed in water to the neck level for a 12-hour period and one subject for a 23-hour period. Eight selected performance tasks were administered: (1) before immersion, (2) during immersion, (3) after immersion and centrifugation so that gross motor and perceptual behavior could be sampled. It was found that behavior was not apparently affected by prolonged water immersion followed by reentry type accelerations. (Author)

93

Chambers, R. M., D. A. Morway, E. L. Beckman, & V. G. Benson 1961 CHANGES IN PERFORMANCE PROFICIENCY UNDER CONDITIONS SIMULATED BY WATER IMMERSION AND CENTRIFUGATION. (Paper, 32nd Annual Meeting of the Aerospace Medical Assoc., Palmer House, Chicago, Illinois, April 24-27, 1961)

94

Chance Vought Astronautics PROPOSAL FOR A STUDY OF THE EFFECTS OF ZERO GRAVITY ON CELL PHYSIOLOGY. (Chance Vought Astronautics, Dallas, Texas)

ABSTRACT: The study proposal is designed to determine the effect of zero gravity on cell physiology. The study consists generally of the comparison of the change in rate of the reversible sol-gel transformation through a range of gravity force including Zero "g". This test is required to evaluate the postulation that since cells have evolved in an environment of 1 "g" the absence of gravitational force may so alter their physio-chemical equilibrium that they will be unable to carry on their normal metabolism.

95

Chasen, L., E. Colabrese, & D. Himmelstein 1960 SEALED ATMOSPHERES AND PSYCHO-PHYSIOLOGICAL FACTORS: A BIBLIOABSTRACT. (Missile and Space Vehicle Dept., General Electric Co., Philadelphia, Pennsylvania) T.I.S. Rept. R6OSD344; ASTIA AD-238 478; Apr. 1, 1960

ABSTRACT: A survey directed toward psychological, physical and biological hazards of space flight; includes literature on the psychological effects of isolation for a prolonged period. 50 references in closed literature; 116 references in open literature.

96

Cherednichenko, V.I. 1960 MAN INTO COSMOS!  
Nauka i Zhyttya 1960(8):

ABSTRACT: Discussion of various problems contingent upon a manned space flight, such as the effect of zero gravity on a human organism, action of the solar radiation.

97

Christensen, Julien M. 1963 PSYCHOLOGICAL ASPECTS OF EXTENDED MANNED SPACE FLIGHT

Paper: American Astronautical Society Symposium on the Exploration of Mars, Denver, Colorado, June 6-7, 1963 Preprint (15)

ABSTRACT: As is the case with virtually all of the other scientific disciplines, the adequacy of available psychological knowledge and principles will receive a severe test from the demands attendant to the development of a successful mission to Mars. This paper offers a sampling of some of the relevant information available in psychology, and an attempt is made to identify areas that will require further attention before predictions in the behavioral area for the Mars trip can be made with confidence. A two-fold thesis is developed. First, psychology has legitimate and important contributions to make to the Mars trip. Second, the advantages, however, are mutual; i.e., it is confidently predicted that participation in this venture will force psychologists to reexamine their traditional principles and theoretical positions and will stimulate an attack on the basic issues of human behavior with refreshing insights gained from new points of vantage.

98

Clamann, H. G. 1959 SEALED CAPSULE STUDIES FOR SMALL ANIMALS.

(Bioastronautics, Advances in Research, Air University, School of Aviation Medicine, Randolph AFB, Texas) Progress Rept. No. 3, March 1959

99

Clamann, H.G 1960 MEDIZIN UND RAUMFAHRT: DER MENSCH IN DER KAPSEL  
(MEDICINE AND SPACE FLIGHT: MAN IN CAPSULE)

Flugkorper (Wiesbaden) 2(1): 16-18, Jan. 1960. In German.

ABSTRACT: This is a review of investigations in the medical problems of space flight as the author presented them during a lecture at Dusseldorf, Germany. The subjects under investigation include weightlessness, acceleration tolerance, pressure suits, food requirements and flight feeding, methods of re-cycling water and of CO<sub>2</sub> -O<sub>2</sub> exchange, isolation, and tolerance to high dry-heat temperatures.

100

Clark, R. T., H. G. Glamann, B. Balke, P. C. Tang, J. D. Fulton, A. Graybiel & J. Vogel 1960 BASIC RESEARCH PROBLEMS IN SPACE MEDICINE: A REVIEW Aerospace Medicine, 31(7):553-577.

ABSTRACT: This report includes studies of disorientation in pilots, closed ecological systems, subgravity state during parabolic flight, survival of terrestrial organisms under extreme environmental conditions, and physiological aspects of training and selection for manned extra-terrestrial flights.

101

Clemenson, C. J. 1958 SOME BIOPHYSICAL AND MEDICAL PROBLEMS INVOLVED IN MANNED SPACE FLIGHT: A REVIEW Astronautik (Stockholm), 1(1):9-36, 1958

ABSTRACT: Medical and biological problems which have to be solved before space flight will be possible are reviewed. Among those reviewed are the following: the effects of loss of life-sustaining properties of the terrestrial atmosphere; the effects of gravitational stress; the problems of food and water supply and of waste disposal during long trips; and effects of the physical stresses of confinement in a narrow cabin under adverse physical conditions. If the crew is properly trained, they will be able to tolerate the necessary acceleration during flight. Although zero gravity causes no abnormal physiological functions of the body, orientation and co-ordination may make the performance of tasks difficult. To solve the problem of storing oxygen and air-purification chemical as well as food and water, photosynthetic air purification and food synthesis from algae material may become necessary. Another risk faced by men in space is exposure to the heavy components of primary cosmic radiation and hits by meteorites.

102

Clodfelter, R. G., & R. C. Lewis 1961 FLUID STUDIES IN A ZERO GRAVITY ENVIRONMENT. (Aeronaut. Systems Div., Wright-Patterson AFB, Ohio) TN 61-84, June 1961

103

Cockett, A.T.K., C.C. Beehler, & J.E. Roberts 1961 HYPODYNAMIC UROLITHIASIS: A POTENTIAL HAZARD DURING PROLONGED WEIGHTLESSNESS IN SPACE TRAVEL. (School of Aerospace Medicine, Brooks AFB, Texas) Review 2-62;

SUMMARY: Hypodynamic urolithiasis as a hazard in space travel is discussed in

the light of present-day knowledge. Emphasis has been placed on several etiologic factors in urinary lithiasis that will be present during space flight. Moreover, as urinary stones may be formed during prolonged space travel, prophylactic measures (physical exercises, diet, and schedules) are suggested for the prevention of stone formation. (Author)

104

Cockett, A.T.K., C.C. Beehler & J.E. Roberts 1962 ASTRONAUTIC UROLITHIASIS:  
A HAZARD DURING PROLONGED WEIGHTLESSNESS  
(Paper, 1962 Meeting of the Aerospace Medical Association, April 9-12, 1962,  
Atlantic City, M.J.)

ABSTRACT: A good physical exercise regime will help prevent muscular atrophy during prolonged weightlessness, but the preservation of the skeletal system is another matter. Weightlessness will remove the stress of gravity which normally provides stimulus for osteoblastic activity with calcium deposition in the bony matrix. Acute osteoporosis (e.g. in polio patients) not infrequently produces urinary stones in young patients, because of immobilization and calcium reabsorption from long bones. Increased urinary sedimentation during prolonged flight may also contribute to calculus formation. A review of such etiologic factors in urolithiasis and prophylactic measures will be presented.

105

Cockett, A. T., C. C. Beehler & J. E. Roberts 1962 ASTRONAUTIC UROLITHIASIS:  
A POTENTIAL HAZARD DURING PROLONGED WEIGHTLESSNESS IN SPACE TRAVEL.  
J. Urol. 88:542-544, Oct. 1962.

106

Cocquyt, P.P. 1950 THE SENSORY ILLUSIONS OF THE AIRMAN  
(SABENA, Belgium Report July 1950)  
R.A.E. Translation No. 354 ASTIA AD 266614

107

Cocquyt, P. P. 1951 THE SENSORY ILLUSION OF PILOTS  
(New York: Flight Safety Foundation, Inc., 1951)

108

Coe, L.A. 1954 SOME NOTES ON THE REACTIONS OF AIRCRAFT PILOTS TO ZERO GRAVITY  
J. Brit. Interpl. Soc. 13:244

ABSTRACT: Twenty qualified pilots were subjected to near-zero gravity for periods up to twenty seconds by maneuvering a Meteor Mark 7 jet trainer. During the zero gravity state, the typical reaction was an immediate feeling of insecurity which resulted in a reflex action of clutching at something. This was followed by a sense of relief and relaxation. Simple mechanical and mental tasks were performed with great variation. Loose floating articles tended to distract the subject. Most of the pilots enjoyed the experience and none of them felt distress or neausea. Dust normally present in the aircraft's atmosphere was soon felt a considerable nuisance.

109

Cole, D.M. and D.E. Muir 1958 AROUND THE MOON IN EIGHTY HOURS  
(The Martin Company, Denver, Colorado) August 19, 1958, M-M-P-58-42

ABSTRACT: A conceptual design of a manned circumular vehicle for the early 1960's is presented, showing how early availability and low cost can be achieved by making maximum use of ICBM hardware and facilities. Results of orbit, space medicine, and re-entry studies critical to the circumular flight are included.

110

Combs, N. K. 1962 THOUGHTS ON INTERFERENCE WITH GASTRIC ACTIVITY DURING PRO-  
LONGED WEIGHTLESSNESS. (Paper, 33rd Annual Meeting of the Aerospace Medical  
Assoc., Chalfonte-Haddon Hall, Atlantic City, N. J., April 9-12, 1962)

ABSTRACT: During prolonged weightlessness, it is believed that gastric action on food could be seriously impaired. A review of physiology texts reveals a disagreement on the role of gravity in stomach processing of food. The weight of food and liquids, it is felt, plays an important role in their passage from the fundus to the pylorus as peristalsis per se is not considered to take place in the upper stomach. In addition, it is difficult to see how the orderly exposure of food to gastric juices could take place if the food were without weight. Inasmuch as prolonged weightlessness cannot be simulated, we can only speculate on some of its effects. Gastric difficulties could pose a serious threat to man's well-being and performance. Until more information is obtained from early space ventures, providing personnel with parasympathomimetic or anticholinergic agents might be indicated.

111

Conley, C. 1963 TOWER TO CREATE ZERO - G CONDITION.  
Daily Oklahoman. 22 Sept. 1963

ABSTRACT: This article describes the zero-gravity tower nearing completion at the Tulsa Division of Douglas Aircraft Co. The 60 foot high chamber will be used to test space vehicle and rocket stage separation systems under simulated space conditions. It will hold systems up to 7½ feet in diameter. From the top of the tower free-fall will be simulated for 1½ secs. (at simulated 100,000 to 180,000 feet), or in bottom catapults, for 3 secs. (CARI)

112

Conley, Michael 1950 THE MEN WHO CAN MAKE SPACE FLIGHT POSSIBLE TODAY.  
J. Space Flight, 2:1-3

ABSTRACT: Suggests a crew of six and the things each will need to know.

113

Conley, M. 1952 A METHOD OF SUPPORTING THE HUMAN BODY STRUCTURE  
DURING SPACE FLIGHT. J. Space Flight 4(9):3-4, Nov. 1952

ABSTRACT: Lightweight zippered supporters, made of webbed cotton fabric, are recommended for use in space ships to protect various parts of the body from effects of acceleration, deceleration, and zero-g conditions. They would be worn underneath the underclothing as a "second skin", to hold the body's shape and prevent rupturing of organs.

114

Convair Astronautics Div. 1960 MAY-JULY PROGRESS REPORT FOR THE COMBINED  
LABORATORY AND AIRPLANE ZERO-G TEST PROGRAM  
(Convair Astronautics Div., General Dynamics Corp., San Diego, Calif.) Aug. 1960



115

Corazzi, U. 1961 POSSIAMO VIVERE NELLO SPAZIO? (COULD WE LIVE IN SPACE?)  
Oltre il cielo (Rome), 5(90):271-274, Oct. 1961. (In Italian)

ABSTRACT: This is a review of the studies done by Colonel Professor Rodolfo Margaria, director of the Institute of Physiology of the University of Milano. The review includes his studies on high altitude physiology, aviation medicine, protection from accelerative forces, respiration and position sense, space flight physiology, mammalian resistance to acceleration, effects of zero gravity on the otolithic apparatus, and the effects of interplanetary voyages on the central nervous system and mental conditions. There is also a biographical sketch of the author included.

116

Corbin, K.B. and H.L. Williams 1960 DIZZINESS.  
Med. Clin. N. Amer. 44:941-51, July 1960

117

Corkindale, K. G. 1961 PSYCHOLOGICAL PROBLEMS OF SPACE FLIGHT. New Scientist  
(London), 10(236):457-459. May 23, 1961.

ABSTRACT: The effects of the following psychological stresses on performance and behavior of the astronaut are summarized: high g forces, weightlessness, isolation, restraint, and sensory deprivation.

118

Cornell Aeronautical Laboratory, Inc. 1958 CORNELL PROBES WEIGHTLESSNESS  
Aviation Week, 68(2):26-28

ABSTRACT: An outline of work being done at Cornell Aeronautical Laboratory, Inc. for Air Research and Development Command. Investigation of the efficiency of man's intellectual functions as opposed to physiological reactions, during weightless space travel in rockets, satellites or other space vehicles.

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Cramer, R. L. 1960 THE RESPONSE OF MAMMALIAN GRAVITY RECEPTORS TO SUSTAINED TILT (Paper, 1960 Meeting of the Aerospace Medical Assoc., 9-11 May 1960, Miami Beach, Fla.)  
See Also: Aerospace Med. 31(4):301, Apr. 1960

ABSTRACT: Studies were made of the behavior of single cells of the projections of the otolith organs in decerebrate and decellebrate cat as the preparation was maintained for extended times in different positions relative to the earth's gravitational field. In every case studied, it was found that there was a rather vigorous initial response to the tilt and that this response diminished considerably over 15 to 30 seconds; the steady-state signal to tilt was relatively weak. (AUTHOR)

120

Cramer, R. L. 1961 RESPONSE OF MAMMALIAN GRAVITY RECEPTORS TO SUSTAINED TILT. (School of Aerospace Medicine, Brooks AFB, Texas) Rept. 62-21; Nov. 1961  
ASTIA AD-272 332

ABSTRACT: Studies were made of the behavior of single cells of the projections of the otolith organs in decerebrate and decellebrate cat as the preparation was maintained for extended times in different positions relative to the earth's gravitational field. In every case studied, it was found that there was a rather vigorous initial response to the tilt and that this response diminished considerably over 15 to 30 seconds; the steady-state signal to tilt was relatively weak (AUTHOR)

121

Crawford, B. M. & W. N. Kema 1961 REMOTE HANDLING OF MASS  
(USAF Behavioral Sciences Lab., Wright-Patterson AFB, Ohio)  
Proj. 7184, Task 718406, ASD TR 61 627, Dec. 1961.

