

2,005

Gord, Biermann 1931 WELTRAUMSCHIFFFAHRT? EINE KURZE STUDIE DES PROBLEMS.
(Space Travel? A Brief Study of the Problems)
(Bremen: F. Leuwer, 1931)

ABSTRACT: Early history of the physical and technical problems of rocketry with a discussion of space travel.

2,006

Gordon, J., R.E. Jensen, W. Sipple, and R.D. Squires 1959 NADC BIOLOGICAL
INSTRUMENTATION SYMPOSIUM OF 10 DEC 1958; FOURTH LETTER REPORT CONCERNING
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR99, Dec. 28, 1959,
ASTIA AD 230 971

ABSTRACT: The electroencephalograph was investigated to determine its usefulness as a means of monitoring certain aspects of cerebral function in air and space craft pilots while in flight. Recording electrodes which include a miniature transistorized amplifier, capable of recording a useful EEG without bulky electrical shielding, were constructed to fit comfortably inside a pilot's head gear. The system is sufficiently insensitive to head movement, G forces and vibration. The following information can be obtained from electroencephalographic tracings: (1) state of hypoxia, (2) eyes open and eyes closed, and (3) state of wakefulness. An EEG, recorded via telemetry, employing a miniature transistorized amplifier and transmitter built into an aviator's head gear was transmitted for a distance of approximately 50 feet through the laboratory walls.

2,007

Gordon, J., R.E. Jensen, W. Sipple, & R.D. Squires 1960 NADC BIOLOGICAL
INSTRUMENTATION SYMPOSIUM OF 10 DEC 1958; FIFTH LETTER REPORT CONCERNING
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-L6012, May 3, 1960.
ASTIA AD 237 819

ABSTRACT: This report deals with the problems of fabrication, testing, and selection of biomedical electrodes suitable for use on human subjects during flight or simulated flight conditions. Small light electrodes have been fabricated which minimize source resistance when the subject's body is in motion or he is being subjected to high accelerations. After testing numerous systems on and off the centrifuge, the most satisfactory electrode restraint system has been fastening cork rubber discs with center hole of electrode and jelly to the skin, followed by a cork rubber cover. Electrode paste is used to secure the electrodes to the scalp for EEG recordings.

2,008

Goria, A. and J. Mallen 1951 IL RADDRIZZAMENTO PASSIVO DEL CORPO A VARIE VELOCITÀ ANGOLARI ED EFFETTI SULLA FUNZIONE RESPIRATORIA E CIRCOLATORIA NELL-UNOMO. (Passive Raising To Upright Position At Various Angular Velocities And Its Effect On Respiratory and Circulatory Function In Man)
Rivista di Medicina Aeronautica, (Rome) 14:386-390, July-Sept. 1951

2,009

Gorokhoff, Boris I. 1962 PROVIDING U.S. SCIENTISTS WITH SOVIET SCIENTIFIC INFORMATION. REVISED EDITION
(Massachusetts Institute of Technology Libraries) Distributed by National Science Foundation, Washington, D.C. April 1962

ABSTRACT: The present report seeks to provide detail of a reference nature on the form and extent of Soviet scientific information in the original language and on what is being done to make such data available to American scientists and engineers who are not familiar with Russian.

2,010

Goshen, C.E. 1961 MAN IN SPACE AND PSYCHOLOGICAL RESEARCH.
Astronautics, 6(3):38-39, March 1961

ABSTRACT: Reviews physiological problems of space flight. Clarifies distinctions between physiological and psychological research as an aid to proper utilization and interpretation of precious data from early manned spaceflight.

2,011

Goswami, S. L., C. p. Trivedi and R. K. Gupta 1961 A PRELIMINARY STUDY OF MOTION INDUCED STRESS IN RATS.
In Arch. Int. Pharmacodyn 134:1-9, Nov. 1, 1961

2,012

Gottlieb, S. 1948 STATIC AND DYNAMIC TESTS OF A TYPICAL FIGHTER PILOT'S SEAT INSTALLATION FOR A 40 G CRASH CONDITION
(Naval Air Material Ctr., Aero Struc. Lab.) NAM 24102, Part I Jan 12, 1948.
ASTIA ATI 37398

ABSTRACT: Tests were conducted on a standard R4D pilot seat and reinforcements made after each failure until seat demonstrated its ability to withstand a 40 g

deceleration load at the c.g. of a 200 lb. dummy in head-on-crash condition. Dynamic tests were made in the NAES drop test machine and static tests were made by applying loads to a steel plate behind the dummy acting through its d.g. Several reinforcements consisted of replacing dural parts with 4130 steel of same gage were required to enable seat to withstand 40 g when shoulder harness passed over fuselage bar. Reinforcements added 3-1/2 lbs. to original seat installation weight. Harness was found to transmit all applied load to seat in a 1:2 ratio of shoulder harness to lap harness load. Reinforced seat withstood 20 g when shoulder harness was passed over seat back to floor attachment. Recommended static loads for transport type seat under 40 g loadings are 3000 lbs. shoulder harness load and 6000 lbs. total lap harness load at 40° upward.

2,012

Gottlieb, S. 1948 STATIC AND DYNAMIC TEST OF A TYPICAL PILOT'S SEAT
INSTALLATION FOR A 40 G CRASH CONDITION
(Naval Air Material Ctr) NAM 24102, Part 2, 2 Sept. 1948. ASTIA AD 51 489

ABSTRACT: The A N Standard 7505 seat used in F6F single-engine fighters was tested to determine what ultimate static carry through structural strength is required to withstand the loads resulting from a 40 g deceleration of about 0.1 sec. duration at the cg of a 200 lb dummy in a head-on crash condition. The harness loads were measured and the Bureau of Standards ring dynamometer used to measure the harness loads was evaluated. It is concluded that the F6F seat with reinforcements is structurally capable of supporting 40 g dynamic loads of 7300 lbs. The general distribution of load between shoulder harness and lap harness at 40° upward is a 1 to 2 ratio. The loads determined with the BuSTds rings are consistently low. These results indicate that dynamic calibration may materially improve the accuracy of the dynamometer.

2,013

Gotzlinger, J. & E. Helsing 1955 A "HUMAN CENTRIFUGE" FOR RESEARCH
INTO PHYSIOLOGICAL FLIGHT STRESSES. ASEA Journal 28(5-6):75-83
May-June 1955

ABSTRACT: A description of the centrifuge installed at the medical research institute, Karolinska Institute, Stockholm, Sweden, for use in physiological investigations involving man as well as animals. The mechanical design, the driving machinery and regulation and setting devices are also discussed.

2nd ABSTRACT: Centrifuge installed at medical research institute, Karolinska Institute, Stockholm, for use in physiological investigations with human being and also for tests on animals; mechanical design, driving machinery, and regulation and setting devices.

2,014

Gougerot, L. 1940 EFFETS PHYSIOLOGIQUES DES FORCES D'INERTIE. ETUDE DES EFFECTS CIRCULATOIRES, RESPIRATOIRES ET VESTIBULAIRES CHEZ L'AVIATEUR.
(The Physiological Effects of Inertia Forces. Study of the Circulatory, Respiratory and Vestibular Effects in the Aviator)
(Paris: Maloine, 1940)

2,015

Gougerot, L. 1947 PERSPECTIVES PHYSIOLOGIQUES SOULEVEES PAR LE PROBLEME ASTRONAUTIQUE (PHYSIOLOGICAL PROBLEMS OF SPACE FLIGHT) Med. aeronaut.
2:63-74

2,016

Gougerot, L. 1953 LA LOI DE WEBER-FECHNER ET VARIATIONS DE LA PESANTEUR APPARENTE (The Law of Weber-Fechner and Variations of the Apparent Gravity)
Medicine Aeronautique (Paris) 8: 119-125.

2,017

Gough, M. N. & A. P. Beard 1936 LIMITATIONS OF THE PILOT IN APPLYING FORCES TO AIRPLANE CONTROLS.
(National Advisory Committee for Aeronautics, Washington, D. C.) NACA TN 550, Jan. 1936.

2,018

Gowdey, C. D. & J. W. Pearce 1955 A SELECTED BIBLIOGRAPHY OF THE OPEN LITERATURE ON AVIATION MEDICINE 1945-1955.
(Defence Research Board, Department of National Defence, Ottawa, Canada)
Rept. DR-9, July 1955. ASTIA AD 87 331

2,019

Gozulov, S. A. 1956 K VOPROSU O KUMULYATIVNOM VLIYANII USKORENIY. (THE PROBLEM OF CUMULATIVE EFFECT OF ACCELERATION). Voyenno-meditsinskiy Zhurnal (Military Medical Journal) 10:55-59, 1956. (Translation in USAF Air Intelligence Information Report "Two Problems in Acceleration: Cumulative Effect and X-Ray Examinations". IR-1600-57. 23 July 1957)

2,020

Gozulov, S. A. 1959 O PERENOSIMOSTI VOZDUSHNOGO POTOKA DEYSTVUYUSHCHEGO
NA LETCHIKA PRI KATAPULTIROVANII (Ability to Withstand Air Current
Acting Upon a Pilot During the Process of Ejection)
(Trans. of Voyenno-Meditsinskiy Zhurnal (USSR) (12):40-44, 1958)
(SLA Translations Center, Chicago, Ill.) 59-19708

2,021

Graham, E.W. & A.M. Rodriguez 1952 RESPONSE OF SOME LINEAR SYSTEMS
TO RANDOM FORCES WITH REFERENCE TO AIRCRAFT BUFFETING.
(Douglas Aircraft Co., Inc., Santa Monica, Calif.) Rept. No. SM-14517,
Sept. 1952. ASTIA AD 240 250.

ABSTRACT: In connection with aircraft buffeting, some studies are made of mechanical systems subjected to random forces. No attempt is made to consider an actual aircraft structure. Instead, highly simplified systems are chosen in order to clarify some of the fundamentals of the problem. Some results are reviewed for free particles and simple oscillators subjected to random forces, considering the transient response in addition to the steady state. An oscillator plus a lever is studied, the fulcrum of the lever corresponding to a nodal point for one mode of an oscillating beam. Two oscillators which are coupled through damping is present. Finally, the equations for response of a uniform slender beam are given. The forcing functions considered are concentrated at a point in space and include a single forcing frequency, a white spectrum and a truncated white spectrum. (The response to the white spectrum is the Brownian motion of the system). The damping is external and applied at a point. (Author)

2,022

Graham, R.A., G.E. Ingram, & W.D. Ingram 1961 PERFORMANCE OF HIGH-VELOCITY
PROPELLANT GUN FOR CONTROLLED IMPACTS.
(Sandia Corporation, Albuquerque, New Mexico) SC-4652. Nov. 1961.

ABSTRACT: The performance of an extensively modified U.S. Army 40 mm gun for producing controlled impacts is described. Various projectile velocities in the range of 200 fps to 3200 fps are achieved by varying the amount of a fast-burning propellant.

2,023

Grandpierre, R. 1939 LES EFFETS PHYSIOLOGIQUES DU VOL EN AVION AUX HAUTES
ALTITUDES (The Physiological Effects of Flight in Aircraft at High
Altitudes)
Revue de physiothérapie (Paris) 15: 49-73

2,024

Grandpierre, R., et al. (Eds.). 1948 ELEMENTS DE MEDICINE AERONAUTIQUE.
(Paris: L'Expansion Scientifique Francaise, 1948.) 502 pp.

2,025

Grandpierre, R., & P. Bouverot 1958 INCIDENCES PHYSIOPATHOLOGIQUES DE L'EMPLOI
DES FUSEES COMME MOYEN DE TRANSPORT (PHYSIOPATHOLOGICAL FACTORS IN THE USE
OF ROCKETS AS A MEANS OF TRANSPORTATION) Concours med. 80:265-267, 269-270

2,026

Grandpierre, R, F. Violette, F. Flandrois and J. B. Tosan 1959 SIGNIFICANCE
AND LIMITATIONS OF RESEARCH ON ANIMALS AND MAN BY MEANS OF CENTRIFUGES
(INTERET ET LIMITES DES RECHERCHES EFFECTUEES SUR L'ANIMAL ET SUR L'HOMME
AU MOYEN DES CENTRIFUGEUSES). Medecine Aeronaut. (Paris) 14(4):325-327,
August 1961

ABSTRACT: Outlines the development of the centrifuge from the time of Darwin. Observes that, because of inherent limitations in the centrifuge, such as the mechanical limitation on rate of acceleration and the difficulty of analyzing data derived from experiments with animals of a different physical configuration and acceleration susceptibility from those of man, the centrifuge will be most useful as an instrument of applied rather than basic research.

2,027

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

ABSTRACT: A review discussion is presented of the pertinent physiologic factors involved in space flight. Consideration is given to (1) cosmic flight acceleration and deceleration tolerances; (2) biologic effects of weightlessness; (3) the kinds, distribution, and variations in intensities of radiations which may be encountered in space flight, the attendant biologic effects (acute, secondary, delayed and chronic, genetic), tolerable dosage, and means of protection; and (4) problems attendant to prolonged life in a closed cabin system. Included in the latter are discussions on (a) fundamental respiratory requirements and regeneration of the cabin atmosphere, (b) sources of oxygen and methods of eliminating carbon dioxide, (c) the utilization of urine and collection of water vapor, and (d) the nutritional requirements of astronauts. (Aerospace Medicine 31(10): 873. Oct. 1960).

2,028

Grandpierre, R., F. Violette, R. Loubiere and G. Chatelier PHYSIOLOGIE DU
VOL SPATIAL (Physiology of Space Flight) Forces aeriennes
françaises, 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 Med. 31(10):873, Oct. 1960).

2,029

Grandpierre, R., F. Violette, F. Flandrois, and J.B. Tosan 1961 INTERET ET
LIMITES DES RECHERCHES EFFECTUEES SUR L'ANIMAL ET SUR L'HOMME AU MOYEN DES
CENTRIFUGEUSES (Interpretations and Limitations of Research Done Upon
Animals and Man by Means of Centrifuges). In Bergeret, P., ed., Bio-Assay
Techniques for Human Centrifuges and Physiological Effects of Acceleration.
(London, New York, Paris: Pergamon Press, 1961) AGARDograph 48.
Pp. 140-146.

ABSTRACT: Following a brief history of the centrifuge since Darwin (1794) the authors discuss the use of centrifuges for studying long duration g, and their technical limitations, especially when extremely rapid accelerations are involved. They then emphasize the limitations of the evaluation of data obtained. The difference between the 2-foot vertical attitude of man and the 4-foot horizontal attitude of the animal is not only of an anatomic nature, and orthostatism physiologically results in important vascular regulations, which implies much caution in the evaluation of data obtained. Summing up, fundamental physiological research is likely soon to be completed, and the use of centrifuges will be restricted to applied research, namely new technique and material testing.

2,030

Grandpierre, R., F. Violette, J. Fabre and Y. Houdas 1961 PHYSIOLOGICAL
PROBLEMS PRESENTED BY SUPERSONIC EJECTIONS. I. (PROBLEMES PHYSIOLOGIQUES
POSES PAR LES EJECTIONS SUPERSONIQUES. I) Forces aeriennes francaises
no. 175, pp. 667-678, November 1961

ABSTRACT: At speeds near 1100 k.m./hour many present-day types of ejection seats do not properly protect the pilot; consequently, the ejection mortality rate at these speeds is high. This report analyzes the disturbances produced by the different physical parameters of high-speed ejections, and the relationships between seat spin, seat mass, altitude, and deceleration. It discusses the problem of rotation during free-fall after seat separation and control of rotation by parachutists. A concluding section outlines the mechanical and physiological effects of ejection and rotation upon both the human body and equipment.

2,031

Grandpierre, R. R. Angiboust, G. Chatelier, and L. Leitner 1962 MODIFICATIONS OF CORTICAL ELECTRICAL ACTIVITY IN ANIMALS SUBJECTED TO DIFFERENT ACCELERATIONS.
In J. Physiol. (Paris) 54:347-348, March-April 1962 (France)

2,032

Grandpierre, Angiboust, and Chatelier 1962 OUTLINE OF THE FIRST PHYSIOLOGICAL RESULTS FROM THE FRENCH BIOLOGICAL ROCKET EXPERIMENT.
Revue de medecine aeronautique (Paris), 1 (4) : 69. July-Aug. 1962

ABSTRACT: A rat exposed to complex accelerations in the head of a Veronique rocket launched into space revealed an intense cortical activity which persisted throughout the flight. In contrast to this cortical activity, the reticular rhythm remained stable until the hundredth second of the ballistic period when the reticular tracing flattened out, decreased progressively, and exhibited slow waves. Cardiac and respiratory rhythms also decreased.