ABSTRACT: Three hypotheses are tested: difference limens for masses handled remotely are greater than for masses handled directly under simulated weightlessness; weightlessness will not affect absolute judgments; tendency to under- and overestimate stimuli that follow large and small ones, respectively, will operate for both judgment and handling conditions. Remote-handling (apparatus--an Argonne Model 8 Master-Slave Manipulator) and direct-handling groups of Ss make judgments of mass after moving stimulus objects to and fro on an air-bearing table. Frequencies of "heavier" responses for the comparison stimuli are examined and normal ogives derived. For absolute judgments, the main effects of basis of judgment, handling method, and stimulus magnitude are evaluated by Wilcoxon's two-tailed rank test. (Tufts)

125

David, H.M. 1962 U.S., REDS SHARE VIEW OF SPACE NAUSEA  
Missiles and Rockets, May 14, 1962.

ABSTRACT: The USSR apparently is pursuing the same line of research into the problem of Titov's "space sickness" as is the United States. U.S. disorientation expert Dr. Ashton Graybiel (Capt. USN) told M/R that the Russian seem to have ruled out the idea that Titov's nausea was caused by some individual defect in his own vestibular mechanisms. The Soviets indicated that the clue to Titov's illness lies in the otolith apparatus. The Russians also indicated that they believe that the nature of the otolith will probably cause the same symptoms in all astronauts who experience prolonged periods of weightlessness. A highlight of the COSPAR meeting was the appearance of Maj. Gherman Titov and Col. John H. Glenn, both of whom presented reports on their trips into space. (CARI)

126

Davydov, V. D. 1961 DAVYDOV ON ARTIFICIAL GRAVITY  
FBIS USSR & East Europe, Nr. 158, August 16, 1961

ABSTRACT: The flight of German Titov made it possible for the first time to study the effect of prolonged weightlessness on the health and capacity of a pilot-cosmonaut. If a prolonged absence of gravity is inconvenient or hinders the normal state of the cosmonaut, it is possible to create artificial gravity on all artificial earth satellites and manned spaceships. The creation of artificial gravity will be brought about by the ship's rotation around its axis. (CARI)

127

Denisov, N. & S. Borzenko 1962 POLET GAGARINA (MATERIALY, OPUBLIKOVANNYYE v "PRAVDE") GAGARIN'S FLIGHT.  
(Foreign Tech. Div., Air Force Systems Command, Wright-Patterson AFB, Ohio)  
FTD-TT-62-844 from Izdatel'stov "PRAVDA", Sept. 1962. ASTIA AD 287 715

ABSTRACT: It was on 12 April 1961 that the Soviet Union carried out the first manned flight into outer space. The spaceship "Vostok," with the USSR pilot-cosmonaut Yu. A. Gagarin on board, was placed into orbit as a satellite of the earth. The satellite vehicle without the last stage of the rocket-carrier, weighed 4,725 kilograms. On the basis of refined data obtained through the evaluation of all measurements, the perigee was at 181 kilometers, and the apogee was at 327 kilometers; the inclination of the orbit was 64° and 57 minutes. Having completed the orbital flight, the satellite vehicle returned to earth successfully, landing in a designated area of our country. This publication contains a detailed account of the flight and relates the great significance of the journey to the entire world.

128

de Pando, M.V. 1958 LOS SATELITES Y LOS VIAJES INTERPLANETARIOS: EFECTOS FISIOLÓGICOS DE LA VARIACIÓN DE LA GRAVEDAD (Artificial Satellites and Interplanetary Travel: Physiological Effects of Change in Gravity) Rev. Real Acad. Cienc. Exact. Fis. Y Nat. Madrid 52(2):141-145. In Spanish.

ABSTRACT: An extended version of an analytical study on the launching of space rockets, (Vol. 52(1):11-61. 1958). An attempt is made of correlating mathematically basic physiological and physical parameters. If  $j$  represents the effects of gravity experienced by a space traveler within the space vehicle ("sensible gravity"), the following formula applies:

$$j = \frac{d^2y}{dt^2} + \frac{ga^2}{(a+y)^2}$$

in which  $y$  is the altitude,  $t$  the time,  $g$  the gravitational acceleration on the surface of the earth, and  $a$  the terrestrial radius. In this formula the expression  $\frac{d^2y}{dt^2}$  represents the effective vertical acceleration and  $\frac{ga^2}{(a+y)^2}$  the effects

of terrestrial acceleration at the altitude  $y$ . The validity of the formula is tested for the following conditions: (1) the vehicle rests on the terrestrial surface; (2) the vehicle travels unaccelerated at a given altitude (this being the case when the upward acceleration equals the weight of the vehicle); (3) the vehicle travels at a given altitude and at a given acceleration.

129

Diefenbach, W.S. 1961 THE ABILITY OF SUBMERGED SUBJECTS TO SENSE THE GRAVITATIONAL VERTICAL  
(Cornell Aeronautical Laboratory, Inc., Buffalo, New York) Internal Research No. 993-004, CAL no. OM-1355-v-1, Jan. 1961

ABSTRACT: The ability to perceive the vertical when submerged in a buoying fluid and subjected to varying amounts of body tilt was studied in a series of pilot experiments. Positional cues were minimized by special equipment. Errors in perception of the vertical had a high linear correlation with the amount of body tilt. It was also found that precision in positioning an unseen control may vary with body tilt. Also included is a brief discussion of possible simulation of weightlessness and implications for design of space controls.

130

Dole, S.H. 1958 INTERNAL ENVIRONMENT OF MANNED SPACE VEHICLES  
(Rand Corporation, Santa Monica, Calif.) Rept. No. P-1309, 24 Feb. 1958.

ABSTRACT: This is a discussion of the effects on the human occupant in a manned space vehicle by composition and pressure of the atmosphere, gravitational forces, temperature, and radiation.

131

Dole, S. H. 1959 ENVIRONMENTAL REQUIREMENTS FOR EXTENDED OCCUPANCY OF MANNED SATELLITES. (Paper, ASME Aviation Conference, Los Angeles, California, March 9-12, 1959) ASME Paper No. 59-AV-12

132

Dole, S.H. 1960 DESIGN CRITERIA FOR ROTATING SPACE VEHICLES.  
(Rand Corp., Santa Monica, Calif.) Research Memo No. RM-2668,  
Contract AF 49(638)700, Proj. RAND, 18 Oct. 1960. ASTIA AD 249 503.

ABSTRACT: Several undesirable physiological side effects can arise from rotating a manned space vehicle in order to provide a simulated gravity field. The phenomena that may produce these side effects are herein analyzed to determine in each case the design restrictions that should be accepted in order to avoid adverse conditions. Based on this set of restrictions, a design envelope, which allows the designer considerable latitude, is based on the following limits: (1) maximum angular velocity, 4 rpm; (2) maximum head-to-foot difference in g's, 15%; (3) minimum rim velocity, 10 ft/sec; (4) maximum simulated gravity field, 1.5 g's; and (5) minimum simulated gravity field 0.01 g. (Author)

133

Dostal, R. and T. Kersey 1960 SPACE MEDICINE.  
Iowa Engineer. 60(4):26-28, January 1960

ABSTRACT: This is the first of a series of two articles explaining the problems men will encounter when they venture into space. The effects of weightlessness and cosmic radiation are discussed in this issue.

134

Douglas, W. K., C. B. Jackson, Jr., et al 1961 RESULTS OF THE MR-4 PREFLIGHT AND POST FLIGHT MEDICAL EXAMINATION CONDUCTED ON ASTRONAUT VIRGIL I. GRISSOM. (Results of the Second U. S. Manned Suborbital Space Flight, NASA Manned Spacecraft Ctr, 21 July 1961)

135

DuBridge, L.A. 1961 ADVENTURES IN SPACE  
Calif. Inst. Technol. Quart. 2:2-8, Spring 1961

136

Dvorak, J., P. K. Isakov, & J. Hospodar 1960 CLOVEK V MEZIPLANETARNIM PROSTORU  
(MAN IN INTERPLANETARY SPACE) (Prague: Orbis, 1960)

ABSTRACT: The book is based mainly on Soviet data and presents the physical aspects of outer space from the biological point of view. Attention is given to the effect of space factors on the body and methods and equipment for human flight in outer space are described. Details of the first experiment with the dog Layka in space flight are given. Return to the Earth, the selection and training of astronauts, scientific results of space flights, and space medicine are treated. No personalities are mentioned. There are 7 references, all Czech. (CARI)

137

Dvorak, J., P. K. Isakov & J. Hospodar. 1960 MAN IN INTERPLANETARY SPACE -  
A SMALL MODERN ENCYCLOPEDIA (CLOVEK V MEZIPLANETARNIM PROSTORU).  
Translated by Aerospace Technical Intelligence Center, Wright-Patterson  
AFB, Ohio, Trans. No. MCL-907 of Ceskoslovenska Spolecnost Pro Sireni  
Politickych A Vedeckych Znalosti, Prague, pp. 1-160, 169-211, 1960.  
ASTIA Doc. No. AD-261 786.

138

Dzendolet, E., & J. F. Rievley 1959 MAN'S ABILITY TO APPLY CERTAIN TORQUES  
WHILE WEIGHTLESS. (Wright Air Development Division, Wright-Patterson AFB,  
Ohio) WADD TR 59-94; ASTIA AD-220 363; April 1959

ABSTRACT: The torque that a maintenance man can exert within a space vehicle while weightless, and hence tractionless, is analyzed. Anthropological literature was reviewed to determine the torques a man can apply under normal conditions. Using elementary physical principles the consequences of applying these torques while tractionless were calculated. Certain of the predictions were verified experimentally. It is tentatively concluded that standard anthropometric data can legitimately be extrapolated to the weightless condition. Suggestions are advanced regarding (a) the optimum body position for a simple tightening task without using a handhold, (b) the use and location of handholds, (c) maximum torque limitations, (d) the use of impulses, and (e) the design of hand tools.

139

Dzendolet, Ernest 1960 MANUAL APPLICATION OF IMPULSES WHILE TRACTIONLESS.  
(Wright Air Development Division, Wright-Patterson AFB, Ohio) WADD TR 60-129  
ASTIA AD-238 021; February 1960

See Also: Human Factors 2(4):221-227, 1960.

**ABSTRACT:** The percentage of naive subjects who, while tractionless in a horizontal plane and anchored by one handhold, push in or pull out a plunger in one motion against various frictional forces and travel distances, decreases directly as the force and distance required. With large-force impulses, the impulse is linear and the situation can be described by the impulse-momentum theorem:  $\int_0^t F dt = mv_1 - mv_0$ . The shape of the impulse is saw-toothed, and its area approximated by taking three-fourths of the area of a rectangle whose base is the duration, and height, the force of the impulse. For this experiment, the maximum duration of an effective impulse for a required force of 40 pounds is 0.5 seconds for a push-in, and 0.3 seconds for a pull-out impulse. A subject, without a handhold, can seat the plunger with a push, and, in spite of the reaction to the impulse, remain attached to the equipment without unseating it. The technique is to allow the reaction to move the subject over as long a distance as possible and, since the total impulse is constant, thus reduce the force. The reduction in force allows the equipment to remain seated since the force is now less than the frictional force needed for seating. (AUTHOR)

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Eckstrand, G.A., M.R. Rockway 1961 SPACECREW TRAINING: A REVIEW OF PROGRESS AND PROSPECTS. (Aeronautical Systems Division, Air Force Systems Command, Andrews AFB, Washington, D.C.) AFSC Project 1710; ASD TR 61-721, ASTIA AD 274190

ABSTRACT: This report reviews current progress and future prospects in the field of spacecrew training. Descriptions of all current astronaut training programs are presented and a number of general conclusions with reference to such training are drawn, based upon the manned space operations which have been conducted to date. In addition to the actual experience which has been gained in training spacecrew personnel, a review is presented of recently completed and current research which is directly relevant to this problem. Several areas in which research should be accelerated are identified.

141

Eckstrand, G. A. 1961 TRAINING OF ASTRONAUTS  
(National Research Council, Washington, D. C.) Publication No. 873.

142

Edholm, O. G. 1940 EFFECT OF GRAVITY ON THE BLOOD PRESSURE OF THE CAT  
J. Physiol. 98:79-96.

143

Eggleston, J. M., & H. D. Beck 1961 A STUDY OF THE POSITIONS AND VELOCITIES OF A SPACE STATION AND A FERRY VEHICLE DURING RENDEZVOUS AND RETURN.  
(National Aeronautics & Space Administration, Wash., D. C.) NASA TR R-87

ABSTRACT: A study is made of the families of nonthrusting ascent trajectories during rendezvous with an orbiting space station and the descent trajectories to the earth's atmosphere. Equations of motion are derived and results are shown for two typical orbits of the station (one circular and one elliptic orbit). Boundaries of launch (at time of booster burnout) and rendezvous conditions are given and the effects of delays in launch time are discussed.  
(AUTHOR)



144

Ehricke, K.A. 1956 ASTRONAUTICAL AND SPACE-MEDICAL RESEARCH WITH AUTOMATIC SATELLITES

(Journal of the Franklin Institute, June 1956)

ABSTRACT: Technical and scientific research aspects in conjunction with technological satellites are outlined and their correlation with various phases of manned astronautics is shown. The survey of the space-medical research by means of bio-satellites also considers the relevant technical and scientific aspects.

145

Emme, A. 1962 COSMIC EXPLORERS.

Sovetskaya Rossiya, 20 Oct. 1960.

(Translation Services Branch, Foreign Technology Division,  
Wright-Patterson AFB, Ohio) FTD-TT 62-602/1-4, 8 May 1962.

ABSTRACT: Before flying into space we must know exactly how various representatives of life will react to everything connected with the flight. A branch of science being developed on earth is the science of space ecology. This deals with the relation of man to cosmic surroundings and his life on other planets. During a recent flight, a radio-television system made possible constant visual contact with occupants of the ship. The g-forces at launch greatly affected the heartbeat and respiration. During acceleration the animals required more oxygen than usual. However, they had no trouble eating under weightless conditions. Mice were used to test cosmic radiation. Another object of space study was nucleic acid, the hereditary factor of all organisms. These molecules can be called "bare genes" or "free genes." Impacts by cosmic particle can cause great disturbances in the structure of this acid; these will be studied physicochemically.

146

Engel'gardt, V. 1961 LIFE, REASON AND THE UNIVERSE

(Joint Publications Research Service, New York, New York) JPRS 8518 29 June 1961

Trans. from Izvestiya (USSR) No 92(13638) p. 3, 1961

ABSTRACT: Space flight is discussed, with reference to weightlessness, cosmic radiation, G-forces, and the new area of investigation, "exobiology".

147

Errebo-Knudsen, E.O., et al 1953 VERDENS-RUMMETS EROBRING (CONQUEST OF SPACE)  
(Copenhagen: Reitzel, 1953)

148

Errebo-Knudsen, E.O. 1953 MENNESKELEGEMET OG RUMMET (THE HUMAN BODY AND SPACE)  
In: Errebo-Knudsen, E.O., et al, Verdens-rummets erobring (Conquest of Space)  
(Copenhagen: Reitzel). Pp. 51-67

149

Escanglon, E. 1950 SPACE-FLIGHT AND ITS CONNECTIONS WITH HUMAN  
PHYSIOLOGY Astronomie, 64:279-287. July/Aug. 1950.  
Abst.: J. Brit. Interplan. Soc., 11:294.

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Farrer, Donald N. & Victor Bogo 1962 CHIMPANZEE PERFORMANCE DURING A SIMULATED  
THREE-DAY SPACE FLIGHT  
(6571 st Aeromedical Research Lab, Holloman Air Force Base, New Mexico)  
ARL-TDR-62-25 Project No. 6893, Task No. 689302 Dec. 1962

ABSTRACT: Chimpanzee performance during a simulated 97-hour space flight profile environment was evaluated with a pilot study and a crossover design. The response rate on the continuous avoidance task was significantly lower for one subject in the 100% O<sub>2</sub> environment, and both subjects performed at lower rates during night work sessions on all tests. There was no evidence of reaction time decrement for any subject on the discrete avoidance task. Food and water consumption was poor during the simulated space flight, but a chimpanzee could withstand a 97-hour flight profile environment of 100% O<sub>2</sub> at 14.7 psi for 15 hours followed by 100% O<sub>2</sub> at 5 psi, for 82 hours without serious performance changes.

151

Federov, E.K. 1962 THE DECISIVE STEP IN THE CONQUEST OF COSMIC SPACE  
Science and Culture (Calcutta) 28(1): 11-14, Jan. 1962

ABSTRACT: Soviet space efforts preparatory to manned space flight included studies dealing with: (1) the conditions encountered during space flight (accelerations, temperature changes, weightlessness, radiations) and means of protecting the astronaut from their effects; (2) providing normal living conditions in the space cabin; and (3) medical selection techniques and training format for astronauts. The system devised for the constant medical supervision of both the pilot's health and working capacity in all stages of flight is discussed. Y.A. Gagarin's orbital flight (April 12, 1961) is briefly mentioned.

152

Fedorov, P. 1960 DOGS ADJUST QUICKLY TO FLIGHT  
FBIS USSR & East Europe, Nr. 164, August 23, 1960

ABSTRACT: This article contains dogs reactions to weightlessness during their space flight on Sputnik V. (CARI)

153

Feltman Research and Engineering Labs., tr. Nov. 1959 ROCKET TECHNOLOGY AND SPACE RESEARCH. Raketentechnik und Raumfahrtforschung 3(2): Apr.-June 1959 (Feltman Research and Engineering Labs., Picatinny Arsenal, N.J., PA translation No. 61) ASTIA AD-228 967

CONTENTS:

Observations on the physiology of the senses during the transition from acceleration to weightlessness

Graphic determination of the main influence parameters and preliminary design parameters of missiles

Further observations on the Russian earth satellites

Technical reports:

The Atlas-Carrier rocket for important space navigation projects

The first artificial planetoid Mechta

Earth satellite Vanguard II with infra-red detectors

Space probe Juno II

Book reviews:

On the thermodynamics of combustion processes

Aviation medicine

154

Fenno, R. M. 1954 MAN'S MILIEU IN SPACE (A SUMMARY OF THE PHYSIOLOGIC REQUIREMENTS OF MAN IN A SEALED CABIN) J. Avia. Med. 25(12):612-622, Dec. 1954  
See also (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item #26

ABSTRACT: It is clear at this time that more work should be done on all phases of sealed cabin acclimitization. It is recommended that pressurization of very high altitude aircraft cabins by superchargers or compressors be de-emphasized in favor of the sealed cabin approach, since pressurization is dependent upon the presence of an atmosphere, thereby limiting the flight of man in a pressurized cabin to that very narrow range of altitude in which a compressible and non-toxic atmosphere can be found. A self-sustaining "balanced aquarium" in space should be the ultimate aim of those concerned with this problem. A possible solution lies in a chemical, mechanical, or photosynthetic gas exchanger or combination of these for the maintenance of our gaseous environment. (CARI)

155

Fenno, R. M. 1954 MAN'S MILIEU IN SPACE (A SUMMARY OF THE PHYSIOLOGIC REQUIREMENTS OF MAN IN A SEALED CABIN) In (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item #26  
See also J. Avia. Med. 25(12):612-622, Dec. 1954

ABSTRACT: It is clear at this time that more work should be done on all phases of sealed cabin acclimitization. It is recommended that pressurization of very high altitude aircraft cabins by superchargers or compressors be de-emphasized in favor of the sealed cabin approach, since pressurization is dependent upon the presence of an atmosphere, thereby limiting the flight of man in a pressurized cabin to

at very narrow range of altitude in which a compressible and non-toxic atmosphere can be found. A self-sustaining "balanced aquarium" in space should be the ultimate aim of those concerned with this problem. A possible solution lies in a chemical, mechanical, or photosynthetic gas exchanger or combination of these for the maintenance of our gaseous environment. (CARI).

156

Finney, J. W. 1961 RUSSIANS CONFIRM TITOV WAS SEASICK: CONDITION LAID TO PROLONGED STATE OF WEIGHTLESSNESS. New York Times, Oct. 5, 1961, Sec. C, p. 8

ABSTRACT: Two Russian scientists confirmed the rumor that Maj. Gherman S. Titov felt seasick throughout most of his 25 hr. space flight in August, 1961. The sickness was attributed to prolonged weightlessness. There were indications during the weightless period of "a definite instability of central nervous system reactions." The astronaut experienced a feeling of disorientation and loss of balance normally supplied by the inner ear. The Russian scientists pointed out that the feeling of weightlessness can be removed by creating artificial gravity in the space ship. (CARI)

157

Fisher, A.C. 1955 AVIATION MEDICINE ON THE THRESHOLD OF SPACE  
Journal of Aviation Medicine 26: 355  
See also: Nat. Geog. Mag. 108(2): 241-278. Aug. 1955

ABSTRACT: A coverage of all aspects of space flight including acceleration, deceleration, and weightlessness.

158

Fisher, A.C., Jr. 1955 AVIATION MEDICINE ON THE THRESHOLD OF SPACE: SERVICE DOCTORS, FACING MEDICAL PROBLEMS UNKNOWN ON EARTH, MAKE POSSIBLE MAN'S EXPLORATION OF THE HOSTILE HEAVENS  
The National Geographic Magazine 108(2): 241-278, August 1955

ABSTRACT: The author reports on his visits to several military and civilian institutions that work on research into the human factors of flight. He describes the effects of the centrifuge at Johnsville, Pennsylvania. Escape from aircraft ditched in water is a subject under investigation at Pensacola, Florida. The author discusses a weightless ride during his visit at Edward's Air Force Base, California. Heat resistant and pressure suits for pilots are under development at Wright-Patterson Air Force Base, Ohio, and at Randolph Air Force Base, Texas. Hyperventilation is another field of research at Randolph Air Force Base. Extreme acceleration and deceleration forces are the subject of a conversation between the author and Col. John P. Stapp. Pilot ejection and the effects of fatigue are being studied at Wright-Patterson Air Force Base. The article is very detailed about the research in all of the fields. (CARI)

159

Flaherty, B. E., D. E. Flinn, G. T. Hauty, & G. R. Steinkamp 1960 PSYCHIATRY AND SPACE FLIGHT. (USAF, School of Aviation Medicine, Aerospace Med. Ctr., Brooks AFB, Texas) Research Rept. 60-80, Sept. 1960 ; ASTIA AD-245 416

ABSTRACT: The stresses of altitude, acceleration and dynamic weightlessness, temperature, radiation and meteorites, day-night cycle, and emotional factors are discussed as they relate to the man-machine system and space flight. The reactions of four subjects to thirty-six hours of confinement in the School of Aviation Medicine Space Cabin Simulator are described. Two of the subjects successfully completed the flight despite having experienced perceptual aberrations. The psychiatric evaluation of the two subjects are presented. The effects of isolation and sensory deprivation are discussed as they relate to the experiments.

160

Flecker, J.F. 1958 MAN IN SPACE  
Air Force, v. 41, no. 3, March 1958, pp. 109-117, 120-123

ABSTRACT: The series of psychological tests underwent by volunteer airman Donald G. Farrell in a U.S. Air Force space cabin mock-up , and the multi-g acceleration experiment carried out by Colonel John Stapp are the subjects reviewed by this author. The results of experiments indicate that proper training about weightlessness could enhance human performance during zero gravity. There is a discussion of the use of "highchairs" for seats, squeeze tubes for feeding, suction-cup shoes for walking, and a closed biological cycle system to meet oxygen requirements. Problems not yet solved include the hazards of cosmic radiation and meteorites and the psychological problem of the "feeling of detachment" on a space traveler. When the North American X-15 is launched in 1959, the pilots will be required to make quick decisions under zero gravity conditions. They will also be exposed to speeds of Mach 5 to Mach 7. Therefore, the flight should help solve various questions about space flight. The author states his ideas concerning space stations and trips to planets.

161

Flexman, R.E., L.M. Seale, & C. Henderson 1963 DEVELOPMENT AND TEST OF THE BELL ZERO-G BELT. (Aerospace Medical Division, 6570th Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio) Rept. No. AMRL-TDR-63-23, March 1963.

ABSTRACT: The assumption is made that a requirement exists for the development of a self-maneuvering system for orbital workers. Such a system will consist of a life support subsystem, maintenance equipment (tools), and a propulsion and control subsystem. This report discusses the general problem areas and specifically reports on the research, development, and testing of the Bell Zero-G Belt,

a research propulsion and control system for maneuvering a man in weightless environment. The flight tests of the belt took place on a large airbearing platform and in a C-131 cargo-type aircraft during zero-g trajectories. The equations of motion derived during the Bell Aerosystems Company sponsored development of the Small Rocket Lift Device (Rocket Belt) are also presented on the adequacy of the research model of a propulsion system and recommendations are made for additional research and development.

162

Flickinger, D. 1959 RESULTS OF ANIMAL INVESTIGATIONS IN SPACE VEHICLES TO DATE. (30th Annual Meeting Aeromed. Assoc., Los Angeles, Calif., April 27-29, 1959)

ABSTRACT: The material analyzed for this summary was contained in relatively few reports (literature dated 1949 through 1959), since the criteria set forth required that only those experiments be included which utilized rocket-engine thrust to propel the biopack into space equivalent atmospheres. This stipulation was made in order to provide pertinent data on not only the biological effects of the space environment itself but also those induced by the dynamic vehicular forces contained in the total flight. Three Russians (Galkin, et al., Bugrov, et al., and Chernov and Yakovlev) and three American (The Henry Group, Van der Wal and Young, and Army Navy Bioflight Project No. 1) reports of working groups are summarized, with major highlights abstracted in order of their date of publication.

163

Flickinger, D. 1959 ZERO GRAVITY EFFECTS LARGELY UNKNOWN  
Aviation Week, v. 70, no. 1, Jan. 1959, pp. 35-39

ABSTRACT: Existing data on the ability of man to function usefully in the weightless state, and other bio-medical aspects of space flight are reviewed in this article. The physiological effects of weightlessness which are discussed include motion sickness, gastrointestinal problems, and skeletal muscle activity problems. The types of equipment needed for weightlessness include all manner of devices for simulators and trainers plus those for food storage and dispensing.

164

Flickinger, D. D. 1961 THE STATUS OF MAN'S ADVANCE ON THE VERTICAL FRONTIER. Lectures in Aerospace Medicine 16-20 January 1961.

165

Fridlender, G.O. 1959 A SYSTEM FOR DETERMINING THE PARAMETERS OF THE MOTION OF A BODY IN SPACE.

Trans. of Akademiy Nauk SSSR. Otdeleniye Tekhnicheskikh Nauk.

Izvestiya: Energetika i Avtomatika, (6):108-117, 1959

(Joint Publications Research Service, Washington, D.C.)

JPRS 3323, 27 May 1960.

ABSTRACT: By using double integration of the error in the reading of the system, which is converted to the position of the optical system, the difficulty of weightlessness in the application of gyrosystems during movement in interplanetary space is bypassed. The method described allows the period of a system to be obtained which is less than the period of stability. It introduces into the system damping effects which prevent the system's being disturbed by the velocities which occur in geosystems.

166

Fukuda, K., T. Tokida, S. Aoki, & T. Takeuchi 1959 JURYOKU NO HENKA GA KINKIN-CHO NI OYOBOSU EIKYO (THE EFFECTS OF VARIATIONS IN GRAVITY ON THE MUSCLE TONE) Nihon Koku Igaku Shinri-Gakkai Kiroku (Tokyo) (Proceedings of the Japanese Society of Aviation Medicine and Psychology) No. 7, p. 3, May 1959

ABSTRACT: The effects of gravitational changes on the tonic labyrinthine reflex in animals were studied. Animals subjected to deceleration, free fall, and motion along a Keplerian trajectory were observed. The effects of an increase in the gravitational forces were studied employing linear and rotational acceleration. The results show that labyrinthine control neck muscle tonus is affected by changes in gravitational forces, and that the rotation and flexion reflex of the neck subsequent to unilateral labyrinthectomy is abolished under conditions of weightlessness (during free fall, Keplerian trajectory) to the point of being difficult to observe.



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Gagarin, Yu. 1961 MATERIAL ON FIRST COSMONAUT'S FLIGHT  
FBIS USSR & East Europe, Nr. 72, April 14, 1961

ABSTRACT: The world's first cosmonaut, Maj. Yuriy Gagarin, in an interview with TASS told about himself and his flight into outer space on 12 April 1961. The Soviet cosmonaut said that when weightlessness set in, he felt excellent. It became easier to do everything. While in the state of weightlessness, I ate and drank and everything occurred just as it does here on Earth. I even worked in that condition--wrote, jotting down my observations--Gagarin says. I was convinced, Gagarin stressed, that weightlessness does not at all affect man's fitness for work. The transition from weightlessness to gravitation, to the appearance of the force of gravity, is smooth. (CARI)

168

Gagarin, Y, V. V. Parin, & H. Mielke 1962 GAGARIN, PARIN SPEAK ON GDR  
TELEVISION. FBIS USSR & East Europe, Nr. 73, April 13, 1962

ABSTRACT: Gagarin briefly discusses the problems of cosmic rays, nutrition during flight. He expresses his hope for the cooperation of all scientists in the research on space flights. Professor Parin discusses three main problems of space flights: length of time of space flights is becoming longer and thus requires a very complex closed ecological system; the danger of radiation; and the extended effect of weightlessness on man. (CARI)

Galkin, A.M., A.R. Kotova, A.V. Petrov, et al. 1958 ISSLEDOVANIYA ZHIZNEDEIATEL' NOSTI ZHIVOTNYKH PRI POLETAKH V GERMETICHESKIKH KABINAKH RAKET DO VYSTOY 212 KM (STUDIES ON VITAL FUNCTIONS OF ANIMALS DURING FLIGHTS IN HERMETIC CABINS OF ROCKETS UP TO 212 KM)

In: Preliminary Results of Scientific Researches on the First Soviet Artificial Earth Satellites and Rockets, Articles XIth, Section of IGY Program (Rockets and Satellites) No. 1 (Moscow, Academy of Sciences, 1958)  
Pp. 112-129. JPRS 'DC-288: 5-28

**ABSTRACT:** Medico-biological investigations during rocket flights into the atmosphere have been conducted systematically in the Soviet Union since 1949, for the purpose of studying shifts in certain physiological functions, behavior of the animals during flights, and any bodily changes as a result of the flights. In 1957, 14 dogs (only 5 dogs are listed, although some were flown 2 or 3 times) were flown in pairs (1 anaesthetized, the other normal) in hermetically sealed biopacks on 7 distinct flights to altitudes of 62 to 130 miles. Pre- and post-flight examinations included blood, chest X-ray, EKG, blood pressure, respiration and pulse, urinalysis, temperature, and body weight. Blood pressure, pulse, and respiration were registered during 3-hr. training periods in the cabin and during centrifuge training. A telemetric control system registered the compartment shell temperature, thermoinsulating lining, and barometric pressure inside the cabin. Physiological functions were measured by means of pickoffs, amplifying units, automatic pressure devices, electric clocks, and automatic optical recording devices. Motion pictures were taken at intervals during flight. The state of the physiological functions was not successfully registered during all parts of the flight projectory, inasmuch as abrupt changes in the direction of action G-stresses interfered with instrument operation and caused sharp animal movements which were reflected in the quality of the recordings. Some data are illustrated, although data are cited for determining the extent of experimental successes. Conclusions were as follows: (1) The vitally necessary conditions were guaranteed by the hermetically sealed cabin. (2) Acute disorder in the physiological functions did not occur, and no postflight changes in behavior were observed. (3) The pulse and respiration rates and the blood pressure of the conscious animals increased during the active part of the flights. During the period of dynamic weightlessness the registered physiological parameters were maintained at a high level for the first two to three minutes, with a tendency to decrease. The physiological indices returned to their original level within 4 to 5 mins. after dynamic weightlessness had begun. In the anaesthetized animals, the pulse rate, respiration, and blood pressure did not differ from their original values during the period of weightlessness. (4) The recovery system guarantees safe landing, although additional work is necessary to insure stabilization and more favorable deceleration conditions during the nose sections' fall from altitudes of 200 km and higher.