2,033

Grant, C. A., tr. O. Perey 1957 FRACTURE OF THE VERTEBRAL END-PLATE IN THE LUMBAR SPINE. An Experimental Biomechanical Investigation.
Acta Orthopaedica Scandinavica, Supplementum No. 25.
(See Perey)

2,034

Grant, D. N. W. 1941 PROBLEMS IN AVIATION MEDICINE AFFECTING MILITARY AVIATION
J. Aviation Med. 12:274-279.

2,035

Grant, D. N. W. 1942 THE GENERAL MISSION OF MILITARY AVIATION MEDICINE
J. Lab. & Clinical Med. Vol. 28, Part I, pp. 577-585.

ABSTRACT: The development of aviation has presented new medical problems. It has brought with it problems of oxygen want, acceleration, unprecedented demands on the special senses, the nervous system, the heart, and other organs. The general mission of aviation medicine, that of the selection and care of flying personnel is and always has been intimately associated with National Defense. The author of this paper discusses the general mission of military aviation medicine. 30,000 new pilots each year must be chosen not only for their ability to learn to fly, but also from the standpoint of their ability to withstand the stress of operational flying over a long period of time.

2,036

Grant, F. C. 1959 IMPORTANCE OF THE VARIATION OF DRAG WITH LIFT IN MINIMIZATION OF SATELLITE ENTRY ACCELERATION.

(National Aeronautics and Space Administration, Langley Research Center, Langley Field, Va.) Tech. Note D-120, Oct. 1959. ASTIA AD 227 118

ABSTRACT: The present investigation shows that the use of realistic drag polars leads to lower peak accelerations than those obtained on the assumption of constant drag coefficient, which, in effect, limits the aerodynamic coefficients to the low-drag side of the maximum lift-drag ratio. An acceleration parameter is derived which defines the minimum peak acceleration in terms of a simple integral of the aerodynamic coefficients of the vehicle.

Numerical calculations are presented for an entry vehicle with a simplified but realistic complete drag polar. The assumed vehicle had a maximum lift-drag ratio of 2.8. For an entry angle of 6° , the peak acceleration is reduced to 1.1 g units as compared with 2.5 g units on the assumption of constant drag coefficient. Corresponding values for 12° were 4.1 g units and 8.3 g units. Entry conditions were 25,900 ft/sec at 350,000 feet. The numerical calculations confirm a simple physical argument which indicates that for entry with minimum peak acceleration, the initial portion of the trajectory should be flown near maximum lift coefficient. The calculated minimum values of acceleration are roughly proportional to the square of the entry angle. The results obtained by use of the derived acceleration parameter are in good agreement with the numerical calculations.

2,037

Grant, F. C. 1960 ANALYSIS OF LOW-ACCELERATION LIFTING ENTRY FROM ESCAPE SPEED. (National Aeronautics and Space Administration, Washington, D. C.) NASA Technical Note D-249; ASTIA AD-237 476

ABSTRACT: An earlier analysis of lifting satellite entry for circular orbit velocities is extended to the case of parabolic orbit velocities. Simple formulas are derived which yield approximations to the minimum loadings for steep entries. The general advantage of operation on the high-drag side of maximum lift-drag ratio is demonstrated analytically. The optimum character of modulation from maximum lift coefficient is shown. A principal parameter is shown to be the ratio of maximum lift coefficient to minimum drag coefficient. The analytical results are compared with those of detailed numerical integrations for an entry vehicle with a simplified but realistic lift polar. (AUTHOR)

2,038

Grant, F. C. 1960 MODULATED ENTRY
(National Aeronautics and Space Administration, Langley Station, Va.)
NASA Tech. Note D-452, Aug. 1960, NASA N62-71026. ASTIA AD 241 616

ABSTRACT: The technique of modulation, or variable coefficients, is discussed and the analytical formulation is reviewed. Representative numerical results

of the use of modulation are shown for the lifting and nonlifting cases. These results include the effects of modulation on peak acceleration, entry corridor, and head absorption. Results are given for entry at satellite speed and escape speed.

2,039

Grant, R.T. and E.B. Reeve 1951 OBSERVATIONS ON THE GENERAL EFFECTS OF INJURY IN MAN, WITH SPECIAL REFERENCE TO WOUND SHOCK.
(London: H.M. Stationery Off., 1951)

2,040

Graveline, D. E. et al 1961 PSYCHOBIOLOGIC EFFECTS OF HYPODYNAMICS INDUCED BY WATER IMMERSION.
(Paper, 32nd Annual Meeting, Aerospace Medical Association, 24-27 April 1961, Chicago, Ill.)

ABSTRACT: Utilizing a technique involving whole body immersion in water, a hypodynamic environment was produced in which the normal weight sensations were removed and movement was effortless. This experiment was conducted with one subject for a 7-day period during which time extensive biologic data were collected. There are definite indications that pronounced functional impairment results from prolonged exposure to hypodynamic conditions. Following the period of immersion marked changes of cardiovascular reflexes and diminished muscular tone were apparent. Hematologic investigations and extensive biochemical studies on blood and urine show significant changes, and there is a gross disruption of psychomotor effectiveness. In general, this study suggests that during prolonged space flight under true weightless conditions the organism may attain a critical state of deconditioning which will seriously attenuate his tolerance for re-entry stresses and the normal gravitational environment. (Aerospace Med. 32(3): 232, March 1961).

2,041

Graveline, D. E. et al 1961 PSYCHOBIOLOGIC EFFECTS OF WATER-IMMERSION-INDUCED HYPODYNAMICS
Aerospace Medicine 32(5):387-400, May 1961.

SUMMARY: Utilizing a technique involving whole-body immersion in water, a hypodynamic environment was produced in which the normal weight sensations were removed and movement was effortless. This experiment was conducted with one subject for a seven-day period during which time extensive biologic data were collected.

There are definite indications that pronounced functional impairment results from prolonged exposure to hypodynamic conditions. There is a marked decrease in the need for sleep, and sleep characteristics observed in this quasi-weightless environment permit us to hypothesize a specific biological function for sleep, suggesting that it provides a period of recovery from the neuromuscular "debt" accumulated by man in counteracting the effects of gravity. Following the period of immersion, marked changes of cardiovascular reflexes and diminished muscular tone were apparent. Hematologic investigations and extensive biochemical studies on blood and urine show some interesting changes, and there is a gross disruption of psychomotor effectiveness. In general, this study suggests that during prolonged space flight under true weightless conditions the organism may attain a critical state of deconditioning which will seriously attenuate his tolerance for re-entry stresses and the normal gravitational environment. Investigation into this area must continue in an effort to further assess these effects, and then to develop appropriate protective devices or techniques.

2,042

Graveline, D. E. and G. W. Barnard 1961 PHYSIOLOGIC EFFECTS OF A
HYPODYNAMIC ENVIRONMENT: SHORT-TERM STUDIES
Aerospace Medicine 32(8):726-736, Aug. 1961.

ABSTRACT: To study the metabolics and functional responses of the body to a state of relative muscular inactivity, four Ss were studied after 6, 12, and 24 hours of water immersion. Supported by water and a form-fitting couch, normal weight sensation was altered and movement became relatively effortless. Functional studies obtained on the Ss included tilt table and heat chamber tests as well as the responses to headward acceleration. Pertinent psychomotor tests and evaluations of muscle strength were also done. The findings were discussed with reference to protective measures needed for orbital flight to enable man to adapt to the new set of environmental demands. (Tufts)

2,043

Gray, G.W. 1943 THE PHYSIOLOGY OF ACCELERATION.
Gray, G.W., Science at War. (New York: Harper & Bros., 1943). pp. 240-243.

2,044

Gray, P. D., N. A. Williams et al. 1961 ROCKETS IN ENVIRONMENT. PHASE I. PARAMETER STUDY. (Aerojet-General Corp., Azuza, Calif.) Rept. no. 2112; Contract AF 04(611)7441, Proj. 3058-03, Oct. 1961, ASTIA AD-275 189

ABSTRACT: Design criteria for space propulsion systems is being studied by defining the space environment, determining the behavior of rocket engine materials and components in this environment, developing design criteria based on the results of these material behavior tests, and designing a piggyback space experiment to verify the conclusions and design criteria established previously. Environmental factors to be considered include: radiation (nuclear, infrared, and ultraviolet), micrometeoroids, temperature, vacuum, and zero gravity. Environmental factors constituting the space environment between 300 and 22,000 n.mi. altitude were defined. The propulsion system materials and components most likely to be exposed to this environment were established, and available data regarding the behavior of these materials in the space environment were surveyed. Deficiencies in these data were determined, and appropriate tests were planned for obtaining data now lacking (AUTHOR)

2,045

Gray, R. F. 1953 RELATIONSHIPS BETWEEN OCULOGYRAL ILLUSIONS AND NYSTAGMUS (U.S. Naval Air Development Center, Johnsville, Pa.) AMAL Proj. NM 001-111-302.

2,046

Gray, R.F. 1954 RESPONSES OF BLINDFOLDED SUBJECT TO TILT FROM HORIZONTAL POSITION. (U.S. Naval Air Development Center, Aviation Med. Acceleration Laboratory, Johnsville, Pa.) Rept. No. NADC-MA-5407, 23 July 1954. ASTIA AD-41658.

ABSTRACT: Blindfolded subjects were moved and positioned manually while lying supine on a tilt-table which could be rotated around any one of 3 major axis. The effects of gravity and of the force turning the table served to partially simulate the effects of the thrust of the engines. As the velocity of tilt or turn was increased, the reaction times of the subjects were reduced until, at the higher angular velocities, the choice reaction times leveled off at approximately .200 or .50 seconds, depending on the type of response switch.

Measurements of pointing vertically while tilted indicated that in the head-foot plane of rotation, there would most probably be a continuously more exaggerated sense of tilt as the total amount of tilt increased. It is thought that the unusually rapid responses, in the main, are due to kinesthetic sensation. Also, insofar as can be determined by discontinuous non-tracking studies, a combination of the pressure, vestibular, tactile, and kinesthetic senses would be better than vision for controlling rapid oscillations in aircraft

2,047

Gray, R.F. 1955 TIME REQUIRED TO RAISE THE ARM IN RESPONSE TO TONIC ELECTRICAL STIMULATION. (Naval Air Development Ctr., Johnsville, Pa.) Project NM 001 111 303, 31 Dec. 1955.

ABSTRACT: Since preliminary experiments had indicated the possibility, it is hoped that a stimulus will be found which would be of assistance in speeding the response of aviators. An adequate stimulator was purchased. It was observed that when both stimulating electrodes are placed on the same muscle, there is an optimum position for each electrode. Under the conditions of this study, then, there will be two motor points for each muscle rather than only one as in the customary arrangement of electrodes. A pulse of direct current which contracts muscle has been found to cause less skin irritation if maintained for a short period of time. The voltage must, of course, be higher when the time of application is reduced. Two hundred and fifty volts maintained for .0001 second has been chosen as the most practical stimulus to be used. Muscle has been regularly contracted in response to a stimulus of only .00001 second duration at 250 volts.

2,048

Gray, R. F., & J. L. Brown 1955 VARIATION OF HUMAN RESPONSES WITH VARIATION OF ACCELERATION PATTERNS. (Naval Air Development Ctr., Johnsville, Pa.) Project NM 001 111 302; 31 Dec. 1955

ABSTRACT: The first study in this series was for the purpose of relating response to rotation on a human centrifuge to the pattern of motion of the centrifuge at one radius. The duration of apparent motion of the visual field during acceleration was found to increase with increase in the duration of angular acceleration and with reduction in the magnitude of acceleration. The study suggested, also, that dizziness due to head motion on the centrifuge was due to coriolis acceleration and that this acceleration acted on the organs of the ear which respond primarily to linear accelerations, rather than, as is usually assumed, on those organs which respond primarily to rotation. Two other conclusions are suggested by the data; (a) that the spinning of the visual field in response to rotation is not due to eye movement, and (b) that the false perception of the vertical in aircraft, called "the leans" is, as hypothesized by Armstrong, due to a perception of the vertical. Furthermore, the data suggest that persons subject to "the leans" can be distinguished on human centrifuges from persons not subject to "the leans".

2,049

Gray, R. F. 1955 THE EFFECTS OF TONIC ELECTRICAL STIMULATION AS A MEANS OF COMBATING ADVERSE CIRCULATORY DISTURBANCES CAUSED BY ACCELERATION. (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-5501; ASTIA AD-55 215

ABSTRACT: Electrical stimulation which caused strong painful contractions of the muscles of the abdominal wall did not significantly increase the G-level at which

the subject lost sight of peripheral lights. Nor was there a significant increase in the G-level at which peripheral light loss occurred when the muscles of the thighs were contracted by the electrical current. Because of the low protection afforded and the high degree of subject discomfort, this method of protection against G-force is considered to be impractical. (AMAL)

2,050

Gray, R. F., et al. 1955 MISCELLANEOUS TESTS AND MINOR INVESTIGATIONS. PHASE V. THE EFFECTS OF TONIC ELECTRICAL STIMULATION AS A MEANS OF COMBATING ADVERSE CIRCULATORY DISTURBANCES CAUSED BY ACCELERATION FORCES. (Naval Air Development Ctr., Johnsville, Pa.) Project NM 001 103 300; TED ADC AE-1402 31 December 1955

ABSTRACT: G-tolerance was recorded when the abdominal muscles were strongly contracted by electrical current, when the muscles of both thighs were contracted by electrical current, and when there was no electrical stimulus. The increase in G-tolerance which occurred during the exposures to electrical contraction of these muscles was found not to be significantly different from the increase in G-tolerance which occurred following a similar number of exposures to acceleration only. It was concluded that tonic electrical stimulation of muscle was not a useful means of protection against the adverse effects of acceleration.

2,051

Gray, R.F. 1956 RELATIONSHIPS BETWEEN OCULOGYRAL ILLUSIONS AND NYSTAGMUS. (U.S. Naval Air Development Center, Johnsville, Penn.) NADC-MA-5609, August 1956, ASTIA AD-107 773.

ABSTRACT: Four human subjects were exposed to various angular accelerations during 228 runs on a human centrifuge. It was observed that nystagmus (oscillatory eye movements of a sawtooth waveform) occurred at times when no oculogyral illusions (visual illusions of rotation) were reported, and oculogyral illusions occurred at times when no nystagmus could be distinguished. It is concluded that not all nystagmus causes oculogyral illusions.

2,052

Gray, R. F. 1957 MECHANICAL SYSTEMS SUGGESTED FOR G PROTECTION. (Naval Air Development Center, Johnsville, Pa.) NADC-MA-5708; 15 July 1957 ASTIA AD 144 106

ABSTRACT: A mechanical system is proposed as a means of increasing tolerance to acceleration. The subject is assumed to be completely underwater in a suit and helmet, both capable of resisting a high pressure atmosphere transmitted through

the water from the subject's chest. Analysis of the system indicates that it could protect against loss of blood from the head and consequent blackout at levels of acceleration considerably higher than 100 G units. However, distortions of organs and blood vessels withing air-containing spaces of the body would tend to establish much lower tolerance levels since blood vessels within the top part of the chest would tend to collapse and cut off circulation. It is possible that circulation through the collapsed blood vessels could be restored by pumps acting to change the volume of the suit. Respiration could be provided by cycling the pressure of the air supplied to the subject. This could be under voluntary control. The suit could serve as a pressure suit for high altitude flying since pressures within the body would be exactly counterbalanced by pressures outside the body. (Author)

2,053

Gray, R.F., & R.J. Crosbie 1958 VARIATION IN DURATION OF OCULOGYRAL ILLUSIONS AS A FUNCTION OF THE RADIUS OF TURN.
(Naval Air Development Ctr., Johnsville, Pa.) NADC MA 5806, May 1959

ABSTRACT: Two subjects were exposed on a human centrifuge at radii of 8, 19, 33, and 50 feet to angular accelerations of 0.03 rad/sec^2 for 7.1 seconds. They were usually kept at the maximum angular velocity of 1.71 rad/sec for a period of 45 seconds and then decelerated according to the normal stopping pattern of the centrifuge in which there was a logarithmic decrement in speed, with a deceleration time constant of 4 seconds. With increase in the radius of turn, there was an average decrease in duration of visual illusions of rotation (oculogyral illusions). Comparing the radius effect with the effect due to repetition, this decrease was seen to be significant for the first oculogyral illusion during rotation and was significant for the first postrotatory oculogyral illusion. At the 50-foot radius additional illusions of rotation, occurring at the same time as the first oculogyral illusion during rotation, but opposite in direction, were occasionally reported by one subject. Such oppositely directed illusions were never reported at smaller radii. Appendices include an analysis of the effects of rotation on a fluid filled ring at various radii and a description of some sensations of rotation and tilt which occur on centrifuges. (Author)

2,054

Gray, R.F. & M.G. Webb 1958 PRELIMINARY STUDY OF G TOLERANCE OF A SUBJECT IN THE G-CAPSULE, PRONE POSITION
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR59, July 8, 1958.