170

Galkin et al. 1959 MEDICO-BIOLOGICAL RESEARCH IN ROCKETS: RESEARCH ON THE LIFE ACTIVITY OF ANIMALS DURING FLIGHTS IN HERMETICALLY SEALED CABINS OF ROCKETS UP TO A HEIGHT OF 212 KM: RESEARCH ON THE LIFE-ACTIVITY OF ANIMALS DURING FLIGHTS IN THE HERMETICALLY SEALED CABINS OF ROCKETS UP TO AN ALTITUDE OF 110 KM. Trans. of mono. Preliminary Results of Research by Means of the First Soviet Artificial Earth Satellites and Rockets (Moscow) p. 109-149. LC or SLA 59-22466

171

Gantz, K. F., ed. 1959 MAN IN SPACE: THE UNITED STATES AIR FORCE PROGRAM FOR DEVELOPING THE SPACECRAFT CREW (New York:, Duell, Sloan, and Pearce, 1959)

ABSTRACT: Contents include: "The Threshold of Space"; "From Aviation Medicine to Space Medicine"; "Basic Factors in Manned Space Operations"; "Biomedical Aspects of Space Flight"; "Biodynamics of Space Flight"; "The Engineered Environment of the Space Vehicle"; "Human Performance in Space"; "Weightlessness"; "Observations in High-Altitude, Sealed-Cabin Balloon Flight"; "Experimental Studies on the Conditioning of Man for Space Crews"; "Escape and Survival During Space Operations"; "Time Dilation and the Astronaut"; "The Spiral Toward Space": "Human Factors Support of the X-15 Program"; "The U. S. Air Force Human Factors Program"; "Blueprint for Space"; and "The Military Impact of Manned Space Operations."

172

Garbell, M.A. 1960 SOVIET RESEARCH ON GRAVITATION: AN ANALYSIS OF PUBLISHED LITERATURE. (Science and Technology Section, Air Information Division, Library of Congress, Washington, D.C.) Rept. No. AID 60-61, Oct. 1960. ASTIA AD 246 700.

ABSTRACT: A survey is given of Soviet research in the field of gravitation with a comparison of Soviet and Western research. The appendix contains a translation of K.P. Stanyukovich's "The Problem of the Physical Nature of Gravity." A correlation is included of Stanyukovich's public statements on weightlessness with views expressed by other Soviet scientists.

173

Gartmann, H. 1957 MAN UNLIMITED. (New York: Pantheon, 1957)

ABSTRACT: Provides information for the layman on some of the psychophysiological stresses man may expect in space flight.

174

Gaspa, P. 1953 PROBLEMES PHYSIOLOGIQUES POSES PAR L'ASTRONAUTIQUE  
(PHYSIOLOGICAL PROBLEMS POSED BY SPACE FLIGHT) Rev. path. gen. comp.  
53:1485-1503

175

Gatland, K. W. 1952 DESIGN FOR ZERO G: A MAN CARRYING ROCKET FOR PHYSIOLOGICAL RESEARCH IN NEAR SPACE. Flight (London) 61:774-775, 779, June 27, 1952

ABSTRACT: The plans for a man-carrying rocket presented by R. A. Smith and H. E. Ross of Great Britain in 1946 are discussed. The rocket, which would be propelled by compressed air and alcohol, would have no tail fins. Its initial thrust would be 60,000 lb., its initial acceleration 9.8 ft/sec<sup>2</sup> (after 110 seconds, the effective acceleration would be 2 g). An automatic device would keep the rocket under control in case the pilot would black out. The essential feature of the missile would be its detachable cabin unit, jettisoned by an automatic compressed-air device shortly before peak altitude would be reached. The cabin would descend by parachute. While outside the effect of the gravitational pull of the earth, various degrees of 'weight' of the pilot may be attained by an axial spin imparted on the cabin by small peroxide-permanganate motors firing tangentially at right angles to its main axis. The range of the rocket has been calculated to be 200 miles, but 180-190 miles is considered the limit of safety.  
(Literatuuroverzicht (Over Ruimtevaartgeneeskunde) (Space Medicine Bibliography)  
(Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag,

176

Gatland, K.W. 1954 PROGRESS TOWARDS ASTRONAUTICS.  
Journal of the British Interplanetary Society, 13(3):142-166, May 1954

ABSTRACT: Review of achievements and opinions recorded in 1949 and progress made by 1954; aerodynamic research techniques developed in United States; specific research aircraft described; design of pressure suits; human centrifuge; research in high atmosphere; guided missiles.

177

Gatland, K.W. 1956 EXPERIMENTS IN SPACE  
Roy. Air Force Flying Rev. 12(3):24-26, Nov. 1956

ABSTRACT: The problems of "weightlessness" (zero gravity) and cosmic radiation which pilots of rocket aircraft will meet in flights outside the atmosphere; some details of American experiments with zero gravity; and description of artificial satellites to be launched in U.S. during the forthcoming International Geophysical Year (1957-58) which will gather data to help throw light on the problems connected with space flight. Diagram showing launching path of the satellites to be launched in 1957, and results of previous launchings.

178

Gatland, K. 1959 MAN INTO SPACE.  
Royal Air Force Flying Rev., 14(9):23-25

ABSTRACT: Reviews United States and Russian achievements in space flight in putting animals into space (monkeys and mice in Aerobee rockets in 1952; white mice in Thor-Able rockets; Gordo, the squirrel-monkey, in a Jupiter nose-cone in 1958; and the dog, Laika, in Sputnik II in 1957). Reviews specifications for the payload of the projected Mercury capsule.

179

Gauer, O. H. and H. Haber 1950 MAN UNDER GRAVITY-FREE CONDITIONS. (In Dept. of the Air Force, German Aviation Medicine, World War II, Vol. I.) (Wash., D. C.: U. S. Govt. Printing Office, 1950) Pp. 641-644.

180

Gauer, O. H., & G. D. Zuidema, eds. 1961 GRAVITATIONAL STRESS IN AEROSPACE MEDICINE (Boston: Little, Brown, & Co., 1961)

CONTENTS:

Gauer, O. H., The Physiology of Acceleration,  
Gauer, O. H., Historical Aspects of Gravitational Stress,  
Gauer, O. H., Definitions: Magnitude, Direction, and Time Course of Accelerative Forces,  
Gauer, O. H., The Hydrostatic Pressure,  
Lawton, R. W., Arterial Blood Pressure Responses to Positive Acceleration in Animals,

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Gauer, O. H., Blood Volume and Gravitational Stress,  
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Gauer, O. H., & S. Bondurant, Effect of Acceleration on Respiration,  
White, W. J., Visual Performance Under Gravitational Stress,  
Brown, J. L., The Physiology of Acceleration-Performance,  
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Edelberg, R., The physiology of Combined Accelerations,  
Bondurant, S., Transverse G: Prolonged Forward, Backward, and Lateral Acceleration,  
Hessberg, R. R., Escape from High Performance Aircraft,  
Stapp, J. P., Human Tolerance to Severe, Abrupt Acceleration,  
Simons, D. C., Sub-Gravity and Weightlessness,  
Zuidema, G. D., Some Physiological Considerations of Space Flight,  
Leverett, S. D., R. U. Whitney, & G. D. Zuidema, Clinical Evaluation of Low G Tolerance,  
Gauer, O. H., The Hydrostatic Indifference Level,  
Lawton, R. W., The Hydrostatic Pressure in the Arterial Tree,  
Leverett, S. D., G. D. Zuidema, Standardization of Human Centrifuge Techniques,

181

Gaume, James G. 1962 PHYSIO-PATHOLOGIC IMPLICATIONS OF CHRONIC WEIGHTLESSNESS (Martin, Denver, Colorado) March 1962.

The effects of chronic weightlessness on the human body are the most difficult to evaluate of all the medical problems which man will encounter in space flight. Much research has been conducted on the effects of weightlessness, but all experiments to date have to do with acute effects, and it is not safe to extrapolate to chronic effects.

182

Gaume, J.G. 1962 THE BIOLOGICAL EFFECTS AND IMPLICATIONS OF WEIGHTLESSNESS (Martin Company, Denver Division) April 1962

ABSTRACT: This research report explores the effects and implications of weightlessness on the human body for extended periods. It cites past research on weightlessness and compares bed rest and water suspension with actual weightlessness in outer space. The document suggests carefully planned muscle exercises as a possible means of preventing ill effects caused to the body by long periods of weightlessness.

133

Gaume, J.G. & W. Kuehnegger 1962 EFFECTS OF CHRONIC LUNAR GRAVITY ON HUMAN PHYSIOLOGY  
(Paper, American Rocket Society Lunar Missions Meeting, July 17-19, 1962, Cleveland, Ohio) ARS Paper No. 2469-62

ABSTRACT: Prolonged exposure of man to lunar gravity causes many physiological problems. This is a review of those problems and a proposal for determining the physical exercises in weightlessness. Suggestions are made for methods to approximate chronic weightlessness. One method is water suspension of the body for periods of more than one week. Another method is prolonged bed rest. During both of these conditions, physiological changes occur. For example, bones demineralize and both minerals and nitrogen are removed from the tissues and excreted through the kidneys. Therefore, it is important for a man in space to get exercise to maintain proper function and structural integrity of the subsystems of the body. The exercise must supplement the work/energy expenditure under the lunar activities and levels so that the sum of both will equal the work/energy expenditure on earth. The exercises must make up the daily energy balance per link and joint.

184

Gazenko, O.G. & V.B. Malkin 1960 BIOLOGIYA KOSMICHESKIKH POLETOV (BIOLOGY OF COSMIC FLIGHTS)  
Nauka i zhizn' 11: 17-22 (and p. 2 of centerfolds), 1958  
See also: Aerospace Technical Intelligence Center, Wright-Patterson AFB, Ohio Trans. No. F-TS-9899, Oct. 1960 ASTIA AD 257 712

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Gazenko, O.G. & V.B. Malkin 1960 BIOLOGY OF COSMIC FLIGHTS (BIOLOGIYA KOSMICHESKIKH POLETOV)  
(Aerospace Technical Intelligence Center, Wright-Patterson AFB, Ohio)  
Trans. No. F-TS-9899, Oct. 1960 ASTIA AD 257 712  
See also: Nauka i zhizn' 11: 17-22 (and p. 2 of centerfolds), 1958

ABSTRACT: Tests with animals carried in rockets up to 110 km showed normal reactions, insofar as they withstood acceleration and retardation satisfactorily, and blood pressure, pulse, and breathing increased only slightly. At heights up to 212 km, especially unfavorable effects were noticed at re-entry of the rockets into the atmosphere. However, the problem of re-entry at 450 km has been solved. Soviet researchers are especially concerned with the problem of re-entry of passengers from space ships. Great difficulties have yet to be

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overcome in solving re-entry at supersonic velocities. The effects of acceleration are being thoroughly studied, whereby it was found that acceleration of 10 G may be endured for several minutes. However, acceleration should be considerably lower than this to maintain operating ability. The authors describe the different operation of re-entry from a cosmic flight; catapulting of pressure cabin from the space ship, slowing down of descent by means of reactive drives and parachute, and finally landing of the cabin with a parachute

186

Gazenko, O. G., & V. I. Yazdovskiy 1961 SOME RESULTS OF PHYSIOLOGICAL REACTIONS TO SPACE FLIGHT CONDITIONS. (Paper, XIIth International Astronautical Congress in Washington, D. C., Oct. 4, 1961)

ABSTRACT: In this discussion of the problems of overload and weightlessness, it is noted that a direct dependence of blood oxygenation on the rate of the blood stream testifies to the active participation of hemodynamics of pulmonary circulation in the oxygenation of the blood in the lungs. Thus, active rearrangement of pulmonary circulation can within certain limits insure the preservation of the necessary blood oxygenation level. However, in view of the apparent inequality of the volumes of blood ejected by the right and left ventricles, and taking into account the progressive storage of blood in the lungs, it is difficult to imagine the possibility of enduring increased gravitation for a lengthy period of time. In the study of the mechanisms of the action of overloads on the central nervous system, tests with aminazine as a means of blocking the impulsation at the level of the reticular formation of the middle brain offer promise. The differences in the frequency of pulse and breathing registered by Gagarin and Titov in centrifugal tests and during actual flight are attributed to emotional stress. With regard to weightlessness, the definite instability which has been indicated in the central apparatus which controls vegetative functions probably results from a change in the afferent impulses. Titov noted unpleasant sensations of vestibular character during the entire period of weightlessness. These require a careful analysis. (CARI)

187

Gazenko, O.G., N.N. Zhukov-Verezhnikov, & V. Ya Kop'yev 1962 TRANSLATIONS FROM NAUKA I ZHIZN' (MOSCOW) (SCIENCE AND LIFE), No. 9, SEPTEMBER 1962.

#### CONTENTS:

"Five Days Which Shook The World" O.G. Gazenko, Pp. 1-12.

"Biology and Flights To Outer Space" N.N. Zhukov-Verezhnikov & V.Ya Kop'yev (Acad. Med. Sci. USSR) Pp. 13-22



188

Gazenko, O.G. 1962 FIVE DAYS WHICH ELECTRIFIED THE WORLD  
(Translation Services Branch, Foreign Technology Div., Wright-Patterson AFB, Ohio)  
FTD-TT-62-1518/1+2 10 Dec. 1962. ASTIA AD 294 530  
Original Source: Nauka i Zhizn', Nr. 9: 2-10. 1962.

ABSTRACT: The space flight of A. Nikolayev and P. Popovich made possible the study of such principally important problems, as man's ability to work under conditions of long lasting weightlessness, cooperation between cosmonauts, their communication with ground observation points and controlling the flight. The problems confronting the cosmonauts have been based on all this. They were required not only to live for several days under conditions of weightlessness, but also to be actively engaged in working operations under the new conditions and also to carry out a program of experimental, in particular medical-biological, investigations. This article describes the extent of the program and the type of functions carried out in the cabin of the ship

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Gazenko, O. 1962 SPACE BIOLOGY  
Joint Publications Research Service, Washington, D.C. JPRS-16677  
Transl. from Nedelya (Moscow), Aug. 5-11, 1962, p. 6-7

ABSTRACT: This article discusses the role of biology in the space sciences in terms of the effects of the space environment on living organisms, and of the methods for selecting and training the astronaut. The space environment problems covered are weightlessness, overloading, radiation, and psychological stresses. The importance of considering these psychological factors when selecting astronauts is considered, and methods of training under isolated conditions are described.

190

Gazenko, O.G. 1962 SOME PROBLEMS OF SPACE BIOLOGY  
Akademiya nauk SSSR. Vestnik (Moskva) 32(1): 30-34, Jan. 1962

ABSTRACT: The General Assembly of the Otdeleniye biologicheskikh nauk Akademii nauk SSSR (Department of Biological Sciences of the Academy of Sciences USSR) met in Moscow in 1961 to discuss problems of space biology. Over 30 reports were made and three films shown. N.M. Sisakyan, V.V. Parin, V.N. Chernigovskiy, and V.I. Yazdovskiy reported on "Problems of Space Biology and Physiology." In the report "Some General Results of Medical and Biological Experiments on Cosmic Earth Satellites", O.G. Gazenko, A.M. Genin, and V.I. Yazdovskiy discussed the main results of the biological experiments. The following three main problems exist at present in space biology: (1) clarification of effect of extremum factors of space on living terrestrial organisms; (2) elaboration of the biological

fundamentals of safeguarding space flight; and life on other planets; (3) investigation of the conditions and forms of life beyond the earth. The factors of space flight affecting living organism may be divided into three groups: (1) overstrain, vibrations, engine noise, weightlessness; (2) ultraviolet, infrared, and visible ranges of radiation, ionizing radiation, concentration of gas and solid matter, temperature conditions, etc.; (3) insulation, restricted space, peculiarities of the microclimate, rhythm of life, nutrition, etc. The cosmonauts Yu. A. Gagarin and G.S. Titov are mentioned. Under the effect of weightlessness, the two Soviet cosmonauts felt a change of heart beat, dizziness, and sickness. The effect of overstrain and protective measures are serious problems. Perfection of biotelemetry is of great importance for the development of space biology. Lately, methods have been elaborated, permitting to study the coordination of arbitrary movements of man and the blood supply to the brain. (CARI)

191

Gebhart, B. 1962 RANDOM CONVECTION UNDER CONDITIONS OF WEIGHTLESSNESS  
AIAA Journal 1(2):380-384, Feb 1963

ABSTRACT: The nature of the transport process between a fluid and its enclosing surface is considered in the presence of random disturbances and, in particular, for conditions likely to prevail in space devices. The argument is developed that disturbances normally present in the motion of such devices may result in relatively effective transport mechanisms. On the basis of assumptions regarding the nature of the disturbances and their mode of occurrence, a number of circumstances are analyzed. The resulting transport rates generally are much greater than would be calculated for the process that would be expected in the absence of all disturbances. (AUTHOR)

192

Cell, C. F. 1962 LONG TERM WEIGHTLESSNESS---ITS POSSIBLE EFFECT ON CELLULAR METABOLISM (Paper, 33rd Annual Meeting of the Aerospace Medical Assoc., Chalfonte-Haddon Hall, Atlantic City, N. J., April 9-12, 1962)

ABSTRACT: The effect of long-term weightlessness on the metabolic function of cell structures in man have been discussed by physiologists in a casual vein since the early concept of manned space flight. The major interest has been directed to the systemic effects of this stressor as related to its effect on the labyrinth, cardiovascular and skeletal systems. The author believes that there is a possibility of more subtle effects at the cell level which may result in cumulative damage to man in long-term weightlessness. He also believes that observing cells in a weightless state throughout their life cycle of 36 to 72

hours may reveal conclusively whether occult cell physiologic disturbance exists. Knowledge of the effect of weightlessness at the cell level will, if negative, render assurance of the ability of man to withstand long-term weightlessness. Positive evidence of disturbed cellular metabolic processes will influence space ship design. The author discusses methods of accomplishing this type of study and believes it is necessary to avoid mistakes in related design concepts that may prove extremely expensive in the future.

193

General Dynamics Corp. 1960 MAY-JULY PROGRESS REPORT FOR THE COMBINED  
LABORATORY AND AIRPLANE ZERO-G TEST PROGRAM  
(General Dynamics Corp., Convair Astronautics Div., San Diego, Calif.)  
August 1960

194

Gerathewohl, S.J. EFFECTS OF GRAVITY-FREE STATE  
In: Schaefer, K.E., Ed. Environmental Effects on Consciousness, (The Macmillan  
Co., New York) pp. 73-85

ABSTRACT: The effects of weightlessness is the subject of this paper. Particular attention is focused on the physical aspects of zero-g; the human-factor aspect of weightlessness; and the ability to function in these states

195

Gerathewohl, S. J. 1952 PHYSICS AND PSYCHOPHYSICS OF WEIGHTLESSNESS: VISUAL  
PERCEPTION. In (School of Aviation Medicine, Randolph AFB, Texas) Epitome  
of Space Medicine  
See also J. Avia. Med. 23(8):373-395, Aug. 1952

ABSTRACT: This is a review of the various factors involved in the visual perception of space and an attempt to analyze the conditions of spatial orientation as they would obtain in the state of subgravity and zero gravity. The circulation of the blood would probably adjust easily to zero gravity, as it does to abnormal postures of the body. Spatial orientation normally relies on two sets of clues, visual and gravitational. Behavior in case of conflicting clues (e.g., the visual and gravitational conflict during various accelerations in flight or on the centrifuge) is discussed in some detail. Nystagmus and visual illusions (oculogravic and oculogyral effects) further interfere with man's control of his environment. The possible hazards of the transition from the gravity state to the gravity-free state are pointed out. A bibliography of 69 references is appended.

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Gerathewohl, S. J. 1952 PHYSICS AND PSYCHOPHYSICS OF WEIGHTLESSNESS:  
VISUAL PERCEPTION  
J. of Aviation Medicine 23(4):373-395 August 1952

ABSTRACT: The rationale of this study was an investigation of the problem, whether and how visual perception will be affected during the transition of man in the sub-gravity and zero-gravity states. In considering the pertinent anatomical and physiological characteristics of the eye it can be concluded that reduction or entire lack of weight of the eyeball will not produce disturbing alterations of the intra-ocular pressure. On the other hand, there is a high probability that visual perception will be affected by psycho-physiological stimulations, which will occur at least during the transition period from the normal state of stimulation (1 g) into the state of weightlessness. It was demonstrated that the pattern of mechano-receptor stimulation will be decisively changed in the gravity-free state. When flying--and especially during blind flying--the mechano-receptor stimulations can be subliminal or suppressed, while the eye can take over the control of position and direction orientation without illusory disturbances. During the transition in the gravity-free state, however, the stimulation of the mechano-receptors is changed in such a way that visual illusions will occur.

197

Gerathewohl, S. 1953 ZUR FRANGE DER ORIENTIERUNG IM SCHWEREFREIEN ZUSTAND  
(ON THE PROBLEM OF ORIENTATION IN THE GRAVITY FREE STATE)  
(In: Space Flight Problems; being a Complete Collection of all Lectures Held at the Fourth Astronautical Congress, Zurich, 1953 (Biel: Laubscher, 1953) pp. 189-195)  
English Abstract: Military Surgeon 113: 342-343, 1953

ABSTRACT: The experiments on the problems of orientation during weightlessness are reviewed. Evidence of the disturbance of labyrinthine functioning is presented in the form of photographs of the mice during flights in a V-2 rocket and two Aero-Jet rockets. The mice with destroyed labyrinths were less confused and had better adaptive behavior than the ones with functioning labyrinths. During experimental flights or reduced gravity, two test pilots, S. Crossfield and C. Yeager, found no serious disturbances of orientation as long as visual reference was possible and the subject was strapped securely to his seat. According to the author, the Weber-Fechner law of the relation between the intensity of sensation and the strength of the stimulus may not hold for conditions of weightlessness.

198

Gerathewohl, S. J. 1953 SOME PROBLEMS OF ORIENTATION IN THE GRAVITY-FREE STATE.

Military Surgeon, 113 (4); 342-343

ABSTRACT: Zero gravity, such as a traveler in a rocket ship would experience in space, has been artificially produced in two series of experimental flights with jet aircraft. One group of flights was made by Test Pilot Burt Crossfield at Edwards Air Force Base, Calif., for the National Advisory Council on Aeronautics. The other was staged by personnel of the Aero Medical Laboratory at Wright-Patterson AFB, Ohio. In both, the weightless condition was achieved for periods up to 42 seconds by flying a predetermined trajectory at very high speed. No ill effects of any consequence were noted in either series of test runs. Pilot Crossfield remarked that 'it did feel unnatural' to be without weight. In some of his earlier trials he noted a sensation of 'befuddlement' which was later overcome. But the flyers found themselves on the whole undisturbed by zero gravity. It is now considered unlikely by most aeromedical researchers that the suspension of gravity in space would do severe harm to the mind or body of the astronaut.

199

Gerathewohl, S.J. 1954 DIE PSYCHOLOGIE DES MENSCHEN IM FLUGZEUG (THE PSYCHOLOGY OF MAN IN AN AIRPLANE

(Deutsche Aeronautische Gesellschaft e. V. (Munich: J.A. Barth, 1954) 269 p. In German

ABSTRACT: This work examines the current knowledge of basic forms of perception and reaction, sensorimotor coordination, the means and limitation of integration of such complexity of stimuli as encountered in flight, as well as the effect of changes in motion, in altitude, in spatial relationship to earth, in velocity, in acceleration, and the effect of changed phenomenological space referents in respect to the individual. In the first chapter, the goal of aviation technology is viewed as striving towards a completely automatic operation and control of the aircraft, whereby man would participate only in emergency situations. The author discusses further the aerotechnical concept of man functioning as part of the servomechanism controlling the aircraft, the equipment and instrumentation of the airplane, and the importance of technical aptitude in the pilot, although such aptitude should not be overestimated. Sensory discrimination and reaction processes in flight, orientation as to the position and movement in space, "feel of the airplane", and subjective illusions in blind flying due to false sensory information are investigated in the next chapter. The last chapter describes the chemistry and physics of the atmosphere, and discusses directional orientation in flight, navigation within and outside the atmosphere, the psychophysiology of high altitude flight, the thermal influence, the psychological effects of speed, the psychophysiology of acceleration, and safety measures.

200

Gerathewohl, S. J. 1954 THE PECULIAR STATE OF WEIGHTLESSNESS.  
In E. J. Kendricks, et al., "Medical Problems of Space Flight"  
Reprint Instructors' Journal, Winter, 1954, Catalogued by ASTIA as AD-144 581  
pp. 16-20

ABSTRACT: Weightlessness is a function of speed and trajectory, produced by the equilibrium of gravity and centrifugal force. Actual weight is the result of the gravitational tug of the earth's mass, drawing objects toward its center. Weightlessness is provided when the body moves in a so-called Keplerian trajectory or during a free-fall. Weightlessness can seriously affect the flyer's behavior and his orientation. Several German scientists first investigated the phenomena of weightlessness. Then the United States Air Force conducted several investigations on the same subject. Dr. James P. Henry and other researchers at Wright-Patterson Air Force conducted several experiments. They found that a labyrinth ectomized mouse was less disturbed by weightlessness than a normal mouse. Dr. H. J. H. von Beckh used both turtles and humans in his studies of weightlessness. He also found that the turtle with the damaged labyrinth behaved normally during weightlessness while the normal ones lost all sense of orientation. In both humans and turtles, von Beckh found that after several weightless sessions, the subjects regained their coordination and accuracy. (CARI)

201

Gerathewohl, S. 1954 UNTERSUCHUNGEN UBER SCHWERELOSIGKEIT AN VERSUCHSPERSONEN UND TIEREN WÄHREND DES LOTRACHEN STURZFLUGES (INVESTIGATIONS ON WEIGHTLESSNESS ON RESEARCH PERSONNEL AND ANIMALS DURING VERTICAL FLIGHT) 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)

202

Gerathewohl, S.J. 1954 COMPARATIVE STUDIES ON ANIMALS AND HUMAN SUBJECTS IN THE GRAVITY-FREE STATE. In (USAF School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item 25  
See also J. Aviation Med. 25(4):412-419, Aug. 1954.

ABSTRACT: This paper discusses the psychophysiological aspect of weightlessness. These concern mainly the question whether the powers of orientation and sensorimotor coordination are disturbed under subgravitational conditions. (CARI)

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Gerathewohl, S.J. 1954 COMPARATIVE STUDIES ON ANIMALS AND HUMAN SUBJECTS IN THE GRAVITY-FREE STATE

J. Avia. Med. 25(4): 412-419, August 1954

Also: USAF School of Aviation Medicine, Randolph AFB, Texas, Epitome of Space Medicine, Item 25 (F)

ABSTRACT: The progress in the field of space medicine on the study of weightlessness during the past five years is the subject of this report.

SECOND ABSTRACT: This paper discusses the psychophysiological aspect of weightlessness. These concern mainly the question whether the powers of orientation and sensorimotor coordination are disturbed under subgravitational conditions. (CARI)

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Gerathewohl, S. J. 1955 THE PECULIAR STATE OF WEIGHTLESSNESS

In USAF School of Aviation Medicine, Randolph AFB, Texas, Epitome of Space Medicine, pp. 16-21

See also USAF Tng. Com. 5:290-296, 1954.

ABSTRACT: Weightlessness is a function of speed and trajectory, produced by the equilibrium of gravity and centrifugal force. Actual weight is the result of the gravitational tug of the earth's mass, drawing objects toward its center. Weightlessness is provided when the body moves in a so-called Keplerian trajectory or during a free-fall. Weightlessness can seriously affect the flyer's behavior and his orientation. Several German scientists first investigated the phenomena of weightlessness. Then the United States Air Force conducted several investigations on the same subject. Dr. James P. Henry and other researchers at Wright-Patterson Air Force conducted several experiments. They found that a labyrinth ectomized mouse was less disturbed by weightlessness than a normal mouse. Dr. H.J.H. von Beckh used both turtles and humans in his studies of weightlessness. He also found that the turtle with the damaged labyrinth behaved normally during weightlessness while the normal ones lost all sense of orientation. In both humans and turtles, von Beckh found that after several weightless sessions, the subjects regained their coordination and accuracy. (CARI)

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Gerathewohl, S. J. 1956 PERSONAL EXPERIENCES DURING SHORT PERIODS OF WEIGHTLESSNESS REPORTED BY SIXTEEN SUBJECTS. Proc. International Astronautical Congress, VIIth (Rome, Sept. 12-22, 1956) Pp. 313-334

See also Astronautica acta (Wien) 2(4):203-217

ABSTRACT: A series of experiments on weightlessness was conducted using a Lockheed T-33 type aircraft for dives and parabola flights yielding practical weightlessness from 10 to 30 seconds duration. Records of the personal experiences of sixteen subjects during these states were obtained by interviews, pilot reports,

and written statements. The majority of subjects felt very comfortable during weightlessness; several subjects reported sensations of motion with no emotional involvement. A small group of subjects experienced discomfort, nausea, and severe symptoms of motion sickness. Tolerance to weightlessness is discussed with regard to space flight. It is theorized that individuals differ significantly as to their susceptibility to sub- and zero-gravity and their adaptability to weightlessness. If the right persons can be selected and adapted, some earlier concepts about artificial acceleration or "quasi-gravity" of space vehicles can be revised. (AUTHOR)

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Gerathewohl, S. J. 1956 PERSONAL EXPERIENCES DURING SHORT PERIODS OF WEIGHTLESSNESS REPORTED BY SIXTEEN SUBJECTS. Astronautica acta (Wien) 2(4):203-217  
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Gerathewohl, S. J. 1956 PERSONAL EXPERIENCES DURING SHORT PERIODS OF WEIGHTLESSNESS REPORTED BY 16 SUBJECTS. In (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine  
See also Astronautica Acta 2:203-217, June 1956

ABSTRACT: A series of experiments on weightlessness was conducted using a Lockheed T-33 type aircraft for dives and parabola flights yielding practical weightlessness from 10 to 30 seconds duration. Records of the personal experiences of sixteen subjects during these states were obtained by interviews, pilot reports, and written statements.