ABSTRACT: The G-Capsule is a device for testing some theories of protection of subjects against acceleration by use of complete immersion of the subject and

by pressurization of his respiratory system through the water against the rigid walls of the capsule to hold his respiratory system at a constant volume. This device was tested at AMAL on the 50-foot centrifuge. The subject was seated in an upright position within the capsule facing away from the center of rotation and was exposed to constantly increasing levels of acceleration from 1 to 9 G. The subject held his breath during each period of centrifuge rotation.

2,055

Gray, R.F. & M.G. Webb 1959 HIGH G PROTECTION
(Paper, Aero Medical Association Meeting, Statler Hilton Hotel,
Los Angeles, April 27-29, 1959)

ABSTRACT: The principal distortions of the body of a person exposed to increased acceleration include displacement of blood within the body with undesirable secondary effects such as (1) loss of vision, (2) loss of consciousness, (3) petechia, (4) pain, (5) heart failure. Other distortions in various parts of the body may also lead to pain. Advantages, problems, and limits of older types of G protective systems are discussed. Theories are presented for methods of using liquid or form-fitting external supports for the body along with respiratory pressurization to counteract the distorting forces. Actual devices worked out to apply these theories are shown. These devices include: (1) the "Mayo tank" first used by Wood, Code, and Baldes in 1942 to test G protection by submersion in water. This has been slightly modified to bring about substantial increase in G protection in 1958; (2) the "G-capsule" and associated equipment which most thoroughly of all devices so far built, is an application of these new theories of body support; and (3) the "N A S A-A M A L moulded couch" built by the National Aeronautics and Space Administration according to some of these ideas and incorporating several other devices or procedures such as partial supination to avoid chest pain as indicated by Wright AFB studies. Through the use of these various devices during the past year, several new records of tolerance to centrifugal acceleration have been established, indications have been gained for improvements on these devices, and it is expected that higher levels of G tolerance will be attained.

(J. Aviation Med. 30(3): 185-186, March 1959)

2,056

Gray, R. F. and C. C. Collins 1959 PILOT PERFORMANCE AND TOLERANCE STUDIES
OF ORBITAL RE-ENTRY ACCELERATIONS. (U. S. NADC, AMAL, Johnsville, Pa.)
Letter Rept. TED ADC AE-1412, Sept. 1959.

2,057

Gray, R. F. & M. G. Webb 1959 PROTECTION AGAINST ACCELERATION BY WATER IMMERSION.
(U.S. Naval Air Development Center, Johnsville, Pa., June 8, 1959)
(American Rocket Society Preprint, ARS Meeting, San Diego, California.)

ABSTRACT: This is a preliminary report of a crude, unsophisticated device for testing the principles of water immersion as a method of protecting man against the effects of acceleration. The results so far indicate that water immersion offers a method of greatly extending man's physical and functional tolerance to acceleration but, at the present time, we cannot predict the ultimate limit of this protection. The authors believe that a practical water immersion system is feasible from an engineering standpoint and that such systems will be found in future space vehicles.

2,058

Gray, R. F. 1959 RELATIONSHIPS BETWEEN SEMICIRCULAR CANAL FUNCTION AND OTOLITH ORGAN FUNCTION. (Naval Air Development Ctr., Johnsville, Pa.)
NADC-MA-5911; ASTIA AD-226 907

ABSTRACT: Data are reviewed indicating human responses which may be the combined result of stimulation of both the otolith organs and the semicircular canals. Some responses attributed to semicircular canals are shown to be similar to those attributed to otolith organ stimulation and vice versa. (AUTHOR)

2,059

Gray, R. F., & D. M. Morway 1959 PRELIMINARY STUDY OF DAMPING OF THE OTOLITH ORGAN SYSTEM BY EPICYCLIC ROTATION. (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-5919, 28 Dec. 1959, ASTIA AD-231 600

ABSTRACT: An attempt was made to determine the basic validity of the concept that the effects of gravity on the otolith organs can be eliminated by tumbling humans around a horizontal axis through the head. The method of testing this concept was to generate oculogravic illusions in subjects on the centrifuge by letting the direction of the resultant of centrifugal acceleration and gravity change in direction through the man so that his perceived vertical would change. Four subjects were tumbled in the plane of rotation of the centrifuge around a true vertical axis. Results indicated that tumbling does reduce the apparent tilt of the oculogravic illusion generated on a centrifuge. The rate of 30 rpm was not sufficiently high to completely eliminate these illusions. The few seconds at 30 rpm noted as being without oculogravic illusions suggested that a higher tumbling frequency may eliminate these illusions.

2,060

Gray, R.F. & M.G. Webb 1960 HIGH G PROTECTION
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-5910; 12 Feb. 1960
ASTIA AD 235 338
See also: Aerospace Med. 32(5) 425-430, May 1961

ABSTRACT: Investigation of mechanical principles important in solving some problems of protection against high acceleration. Also discussed is a study of the effects of acceleration on humans in the positive $g(+g_z)$ position when submerged to eye level in a tank of water. Subjects are also studied in the prone position ($-g_x$) while completely submerged with respiratory pressurization.

2,061

Gray, R. F. 1960 FUNCTIONAL RELATIONSHIPS BETWEEN SEMICIRCULAR CANALS AND OTOLITH ORGANS.
Aerospace Med. 31(5):413-418, May 1960.

ABSTRACT: The generally accepted theory about how the vestibular organs function to maintain balance is that (1) the static group consisting of the otolith organs, the utricles and saccules, respond to linear accelerations and gravity and not to angular accelerations, and (2) the rotary group consisting of the six semicircular canals respond to angular accelerations and not to linear accelerations or gravity. Although this distinction has existed since 1890 it is inadequate for the explanation of many observations concerning response to vestibular stimulation. This report contains results of vestibular experiments on the human centrifuge at Johnsville, Pa.

2,062

Gray, R.F. 1960 PERFORMANCE SPECIFICATIONS FOR THREE NEW FLIGHT MOTION SIMULATORS
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-6028, June 30, 1960

ABSTRACT: Performance specifications are outlined for three flight motion simulators to measure and improve human tolerance and performance in acceleration environments. These specifications are for devices deemed desirably by the Navy's Aviation Medical Acceleration Laboratory at Johnsville, Pa. They include: (1) a device having five degrees of freedom, three angular and two linear, for the purpose of oscillation of humans; (2) a centrifuge with a 25-foot radius capable of attaining 400 G with a 5000 pound payload; and (3) a 600-foot bounce tower capable of generating accelerations between 10 and 1000 G on payloads weighing up to 10,000 pounds.

2,063

Gray, F. R., R.J. Crosbie, R.A. Hall, J.A. Weaver and C. C. Clark 1961 CORIO-
LIS ACCELERATION EFFECTS ASSOCIATED WITH MOVEMENT OF HUMANS BY A POWERED
GIMBAL SYSTEM ON A HUMAN CENTRIFUGE.

(Paper presented at 32nd annual meeting, Aerospace Medical Assoc., 24-27
April 1961, Chicago, Ill.)

ABSTRACT: Three subjects were exposed to rotation at 1.0 G or 3.0 G at the 50-foot radius of a centrifuge. These gave angular velocities of the centrifuge of .80 and 1.39 radians per second, respectively. Simultaneously each subject was rotated around an axis close to this body by means of a powered gimbal system. These secondary rotations (maneuvers) occurred around an axis parallel to the radius of the centrifuge (0°), almost parallel to the axis of the centrifuge (272°), or around an axis half way between these (325°). These maneuvers had angular velocities of (a) .3927 rad/sec, (b) .1964 rad/sec, (c) .0982 rad/sec, or (d) .0491 rad/sec. In general the subjects reported or failed to report visual coriolis illusions in accordance with predictions of torque generated in the semicircular canals by coriolis accelerations. Estimates of thresholds were obtained. (Aerospace Med. 32(3):232, March 1961)

2,064

Gray, R. F. and M. G. Webb 1961 HIGH G PROTECTION
Aerospace Medicine 32(5):425-430, May 1961.

SUMMARY: Model studies are discussed concerning mechanical principles thought to be important in solving some problems of protection against high accelerations. Also discussed are (1) a study of the effects of acceleration on humans in the positive G ($+G_z$) position when submerged to eye level in a tank of water. Breath holding permitted water pressure to increase the air pressure in the respiratory system of these subjects, and (2) subjects were studied in the prone position ($-G_x$) while completely submerged with respiratory pressurization.

One subject's tolerance was increased by 13 G in the positive G position and by 15 G in the prone position. Other subjects showed unusually high G-tolerance in these positions. Undesirable effects had to do with translocation of air headward with the subjects in the positive G position and with bleeding and pain in the frontal sinuses and abdominal pain when the subjects were in the prone position.

2,065

Gray, R. F. et al 1961 CORIOLIS ACCELERATION EFFECTS ASSOCIATED WITH
MOVEMENT OF HUMANS BY A POWERED GIMBAL SYSTEM ON A HUMAN CENTRIFUGE
Aerospace Medicine 32(3):232, March 1961.

ABSTRACT: Three subjects were exposed to rotation at 1.0 G or 3.0 G at the f0-foot radius of a centrifuge. These gave angular velocities of the centrifuge of .80 and 1.39 radians per second, respectively. Simultaneously each subject was rotated around an axis close to his body by means of a powered gimbal system. These secondary rotations (maneuvers) occurred around an axis parallel to the radius of the centrifuge (0°), almost parallel to the axis of the centrifuge (272°), or around an axis half way between these (325°). These maneuvers had angular velocities of (a) .3927 rad/sec, (b) .1964 rad/sec, (c) .0982 rad/sec, or (d) .0491 rad/sec. In general the subjects reported or failed to report visual coriolis illusions in accordance with predictions of torque generated in the semi-circular canals by coriolis accelerations. Estimates of thresholds were obtained.

2,066

Gray, R.F. R.J. Crosbie et al. 1961 THE PRESENCE OR ABSENCE OF VISUAL
CORIOLIS ILLUSIONS AT VARIOUS COMBINED ANGULAR VELOCITIES.
(Aviation Medical Acceleration Lab., Johnsville, Pa.) NADC-MA-6131,
Report no. 1, ASTIA AD-266 893

ABSTRACT: Three subjects were exposed to rotation at 1 G or 3 G at the 50 ft. radius of a centrifuge which gave angular velocities of 0.80 or 1.39 radians per second, respectively. Simultaneously, each subject was rotated around an axis close to his body by means of a powered gimbal system. These secondary rotations (maneuvers) occurred around an axis parallel to the radius of the centrifuge (0 degrees), almost parallel to the axis of the centrifuge (272°), or around an axis half way between these (315 degrees). These maneuvers had nominal angular velocities of 0.3927 rad/sec, 0.1964 rad/sec, 0.0982 rad/sec or 0.0491 rad/sec. In general, the subjects reported visual coriolis illusions in accordance with predictions of such illusions based upon the magnitude of torques being developed by the coriolis acceleration. Therefore, it is likely that coriolis acceleration acts to develop the coriolis illusions. Estimates of thresholds were obtained. (Author)

2,067

Graybiel, A., & R. A. McFarland 1941 THE USE OF THE TILT TABLE TEST IN
AVIATION MEDICINE. J. Avia. Med. 12(3):194-211

ABSTRACT:

(a) The tilt table test provides a good method of testing the functions of the peripheral vascular system.

- (b) Out of 91 subjects tested, 9 collapsed or fainted, 13 responded poorly, 58 responded fairly well and 11 well.
- (c) When the subject's response was correlated with changes in blood pressure and pulse, the most important items in order of significance were (1) fall in systolic blood pressure (2) fall in pulse pressure (3) increase in heart rate.
- (d) The wide variation in response is due to individual differences and to a number of factors which render an individual physically unfit.
- (e) Response to tilting may be improved by training.
- (f) It has been noted that there is correlation between fainting and "blacking out" in pull outs from dives. Consequently a method of testing this susceptibility should be of value in aviation medicine.
- (g) Results so far warrant further exploration of the possibilities of the tilt board and standardization of the procedure.

2,068

Graybiel, A. 1942 SOME PROBLEMS IN AVIATION MEDICINE.
J. Lab. & Clinical Med. Vo. 28, Part I, pp. 590-596.

ABSTRACT: A general discussion of pilot selection, oxygen lack, decompression illness, acceleration, and motion sickness.

2,069

Graybiel, A. 1943 SOME PROBLEMS IN AVIATION MEDICINE.
J. Lab Clin Med. 28:590-596, Feb. 1943.

ABSTRACT: Because aviation medical is a specialized field in medicine, it naturally has unique problems. Among those problems is that of pilot selection. Out of a large number of apparently healthy individuals, only a small number are really fitted, both physically and psychologically to pilot an airplane. The hazards facing pilots are lack of oxygen, decompression, illness, acceleration, airplane sickness, and earache.

2,070

Graybiel, A. 1945 DISORIENTATION IN PILOTS Contact (Pensacola) 5:412-425

ABSTRACT: The problem of orientation in pilots, considered in its broadest meaning, embraces most of the aspects of aviation medicine. A partial outline of possible etiological factors is presented under three main headings -- namely the aerial environment, the plane, and the pilot. The physiogenesis of aviator's vertigo is reviewed, and man's limited ability to cope with this form of disorientation is emphasized. Two forms of visual illusion, auto-kinesis, and the oculo-gyral illusion are briefly discussed, and their significance in aviation is briefly commented upon.

2,071

Graybiel, A. & D. I. Hupp 1945 THE OCULO-GYRAL ILLUSION: A FORM OF APPARENT MOTION WHICH MAY BE OBSERVED FOLLOWING STIMULATION OF THE SEMICIRCULAR CANALS.

(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR00t.13-6001.1.4.

1 Nov. 1945. ASTIA ATI 69 562.

See also J. Aviation Med. 17(1):3-27, Feb. 1946.

ABSTRACT: In experiments conducted by the author, it was found that

(1) Rotatory acceleration may give rise to a visual illusion of movement which is termed the oculo-gyral illusion. It is the result of nystagmus produced reflexly by stimulation of the sensory receptors in the semicircular canals.

(2) In the light, and especially if visual cues are plentiful, relatively strong stimulation is required to produce even weak illusory effects.

(3) If an object is viewed in darkness, relatively weak stimulation will produce strong illusory effects. The threshold for stimulation in the case of the horizontal canals is in the neighborhood of 0.3 degrees per second. When the fixation object consists of a single light the oculo-gyral illusion is complicated by the phenomenon of autokinesis. The latter is largely abolished by using a three-dimensional target.

(4) The direction of the apparent movements of induced afterimages both during and following rotation is exactly opposite to that observed when a real target is fixated.

(5) The relationship between head position or change in head position and the direction of apparent movement indicates the relatively simple reflex character of the phenomenon.

(6) Hyoscine hydrobromide in doses as large as 3/200 of a grain had no appreciable effect on the oculo-gyral illusion.

(7) The oculo-gyral illusion offers a simple means of studying the sensitivity of the sensory receptors of the semicircular canals, the reflexly produced nystagmus and related phenomena.

(8) This illusion is of importance in night flying.

2,072

Graybiel, A. 1945 THE OCULO-GYRAL ILLUSION.

Fed. Proc. 4(1):25

ABSTRACT: During the course of some studies on the autokinetic sensation it was found that if a person undergoing slow rotation suddenly stops and fixates a stationary light in an otherwise dark room, the light appears to move rapidly in a direction opposite to that of the previous rotation. This phenomenon, which is the result of stimulation of the labyrinth, is not observed in a well lighted room except after strong stimulation.

A series of tests were carried out in a dark room in which the subject and a lighted target were rotated together. The chief variables were (1) the strength of the stimulus, (2) the nature of the fixation target and (3) the position of the subject's head. It was found that subjects after being rotated one revolution in 60 seconds and suddenly stopped, report apparent movement of the target for 15-20 seconds in the direction opposite to rotation. The target appears to move rapidly at first, then more slowly and finally seems to wander off in a manner characteristic of the autokinetic movement. The oculo-gyral illusion may be observed even after much weaker stimuli, namely, on sudden decelerations following rotations of 30 degrees at a rate of one revolution per minute, or rotations of 100 degrees at a rate of one revolution in 2 minutes. Nystagmus is not observed after rotations at these slow speeds. After-images do not behave in the same manner as the target light. If the head is inclined 90° toward the shoulder, after producing a strong o.g.i. in a horizontal plane, the apparent movement shifts to a vertical plane indicating the reflex characteristic of the phenomenon.