RESULTS: The majority of our subjects felt very comfortable during weightlessness; several subjects reported sensations of motion with no emotional involvement. A small group of subjects experienced discomfort, nausea, and severe symptoms of motion sickness.



Tolerance to weightlessness is discussed with regard to space flight. It is theorized that individuals differ significantly as to their susceptibility to sub and zero-gravity and their adaptability to weightlessness. If the right persons can be selected and adapted, some earlier concepts about artificial acceleration or "quasi-gravity" of space vehicles can be revised. (AUTHOR)

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Gerathewohl, S.J., H. Strughold, & H.D. Stallings 1957 SENSOMOTOR PERFORMANCE DURING WEIGHTLESSNESS: EYE-HAND COORDINATION.  
J. Aviation Med. 28(2):7-12. See also (USAF School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item 34 (F)

ABSTRACT: A series of experiments was performed to study sensomotor performance and adaptation during the weightless condition. Subgravity and zerogravity states were produced by flying dives at high altitudes in a T-33A type aircraft. The results of a simple aiming test obtained from seven subjects show that eye-hand coordination is moderately disturbed by increased or decreased acceleration. The subjects already adjusted to the situation during the first six exposures to weightlessness. (Author)

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Gerathewohl, S. J., H. Strughold, & H. D. Stallings 1957 SENSOMOTOR PERFORMANCE DURING WEIGHTLESSNESS: EYE-HAND COORDINATION. In (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item 34  
See also J. Avia. Med. 28(2):7-12, Feb. 1957

ABSTRACT: A series of experiments was performed to study sensomotor performance and adaptation during the weightless condition. Subgravity and zerogravity states were produced by flying dives at high altitudes in a T-33A type aircraft. The results of a simple aiming test obtained from seven subjects show that eye-hand coordination is moderately disturbed by increased or decreased acceleration. The subjects already adjusted to the situation during the first six exposures to weightlessness. (AUTHOR)

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Gerathewohl, S. J., & H. D. Stallings, Jr. 1957 LABYRINTHINE POSTURE REFLEX (RIGHTING REFLEX) IN THE CAT DURING WEIGHTLESSNESS. In (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item 36  
See also J. Avia. Med. 28:345-355, Aug. 1957

ABSTRACT: Experiments on the postural righting reflex were made using (1) four young kittens before the reflex was developed, and (2) four older kittens with the reflex well established. On the ground, the animals were dropped in upside-down position from an altitude of about twenty inches, and later in the air exposed to periods of about twenty to thirty seconds of practical weightlessness. The reflex was studied in T-33 and F-94 aircraft under both blindfold and non-blindfold conditions. The behavior of the cats was recorded on 16 mm. film. The motion pictures were evaluated by repeatedly watching the film, and by an analysis of the individual frames. On the ground, the younger animals fell straight down; the older ones turned upright immediately after release without exception. In the air, the younger kittens floated upside-down during weightlessness; the older ones turned upright at the beginning of the weightless state, but their reflex failed after several exposures. By and large, it was observed that the postural righting reflex of the cat ceased to function after a period of about twenty seconds of practical weightlessness; and that the available visual cues did not affect essentially the reflex pattern. (AUTHOR)

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Gerathewohl, S.J., and H.D. Stallings 1957 THE LABYRINTHINE POSTURE REFLEX (RIGHTING REFLEX) IN THE CAT DURING WEIGHTLESSNESS.  
J. Aviation Med. 28(4):345-355. Aug. 1957.

SUMMARY AND CONCLUSIONS: Experiments on the postural righting reflex were made using (1) four young kittens before the reflex was developed, and (2) four older kittens with the reflex well established. On the ground, the animals were dropped in upside-down position from an altitude of about twenty inches, and later in the air exposed to periods of about twenty to thirty seconds of practical weightlessness. The reflex was studied in T-33 and F-94 aircraft under both blind-fold and non-blindfold conditions. The behavior of the cats was recorded on 16 mm. film.

212

Gerathewohl, S.J. 1957 PHYSIOLOGICAL AND PSYCHOLOGICAL TOLERANCE TO WEIGHTLESSNESS (Paper, American Rocket Society Spring Meeting, April 4-6, 1958, Washington, D.C.)  
Preprint No. 390-57

ABSTRACT: During flights in a Lockheed T-33 and F-94 aircraft, 47 subjects were

subjected to 10 to 40 seconds of weightlessness. There were many responses and a variability of the tolerance threshold to physiological and psychological effects. Twenty-two of the subjects enjoyed the weightless period and the author concluded that select personnel can be expected to function properly during weightlessness.

213

Gerathewohl, S. 1957 PHYSIOLOGICAL AND PSYCHOLOGICAL TOLERANCE FOR SURVIVAL TO WEIGHTLESSNESS: (School of Aviation Medicine, Randolph AFB, Texas)

ABSTRACT: Experiments on weightlessness were conducted using a Lockheed T-33 and an F-94 type aircraft for parabolic flights yielding virtual weightlessness from 10 to 40 seconds. The responses of the 47 subjects were highly individualistic and indicated a great variability of the tolerance threshold to physiological and psychological effects. The findings suggest that 22 subjects enjoyed the short abaric condition, and that select personnel can be expected to function properly during prolonged exposure to weightlessness. (Literatuuroverzicht (Over Ruimtevaartgeneeskunde) (Space Medicine Bibliography) (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

214

Gerathewohl, S. J. 1957 WEIGHTLESSNESS  
Astronautics 2(4):32-34, 74-75, Nov. 1957.

ABSTRACT: Discussion of the phenomenon and reports on experimental studies of weightlessness conducted at USAF School of Aviation Medicine.

215

Gerathewohl, T. 1957 SUBJECTIVE SENSATIONS DURING BRIEF PERIODS OF WEIGHTLESSNESS  
Riv. Med. Aeronaut. 20(1) Jan. - Mar. 1957.

216

Gerathewohl, S. J., et al. 1957 PRODUCING THE WEIGHTLESS STATE IN JET AIRCRAFT. (School of Aviation Medicine, Randolph AFB, Texas) Rept. 57-143; August 1957; ASTIA AD-149 703  
See also USAF School of Aviation Medicine, Randolph AFB, Texas, Epitome of Space Medicine, Item 10

ABSTRACT: Some simple arithmetic functions were used for computing duration, height, and angle of climb of flight parabolas for producing the weightless state in jet aircraft. The results, based upon certain flying characteristics of the T-33, F-94, and F-104, are in good agreement with the data obtained for the first two types of aircraft mentioned during actual zero-gravity maneuvers. Certain flying safety hazards were noticed in the T-33 but remedied through appropriate measures. The F-94C Starfire proved to be superior to the T-33 with regard to safety and duration of weightlessness obtained. If the F-104 were made available for aeromedical research, weightlessness could be produced for more than 1 minute. (AUTHOR)

217

Gerathewohl, S.J. 1958 PRODUCING THE WEIGHTLESS STATE IN JET AIRCRAFT  
In: International Astronautical Congress, Proceedings of the VIIth, 1957  
(Wien: Springer-Verlag, 1958), pp. 533-542

ABSTRACT: In the conclusion it is stated that the pilot had flown all zero-gravity research flights at the School of Aviation Medicine and had experienced weightless 3 minutes each flight or a total of 11 hours with no apparent physiological effects.

218

Gerathewohl, S. J., & H. D. Stallings 1958 EXPERIMENTS DURING WEIGHTLESSNESS, A STUDY OF THE OCULO-AGRAVIC ILLUSION. (Paper, 29th Annual Meeting of the Aero Medical Association, March 24-26, 1958, Washington, D. C.)  
(School of Aviation Medicine, Randolph AFB, Texas) Rept. No. 58-105; ASTIA AD-203 801; July 1958  
See also J. Aviation Med. 29(7):504-515

ABSTRACT: To investigate visual illusions during flight, an F-94C type aircraft was flown through various maneuvers. They included turns, pushovers, pullouts, and aileron rolls producing accelerations of different directions and magnitude, as well as short periods of weightlessness. The observer induced a strong visual after-image and described its apparent motion. Increase of acceleration was found to be associated with an apparent downward movement, and weightlessness with an apparent upward movement of the visual after-image. This latter phenomenon was called the oculo-agravic illusion. (AUTHOR)

219

Gerathewohl, S. J., & H. D. Stallings 1958 EXPERIMENTS DURING WEIGHTLESSNESS:  
A STUDY OF THE OCULO-AGRAVIC ILLUSION. J. Avia. Med. 29(7):504-516, July  
1958

ABSTRACT: To investigate the phenomenon known as the "oculo-agravic illusion", an observer was placed in the rear seat of an F-94C type aircraft, which was then flown through various maneuvers including: turns, push-overs, pull-ups, and aileron rolls. These maneuvers produced accelerations of different directions and magnitudes. Parabolas and double parabolas were performed to produce short periods of weightlessness because the oculo-agravic illusion can be best observed in the zero-gravity state. The observers experienced strong visual after-images, and their descriptions of these after-images were recorded during the maneuver. By this means, the apparent motion and displacement of the after-images were correlated with their associated maneuver.

220

Gerathewohl, S. J., & H. D. Stallings 1958 EXPERIMENTS DURING WEIGHTLESSNESS  
A STUDY OF THE OCULO-AGRAVIC ILLUSION. (School of Aviation Medicine,  
Randolph AFB, Texas) Rept. 58 105, July 1958

ABSTRACT: To investigate visual illusions during flight with particular attention to conditions of sub- and zero-gravity, an F-94C type aircraft was flown through various maneuvers. They included turns, pushovers, pullouts, and aileron rolls producing accelerations of different directions and magnitude, as well as short periods of visual after-image and described its apparent motion. There were 15 reliable observers tested. Reports of apparent displacement were analyzed in terms of the condition that produced the illusion. The illusion connected with weightlessness (upward movement) was named the oculo-agravic illusion.

221

Gerathewohl, S.J. & J.E. Ward 1958 PSYCHOPHYSIOLOGIC AND MEDICAL STUDIES OF  
WEIGHTLESSNESS (Second International Symposium on the Physics and Medicine of  
the Atmosphere and Space, Randolph AFB, Texas) Nov. 1958

ABSTRACT: The characteristics of flight trajectories for eight types of vehicles to produce weightlessness of maximum duration are shown in Table I. Although over one minute of exposure can be obtained by high performance aircraft, this technique has some shortcomings.

222

Gerathewohl, S. J. 1958 WEIGHTLESSNESS: THE PROBLEM AND THE AIR FORCE  
RESEARCH PROGRAM. Air University Quarterly Review 10(2):121-141, Summer, 1958

ABSTRACT: Includes table on responses of 47 human subjects to short periods of virtual weightlessness and discussion of psychological aspects.

223

Gerathewohl, S. J. 1958 EFFECTS OF GRAVITY-FREE STATE  
(1st International Symposium on Submarine and Space Medicine, U. S. Naval  
Submarine Base, New London, Conn., Sept. 8-12, 1958)

224

Gerathewohl, S.J. and G.R. Steinkamp 1958 HUMAN FACTORS  
REQUIREMENTS FOR PUTTING A MAN INTO ORBIT. In Hecht, F., ed.  
IXth International Astronautical Congress, Proceedings, 1958.  
( Vienna: Springer Verlag, 1959 )

225

Gerathewohl, S. J. 1959 WEIGHTLESSNESS  
In Gantz, K. J., ed., Man in Space  
(New York: Duell, Sloan, & Pierce, 1959) Chapter 8

226

Gerathewohl, S.J. 1959 PSYCHOLOGICAL PROBLEMS OF SELECTION, HOLDING,  
AND CARE OF SPACE FLIERS. (Army Medical Services, Research and  
Development Command) Reports control symbol CSCRD-16-4, 13 Nov. 1959.

ABSTRACT: The psychological requirements for the selection, holding, and care of space fliers is investigated. The selection methods are scrutinized as to their validity and applicability to the problem. Examples of related activities are presented. The main purpose of the preparations must be to establish a natural pattern of conditioning and familiarization, to develop skill and abilities parallel to the development of the hardware, and to maintain the interest and motivation of the astronaut. (Author)

227

Gerathewohl, S.J., & G.R. Steinkamp 1959 HUMAN FACTORS REQUIREMENTS FOR  
PUTTING A MAN IN ORBIT. Astro. Acta 5:73-84

ABSTRACT: Man's survival and operational capability in an artificial earth satellite depend primarily on the reliability and accuracy of the launching, guidance and recovery operations on the one hand, and on the perfection of his engineered environment, on the other. Although the human organism is more sensitive and vulnerable than that of man other creatures, his greater versatility and higher intelligence assure his survival under new and threatening circumstances. If a physiologically habitable environment is created, and if its functions during orbiting are secured, the human passenger can withstand the stresses involved in manned satellite operations of a limited duration.

228

Gerathewohl, S. J. 1959 SURVIVAL IN SPACE.  
Space Journal, March-May 1959

229

Gerathewohl, S. J. 1959 EQUIPMENT FOR MANNED SPACE CAPSULES AND LUNAR BASES.  
(Army Medical Research Labs., Bioastronautics Research Unit, Ft. Knox, Ky.)  
Special Rept. 28 Feb. 1959

ABSTRACT: The construction of second and third generation boosters developing several million pounds of thrust leads by necessity to manned space flight. This not only requires the advancement of engineering capabilities and space technology, but also demands an acceleration of bioastronautical research and the projection of information already available into the region of outer space. Equipment variables which are thought to be significant for man's exploration and survival in space are discussed in this first report, and sets of research task necessary for the accomplishment of manned space missions are proposed.

230

Gerathewohl, S.J. 1960 PERSONAL EXPERIENCES DURING SHORT PERIODS OF WEIGHTLESS-  
NESS IN JET AIRCRAFT AND ON THE SUBGRAVITY TOWER  
(Paper, Symposium on Motion Sickness in Weightlessness Research, March 1960,  
Wright-Patterson AFB, Ohio)

231

Gerathewohl, S. J., S. W. Downs, Jr., et al. 1960 BIO-TELEMETRY IN THE NOSE CONES OF THE U. S. ARMY JUPITER MISSILES. Reprint: IRE Trans. MIL-4:288-302 April-July 1960

ABSTRACT: The primary objective of the bio-flights was to demonstrate that animals can survive ballistic flights unharmed, if an adequate life support is provided. The secondary aim was to design, construct and test such a system, to develop countdown and launching procedures, and to recover the specimen after flight. Technical and scientific information on the physiologic and behavior status of the animal was to be gained thru telemetry. Although the first animal was lost, valuable data were obtained on the functioning of the bio-package during flight. They served to improve the second experiment, which added substantially to the understanding of the biomedical requirements for space flight. Able and Baker were the first primates recovered unharmed from an operational IRBM nose cone after reentering the earth's atmosphere. (AUTHORS)

232

Gerathewohl, S.J. 1960 RECENT EXPERIMENTS ON SUBGRAVITY AND ZERO-G STRESS (Paper, 31st Annual Meeting, Aerospace Medical Association, May 1960, Miami Beach, Fla)

ABSTRACT: Subgravity and zero-G have long been considered an unfavorable environmental condition. For about one decade, several experimenters in this country and abroad have studied the stress as involved in actual and simulated weightlessness on both animals and man. Since weightlessness actually produces a stressless situation, the immersion method has attracted special attention. In this case, no particular surface area has to carry the weight of the body, and the internal stress forces seem to be minimized. Moreover, the remaining stress within the body is isotropic, if the difference in hydrostatic pressure remains small. All this is true within certain limits for the homogenous and non-sensoric part of the organism. Gravity and acceleration changes directly act upon the specific gravireceptors. Stimulation of the vestibular system by angular acceleration will not occur in flight parabolas and orbits, if the subject is at rest, since the rotation of a vehicle around its y-axis does not produce vestibular Coriolis effects. Only rotations of the unrestrained subjects cause extreme disorientation after a few revolutions which, in fact, border on severe cases of vertigo, at times. However, with a visual frame of reference and experience in unrestrained floating, moving, and performing, the weightless condition does not appear to be a serious obstacle to space flight.



233

Gerathewohl, S. J., & J. E. Ward 1960 PSYCHOPHYSIOLOGIC AND MEDICAL STUDIES OF WEIGHTLESSNESS. In Benson, O. O., & H. Strughold, eds., Physics and Medicine of the Atmosphere and Space (Proceedings of the Second International Symposium on the Physics and Medicine of the Atmosphere and Space, held at San Antonio, Texas, November 10, 11, and 12, 1959, sponsored by the School of Aviation Medicine, Aerospace Medical Center (ATC) Brooks AFB, Texas) (New York: John Wiley & Sons, 1960) Chapter 26, pp. 422-434

ABSTRACT: Reports study of group of 46 men and one woman for weightlessness tolerance at the USAF School of Aviation Medicine. Tabular account of results with psychological reactions.

234

Gerathewohl, S. J. 1961 ZERO-G DEVICES AND WEIGHTLESSNESS SIMULATORS. (National Academy of Sciences, National Research Council, Washington, D. C.) Publication No. 781; Library of Congress Catalog Card No. 60-60044

ABSTRACT: This report concerns the devices, methods, and techniques which have been used for the investigation of the effects of zero-G and weightlessness by many investigators. The report is not a scientific treatise of the problem of weightlessness and the effect of sub- and zero- gravity upon the organism, but rather a description of research equipment techniques.

SECOND ABSTRACT: Concerns the devices, methods, and techniques, which have been used for the investigation of the effects of zero-G and weightlessness by many investigators. Part I deals with devices which can be used for producing sub- and zero- gravity, viz., vertical-motion devices, aircraft, and ballistic missiles. A simple-mathematical treatment of the physical parameters involved in sub- and zero-G conditions precedes the discussion of each of these three methods. In Part II, instruments and techniques for the simulation of weightlessness are described. The objective of this survey is to assure maximum usefulness of such devices and optimum cooperation between agencies and to guarantee that new requirements of the future be incorporated in research proposals on bioastronautics.

235

Gerathewohl, S. J. 1962 EFFECT OF GRAVITY-FREE STATE  
In Schaefer, K. E., ed., Environmental Effects on Consciousness.  
(New York: The MacMillan Co., 1962) Library of Congress Catalog Card No. 61-9079, pp. 73-85

ABSTRACT: The effect of the gravity-free state on the organism has been the subject of theoretical speculation ever since the pioneers of rocketry opened the door to space flight. However, only during the last decade were the means available to study the problem experimentally. Scientists of various countries, particularly in the United States and Russia, applied ingenious methods of producing

the gravity-free state for biological research. The purpose of this paper is to survey the present state of the art, and to draw some conclusions about the effects of weightlessness.

This survey tries to focus the three critical problem areas given in Table 1. They concern (1) the physical aspect of zero-G; (2) the human-factor aspect of weightlessness; and (3) the operational implications of these states. Although this table is neither exhaustive nor complete, it is shown here because it summarizes the main subjects of research. (AUTHOR)

236

Gerathewohl, S.J. & B.E. Gernandt 1962 PHYSIOLOGICAL AND BEHAVIORAL SCIENCES  
In: National Aeronautics & Space Administration, Wash, D.C.: Bioastronautics  
NASA SP-18, Dec. 1962

ABSTRACT: The bioastronautical program of the National Aeronautics and Space Administration is based on the classical disciplines of the life sciences as major areas of research. Since man is a terrestrial organism, he has been studied almost entirely under this aspect. However, with his entry into extraterrestrial space, new conditions arise which warrant intensive investigation. Generally, the physiologic research concerns the fundamental bases of human functions, the determination of man's tolerances, and his protection against stressful alterations of his biological homeostasis. The behavioral studies mainly deals with man's performance capabilities and limitations under normal and extreme conditions. In accordance with NASA's mission, the work in these areas is primarily applied and supporting in nature; but there is also a need for basic research. The scope of these investigations reached from such academic problems as biologic pattern formation and localization at the cellular level to the practical application of cybernetic principles for the monitoring of the organism and the complex systems, communication and information theory, and orientation and navigation processes in animal and man. Also included in this program is the blending of the disciplines of biology and physics in such fields as biotechnology and bionics, which are aimed at the development of improved techniques and instruments as well as of the acquisition of new information. The requirements of man in space necessitate those research efforts, which will result in design criteria for various types of equipment, protective devices, life support systems, communication channels, displays, and controls for space flight and planetary explorations. However, in many ways is the life scientist not yet in a position to inform the engineer, which conditions he must produce in order to accommodate the man or what systems must be made available for his protection. This paper will describe some of the NASA's efforts to answer this question. The bioastronautics program of the NASA will cover a much wider range of subjects in which the universities can play a major role. (Author)

237

Gil'bert, L. 1961 BEFORE A MANNED FLIGHT  
Znaniye-Sila (Moscow) 10:6-8  
(Air Force Systems Command, Foreign Tech. Div., Wright-Patterson AFB, Ohio)  
Trans. No. MCL-1280/1; 17 Aug. 1961; ASTIA AD-269 651

ABSTRACT: A discussion is presented of the effects of g-forces, (acceleration and deceleration), and of weightlessness.

238

Gillings, W.H. 1950 THE EFFECTS OF INTERPLANETARY FLIGHT Brit. Interplan. Soc. J  
9:105-107, May 1950

239

Golikov, A. & N. Smirnov 1960 INTERSTELLAR TRAVELLERS  
(Air Information Division, Wright-Patterson AFB, Ohio) AID Rept. No. 61-72  
ASTIA AD 260 501  
Original Source: Ogonek 35: 2

240

Golikov, A. & N. Smirnov 1960 FOUR-LEGGED ASTRONAUTS  
(Air Information Division, Wright-Patterson AFB, Ohio) AID Rept. No. 61-72  
ASTIA AD 260 501  
Original Source: Ogonek 49: 2

241

Goodman, B. D. 1961 THE PSYCHOLOGICAL AND SOCIAL PROBLEMS OF MAN IN SPACE:  
A LITERATURE SURVEY  
(System Development Corporation, 2500 Colorado Ave., Santa Monica,  
Calif.) Field Note 5220, March 2, 1961 ASTIA AD 252 434.

ABSTRACT: What type of man will be able to endure the silence and loneliness of space, with no human voice to speak to him, no human ear to listen? What type of man can remain alert and maintain his performance, removed from ordinary sensory stimuli, enclosed in the cramped quarters of a space capsule as it leaves the earth and all that is familiar?

A review of space literature shows that the primary emphasis in research has been on engineering--designing the space vehicle to get man into space, and providing the proper closed ecological system, the necessary controls, displays, and equipment to make it possible for him to survive there. This phase of research has involved studying man and his physiological needs, and analyzing human tolerances to environment variances. An accompanying, but less emphasized phase has been concerned with the study of the psychological and social problems of man in space.

It is the purpose of this bibliography to bring together the reports, books, and periodical articles published through January 1961 in the specific area of behavioral science related to space flight, or as it is sometimes called "space psychology." This area includes social and sensory isolation, psychological assessment and training, fatigue, confinement, performance under stress, work schedules, motivation, weightlessness, disorientation, emotional stability, and the day-night cycle.

Citations listed are unclassified unless otherwise noted. All titles are unclassified. To facilitate ordering items listed in the Technical Abstract Bulletin (TAB) of the Armed Services Technical Information Agency, ASTIA documents (AD) numbers have been given when available.

242

Goodman, B.D. 1961 PSYCHOLOGICAL AND SOCIAL PROBLEMS OF MAN IN SPACE - A LITERATURE SURVEY  
American Rocket Society Journal 31(7): 863-872, July 1961

ABSTRACT: What type of man will be able to endure for months or even years the vast silence and loneliness of space, far removed from the sounds and sights of his natural environments? What type of man can remain alert and maintain his performance, deprived of ordinary sensory stimuli, enclosed in the cramped quarters of a space capsule as it leaves Earth and all that is familiar? It is the purpose of this bibliography to bring together the reports, books, and periodical articles published thru the early part of 1961 dealing with the specific area of behavioral science related to space flight, or as it is sometimes called "space psychology." This area includes problems of confinement, isolation, sensory deprivation, weightlessness, psychological assessment and training, motivation and morale, emotional stability, boredom and fatigue, performance under stress, and work load. (Author)

243

Gougerot, L. 1952 WILL MAN BE ABLE TO LIVE ON BOARD A SPACE SHIP?  
Science et Vie, Special Astronautical Issue, 116-133

244

Gourgerot, L. 1953 LOI DE WEBER-FECHNER ET VARIATIONS DE LA PESANTEUR APPARENTE  
(The Weber-Fechner Law and Variations of Apparent Weight)  
Med. aeronaut. (Paris), 8:119-125.

245

Grandpierre, F.A.F. 1959 ETAT ACTUEL DES RECHERCHES ET ETUDE CRITIQUE DES  
TROUBLES PHYSIOLOGIQUES POUVANT APPAIRE AU COURS DES ETATS DE SUBGRAVITE  
(THE PRESENT STATE OF RESEARCH STUDIES OF PHYSIOLOGICAL PROBLEMS DURING  
THE STATE OF SUBGRAVITY) 2nd World and 4th European Congress on Aviation  
and Space Medicine, Rome, Italy, 27-31 October, 1959

246

Grandpierre, R., F. Biolette, R. Loubiere & G. Chatelier 1960 PHYSIOLOGIE DU  
VOL SPATIAL (Physiology of Space Flight)  
Forces aeriennes francaises 14(159): 789-823, May 1960 and 14(160): 969-986,  
June 1960.

ABSTRACT: The following subjects are reviewed: Acceleration and deceleration  
tolerances, weightlessness, radiation, prolonged life in a space cabin, oxygen  
regeneration, utilization of urine and collection of water vapor, and the  
nutritional requirements of astronauts. (Aerospace Medicine 31(10): 873,  
October 1960)

247

Grandpierre, R., R. Angiboust, G. Chatelier and L. Leitner 1962 THE  
EFFECTS OF THE ABSENCE OF WEIGHT ON THE ELECTRICAL ACTIVITY OF THE CENTRAL  
NERVOUS SYSTEM OF THE RAT.  
In C. R. Soc. Biol. (Paris) 156:121-122, 1962

248

Grant, L.J. 1956 LIFE UNDER LOW GRAVITY CONDITIONS.  
J. Space Flight 8(8):3-5. Oct. 1956.

ABSTRACT: The low-gravity conditions which will be encountered on space flights,  
e.g., to the moon, present different problems from those associated with zero  
gravity. First, the dichotomy between mass and weight, nonexistent on the earth,  
has serious implications for the construction of space suits for exploration on

the moon, locomotion of the explorers, and transportation on the moon surface. If low gravity is accompanied by low pressure it will cause an increase in capillary siphonage, evaporation problems due to high vapor pressure and low boiling point, a high rate of evaporation, and poor sound conduction. Several prophylactic measures are suggested to counteract muscular atrophy during a long-term stay at low gravity.

249

Grantham, W.D. EFFECTS OF MASS-LOADING VARIATIONS AND APPLIED MOMENTS ON MOTION AND CONTROL OF A MANNED ROTATING SPACE VEHICLE. (National Aeronautics and Space Administration, Washington, D.C. ) Technical note D-803; ASTIA AD- 255 528; May 1961

ABSTRACT: An analytical study has been made to determine the effects of mass-loading variations on a hypothetical earth-satellite space station, rotating to provide an artificial gravity. Results indicate that the shifting of masses within the rotating craft could bring about large oscillations in the attitude angles and in some cases the craft could even diverge about an axis other than the axis of initial rotation. Constant-rate inertia wheels and jet-reaction moments can be used to minimize the undesirable motions. (Author)

250

Graveline, D. E., & B. Balke 1960 THE PHYSIOLOGIC EFFECTS OF HYPODYNAMICS INDUCED BY WATER IMMERSION. (School of Aviation Medicine, Brooks AFB, Texas) Research Rept. 60-88; ASTIA AD-247 163; Sept. 1960

ABSTRACT: Body immersion in water was used to produce an experimental situation in which the normal weight sensation was altered and in which slow movements were effortless. The hypodynamic effects of such immersion on orthostatic tolerance, on cardio-respiratory adaptability to physical stress, and on other biologic and psychophysiologic parameters were studied on one human subject in experiments of 2 and 7 days duration, respectively. Pronounced functional deterioration resulted from the hypodynamic situation in both experiments; cardiovascular reflexes were severely disturbed and muscular tone was diminished. The extensive biochemical studies on blood and urine showed marked deviations from the normal. Psychomotor effectiveness, tested on a complex systems task, was impaired noticeably. The need for sleep appeared to be markedly reduced during the periods of water immersion.