2,073

Graybiel, A., and B. Clark 1945 THE AUTOKINETIC ILLUSION AND ITS
SIGNIFICANCE IN NIGHT FLYING. J. Aviat. Med. 16:111-151

ABSTRACT: This investigation was undertaken to determine the reasons for the great number of crashes upon landing - pilots seem confused or disoriented at the time of the crash. The difficulties they experienced seemed to fall into several categories: disturbances in equilibrium, states of confusion, temporarily losing track of events, various types of optical illusions. Autokinesis was one of illusions here investigated. More than 500 subjects were used to study characteristics of the autokinetic illusion and its significance in night flying. In general, autokinetic movement appears after a delay of a second, lasts about 10 seconds in a particular direction, is observed half of the time, is slow, has a small angular displacement, may occur in any direction and is difficult to suppress. The article includes a historical summary and bibliography, and the data of the experiments. In addition of the conclusions mentioned, above is the fact that the illusion is not readily abolished. Insofar as the reduction of autokinesis is concerned, one of the recommendations made is that planes flying at night should have at least three lights in a different vertical and horizontal plane visible from any angle.

2,074

Graybiel, A., B. Clark, K. MacCorquodale and D. I. Hupp 1946 ROLE OF VESTIBULAR NYSTAGMUS IN THE VISUAL PERCEPTION OF A MOVING TARGET IN THE DARK.
Amer. J. Psychol. 59:259-266.
See also (Naval School of Aviation Medicine, Pensacola, Fla.) Proj.
MR 13-6001.1.5., 14 Jan. 1946.

ABSTRACT: Six well-trained subjects were rotated in the dark in a Link trainer at speeds up to 25 rpm. while observing an illuminated model plane which rotated

to the right around the subject's head at 0.95 revolutions per minute. The subject reported on velocity and direction of movement and the amount of displacement of the plane relative to himself. No attempt was made to discriminate between real and apparent movement. It was found that when a subject was at rest, watching the moving target, and then was abruptly accelerated, the target lost motion but was rapidly displaced in the opposite direction. With continuing rotation, the subject's sensation of motion decreased, while the plane rotated rapidly around him. Following cessation of rotation, the target rushed rapidly in the direction opposite to that in which the subject had been rotating. This effect is designated as the oculogyral illusion.

2,075

Graybiel, A., D. I. Hupp, & J. L. Patterson, Jr. 1946 THE LAW OF THE OTOLITH ORGAN.

ABSTRACT: Experiments on a human centrifuge provided means for distinguishing between the effects of angular acceleration on the semi-circular canals and of g on the otolith organs and yielded the following law: If, in the absence of visual orientation, man is subjected to accelerative force, the perception of the vertical will eventually coincide with the direction of the resultant of this force and the force of gravity.

Corollaries:

(a) An object in the field of vision which does not provide a clue for orientation to the earth will eventually be projected in space in accordance with the apparent vertical direction. (b) If objects in the field of vision do provide clues for orientation to the earth a conflict between visual and otolithic stimuli results and the resolution favors visual orientation to the earth. (c) If the body maintains a constant relationship to the direction of the resultant g one will not be aware of any change from the true vertical position. (d) If the body maintains a constant relationship with the true vertical position one will be conscious of a tilt or rotation. The apparent change from the true vertical will be equal, eventually to the angular displacement which the resultant g makes with the true vertical and will be in the same plane, but the signs of the angle will be opposite. Both the direction and degree of apparent displacement will be independent of a particular position of the body. (Federation Proceedings 5(1): 35, 1946)

2,076

Graybiel, A., B. Clark, K. MacCorquodale, & D. I. Hupp 1946 THE ROLE OF VESTIBULAR NYSTAGMUS IN THE VISUAL PERCEPTION OF A MOVING TARGET IN THE DARK. (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.5., 14 Jan. 1946
See also Amer. J. Psychol. 59:259-266

2,077

Graybiel, A., B. Clark, & K. MacCorquodale 1946 THE ILLUSORY PERCEPTION OF MOVEMENT CAUSED BY ANGULAR ACCELERATION AND BY CENTRIFUGAL FORCE DURING FLIGHT. I. METHODOLOGY AND PRELIMINARY RESULTS. (Naval School of Aviation Medicine, Pensacola, Fla.) Project MR005.13-6001.1.6, 25 March 1946
See also J. Exp. Psychol. 37(2):170-177, Apr. 1947

2,078

Graybiel, A. & D. I. Hupp 1946 THE OCULO-GYRAL ILLUSION: A FORM OF APPARENT MOTION WHICH MAY BE OBSERVED FOLLOWING THE STIMULATION OF THE SEMI-CIRCULAR CANALS.
J. Aviation Med. 17(1):3-27.
See also (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR 005.13-6001.1.4., 1 Nov. 1945.

ABSTRACT: Stimulation of the canals produced by acceleration may influence visual perception. In the daylight, and if visual cues are plentiful relatively strong stimulation is required before effects are produced. If cues are reduced by darkness, relatively weak stimulation of the labyrinth may cause strong illusions of apparent movement which may persist after all other sensations of rotation have disappeared. Because aviators subjected to even small angular accelerations while flying at night are in ideal circumstances to experience these illusions, the phenomenon is of importance in aviation.

The article includes a historical summary of interest in this illusion and discusses also the experimental procedure where the end organs are stimulated by rotation and the recording of the manner and extent to which this influences visual perception. The subjects were rotated in the Barany chair and Link trainer.

2,079

Graybiel, A., B. Clark, & K. Mac Corquodale 1947 SENSORY PERCEPTION OF MOVEMENT
J. Exp. Psychol. 37:170-177

ABSTRACT: A method was evolved to observe and report the effects of angular acceleration and variations in gravity on visual perception during flight. The visual stimulus was a collimated "star" installed in the rear cock-pit of a standard Navy training plane. All observations were made in complete darkness. Both the pilot's and observer's verbal reports were dictated into an airborne wire recorder which also provided a time line. These recordings were transcribed in the laboratory and all analyses were made from these transcriptions. Preliminary experiments were carried out on three subjects using five basic maneuvers in addition to control periods of straight and level flight. For the first time it has been shown that angular acceleration and gravity during flight induce illusory perceptions of motion and displacement of an objectively motionless object. The magnitude of the illusory effects may be great, the fixation object appearing to be displaced as much as 60° from its actual position. The significance of this finding for aviation is evident. The method is adaptable to a number of types of studies concerned with the influence of angular acceleration and gravity on visual perception.

2,080

Graybiel, A., W. A. Kerr, D. I. Hupp & H. Bartley 1947 THRESHOLD OF STIMULATION OF THE HORIZONTAL SEMICIRCULAR CANALS IN MAN WITH PARTICULAR REFERENCE TO THE SIGNIFICANCE OF THE FIRST DERIVATIVE OF ANGULAR ACCELERATION AS A STIMULUS.
(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001 - .1.17., 12 March 1947
See also Amer. J. Psychol. 61:21-36, 1948.

ABSTRACT: By use of the human centrifuge, records of responses both to constant angular acceleration and to changes in angular acceleration were obtained.

The indicator was the oculo-gyral illusion, and three types of responses were obtained, "left movement", "no movement", and "right movement".

The responses were made at 20-second intervals and were related to the mean angular acceleration calculated for the preceding 20-second period. In order to obtain the most reliable relations between changes in angular acceleration and response, the mean change between four 20-second periods (80-second) had to be used.

Fairly consistent relationships between the direction and amount of change in acceleration, as expressed in each of the three types of response were obtained.

2,081

Graybiel, A., B. Clark & K. MacCorquodale 1947 THE ILLUSORY PERCEPTION OF MOVEMENT CAUSED BY ANGULAR ACCELERATION AND BY CENTRIFUGAL FORCE DURING FLIGHT. I. Methodology and Preliminary Results.
J. Exp. Psychol. 37:170-177, April 1947.
See also (Naval School of Avia. Med., Pensacola, Fla.) Proj. MR005.13-6001.1.6, 25 March 1946.

2,082

Graybiel, A., & B. Clark 1947 LINEAR ACCELERATION AND DECELERATION AS FACTORS INFLUENCING NON-VISUAL ORIENTATION DURING FLIGHT. (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.18., 25 Sept. 1947
See also J. Avia. Med. 20(2):92-101, April 1949

2,083

Graybiel, A., & B. Clark 1947 APPARENT ROTATION OF A FIXED TARGET ASSOCIATED WITH LINEAR ACCELERATION IN FLIGHT. (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.19., 27 Sept. 1947
See also Amer. J. Ophthalmol. 32:549-557, 1949

2,084

Graybiel, A. 1948 LINEAR ACCELERATION AND OPTICAL ILLUSION.
Rept. 19, Proj X-148. USN Bumed News Ltr., Av. Supp. 9:15.

2,085

Graybiel, A., W.A. Kerr, S.H. Bartley 1948 THRESHOLDS OF THE SEMI-CIRCULAR CANALS
Amer. J. Psychol. 61:21-36

2,086

Graybiel, A., J. L. Patterson, & J. M. Packard 1948 SUNBURN AS CAUSE OF TEMPORARY LOWERING OF BLACKOUT THRESHOLD IN FLYERS. J. Avia. Med. 19:270-275
See also (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-7004.5.1., 3/3/48

ABSTRACT:

- 1) Three cases are described in which sunburn was responsible for a decrease in circulatory adjustment to change in posture or to higher accelerative forces.
 - 2) In the case of a flight instructor there were no symptoms in the course of ordinary living, but ease of blackout was observed during various maneuvers in flight. Failure to associate sunburn with this decreased blackout threshold almost led to mismanagement of the case.
 - 3) Flight surgeons should be aware of this phenomenon.
- (DACO)

2,087

Graybiel, A., W. A. Kerr, & S. H. Bartley 1948 STIMULUS THRESHOLDS OF THE SEMICIRCULAR CANALS AS A FUNCTION OF ANGULAR ACCELERATION. American J. Psychology 61(1):21-36, Jan. 1948
NOTE: Reel 7, Flash 6, Item 31

SUMMARY AND CONCLUSIONS: (1) By use of the human centrifuge records of responses both to constant angular acceleration and to changes in angular acceleration were obtained. (2) The indicator was the oculo-gyral illusion, and three types of responses were obtained, 'left movement', 'no movement', and 'right movement'. (3) The responses were to mean conditions over periods of 20 sec., rather than to conditions at the instant. In order to obtain reliable relations between small changes in angular acceleration and response, the mean rate during four 20-sec. periods (80 sec.) had to be used. (4) Fairly consistent relationships between the direction and amount of change in angular acceleration, as expressed in each

of the three types of response were obtained. (5) A threshold for change in both positive and negative angular acceleration was determined. It was of the order of 0.12 degrees/sec. (6) It was also found that the reliability of response to constant acceleration decreased as the length of the period to which response referred increased beyond 20 sec., at near-threshold rates. Beyond the 20-sec. period, accuracy not only diminishes but reversals in response tend to occur. The individual not only becomes unaware of acceleration as indicated by the oculogyral illusion, but he also tends to see movement of the target in the opposite direction. (Author)

2,088

Graybiel, A., W. Kerr, D. Hupp & S. Bartley 1948 THRESHOLD OF STIMULATION OF THE HORIZONTAL SEMICIRCULAR CANALS IN MAN WITH PARTICULAR REFERENCE TO THE FIRST DERIVATIVE OF ANGULAR ACCELERATION AS A STIMULUS.

Am J. Psychol. 61(1):21-36, Jan. 1948.

See also (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.17., 12 March 1947.

2,089

Graybiel, A., J. L. Patterson & J. M. Packard 1948 SUNBURN AS CAUSE OF TEMPORARY LOWERING OF BLACKOUT THRESHOLD IN FLYERS.

(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-7004.5 - .1., 3 March 1948.

See also J. Aviation Med. 19:270-275.

ABSTRACT:

1) Three cases are described in which sunburn was responsible for a decrease in circulatory adjustment to change in posture or to higher accelerative forces.

2) In the case of a flight instructor there were no symptoms in the course of ordinary living, but ease of blackout was observed during various maneuvers in flight. Failure to associate sunburn with this decreased blackout threshold almost led to mismanagement of the case.

3) Flight surgeons should be aware of this phenomenon.

(DACO)

2,090

Graybiel, A., & B. Clark 1949 LINEAR ACCELERATION AND DECELERATION AS FACTORS INFLUENCING NON-VISUAL ORIENTATION DURING FLIGHT J. Avia. Med. 20(2):92-101, April 1949

See also (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.18., 25 Sept. 1947

2,091

Graybiel, A., & R. H. Brown 1949 THE DELAY IN VISUAL REORIENTATION FOLLOWING EXPOSURE TO A CHANGE IN DIRECTION OF RESULTANT FORCE ON A HUMAN CENTRIFUGE (Naval School of Aviation Medicine, Pensacola, Fla.) Research Rept. NM 001 110 500.3.; Proj. NM 001 037; 5/25/49 ASTIA ATI 122 354
See also J. Gen. Psychol. 45(2):143-150, Oct. 1951

ABSTRACT: Three subjects were exposed on a human centrifuge to a change in direction of resultant G relative to the body axis. Under the conditions of the experiment the illusion was created wherein a horizontal target line appeared to rotate through an angle corresponding to the change in direction of the resultant force. The subject actually rotated the line counter-clockwise in order to maintain the line horizontal for himself. A marked discrepancy was noted between the time required to impress the physical force on the subject and the period during which he found it necessary to make adjustments in keeping the line horizontal. This discrepancy was regarded as a measure of the delay in the subject's visual reorientation to a change in direction of resultant G. It is thought that a possible cause of the delay may lie in the characteristic behavior of the otolith organ. This lag phenomenon is of importance to aviation inasmuch as the full disorientating effects of a change in direction of resultant G relative to the body axis will not become manifest if the exposure time is short.

2,092

Graybiel, A., & B. Clark 1949 APPARENT ROTATION OF A FIXED TARGET ASSOCIATED WITH LINEAR ACCELERATION IN FLIGHT. Amer. J. Ophthalmol. 32:549-557
See also (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.19., 27 Sept. 1947

2,093

Graybiel, A. 1950 THE EFFECT OF A CHANGE IN DIRECTION OF RESULTANT FORCE ON SOUND LOCALIZATION: THE AUDIOGRAVIC ILLUSION. (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.23., 10 March 1950

SUMMARY: An experiment was carried out in which four healthy male subjects estimated the location of a source of sound while being subjected to a change in direction of resultant force with respect to themselves.

A consistent error was made in terms of a non-visual vertical-horizontal frame of reference. The error amounted to about 70 percent of the angle ϕ and a linear relationship was found to exist between the two.

This phenomenon has been termed the audiogravic illusion and it can be readily explained on the basis that the egocentric localization of the horizon, under the conditions of our experiment, accords with the change in direction of resultant force.

2,094

Graybiel, A. 1950 SPATIAL DISORIENTATION IN FLIGHT.
(U.S. Naval School of Aviation Medicine, Pensacola, Fla.)
Proj. No. NM 001 059.01.24, 15 November 1950. ASTIA ATI 94 151

ABSTRACT: The pilot, free to maneuver his plane in space, is confronted with unique and sometimes difficult problems in spatial orientation. This may be looked upon as a phenomenon of perception representing the individual's interpretation of stimuli originating in sensory receptors. This total sensory experience is useful in orientation to the plane but only visual perception can safely be used for orientation to the earth and to other objects in space. Thus, the pilot must learn to distinguish between spatial orientation based on visual perception alone and that based on a sensory experience which includes orientation to gravity or to the direction of resultant force. This is an acquired accomplishment which is subject to all the laws of learning and forgetting. Loss of orientation or disorientation may readily result in the absence of any pathological factor and when all of the sense organs are functioning normally. The two most important causes are inadequate visual perception and the misuse of gravitational cues. Inadequate visual perception may be related to the physical stimulus per se, the influence of stimuli from other sense organs or the effect of central factors on visual perception. The perceptual data may be inadequate on the basis of many environmental factors both within and without the plane. Finally the fact that a person perceives things in a manner which accords with his past experience is emphasized. A few suggestions are made regarding the way in which disorientation might be prevented.

2,095

Graybiel, A., & R. H. Brown 1951 THE DELAY IN VISUAL REORIENTATION FOLLOWING EXPOSURE TO A CHANGE IN DIRECTION OF RESULTANT FORCE ON A HUMAN CENTRIFUGE. J. Gen. Psychol. 45(2):143-150, Oct. 1951
See also (Naval School of Aviation Medicine, Pensacola, Fla.) Research Rept. NM 001 110 500.3.; Proj. NM 001 037; 5/25/49

ABSTRACT: The authors suggest that a possible cause of such delay in visual reorientation may lie in the characteristic behavior of the otolith organ. This delay is of importance in aviation inasmuch as a flyer who is subjected to rapid acceleration or deceleration over a short period may not experience the full effects of his disorientation.

2,096

Graybiel, A. 1951 SPATIAL DISORIENTATION IN FLIGHT.
The Mil. Surg. 108:287-294
See also (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.24.; NM 001 059.01.24, 15 Nov. 1950.

2,097

Graybiel, A. 1951 THE OCULOGRAVIC ILLUSION

(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. NM 001 059.01.27, MR005.13-6001.1.27, Rept. No. 27, 25 Dec. 1951. ASTIA ATI 139 629.

See also A.M.A. Arch Ophthalm. 48(5):605-615

ABSTRACT: Evidence was obtained that neither ocular nystagmus nor rotation of the eye is responsible for producing the oculogravic illusion. The illusion was produced in subjects seated on a rotatable platform in a dark room while they were fixating on a collimated star directly before them. Their stationary positions were changed by centripetal acceleration which provided a resultant force at 45 degrees in about 3 seconds, where the resultant force is the vector sum of the centripetal force from behind and gravitational force from below. After the initial jerk, the subjects felt as though they were being tilted back-along with the supporting structures and as though the star were rising. The estimate of the degree of the star's displacement above the horizon was closely related to the angle between resultant force and direction of gravity. Experiments under modified conditions (providing an after-image, changing body positions by facing toward or away from the center of rotation, or allowing adaptation to the centripetal force) indicated that the illusion originates in a psychophysiological mechanism and is unrelated either to the tracking of an image over the retina or to the reflex connection at the level of the oculo-motor nuclei which cause eye movement.

2,098

Graybiel, A. 1952 THE EFFECT ON VISION PRODUCED BY STIMULATION OF THE SEMI-CIRCULAR CANALS BY ANGULAR ACCELERATION AND STIMULATION OF THE OTOLITH ORGANS BY LINEAR ACCELERATION. In White, C. S., & O. O. Benson, Jr., eds., Physics and Medicine of the Upper Atmosphere, A Study of the Aeropause (Albuquerque, N. Mex.: Univ. of New Mexico Press, 1952) pp. 494-508

ABSTRACT: The physiological mechanism of oculogyral and oculogravic illusions is briefly discussed. No evidence has been found to the effect that repeated angular acceleration would lead to habituation and decrease oculogyric illusion. Rapid changes from positive to negative acceleration result in decreased oculogyric illusion, but the aftereffect increases with the lengthening of intervals between changing accelerations. Experiments made in actual flight revealed that oculogyric illusions aid the pilot with regard to the orientation of the plane, but cause disorientation with regard to localization of objects outside the plane. Oculogravic illusions can be demonstrated using the human centrifuge. They manifest themselves in the fact that the subject perceives an apparent tilting of his chair and supporting structure while fixing his eyes on a small luminous object. Unlike oculogyric illusion (which is due to nystagmus), oculogravic illusion is independent of the movements of the eyeball.

2,099

Graybiel, A., J. I. Niven & T. E. Walsh 1952 THE DIFFERENTIATION BETWEEN SYMPTOMS REFERABLE TO THE OTOLITH ORGANS AND SEMI-CIRCULAR CANALS IN PATIENTS WITH NON-SUPPURATIVE LABYRINTHITIS.
(Naval School of Aviation Medicine, Naval Air Station, Pensacola, Fla.)
NM 001 059.01.29; March 10, 1952. ASTIA ATI 155 263.

ABSTRACT: Five patients with symptoms characteristic of non-suppurative labyrinthitis were largely or wholly relieved following unilateral labyrinthectomy. After recovery from the operation they were subjected to both angular and rectilinear accelerations which stimulated respectively the sensory elements in the horizontal pair of semicircular canals and otolith organs. The symptoms induced by a change in direction of resultant force, which included stimulation of the otolith organs, were an apparent tilting of the body and the apparent displacement of objects so that they appeared to assume a new position in space. When their spontaneous symptoms were interpreted in the light of the induced symptoms, it became evident that the disturbances in equilibrium might be mainly referable to either one or both portions of the non-acoustic labyrinth. The spontaneous disturbances were mainly referable to the semicircular canals in two cases, the otolith organs in one, and to both sensory organs in the remaining two. (Author)

2,100

Graybiel, A. & J. I. Niven 1952 THE ABSENCE OF RESIDUAL EFFECTS ATTRIBUTABLE TO THE OTOLITH ORGANS FOLLOWING UNILATERAL LABYRINTHECTOMY IN MAN.
(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1 - 33., 22 Oct. 1952. ASTIA TIP U-25734

ABSTRACT: Five control and five unilaterally labyrinthectomized subjects were exposed to centripetal forces on a human centrifuge. Their ability to estimate apparent change in position of a visual object and change in body position during exposure to centripetal force was recorded. No significant differences between the subjects were revealed. Residual effects attributable to the unilateral destruction of the otolith organs were negligible. (TIP abstract)

2,101

Graybiel, A. & B. Clark 1952 DURATION OF OCULOGYRAL ILLUSION AS A FUNCTION OF THE INTERVAL BETWEEN ANGULAR ACCELERATION AND DECELERATION. ITS SIGNIFICANCE IN TERMS OF DYNAMICS OF SEMICIRCULAR CANALS IN MAN.
J. Appl. Physiol. 5:147-152, Oct. 1952.

ABSTRACT: Subjects were placed in a Link Trainer which was modified to rotate only in the horizontal plane and could be rapidly arrested by a brake mechanism. The trainer was rotated at various rates of acceleration, and peak velocities were kept constant for a varying length of time (0, 10, 20, 30, and 60 seconds) before rapid deceleration was applied. The duration of first and second oculo-

gyral effects (e.g. the apparent movement of a luminous object first in the direction of the turn and then in the opposite direction) reported by the subjects were timed to the nearest second. It was found that the duration of both oculogyral effects was proportional to the rate of acceleration and could be expressed as a function of the length of the constant-velocity interval between acceleration and deceleration: it increased rapidly after an interval of 0 to about 20 seconds, then remained almost constant (about 25 seconds), thus indicating a state of physiological adaptation. The findings are correlated with the physiological mechanism of the semicircular canals. In applying the data to conditions encountered by pilots during night flights it is concluded that similar illusory after-effects may be expected after rotation of a plane about one of its axes and may impair spatial orientation to a minor degree.

2,102

Graybiel, A. 1952 OCULOGRAVIC ILLUSION.

A.M.A. Arch. Ophthalmol., 48(5):605-615

See also (Naval School of Aviation Medicine, Pensacola, Fla.)

Proj. No. MR 005-13-6001, Rept. No. 27, 29 Dec. 1951. ASTIA ATI 139 629

ABSTRACT: When a person is subjected to a change in direction of resultant force relative to himself, he experiences an illusion wherein objects in the visual field, stationary with respect to the observer, appear to move and to assume a new position more or less in accord with the direction of resultant force. This phenomenon has been termed the oculogravic illusion.

Under the experimental conditions the subject perceived direct and indirect orientation cues. The former had their origin in stimulation of sensory elements by tension and pressures induced by resultant force. The indirect cues were provided by the perception of objects in the visual field which retained their original position with respect to the gravitational vertical. It was in the resolution of these conflicting cues that objects in the visual field appeared to move and to be displaced. The important variables determining the appearance of the illusion were (1) the pattern of centripetal acceleration, (2) the position of the subject, and (3) the visual framework. When the direction of resultant force was shifted with respect to the subject, the illusion consisted of apparent movement and apparent displacement of objects in the visual field. If the relation between resultant force and subject was fixed, apparent displacement was observed, but not apparent movement.

2,103

Graybiel, A. 1954 FLYING STRESS AND HEART DISEASE IN U.S. NAVAL AVIATORS.

(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-

7004.5.10., 12 Oct. 1954

ABSTRACT: A study of flying stress and its relation to heart disease in U.S. Naval Aviators indicates that these aviators are, if anything, less susceptible to hypertensive and coronary heart disease than are non-flying officers. The

existence of flying stress is not denied; however, short periods of stress are followed by long periods during which recovery from strain can take place.

For this report Naval Aviators were regarded as a single occupational group and the inquiry centered around (1) experiences in the Cardiac Clinic at the U.S. Naval School of Aviation Medicine, (2) the results of a 12-year follow-up study of 1056 Naval Aviators, and (3) comparison of the incidence of heart disease in flying and non-flying Naval Officers.

2,104

Graybiel, A. 1954 THE CONCEPT OF AVIATION MEDICINE
(Naval School of Aviation Medicine, Pensacola, Fla.) Research Rept.
NM 001 059.25.18., 10 Sept. 1954

ABSTRACT: This report emphasizes the need for a generalized concept of aviation medicine sufficiently broad to include all of the human aspects of aviatational activities and in turn the effects of these activities on man. This is done by analyzing aviatational activities for the human elements and structuring the concept out of these elements.

2,105

Graybiel, A. & J. L. Patterson 1954 THRESHOLDS OF STIMULATION OF THE OTOLITH ORGANS AS INDICATED BY THE OCULOGRAVIC ILLUSION.
(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001,
NM 001 059.01.38; 26 July 1954. ASTIA AD 44 402
See also J. Appl. Physiol. 7:666-670, 1955.

ABSTRACT: The oculogravic illusion was utilized as an indicator mechanism in determining the perceptual thresholds of change in the direction of resultant force; this force, the vectorial sum of the forces of gravity and acceleration in a human centrifuge, is expressed by the angle (θ) it makes with the gravitational vertical. The mean threshold for 3 subjects in the sitting position was 0.000344 g ($\theta = 1.5$) for the 75% correct response level. Corresponding values for the subjects lying on their right sides were 8.9, and the curve of threshold responses was bimodal. Curves of the threshold values of subjects in an upside-down position resembled the initial portion of the curve obtained with the subjects lying. The findings supported the hypothesis that the otolith organ functions best with the head upright and fails to function with the head down.

2,106

Graybiel, A 1955 MEDICAL ASPECTS OF FLYING.
(Naval School of Aviation Medicine, Pensacola, Fla.) July 1955.
ASTIA AD 116 428

2,107

Graybiel, A. 1955 FLYING STRESS AND HEART DISEASE IN NAVAL AVIATORS.
J. Aviation Med. 26(4):329-336.

SUMMARY: 1. The object of this study was to determine the importance of flying stress in precipitating myocardial infarction or in predisposing the naval aviator to hypertensive and coronary heart disease.

2. The data presented indicate that naval aviators are, if anything, less susceptible to hypertensive and coronary heart disease than are non-flying naval officers.

3. The explanation does not lie in denying the existence of flying stress. The most reasonable explanation lies in the fact that short periods of flying stress are followed by long periods during which recovery from strain can take place.

2,108

Graybiel, A., & J. L. Patterson 1955 THRESHOLDS OF STIMULATION OF THE OTOLITH ORGANS AS INDICATED BY THE OCULOGRAVIC ILLUSION. J. Appl. Physiol. 7:666-670
See also (Naval School of Aviation Medicine, Pensacola, Fla.) Research Rept. NM001 059.01.38; MR005.13-6001.1.38., 7/26/54; ASTIA AD-44 402

ABSTRACT: The oculogravic illusion described by Graybiel (Arch. Ophthalmol. (N. Y.) 48:605-615, 1952) was utilized as an indicator mechanism in determining the perceptual thresholds of change in the direction of resultant force; this force, the vectorial sum of the forces of gravity and acceleration in a human centrifuge is expressed by the angle (θ) it makes with the gravitational vertical. The mean threshold for 3 subjects in the sitting position was 0.000344 g ($\theta=1.5$ degrees) for the 75% correct response level. Corresponding values for the subjects lying on their right sides were 8.9 degrees, and the curve of threshold responses was bimodal. Curves of the threshold values of subjects in an upsidedown position resembled the initial portion of the curve obtained with the subjects lying. The findings supported the hypothesis that the otolith organ functions best with the head upright and fails to function with the head down. (ASTIA)

2,109

Graybiel, A., 1955 AVIATION MEDICINE.
In Cecil & Loeb, eds., A Textbook of Medicine, 9th Ed.
(Philadelphia; London: W.B. Saunders, 1955) pp. 510-516

2,110

Graybiel, A. 1956 PROBLEMS INVOLVING THE PILOT AND HIS TASK: THE CHANGING EMPHASIS IN AVIATION MEDICINE.
(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. no. NM 001 105 106, Rept. no. 1, June 1956. ASTIA AD 105 695.

ABSTRACT: "The problem: Aviation medicine is a specialty which has undergone radical changes in emphasis during its brief existence. The critical problems involving the professional pilot are no longer medical in the usual meaning of this term but center around his task in the cockpit where the distinction between man the instrument and man the individual becomes artificial. The great complexity of this task places demand on the pilot in which mental qualifications are most important. Findings: Many agencies with interlocking interests play a part in the solution of the problems encountered. A greater coordination among these agencies would be beneficial. Designers, engineers, research workers, the aviation examiner, and the pilot himself with a firm appreciation of what is truly involved in "success in flying" can make important contributions." (US-NSAM)

2,111

Graybiel, A., J. I. Niven & K. MacCorquodale 1956 THE EFFECT OF LINEAR ACCELERATION ON THE OCULOGYRAL ILLUSION.
(Naval School of Aviat. Med., Pensacola, Fla.) Res. Proj. No. NM 001 110 100, Rept. No. 42; 13 July 1956. ASTIA AD 127 827.

ABSTRACT: The results of this study show that the duration of the oculogyral illusion is an increasing function of increasing angular acceleration. The heading of the observer relative to the axis of rotation of the centrifuge does not affect the duration of the oculogyral illusion. The increased magnitude of the linear acceleration component experienced when the seating radius was increased from 2 feet to 17 feet did not affect the duration up to centrifuge speeds of 8 r.p.m. (maximum angle $\phi = 20$ degrees). The increase in magnitude of the linear acceleration component with increase in centrifuge speed beyond 8 r.p.m. becomes increasingly disruptive of performance, as oculogravic effects become dominant. The sign of the acceleration i.e., positive and negative acceleration, most probably does not influence the duration. (Author)

2,112

Graybiel, A. & J. I. Niven 1956 THE OCULOGRAVIC ILLUSION: A SPECIFIC PERCEPTUAL RESULTANT OF STIMULATION OF THE OTOLITH ORGANS.
(U.S. Naval School of Aviation Medicine, Pensacola, Fla.) Proj. NM 001 110 100, Report No. 40.

2,113

Graybiel, A. 1956 THE IMPORTANCE OF THE OTOLITHIC ORGANS IN MAN BASED UPON A SPECIFIC TEST FOR UTRICULAR FUNCTION.
Ann. Otol. Rhin. & Laryng. 65:470-487, June 1956.

2,114

Graybiel, A. & J. I. Niven 1956 PERSISTENCE OF THE AUTOKINETIC ILLUSION IN PERSONS WITH BILATERAL INJURY OR DESTRUCTION OF THE LABYRINTH OF THE INNER EAR.
(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.41, 12 July 1956.

ABSTRACT: In the absence of angular acceleration, the sensory elements in the cupulae might be stimulated in random fashion by weak currents in the endolymph. Experiments are described in which this possibility was explored through the use of subjects with bilateral labyrinthine injury.

It was found that the sensory organs of the inner ear are not essential for perception of the autokinetic illusion. Responses made by the subjects fell within the normal range, but this is not proof that inner ear organs have no influence on perception of the autokinetic phenomenon.

2,115

Graybiel, A., & R. C. Woellner 1957 THE PERCEPTION OF VERTICAL IN THE PRESENCE OF INCREASED ACCELERATIVE FORCES. (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.45., 31 Oct. 1957

2,116

Graybiel, A. 1958 ORIENTATION IN SPACE WITH PARTICULAR REFERENCE TO VESTIBULAR FUNCTIONS (Presented at International Symposium on Submarine and Space Medicine New London, Connecticut, 1958)

2,117

Graybiel, A., & R. C. Woellner 1958 A NEW AND OBJECTIVE METHOD FOR MEASURING OCULAR TORSION. (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001.1.46., 15 May 1958

2,118

Graybiel, A., R.H. Holmes, D.E. Beischer et al. 1959 AN ACCOUNT OF EXPERIMENTS IN WHICH TWO MONKEYS WERE RECOVERED UNHARMED AFTER BALLISTIC SPACE FLIGHT Aerospace Medicine 30(12): 871-931, Dec. 1959

ABSTRACT: An account has been given of two experiments in which three monkeys were carried in Jupiter missiles 300 miles into space. In the first, a squirrel monkey survived in good condition till a mishap occurred to the vehicle re-entry.

In the second, an American-born rhesus and a squirrel monkey were recovered uninjured. Details have been furnished covering the construction of the bio-capsules, the provisions for a closed life support environment, the equipment and arrangements for monitoring the responses of the monkeys, and the experimental findings.