This area of research is vital to the man-in-space program. Weightless or near-weightless conditions in space flight are expected to produce a similar hypodynamic effect on the organism as was caused by water immersion. Such loss of functional reserves may severely interfere with the astronaut's capability to adjust adequately to returning gravitational forces. (AUTHOR)

251

Graveline, D.E. 1961 MAINTENANCE OF CARDIOVASCULAR ADAPTABILITY DURING PROLONGED WEIGHTLESSNESS  
(Air Force Systems Command, Aeronautical Systems Div., Biomedical Lab., Wright-Patterson AFB, Ohio) Project 7222, Report No. TR 61-707, Task 722201, Dec. 1961. ASTIA AD 273 605

ABSTRACT: During zero gravity, special techniques must be used to help the astronaut maintain cardiovascular adaptability and provide optimum tolerance during reentry. An experiment has been completed using an arrangement that would initiate compensatory cardiovascular reflexes much like those initiated by the hydrostatic pressure effects of standing. The experiment used multiple tourniquet arrangements to intermittently obstruct venous return from the periphery. Subjects were first immersed for six hours with no protection. Later, the same subjects were immersed for five hours with protection. During both tests, the orthostatic tolerance of the subjects was recorded and compared. In all subjects, the tourniquet arrangement maintained average or above average cardiovascular adaptability

252

Graveline, D. E., & G. W. Barnard 1961 PHYSIOLOGIC EFFECTS OF A HYPODYNAMIC ENVIRONMENT SHORT TERM STUDIES. (Wright Air Development Division, Wright-Patterson AFB, Ohio) WADD TR 61-257; ASTIA AD-262 992; March 1961

See also Aerospace Medicine 32(8):726-736, Aug. 1961

ABSTRACT: By a technique involving complete immersion in water, a hypodynamic situation was produced in which normal weight sensations were altered and movement was relatively effortless. Four subjects were evaluated after 6, 12, and 24 hours of this environment. Tilt table, centrifuge, and heat chamber studies demonstrated significant cardiovascular deterioration even after the 6-hour runs, becoming more severe with the 12- and 24-hour experiments. Pertinent psychomotor evaluations, anthropometric measures, and urine and blood studies also were done. The results of this study indicate that the cardiovascular adaptation to a hypodynamic environment of this type occurs early and the deterioration from even a 6-hour exposure is apparent. (AUTHOR)

253

Graveline, D. E. & M. M. Jackson 1961 DIURESIS ASSOCIATED WITH PROLONGED WATER IMMERSION. Report on Biophysics of Flight. (Aerospace Medical Lab., Aeronautical Systems Div., Wright-Patterson Air Force Base, Ohio) ASD TR 61-651, December 1961. ASTIA Doc. No. AD-273 201.

ABSTRACT: Utilizing complete water immersion, balanced respiration, and unrestricted activity, the diuretic response of five human subjects to 6-hour periods in this environment was studied. The results indicate that the low specific gravity diuresis which occurs in this situation is of the water-diuresis type, with decreased urinary concentrations of sodium, potassium, urea, and creatinine. (Author)

254

Graveline, D. E., & G. W. Barnard 1961 PHYSIOLOGIC EFFECTS OF A HYPODYNAMIC ENVIRONMENT SHORT TERM STUDIES. Aerospace Medicine 32(8):726-736, Aug. 1961

See also (Wright Air Development Division, Wright-Patterson AFB, Ohio)  
WADD TR 61-257; ASTIA AD-262 992; March 1961

ABSTRACT: By a technique involving complete immersion in water, a hypodynamic situation was produced in which normal weight sensations were altered and movement was relatively effortless. Four subjects were evaluated after 6, 12, and 24 hours of this environment. Tilt table, centrifuge, and heat chamber studies demonstrated significant cardiovascular deterioration even after the 6-hour runs, becoming more severe with the 12- and 24-hour experiments. Pertinent psychomotor evaluations, anthropometric measures, and urine and blood studies also were done. The results of this study indicate that the cardiovascular adaptation to a hypodynamic environment of this type occurs early and the deterioration from even a 6-hour exposure is apparent. (AUTHOR)

255

Graveline, D. E. 1961 EFFECTS OF POSTURE ON CARDIOVASCULAR CHANGES INDUCED BY PROLONGED WATER IMMERSION. Rept. for Mar-May 61, on Biophysics of Flight. (Aerospace Medical Lab., Aeronautical Systems Div., Wright-Patterson AFB, Ohio) ASD TR 61-563, October 1961. ASTIA Doc. No. AD-270 869.

ABSTRACT: Previous hypodynamic research using water-immersion techniques was done with the subjects in a semi-reclining position. To evaluate the possible influences of posture and negative immobilization on the cardiovascular deterioration associated with prolonged water immersion, a technique was employed which allowed complete freedom of activity, position, and attitude. Five subjects were evaluated for functional change after 6 hours in this environment. The results indicate that postural factors play an insignificant role in the mechanism of cardiovascular alteration induced by water immersion. (Author)

256

Graveline, D. E., B. Balke, R. E. McKenzie, & B. Hartman 1961 PSYCHOBIOLOGIC EFFECTS OF WATER-IMMERSION-INDUCED HYPODYNAMICS Aerospace Medicine 32(5): 387-400, May 1961

ABSTRACT: A weightless environment in which movement was effortless was produced by whole body immersion in water. One subject was immersed for seven days. The data collected during that time indicated that serious functional impairment was



a result of immersion. The urine showed significant changes and there was a gross disruption of psychomotor effectiveness. In conclusion, the author states that during weightlessness in space flight the organism may undergo critical deconditioning which will attenuate his tolerance for re-entry stress and the normal gravitational environment.

257

Graveline, D.E. 1962 MAINTENANCE OF CARDIOVASCULAR ADAPTABILITY DURING PROLONGED WEIGHTLESSNESS  
Paper: 33rd Annual Meeting of the Aerospace Medical Association, Chalfonte-Haddon Hall, Atlantic City, N.J., April 9-12, 1962

ABSTRACT: It is expected that during prolonged zero gravity because of the absence of hydrostatic pressure influences, special techniques will be necessary to maintain cardiovascular adaptability and provide the orbiting astronaut with optimum tolerance for re-entry stresses. The author has devised a multiple tourniquet approach to intermittently obstruct venous return from the periphery, simulating the hydrostatic pressure effects of standing and thereby "triggering" compensatory cardiovascular reflexes. Following 6-hour periods of water immersion with tourniquet protection, the orthostatic tolerance of 5 subjects was determined and compared with that obtained following previous 6-hour immersion tests with no protection. The results are presented and discussed.

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Graveline, D. E., & M. McCally 1962 BODY FLUID DISTRIBUTION: IMPLICATIONS FOR ZERO GRAVITY. Aerospace Medicine 33(11):1281-1290, Nov. 1962

SUMMARY: In a weightless environment hydrostatic pressure effects are eliminated. In the situation of recumbency in which hydrostatic pressure influences are minimized by the horizontal position, significant redistribution of body fluids occurs. In recumbency blood volume initially increases and is redistributed cephalad with increased intrathoracic filling. Atrial volume receptors are presumably stimulated reflexly inhibiting the release of ADH, causing a water diuresis. Renal blood flow is augmented and glomerular filtration is increased. The urine excreted in this circumstance is characterized by decreased osmolarity and by decreased concentration but increased output of sodium, potassium and urea. This response appears to be directly related to hydrostatic pressure influences and suggests the possibility that in a weightless state significant redistribution of body fluids can be expected with a compensatory diuretic response having the above characteristics. (AUTHOR)

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Graveline, D. E. and M. M. Jackson 1962 DIURESIS ASSOCIATED WITH PROLONGED WATER IMMERSION J. Appl. Physiol., May 1962 17(3):519-524

ABSTRACT: Utilizing complete water immersion, compensated respiration, and unrestricted activity, the diuretic response of five human subject to 6-hr. periods in this environment was studied. The results indicate that the low specific gravity diuresis which occurs in this situation has characteristics of both a water and an osmotic diuresis. Possible physiologic mechanisms are discussed

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Graveline, D. E., & M. McCally 1962 SLEEP AND ALTERED PROPRIOCEPTIVE INPUT AS RELATED TO WEIGHTLESSNESS: WATER IMMERSION STUDIES. (6570th Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio) AMRL-TDR-62-83; ASTIA AD-286 022

ABSTRACT: The "free-floating" condition of immersion is associated with substantial alterations in mechano-receptive feedback to the central nervous system in a manner similar to the free-floating condition of weightlessness. One area having rather immediate operational application concerns sleep under these conditions. In this study electroencephalographic and electrooculographic recordings were made during sleep of completely immersed, neutrally buoyant subjects. Sleep records were obtained while using both tether and clamshell sleeping facilities and were compared to each subject's normal bedrest sleep records. The results are presented and their possible application to prolonged weightlessness is discussed. (AUTHOR)

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Graybiel, A. and B. Clark 1960 SYMPTOMS RESULTING FROM PROLONGED IMMERSION IN WATER: THE PROBLEM OF ZERO G ASTHENIA. (US NAVAL School Aviat. Med. Res., Pensacola, Fla.) Juny 15, 1960 Rep. MR005.15-2001, Subtask 1, Rep. 4:1-27

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Graybiel, A., & B. Clark 1960 SYMPTOMS RESULTING FROM PROLONGED IMMERSION IN WATER: THE PROBLEM OF ZERO G ASTHENIA. (Naval School of Aviation Medicine Pensacola, Fla.) Proj. MR005.15-2001.1.4., 25 July 1960; ASTIA AD-244 932 See also Aerospace Medicine 32(3):181-196, Mar. 1961

ABSTRACT: In order to reduce the effects of G on the body, three subjects were floated in tanks of physiological saline solution for ten hours per day for two weeks while systematic attempts were made to eliminate any effects of sensory deprivation. Tests of cardiovascular function and muscular strength and

coordination were given before, during, and after the experiment. The results indicated little or no systematic change in the tests of muscular strength and coordination, but all three subjects showed marked postural hypotension on the tilt-table during and following the period of immersion. These results are discussed in terms of possible implications for space flight.

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Graybiel, A. & B. Clark 1961 SYMPTOMS RESULTING FROM PROLONGED IMMERSION IN WATER: THE PROBLEM OF ZERO G ASTHENIA  
Aerospace Medicine 32(3):181-196, March 1961.

ABSTRACT: To evaluate changes in fitness of Ss while the effects of gravity on the body were reduced, three healthy young men were floated in tanks of physiologic saline solution for ten hours a day during a two-week period. When not immersed, they remained in bed, and great care was taken to minimize both muscular activity and sensory deprivation. A series of tests of muscular strength and coordination and of physiological function were given. Some of these were given only before and after immersion and others at periodic intervals during immersion. Analysis was made of the test data and of observations relating to psychological stresses. Implications of the findings for the zero-g state were discussed. (Tufts)

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Graybiel, A. 1962 ORIENTATION IN SPACE, WITH PARTICULAR REFERENCE TO VESTIBULAR FUNCTIONS. In Schaefer, K.E., ed., Environmental Effects on Consciousness. (New York: The MacMillan Co., 1962) Pp. 64-72

ABSTRACT: In man the sensory organs in the vestibular labyrinth contribute little to orientation in space if comparison is made with the otolith apparatus in fishes and the semicircular canals in birds. Persons who have lost the function of these vestibular sense organs are scarcely handicapped by day and, for all ordinary activities, are little handicapped at night. Indeed, the great importance of these organs rests in the fact that they are potentially capable of causing disorientation. This may result from pathological factors or from circumstances in which persons are exposed to unusual patterns of stimulation. Such patterns may be encountered in flight, and the conclusion is reached that under certain conditions it would be advantageous to the space traveler if these sensory organs, especially the semicircular canals, were non-functioning.

DISCUSSION: It is not unreasonable to postulate that the semicircular canals and otolith apparatus will contribute very little to the orientation of a

traveler in space and may prove to be a decided handicap. The chief difficulties will arise from the visual disorientation and canal sickness if persons are subjected to Coriolis accelerations. If it should be found desirable to generate an artificial gravitational field by means of rotation, persons with normal semicircular canals would suffer unless the rate of rotation was very slow. In view of this possibility more studies are needed with regard to screening large populations to determine if otherwise healthy persons are relatively insensitive to stimulation of the canals, to determine the limits of adaptation, and to explore means of reducing or abolishing the function of the canals. The absence of this function would not handicap the person aloft and limit him very little under all ordinary conditions.

The role of the otolith apparatus is less well understood than that of the semicircular canals but, in all likelihood, it is less important for good or bad (Lansberg, 1958). If it were impossible to abolish the function of the canals without also destroying the function of the otolith apparatus, the loss might be appreciable but not great. (Author)

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Graybiel, Ashton 1962 THE SIGNIFICANCE OF THE VESTIBULAR ORGANS IN THE PROBLEMS POSED BY WEIGHTLESSNESS (Committee on Space Research (COSPAR), The Hague(Netherlands) NASA Grant R-47, NASA N62-15219

**ABSTRACT:** An attempt is made to define the symptomatology which may be specifically ascribed to the semicircular canals and to the otolith apparatus or to any interaction between the two; and thus to define canal sickness, otolith sickness and vestibular sickness. The two force environments discussed are weightlessness and the inertial forces generated in the effort to overcome weightlessness. The two sensory organs involved, collectively termed the vestibular organs, are the semicircular canals which are stimulated by angular and coriolis accelerations, and the otolith apparatus, stimulated by linear accelerations. Evidence is presented that the syndrome canal sickness occurs when the semicircular canals are exposed to unusual patterns of angular accelerations of sufficient magnitude and duration. Cardinal symptoms are visual and postural illusions, sweating, nausea and vomiting, somnolence, apathy, and difficulty in walking. A specific syndrome analogous to canal sickness has yet to be ascribed to the otolith apparatus; on the other hand, the otolith apparatus has not been ruled out as a possible cause of symptoms during exposure to zero g. Difficulties are encountered partly because weightlessness affects all gravireceptors, and partly because prolonged weightlessness has not been simulated under terrestrial conditions. An experimental program is under way with human subjects and squirrel monkeys to determine whether otolith sickness may result from bizarre stimulation of these sensory organs under terrestrial conditions.

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Graybiel, A. 1962 THE SIGNIFICANCE OF THE VESTIBULAR ORGANS IN THE PROBLEMS  
POSED BY WEIGHTLESSNESS

(Paper, Third International Space Science Symposium and Fifth COSPAR Plenary  
Meeting, April 30-May 9, 1962, Washington, D.C.) NASA N62-15219

ABSTRACT: In defining the symptoms ascribed to the semicircular canals and to the otolith apparatus or to any interaction between the two, the author also describes canal sickness, otolith sickness, and vestibular sickness. The environment is one of weightlessness or the inertial forces generated to overcome weightlessness. The semicircular canal is stimulated by angular and coriolis acceleration and the otolith apparatus is stimulated by linear acceleration. Canal sickness is stimulation of the semicircular canals by angular acceleration. Symptoms of canal sickness include sweating, nausea and vomiting, apathy, illusions, and difficulty in walking. An illness like canal sickness has not yet been ascribed to the otolith apparatus. However, it may be a possible cause of symptoms during exposure to zero g. The difficulty in experimenting with weightlessness is that it cannot be simulated under terrestrial conditions. At the present time a program is experimenting with humans and squirrel monkeys to determine whether otolith sickness might result from stimulation of these sensory organs under terrestrial conditions.

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Green, F. H. 1958 CO2 DISPOSAL, LEAKPROOFING, ZERO GRAVITY: PROBLEMS  
FOR SPACECRAFT AIR CONDITIONING. Aviation Age. 29: 174 - 179, May 1958

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Grether, W. F. 1962 PSYCHOLOGY AND THE SPACE FRONTIER  
Amer. Psychologist 17(2):92-101, Feb. 1962

ABSTRACT: The contribution of psychologists to space flight work is summarized according to its historical progression with emphasis on engineering psychology. The work of a few outstanding psychologists in the Project Mercury is cited, e.g., in astronaut selection, training, and performance data. Others contributed analysis of work load during Mercury flights, development of a new type of attitude indicator, analysis of equipment failure, simulator design, and research on the effects of weightlessness. Future areas for research deal with overcoming effects of prolonged confinement to a small space vehicle, human performance in zero-g conditions, perceptual problems in space, and diurnal cycle adjustment.  
(Aerospace Medicine 33(8):1034, Aug. 1962)