2,119

Graybiel, A., B. Clark, & J. J. Zarriello 1959 OBSERVATIONS ON HUMAN SUBJECTS LIVING IN A "SLOW ROTATION ROOM" FOR PERIODS OF TWO DAYS: CANAL SICKNESS. (Naval School of Aviation Medicine, Pensacola, Fla.) Research Project MR005.13-6001.1.49., 10/15/59; ASTIA AD-232 510
See also Arch. Neurol. 3:55-73, 1960

ABSTRACT: This study was designed to investigate the consequences of prolonged constant rotation of human subjects living in a slow rotation room. Five healthy subjects and one control subject were subjected to rotations varying from 1.71 rpm to 10.0 rpm for periods of two days each. During each run they engaged in a series of tasks designed to serve as stressors and at the same time give some measure of their performance during the period of rotation. Under the experimental conditions, angular acceleration constituted the dominant stimulus, while the small centrifugal force played an unimportant role. Five normal subjects experienced symptoms which, in their variety and prominence, seemed to be out of proportion of the mild stimulus condition. The cardinal subjective symptoms were headache, dizziness, sleepiness, depression, visual illusions, and nausea. Cardinal signs were pallor, sweating, difficulty in walking, oliguria, and vomiting. In some instances, particularly at the higher rotational velocities, the symptoms were so severe that the subject was unable to carry out any useful task. Adaptation occurred after a period of hrs. to days, and the symptoms either disappeared or were reduced in severity. Inasmuch as the symptoms arose directly or indirectly as a result of stimulation of the semicircular canals, the term calan sickness appears to be a useful designation. A control subject with loss of vestibular function reported no sensations of rotation nor any unpleasant symptoms whatsoever. His only difficulty was in walking due to centrifugal force at the higher velocities. After-effects following the forty-eight period of rotation were usually much less prominent than during the rotation itself, but in some cases the symptoms were quite as strong as they were during rotation. The most prominent effects were difficulty in walking and fatigue. The control subject showed none of these symptoms. (CARI)

2,120

Graybiel, A., D. E. Beischer, W. C. Hixson, A. J. Moss, & D. E. Stullken 1960
MEDICAL ASPECTS OF THE PROJECT MERCURY RECOVERY PROGRAM. (School of Aviation
Medicine, Pensacola, Fla.) SAM P-14

ABSTRACT: This report deals with the care and handling of the astronaut following impact and is presented in two parts. Part I is a methodical treatment of the principal elements in medical planning of the recovery program. Part II is a specific plan for a manned flight of three orbits.

2,121

Graybiel, A., J.C. Meek, D.E. Beischer, & A.J. Riopelle 1960 OBSERVATIONS OF
CANAL SICKNESS AND ADAPTATION IN CHIMPANZEES IN A "SLOW ROTATION ROOM."
(U.S. Naval School of Aviation Medicine, Pensacola Air Station, Fla.)
Proj. MR005.13 6001, Subtask 1, Rept. 55, Oct. 1960. ASTIA AD 260 748.

ABSTRACT: To complement the studies on man of the effects of varying speeds of constant slow rotation, two chimpanzees, one with normal and one with disturbed vestibular function, were subjected to rotations varying from 1.9 to 10.0 rpm in a slow rotation room. The animals were observed for manifestations of "canal sickness" as seen in man. The animals were further studied under conditions of subcritical stimulation for two days to ascertain whether adaptation would occur. The usefulness of the chimpanzee as an experimental animal for studying the phenomenon of canal sickness was discussed. (Tufts)

2,122

Graybiel, A., B. Clark, & J. J. Zarriello 1960 OBSERVATIONS ON HUMAN SUBJECTS
LIVING IN A "SLOW ROTATION ROOM" FOR PERIODS OF TWO DAYS: CANAL SICKNESS.
Arch. Neurol. 3:55-73, 1960
See also (Naval School of Aviation Medicine, Pensacola, Fla.) Research
Project MR005.13-6001.1.49., 10/15/59; ASTIA AD-232 510

ABSTRACT: This study was designed to investigate the consequences of prolonged constant rotation of human subjects living in a slow rotation room. Five healthy subjects and one control subject were subjected to rotations varying from 1.71 rpm to 10.0 rpm for periods of two days each. During each run they engaged in a series of tasks designed to serve as stressors and at the same time give some measure of their performance during the period of rotation. Under the experimental conditions, angular acceleration constituted the dominant stimulus, while the small centrifugal force played an unimportant role. Five normal subjects experienced symptoms which, in their variety and prominence, seemed to be out of proportion of the mild stimulus condition. The cardinal subjective symptoms were headache, dizziness, sleepiness, depression, visual illusions, and nausea. Cardinal signs were pallor, sweating, difficulty in walking, oliguria, and vomiting. In some instances, particularly at the higher rotational velocities, the symptoms were so severe that the subject was unable

to carry out any useful task. Adaptation occurred after a period of hrs. to days, and the symptoms either disappeared or were reduced in severity. Inasmuch as the symptoms arose directly or indirectly as a result of stimulation of the semicircular canals, the term calan sickness appears to be a useful designation. A control subject with loss of vestibular function reported no sensations of rotation nor any unpleasant symptoms whatsoever. His only difficulty was in walking due to centrifugal force at the higher velocities. After-effects following the forty-eight hr. period of rotation were usually much less prominent than during the rotational itself, but in some cases the symptoms were quite as strong as they were during rotation. The most prominent effects were difficulty in walking and fatigue. The control subject showed none of these symptoms. (CARI)

2,123

Graybiel, A., E. Guedry, W. Johnson, & E. R. Kennedy 1960 ADAPTATION TO BIZARRE STIMULATION OF THE SEMICIRCULAR CANALS AS INDICATED BY THE OCULOGYRAL ILLUSION. (Naval School of Aviation Medicine, Pensacola, Fla.) Research Project MRO05.13-6001, Rept. No. 53; ASTIA AD-244 936
See also Aerospace Medicine 32(4):321-327, Apr. 1961
See also (Army Medical Research Lab., Fort Knox, Ky.) Rept. No. 464; ASTIA AD-253 099

ABSTRACT: Four healthy male subjects 19 to 23 years of age were exposed to tilt in a specially constructed chair mounted in a rotating room which is built around the center of a human centrifuge. Determinations of the course of the adaptation to the oculogyral illusion are reported. Also compared are the effects of their voluntary head movements. Information obtained appears to have application to anticipated problems in manned orbiting satellites and to any rotating installation where personnel will be exposed to angular velocities above 2.0 rpm.
(AUTHOR)

2,124

Graybiel, A., E. Guedry, W. Johnson, & E. R. Kennedy 1960 ADAPTATION TO BIZARRE STIMULATION OF THE SEMICIRCULAR CANALS AS INDICATED BY THE OCULOGYRAL ILLUSION. (Army Medical Research Lab., Fort Knox, Ky.) Rept. No. 464; ASTIA AD-253 099L
See also (Naval School of Aviation Medicine, Pensacola, Fla.) Research Proj. MRO05.13-6001, Rept. No. 53; ASTIA AD-244 936
See also Aerospace Medicine 32(4):321-327, Apr. 1961

ABSTRACT: Four healthy male subjects 19 to 23 years of age were exposed to tilt in a specially constructed chair mounted in a rotating room which is built around the center of a human centrifuge. Determinations of the course of the adaptation to the oculogyral illusion are reported. Also compared are the effects of their voluntary head movements. Information obtained appears to have application to anticipated problems in manned orbiting satellites and to any rotating installation where personnel will be exposed to angular velocities above 2.0 rpm.
(AUTHOR)

2,125

Graybiel, A. & B. Clark 1961 PERCEPTION OF THE HORIZONTAL OR VERTICAL WITH HEAD UPRIGHT, ON THE SIDE, AND INVERTED UNDER STATIC CONDITIONS AND DURING EXPOSURE TO CENTRIPETAL FORCE.

(USN School of Aviation Medicine, Pensacola Air Station, Fla.)

Proj. MR005.13 6001, Subtask 1, Rept. 60, 15 Aug. 1961. ASTIA AD 266 066

See also Aerospace Medicine 33(2):147-155, Feb. 1962.

ABSTRACT: The present experiment attempted to measure the accuracy of visual egocentric localization in widely different body (head) positions and the change in localization induced by a change in direction of the gravitational-inertial force environment. The ability of five healthy subjects to set a luminous line to the horizontal while in the dark was measured with head upright, on the side, and inverted both under static conditions and during exposure to centripetal force. In general, the findings were the same for all subjects and interindividual differences did not affect any of the major findings significantly. Under static conditions egocentric visual localization was quite accurate with head upright, inaccurate with head inverted, and grossly in error with head on the side. When the subjects were exposed to centripetal force with a change in direction of force making an angle of 6 degrees or 12 degrees, the oculogravic illusion was perceived with head erect, not exhibited with head inverted, and not measurable with head on the side. The significance of these findings is discussed with reference to the function of the otolith apparatus and other factors. (Author)

2,126

Graybiel, A., & B. Clark 1961 ESTIMATE OF THE HORIZONTAL OR VERTICAL WITH HEAD UPRIGHT, ON THE SIDE, AND INVERTED UNDER STATIC CONDITIONS AND DURING EXPOSURE TO CENTRIPETAL FORCE. (Paper, 32nd Annual Meeting of the Aerospace Medical Assoc., Palmer House, Chicago, Illinois, April 24-27, 1961)

ABSTRACT: The observations were carried out on five subjects. The task consisted of setting a luminous line in the dark: (1) before rotation, (2) when exposed to centripetal force resulting in a change in direction of force relative to the subject (angle 0 6° or 12°), and (3) after cessation of rotation. Seated upright, the estimations of the horizontal were quite accurate before and after rotation, while, during exposure to centripetal force, a correction was regularly made in accord with the change in angle 0 (oculogravic illusion). Lying on the side or with head inverted, all subjects exhibited gross inaccuracies in setting the line under static conditions, and the oculogravic illusion could not be demonstrated.

2,127

Graybiel, A., E. Guedry, W. Johnson & E. R. Kennedy 1961 ADAPTATION TO BIZARRE STIMULATION OF THE SEMICIRCULAR CANALS AS INDICATED BY THE OCULOGYRAL ILLUSION.

Aerospace Medicine 32(4):321-327, April 1961.

See also (Army Medical Research Lab., Ft. Knox, Ky.) Rept. No. 464; ASTIA AD 253 099

See also (Naval School of Aviation Medicine, Pensacola, Fla.) Research Proj. MR005.13-6001, Rept. No. 53; 27 July 1960. ASTIA AD 244 936.

ABSTRACT: Four healthy male subjects 19 to 23 years of age were exposed to tilt in a specially constructed chair mounted in a rotating room which is built around the center of a human centrifuge. Determinations of the course of the adaptation to the oculogyral illusion are reported. Also compared are the effects of their voluntary head movements. Information obtained appears to have application to anticipated problems in manned orbiting satellites and to any rotating installation where personnel will be exposed to angular velocities above 2.0 rpm.
(Author)

2,128

Graybiel, A. 1962 AEROSPACE MEDICINE AND PROJECT MERCURY.

Aerospace Medicine 33(10):1193-1198. Oct. 1962.

ABSTRACT: Broadly considered, the medical aspects of space fall into such well-known categories as Selection of the Astronaut, Indoctrination in Life Support Systems, Medical Care, and Periodic Re-evaluation. However, in Project Mercury there were unusual problems to take into account. These stemmed from the (1) small number of astronauts, (2) small payload (3) characteristics of the flight profile, (4) hostility of the environment aloft, and (5) landing on water. The problems generated by these factors centered around: (1) close interrelationships between medical and professional fitness of the astronauts, (2) need for continuous monitoring of the physiological responses and environmental conditions during flight, (3) medical logistics of "recovery", and (4) maximal exploitation of the flight for scientific purposes.

2,129

Graybiel, A & others 1962 HUMAN PERFORMANCE DURING TWO WEEKS IN A ROOM ROTATING AT THREE RPM (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. MR005.13-6001, Subtask 1, rept. no. 74, 28 Aug. 1962

2,130

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)

2,131

Graybiel, A., & W. H. Johnson 1962 A COMPARISON OF THE SYMPTOMATOLOGY EXPERIENCED BY HEALTHY PERSONS AND SUBJECTS WITH LOSS OF LABYRINTHINE FUNCTION WHEN EXPOSED TO UNUSUAL PATTERNS OF CENTRIPETAL FORCE IN A COUNTER-ROTATING ROOM. (Naval School of Aviation Medicine, Pensacola, Fla.) BuMed Project MR005.13-6001 Subtask 1, Rept. No. 70, DRML Proj. PCC-D50-93-10-71; NASA Order No. R-47, 22 June 1962

ABSTRACT: Normal subjects and deaf persons with bilateral labyrinthine defects were exposed to unusual patterns of linear acceleration in an attempt to disturb normal functional mechanisms in the brain stem. Through the use of a counter-

rotating room it was possible, at the same time, to avoid angular or Coriolis accelerations. Some of the normal but none of the labyrinthine defective subjects experienced motion sickness. The results are discussed in terms of the etiologic role of the vestibular sensory organs. (AUTHOR)

2,132

Graybiel, A., & B. Clark 1962 PERCEPTION OF THE HORIZONTAL OR VERTICAL WITH HEAD UPRIGHT, ON THE SIDE, AND INVERTED UNDER STATIC CONDITIONS AND DURING EXPOSURE TO CENTRIPETAL FORCE. Aerospace Medicine 33(2):147-155, Feb. 1962
See also (Naval School of Aviation Medicine, Pensacola, Fla.) Rept. No. 60; Proj. No. MR005.13-6001; NASA Grant No. R-1; ASTIA AD-266 066

ABSTRACT: The present experiment attempted to measure the accuracy of visual egocentric localization in widely different body (head) positions and the change in localization induced by a change in direction of the gravitational-inertial force environment. The ability of five healthy subjects to set a luminous line to the horizontal while in the dark was measured with head upright, on the side, and inverted both under static conditions and during exposure to centripetal force. In general, the findings were the same for all subjects and interindividual differences did not affect any of the major findings significantly. Under static conditions egocentric visual localization was quite accurate with head upright, inaccurate with head inverted, and grossly in error with head on the side. When the subjects were exposed to centripetal force with a change in direction of force making an angle of 6 degrees or 12 degrees, the oculogravic illusion was perceived with head erect, not exhibited with head inverted, and not measurable with head on the side. The significance of these findings is discussed, with reference to the function of the otolith apparatus and other factors. (AUTHOR)

2,133

Graybiel, A., & B. Clark 1963 MEASUREMENTS OF THE OCULOGRAVIC ILLUSION IN HEALTHY SUBJECTS AND IN PERSONS WITH BILATERAL VESTIBULAR DEFECTS WITH A NOTE ON ITS USEFULNESS AS A SPECIFIC INDICATOR OF OTOLITH FUNCTION. (Paper, 34th Annual Meeting of the Aerospace Medical Association, Statler-Hilton Hotel, Los Angeles, Calif., April 28 - May 2, 1963)

ABSTRACT: Experiments on a human centrifuge were carried out with nine normal subjects and ten bilateral labyrinthine defective deaf persons who, because their otolith function was unknown, were referred to as OFU subjects. Particular care

was taken to ensure that conditions were favorable for perception of the oculo-gravic illusion which has been defined as an apparent movement and displacement of the visual field when a person is exposed to a change in direction of the gravitational inertial force environment relative to himself. The subject's task was to observe a line of collimated light in the dark, report whether he perceived any apparent motion, and, if the line appeared to be displaced from the horizontal, to restore it to that position. Findings in the normal subjects were remarkably uniform; tables or curves based on mean values of the group were characteristic for all. In the OFU subjects inter- and introindividual variances were so great that it was difficult to combine the results; therefore, the findings had to be summarized on an individual basis. Moreover, there was evidence of learning in the OFU subjects which tended to complicate interpretation of the results. The usefulness and limitations of this test as an indicator of otolith function are pointed out.

2,134

Grayfer, G.R. & A.I. Bykhovskiy 1936 PROPHYLAXIS OF ANKLE INJURIES IN
PARACHUTE JUMPERS
Sovetskaya khirurgiya (Moscow) 7: 115-118.

2,135

Great Britain, Ministry of Supply DYNAMIC LOADS IN AIRPLANES UNDER GIVEN
IMPULSIVE LOADS WITH PARTICULAR REFERENCE TO LANDINGS AND GUST LOADS
ON A LARGE FLYING BOAT. Research memorandum 2221.

2,136

Greaves, F.C., Draeger, Brines, Shaver, & Cary 1943 AN EXPERIMENTAL
STUDY OF UNDERWATER CONCUSSION.
U.S. Nav. Med. Bull. 41:339-352, March 1943.

2,137

Greeley, P. O., H. Jorgenson, W. G. Clark, D. R. Drury & J. P. Henry. 1945
EFFECT OF ANOXIA ON G TOLERANCE.
(Nat'l. Res. Council, Div. Med. Sci., Comm. on Aviat. Med., Washington, D.C.)
CAM Rept. No. 480, 22 Oct. 1945.

2,138

Greeley, P. O. et al. 1945 EFFECT OF ANOXIA ON MAN'S TOLERANCE TO POSITIVE ACCELERATION.
(National Research Council, Committee on Aviation Med., Washington, D.C.)
CAM Rept. no. 500, 30 December 1945.

ABSTRACT: Ten centrifuge trained subjects were subjected to positive acceleration on a centrifuge which attained maximum acceleration at the rate of 3 g's per second and which maintained maximum acceleration for 15 seconds. A total of 301 runs were made. The inherent g tolerance of each subject was determined before, during, and after anoxia. Each determination was repeated in the same manner on 2 or 3 different occasions. The g tolerance was determined by recorded responses to visual and auditory signals and by changes in ear opacity (blood content of the ear). The g ranged from amgnitudes which caused no visual symptoms, to those causing blackout. Anoxia was induced by breathing a gas mixture containing 11.5% oxygen and 88.5% nitrogen until a steady state was reached of Millikan oximeter readings (ca. 15 minutes), and maintained during the centrifuge tests. All subjects were at low oxygen tensions for 30-40 minutes. Return to normal was effected by breathing room air again for ca. 15 minutes.

Although oxyhemoglobin saturation was reduced to an average of 64% (range 59-75%), as determined by oximetry and Van Slykes, there was no significant decrease in g tolerance (average 0.1 g; maximum for blackout in any one case, 0.4 g).

The results support and extend those reported by Gauer. (Fed. Proc. 5(1):35)

2,139

Green, C.D., B.E. Welch, W.L. Brown, L.E. Lamb, P.C. Tang, D.B. Gisler, et al. 1961 STUDIES OF ESCAPE FROM BALLISTIC SPACE VEHICLES. I. BIOMEDICAL EVALUATION. II. INSTRUMENTATION. (School of Aerospace Medicine, Brooks AFB, Texas) Rept. 61-29, Apr. 1961. ASTIA AD-254 065.

ABSTRACT: Biomedical information on primates successfully flown through programmed escape profiles was obtained in conjunction with the NASA project "Little Joe." Animal response during acceleration, deceleration, re-entry, and water impact demonstrated survivability. Also recorded and evaluated were: (a) environmental data (i.e., relative humidity, total gas pressure, O₂ partial pressure, and gas temperature); (b) physiologic data (i.e., respiratory rate, pulse rate, and cardiac rhythm from ECG tracings); (c) psychomotor performance data; and (d) oculomotor movement. These experiments substantiate, under actual flight conditions, physical and biologic design criteria for biopacks, physiologic sensor response, and performance criteria during all phases of the ballistic trajectory and recovery operations from an impact area. (Authors)

2,140

Green, D. M. 1943 AIRSICKNESS IN BOMBER CREWS.
J. Aviation Med. 14:366.

2,141

Green, H. D. 1943 AVIATION PHYSIOLOGY. III. ACCELERATION.
Clin. Bull. West. Res. Univ. 7:25-27, 1943.

2,142

Green, H. D. 1944 AVIATION PHYSIOLOGY WITH PARTICULAR REFERENCE TO THE
CIRCULATION.
In O. Glasser, ed., Medical Physics (Chicago: Year Book Publishers, Inc.,
1955) I, 22-26.

2,143

Green, I. D. & B. F. Burgess 1961 SOME OBSERVATIONS OF THE EFFECTS OF 100
PER CENT OXYGEN AND POSITIVE ACCELERATION ON R.A.F. AIRCREWS.
(Paper 32nd Annual Meeting, Aerospace Medical Association, 24-27 April 1961,
Chicago, Ill.)

ABSTRACT: A set of symptoms experienced by aircrew following flights during
which they have been subjected to high levels of positive acceleration whilst
breathing 100 per cent oxygen has been recognized by the Royal Air Force for
several years. The incidence of this syndrome amongst pilots is given. Radio-
graphs of the chest taken after flight and the effects of the disorder upon lung
volume are described. The significance of these effects is discussed together
with the need for further experimentation and the form that this should take.
(Aerospace Med. 32(3):232-233, March 1961)

2,144

Green, I. D. 1961 RESPONSE OF THE HUMAN RETINAL VESSELS TO POSITIVE PRESSURE
BREATHING. Aerospace Medicine 32(5):407-411, May 1961

ABSTRACT: Photographs of the human retinal vessels have been taken during posi-
tive pressure breathing at a pressure of 60 mm. Hg without counterpressure to the
eyes, and examined. Evidence is put forward to suggest that under these circum-
stances there is little likelihood of intra-ocular adequately supported by the
accompanying increase in tension of the intra-ocular fluid. (AUTHOR)

2,145

Green, I. D., & B. F. Burgess 1962 AN INVESTIGATION INTO THE MAJOR FACTORS CONTRIBUTING TO POST FLIGHT CHEST PAIN IN FIGHTER PILOTS. (RAF, Institute of Aviation Medicine, Farnborough) FPRC Rept. No. 1182, Jan. 1962
ASTIA AD-283 051

ABSTRACT: A field trial is described which investigated the part played by each of three factors (level of applied acceleration, breathing of 100% oxygen, wearing an anti-g suit) in the production of a post-flight syndrome (characterized by cough, chest pain, limitation of inspiration) experienced by fighter pilots. Chest x-rays were taken and lung volume measurements made of six pilots before and after flight in Hunter Mark 6 aircraft. The results of the test and symptoms experienced by these pilots led to the conclusion that all three factors under investigation contributed to the syndrome. The possible pathological changes that may have taken place during the flights are discussed together with the likelihood of any ill effects such changes might produce. (AUTHOR)

2,146

Green, W.D. Jr., T.B. Smith, and P. Felsenthal. 1961 PRECISION VELOCITY MEASUREMENT FOR INERTIAL GUIDANCE TESTING. (Allied Research Assoc., Inc., Boston, Mass.) ASTIA AD-266 737

ABSTRACT: Two practical solutions are advanced to the problem of measuring the velocity of the center of gravity of a rocket sled to 1 part in 10 to the 5th power over a speed range of 200 to 5,000 ft/sec. Solutions are based on a combined space-time/accelerometer system. The characteristics of the systems and the manner in which they meet the requirements are discussed and a program is outlined whereby either system may be introduced as the standard velocity measuring system for the sled test facility at the Air Force Missile Development Center. In reaching the conclusion that the combined space-time/accelerometer system is the optimum solution, other methods were investigated. Results of these studies of direct physical methods, as well as methods from which velocity may be inferred, are discussed. None of the methods examined was found to offer a satisfactory solution to the problem at hand. It is pointed out that quality of instrumentation must be paramount in developing any velocity measuring system and no amount of statistical operations with the data can compensate for data of poor quality. (Author)

2,147

Greenberg, S. 1957 UNDERWATER ESCAPE PROGRAM F9F-4 AIRPLANE LOW-LEVEL DROP TESTS, KEY WEST - August 1957
(U. S. Naval Air Development Center, Johnsville, Pa.) NADC-ED-5720.
25 Sept. 1957 ASTIA AD 408 135.

ABSTRACT: An attempt was made to investigate and critically analyze the parameters involved in pilot escape from present day fighter, attack and

trainer type aircraft during a crash at sea incident to aircraft carrier operation. This report covers the basic research data pertinent to pilot underwater egress obtained during August 1957, by crashing 3 navy service F9F-4 aircraft into approximately 22 fathoms of water off the shores of Key West, Florida. A sinking rate of 7.5 feet per second is the maximum attained in this series of tests. The plastic canopy bubble on this particular aircraft would not withstand differential pressures in excess of 16 psi.

2,148

Greenberg, S. H. 1958 UNDERWATER ESCAPE PROGRAM. DESCRIPTION OF F86D-11 AIRPLANE 50-FOOT DROP TEST, KEY WEST, FLORIDA - 25 MARCH 1958.
(Naval Air Development Ctr., Johnsville, Pa.) NADC-ED-5816; Interim Rept. No. 3; 25 Aug. 1958. ASTIA AD 231 439.

ABSTRACT: The results of a 50-foot free-fall drop test of an F86D-11 airplane striking the water in a flat attitude from the YD-203 yard derrick at the U. S. Naval Air Station, Key West, Florida, on 25 March 1958, have been compiled and presented in this report. Physiological effects of impact accelerations and underwater canopy implosion on an anthropometric dummy and shock damage to the airframe are discussed. As would be expected, damage caused by the implosion was localized at the pilot and pilot seat. Seat-to-head forces were in excess of the threshold values for vertebral damage. Additional tests are recommended.

The aircraft exhibited the characteristic return-to-surface-after-impact behavior and verified a basic assumption underlying previous tests (i.e., that sink rate is substantially independent of initial impact velocity).

2,149

Greenburg, Sidney H. 1958
UNDERWATER ESCAPE PROGRAM. DESCRIPTION OF F86D-11 AIRPLANE 50-FOOT
DROP TEST KEY WEST, FLORIDA
(Naval Air Development Center, Johnsville, Pa.)
Rept. no. NADC-ED-5816 March ASTIA AD 231 439

ABSTRACT: Tests were performed to determine (1) the effect of high-velocity vertical entry on the sinking time of aircraft in water; (2) the structural damage sustained by the aircraft on impact; and (3) the physiological shock the pilot suffers when subjected to water collisions of this nature. Damage resulting from implosion of the canopy due to dept pressure and the accompanying physiological implications are also discussed. Shock loadings sustained by the anthropometric dummy in the F86D011 aircraft reached a peak acceleration of 62g, with values well above 25g for 30 msec. This shock loading was greater than that sustained by any other part of the airframe when the complete system was subjected to the 50-foot fall. The acceleration was a rate of onset of approximately 6000 g/sec which, at the g loading and duration of sustained shock,

represents values well above the threshold of vertebral damage, signifying a high expectancy for extensive spinal injury. The opening in the canopy resulting from the implosion appeared to be large enough to permit egress of the pilot and his equipment from the cockpit. Only 19 sec were required from entry to submersion. The increase in the rate of submergence in the latter test must have been contributed by the higher entry velocity, accompanied by greater water penetration of aircraft, and by extensive impact damage which destroyed watertightness and buoyancy of the airframe. (See also AD-231 389) (ASTIA)

2,150

Greenewald, R.E., R.J. Taylor and J. Lew 1949 EFFECTS OF AIRPLANE
DESIGN ON ACCELERATIONS EXPERIENCED IN SUPERSONIC FLIGHT.
(Cornell Aeronautical Laboratory, Inc., Buffalo, New York)
Report No. BC-531-S-11, ASTIA ATI-90379

ABSTRACT: Accelerations and decelerations resulting from flight maneuvers, atmospheric disturbances and power failures during supersonic flight are presented as individual problems. General solutions of some problems have been combined with the human tolerance to acceleration and show the limit of conditions resulting from the participation of a pilot or crew in such conditions

2,151

Greenfield, A. D. M. 1945 EFFECT OF ACCELERATION ON CATS, WITH AND WITHOUT
WATER IMMERSION.

ABSTRACT: Forty cats, anaesthetized with chloralose, were centrifuged to produce accelerations up to 20 G in the head-tail axis measured at the heart. Continuous records of acceleration and of arterial, right auricular and intrapleural pressures were obtained. Without water immersion, arterial pressure showed an abrupt fall with onset of acceleration, reached zero at the head level at 3-4 G, and remained approximately constant during 1 min. runs. Right auricular pressures fell, but this was partly offset by the fall in intrapleural pressure. Following the run, the auricular pressure returned to its resting value, but the arterial pressure rose for 1-3 min. to a height greatly exceeding the resting value. Immersion in water at body temperature to levels lower than 4 cm. below the cardiac apex made little difference to the response, but with the water level at the cardiac apex it required an acceleration of about 10 G to reduce the arterial pressure to zero at the head. After the first 10 sec. of the run, arterial pressure showed an increase of 60-80 mm. Hg, which was abolished by carotid sinus denervation. When this compensation had occurred, it required 15-20 G to reduce arterial pressure to zero at the head, corresponding to a pressure of about 300

mm. Hg at the heart. The right auricular pressure showed only a slight rise during the run. Following the run the arterial pressure rose above the resting value for 1-3 min. by an amount proportional to the compensation occurring during the run. This rise was also abolished by carotid sinus denervation. Raising the water level above the cardiac apex gave only slight further improvement of the arterial pressure response, but the right auricular pressure showed a greater rise during the run. Respiration was slowed and became shallow with occasional gasps in the non-immersed animals, but was well maintained in the water-immersed animals up to 16 G. Following exposure to 15-20 G with water immersion for several half-minute runs, death frequently occurred, and subendocardial haemorrhages were observed in the left ventricle. (J. of Physiology 104:5P-6P, 10 Feb. 1945)

2,152

Greenhouse, S. C., & B. Reznick 1961 CALIBRATION OF ACCELEROMETER SYSTEMS
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. 595-603

CONCLUSIONS: It is our opinion that not enough emphasis has been placed upon system calibrations, as contrasted with calibrations which combine the individual errors of the major units that comprise the system. In trying to improve his instrumentation, one of course should carefully examine all its elements until he is convinced that the individual units are satisfactory for his real needs. Then it is our contention that his attention should be focused on the use of rather rapid but sufficiently accurate system calibrations, such as have been described in this article. (AUTHOR)

2,153

Greening, C. P. 1961 CORIOLIS EFFECTS ON OPERATOR MOVEMENTS IN ROTATING VEHICLES.

ABSTRACT: Rotation of manned space vehicles has frequently been considered as a means of providing artificially some of the characteristics of a gravity field. The relatively high rates of rotation anticipated in moderate-sized vehicles will bring into prominence a class of phenomena known as Coriolis effects. In this paper, the magnitude and direction of the forces on the human body associated with Coriolis effects are studied analytically as a function of vehicle spin rates, bodily movement rates and the orientation of vehicle work areas. Relationships among the pertinent variables are expressed parametrically, and also discussed qualitatively. Some implications for work station arrangement are discussed. (Aerospace Medicine 32(3):233, March 1961)

2,154

Greening, C.P. 1961 CORIOLIS EFFECTS ON OPERATOR MOVEMENTS IN ROTATING VEHICLE
(Paper presented at 32nd annual meeting, Aerospace Medical Association,
24-27 April 1961, Chicago, Ill.)

ABSTRACT: In this paper, the magnitude and direction of the forces on the human body associated with coriolis effects are studied analytically as a function of vehicle spin rates, bodily movement rates and the orientation of vehicle work areas. Relationships among the pertinent variables are expressed parametrically, and also discussed qualitatively. Some implications for work station arrangement are discussed. (Aerospace Med., 33(5):579-582, May 1962)

2,155

Gregg, Lee W., Richard G. Pearson, and Alfred C. Barnes, Jr. 1961
PREDICTION OF DEGREE OF INJURY FROM IMPACT AND DAMAGE VARIABLES
IN LIGHTPLANE ACCIDENTS
(Aviation Crash Injury Research, Phoenix, Ariz.)
Rept. no AvCIR 61-1; TREC Tech. rept. no. 61-94 August
ASTIA AD 265 091L

ABSTRACT: Accident severity in lightplane accidents can be described by means of impact variables such as impact velocity and angle of impact, or by ratings of the resultant damage to the aircraft. Both kinds of factors may be useful predictors of degree of injury sustained by the occupant. An analysis of 913 accidents was undertaken to determine the extent to which individual, gross accident variables predict severity of injury as measured by the AvCIR Injury Scale and by the proportion of fatalities. Damage severity ratings, especially AvCIR's composite Accident Severity rating, predicted degree of injury more effectively than did the primary impact variables. A composite impact severity measure derived from the primary impact variables improved prediction but still not to the level of the damage ratings. The need for an adequate description of the circumstances surrounding an accident event in terms of the physical impact conditions is emphasized by these findings. Both injuries and damage to the aircraft are effects of an accident. What is required is a more accurate specification of their causal determinants.
(AUTHOR)

2,156

Gregg, L. W. & R. G. Pearson 1961 FACTORIAL STRUCTURE OF IMPACT AND
DAMAGE VARIABLES IN LIGHTPLANE ACCIDENTS.
Hum. Factors 3(4):237-244, Dec. 1961

ABSTRACT: This paper presents "a rational analysis of the relationships among a number of variables associated with lightplane accidents together

with an empirical evaluation of the adequacy of the logical structure for describing such accidents." Some of these variables are: impact condition--velocity, angle, attitude, terrain; injury to occupant--degree and location; damage to occupant's structural environment; damage to cockpit and cabin; damage to other structures. A factor analysis is performed on the data from 154 accidents. Four factors which describe the conditions at impact are found; the relationship between injury to occupant and proximity of structural damage is demonstrated; the relationship among damage variables is compared to that between damage and impact variables. (Tufts)

2,157

Gregg, Lee W., and Richard G. Pearson 1961
FACTOR ANALYSIS OF LIGHTPLANE ACCIDENT IMPACT AND DAMAGE VARIABLES
(Aviation Crash Injury Research, Phoenix, Ariz.)
Rept no. AvCIR 61-6 TREC TR 61-122 August
ASTIA AD 266 410L

ABSTRACT: A conceptual framework through which accident variables are defined and certain cause-and-effect relationships are established is confirmed through application of the technique of factor analysis to a set of lightplane accident data. Relationships between aircraft structural damage and injury to the occupant were seen to increase as a function of proximity. Individual measures of the consequences of impact were found to intercorrelate higher than the implied cause-effect relations from impact to damage. (AUTHOR)

2,158

Greig, D.D.A. 1940 REPORT ON PRACTICAL FLYING TESTS CARRIED OUT WITH "SPECIAL FLYING SUIT" (DESIGNED BY DR. FRANKS) BETWEEN JUNE 1st AND JUNE 5th, 1940. SPITFIRE L.1090.
(National Research Council, Canada) Rept. No. C-2830, 8 June 1940.

ABSTRACT: Flight tests were carried out with the special flying suits designed by Dr. Franks in a Spitfire. A pilot who normally "blackout" between 3 to 5 G's was able to make manoeuvres going up to over 8 G without feeling any effect of the "blackout". It is felt that the principle involving the design of the suit is sound but in its present form it is not a practical proposition. The results obtained were of such a convincing nature however, that further development is strongly recommended.

2,159

Greiner, T. 1956 THE EFFECT OF A VASOCONSTRICTOR, METARAMINOL, ON HUMAN TOLERANCE TO ACCELERATION. (Wright Air Development Center, Air Research and Development Command, Wright-Patterson AFB, Ohio) WADC TR 56-575. Nov. 1956. ASTIA AD 110545.

ABSTRACT: Recent manipulation of various factors in human acceleration uncovered an unexpectedly large improvement in tolerance, the reflex circulatory adjustment that develops when acceleration is gradually induced. If a similar reflex pattern is activated by a drug, some of the improved tolerance might be available to the quickly entered acceleration of combat flying. In the largest practical doses, metaraminol increased g-tolerance an average of 0.7 g-unit, only one-third of the advantage conferred by full mobilization of the reflexes with slow onset acceleration, and far less than that provided by the standard g-suit in rapid onset acceleration.

2,160

Greiner, T. June 1956 THE EFFECT OF A VASOCONSTRICTIVE AGENT, METARAMINOL, ON HUMAN TOLERANCE TO ACCELERATION. J. Pharmacol. Exp. Ther. 117 (2):228-231 See also WADC TR 56-575, Nov. 1956, ASTIA AD 110 545

ABSTRACT: Recent manipulation of various factors in human acceleration uncovered an unexpectedly large improvement in tolerance, the reflex circulatory adjustment that develops when acceleration is gradually induced. If a similar reflex pattern is activated by a drug, some of the improved tolerance might be available to the quickly entered acceleration of combat flying. In the largest practical doses, metaraminol increased g-tolerance an average of 0.7 g unit, only 1/3 of the advantage conferred by full mobilization of the reflexes with slow onset acceleration, and for less than that provided by the standard g-suit in rapid onset acceleration. (DACO)

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Gresser, A. 1959 THE AIRPLANE DISASTER OF 6 FEBRUARY 1958 AT MUNICH-RIEM. SURGICAL REPORT. Muenchen Med Wschr 101:1569-71; contd., 11 Sept. 1959

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Gresser, A. 1959 THE AIRPLANE DISASTER OF 6 FEBRUARY 1958 AT MUNICH-RIEM. SURGICAL REPORT. Muenchen Med Wschr 101:1606-9; concl., 18 Sept 1959

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Gressitt, T.J. 1962 SLOW-ROTATION, A HUMAN ENGINEERING PROBLEM IN THE NIKE-ZEUS GUIDED MISSILE SYSTEM. (Institute of Environmental Sciences, Mt Prospect, Ill.) Reprint 62-385

ABSTRACT: The NIKE-ZEUS Guided Missile system, now in an advanced state of development for the Department of the Army, was designed and developed by Bell Telephone Laboratories under a Western Electric Company prime contract from the Army Ordnance Missile Command.

The design of equipment for enhanced service ability and to promote personnel comfort and safety in rotating environments was aided by the application of principles evolved through the study of human factors. Consultation with other agencies, experimentation in the test chamber, and operational experience at both White Sands and Kwajalein have contributed to mitigation of a difficult environmental problem.

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Grether, W. F. 1947 ACCELERATION (G)
In "Survey of Display Problems in the Design of Aviation Equipment,"
In P. M. Fitts, ed., Psychological Research on Equipment Design (Air Materiel Command, Wright-Patterson AFB, Ohio) Rept. No. 19; ATI-125 983, p. 31

ABSTRACT: As the accelerative or G forces encountered in maneuvering aircraft are increased, resulting in disturbance of the normal distribution of blood to the brain and other parts of the body, there is known to be first a narrowing of the visual field, then complete loss of vision, then loss of hearing, and finally loss of consciousness. Effects are somewhat different for positive G (head to foot) and for negative G (foot to head). Human tolerance to G can be increased somewhat by the G suit and by voluntary muscular contractions, both of which resist the flow of blood away from the upper part of the body. It is not known what, if any, losses occur in sensory and interpretive processes at G levels below those necessary to produce narrowing of the visual field. Research is needed to show whether or not such losses occur and whether there is a selective effect on different perceptual processes, so that equipment or tactics can be modified if necessary. Results also may have important implications for an understanding of cerebral functions. (AUTHOR)

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Grether, W. F. 1963 HUMAN PERFORMANCE CAPABILITIES FOR MILITARY OPERATIONS IN SPACE. (Paper, Lectures in Aerospace Medicine, School of Aviation Medicine, Brooks AFB, Texas, 4-8 February 1963)

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Griffin, D. R. 1953 SENSORY PHYSIOLOGY AND THE ORIENTATION OF ANIMALS
Amer. Sci. 41:209-244

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Griffith, C. R. 1920 THE ORGANIC EFFECTS OF REPEATED BODILY ROTATION.
J. Exp. Psychol. 3(1):15-47.

ABSTRACT: As truning is repeated from day to day, the duration of the after-nystagmus, the number of ocular movements made, and the duration of the apparent movement rapidly decrease. The major part of this decrease occurs within the first few days. The decrease takes place not only from day to day but also within a period of ten trials on any single day. The amplitude of the ocular movements and the number of movements made per second also decrease as repetitions increase. Furthermore, certain other organic effects, especially those known as past-pointing, decrease in the same manner. The time of nystagmus changes with the speed of rotation and with the number of revolutions and that it is increased when the chair is abruptly halted. As to other conditions under which nystagmus wavier in degree and amount, the following factors must be considered: (a) the time of day during which rotation is carried on; (b) the amount and number of rest-intervals between turnings and between series; and (c) the general organic state of the subject. Finally, nystagmus may be modified indirectly by 'transfer.' In general, investigators found the organic effects of rotation to be highly variable in their appearance and, moreover, so amenable to practice that they may entirely disappear within a relatively short time, provided rotation is repeated from day to day.

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Griffith, C. R. 1924 A NOTE ON THE PERSISTENCE OF THE "PRACTICE EFFECT" IN ROTATION EXPERIMENTS.
J. Comp. Psychol., 4:137-150, April 1924.

ABSTRACT: Previous studies have established the fact that after-nystagmus or post-rotation nystagmus decreases rapidly in duration and in the amount of movement under repeated turnings. From this study the following inferences seem justified:

1. The "practice effect" persists for fairly long periods of time. Although the effect may not be apparent in a single truning after a long interval, nevertheless, the time taken to reduce post-rotation nystagmus in a second series is notably shorter than the time taken in the original practice series.
2. When all the conditions of rotation are kept constant—save for the number of turnings—the practice effect is found to modify the mental and bodily results of rotation in the same relative way regardless of the number of turnings.
3. Curves built upon data from repeated turning bear a striking resemblance to the traditional learning curve. At any rate the "practice effect" does not seem to be a simple matter of fatigue or of adaptation.

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Griffith, R., W. Nordberg, & W.G. Stroud 1956 THE ENVIRONMENT OF AN
EARTH SATELLITE. (U.S. Army, Signal Corps Engineering Labs.,
Fort Monmouth, N.J.) SC Project 172A, DA Project 3 99 07 023,
Tech. Memo. NR M 1747, March 1956. Rev., Nov. 1956.

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

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Grigor'ev, Iu. G. 1961 ON THE PROBLEM OF THE CHARACTER OF THE DEVELOPMENT
OF VEGETATIVE REACTIONS IN SUBJECTS WITH THE USE OF ANGULAR ACCELERATIONS
OF VARIOUS RATES.
In Vestn. Otorinolaring 23:76-81, Nov.-Dec. 1961 (Russian)

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Grimm, J.R. 1959 ENVIRONMENTAL TEST FACILITIES AT WRIGHT AIR DEVELOPMENT
CENTER (Aeronautical Accessories Lab., Wright Air Development Center,
Wright-Patterson Air Force Base, Ohio) WADC TN 59-369, ASTIA AD-232 476.

ABSTRACT: Environmental test facilities operated at the Wright Air Development Center are listed and pertinent information about the facilities, including the specimen load capacity, test conditions, manufacturer, responsible laboratory, location. Facilities are grouped in accordance with test requirements set forth in MIL-E-5272. Test conditions include high temperature, low temperature, high-low temperature, humidity, altitude, temperature-altitude, salt spray, fungus, sunshine, sand and dust, explosive atmosphere, vibration, acceleration, shock, and several miscellaneous environmental conditions. (Author)

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Grinsted, A. D. & R. K. Ambler 1951 A STUDY OF THE DIURNAL DISTRIBUTION
OF AIRCRAFT ACCIDENTS IN NAVAL AIR TRAINING
(USN Sch. Av. Med, Pensacola, Fla.)
Res. Rept. No. NM 001 059.20.01, 15 April 1951

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Grinsted, A.H., Jr. 1962 EVALUATION OF ACCELERATION ENVIRONMENT OF B-52/
GAM-77 WEAPON SYSTEM IN HIGH-SPEED, LOW-LEVEL CAPTIVE FLIGHT (PROJECT
ROUGH RIDE) (U). (Air Force Proving Ground Command, Eglin AFB) Rept.
No. APGC TDR 62-18; ASTIA AD 328 857.

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

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

2,175

Griswold, R. L., & I. Gray 1956 CONDITIONING OF RATS TO TUMBLING TRAUMA BY
ELECTROCONVULSIVE SHOCK (Walter Reed Army Institute of Research, Washington,
D. C.) WRAIR 182-56; ASTIA AD-125 925.

ABSTRACT: Rats have been made relatively resistant to the lethal effects of tumbling trauma by a previous series of electroconvulsive shocks (ECS). ECS causes an immediate marked rise in the plasma concentrations of adrenaline and noradrenaline, as a result of the electrical stimulation of the sympathetic nervous system. The plasma concentrations of adrenaline and noradrenaline, which are elevated in response to trauma, show a more rapid fall after termination of trauma in the ECS-conditioned animals than in the controls. There is no significant alteration in the sensitivity of ECS-conditioned rats to toxic doses of adrenaline and noradrenaline. (AUTHOR)

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Groat, R. A., H. W. Magoun, F. L. Dey and W. F. Windle 1944 FUNCTIONAL ALTERATIONS IN MOTOR AND SUPRANUCLEAR MECHANISMS IN EXPERIMENTAL CONCUSSION. Am. J. Physiol. 141:117.

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Grodsky, M.A., and G.W. Levy 1963 HUMAN FACTORS IN SPACE FLIGHT. (New Jersey: Prentice-Hall, Inc.) In preparation, Spring, 1963.

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Groen, J. J., & L. B. W. Jongkees 1948 TURNING TEST WITH SMALL REGULABLE STIMULI IV. THE CUPULOGram OBTAINED BY SUBJECTIVE ANGLE ESTIMATION. J. Laryng. and Otol. 62:236-240

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Groen, J. J. 1956 THE SEMICIRCULAR CANAL SYSTEM OF THE ORGANS OF EQUILIBRIUM II. Phys. in Med. and Biol. 1(2):103-117.

ABSTRACT: The vertebrates, fishes, reptiles, amphibians, birds and mammals have all the same fundamental construction of their organs of equilibrium, although there are as many differences in final shape as there are species. Notwithstanding these differences it can be stated that the common base of the organs is always recognizable. This paper contains a detailed description of the semi-circular canal system of the organs of equilibrium. The author describes the function of the otolith, because, being the oldest vestibular sensory element it has some of the fundamental properties found in the semicircular canals. In the case of the semi-circular canals, the threshold of the of the peripheral organ is determined with a rotating chair. The smallest impulse moment, expressed as the just perceptible sudden change of an angular velocity, lies between 1 and 3°/sec., depending on the sensitivity of the test subject. The threshold for an angular acceleration is of the order of 0-2/sec². In the macula neglecta, only change of acceleration will provoke action potentials. It is an organ which is extremely sensitive to vibration. The saccule macula and the utricle macula show a similar behavior. It appears that the border areas of the macula contain these change-receptors, whereas the central region has more acceleration-sensitive receptors.

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Groen, J. J. 1957 THE SEMICIRCULAR CANAL SYSTEM OF THE ORGANS OF EQUILIBRIUM.
II.
Physics in Med. and Biol. (London) 1(3):225-242.

ABSTRACT. The function of the semicircular canal system is considered on the mechanical basis of the heavily damped torsion pendulum. It appears that this point of view has a first approximation validity. The deviations in the responses of the predicted mechanical behaviour point mainly to an inhibition of central origin. The so-called 'normal test subject' tends to suppress the signals passing the stations between labyrinth and brain in a progressive manner: nystagmus is less distorted than sensation. A comparison between these two responses may yield information on the (dis)function of the vestibular tract.
(Author)

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Grollman, A. 1928 THE EFFECT OF VARIATION IN POSTURE ON THE OUTPUT OF THE
HUMAN HEART. Amer. J. Physiol. 86:285-301

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Gross, A.G., A.Z. Klain and C.F. Lombard 1949 A NEW CONDUCTIVITY-
TYPE PRESSURE TRANSDUCER. (University of Southern Calif., School of
Medicine, Los Angeles) Contract N6ori77, Task 1, 31 March 1951

ABSTRACT: In an attempt to find a suitable technique for the measurement of pressures in brain concussion research, the technique reported by Gurdjian and Lissner based on the electrical conductivity of an electrolyte as a function of pressure was investigated.

The path of this investigation is traced showing the technique used and the findings upon which the conclusions are based.

It was found that a pressure transducer operating on the conductivity pressure principle would be too insensitive for practical use. It was deduced that the high sensitivities obtained by Gurdjian and Lissner were of an accidental nature.

A new type pressure transducer based on the compression and expansion of a very small bubble of gas in an electrolyte is presented and an evaluation given.

It was concluded that although this new type transducer might have definite application in certain fields of research it has definite limitations precluding its use for the measurement of impact phenomena.

2,183

Gross, A. G., A. Z. Klain and C. F. Lombard

1949 A NEW CONDUCTIVITY-

TYPE PRESSURE TRANSDUCER

(Office of Naval Research, Washington, D. C.)

December 1949

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SUMMARY: In an attempt to find a suitable technique for the measurement of pressures in brain concussion research, the technique reported by Gurdjian and Lissner based on the electrical conductivity of an electrolyte as a function of pressure was investigated.

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A new type pressure transducer based on the compression and expansion of a

2,184

Gross, Arthur G. 1958 A NEW THEORY ON THE DYNAMICS OF BRAIN CONCUSSION AND BRAIN INJURY

Journal of Neurosurg. 15(5): 548-561 Sept. 1958

ABSTRACT: The basic purpose of this research effort has been to investigate the dynamics of the head and its contents when subject to impact. The actual experimentation involved was limited to the study of the dynamics of fluid-filled glass flasks simulating the human head. Although the medical literature on brain concussion was carefully reviewed for guidance of this study, the actual research was of an engineering nature, conducted by engineering personnel.

If it can be established that concussion of the brain is produced by, or occurs simultaneously with, cavitation, it then may be possible to obtain considerable information on the threshold of concussion from research on impact on human cadavers.

very small bubble of gas in an electrolyte is presented and an evaluation given.

It was concluded that although this new type transducer might have definite application in certain fields of research it has definite limitations procluding its use for the measurement of impact phenomena.

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Gross, A. G. 1958 IMPACT THRESHOLDS OF BRAIN CONCUSSION
J. of Aviation Medicine 29(10):725-732, October 1958

ABSTRACT: An analysis was made of the resonance-cavitation theory of brain concussion, evaluating the various physical factors that relate to the impact thresholds of brain concussion. A formula for computing the impact threshold for countercoup cavitation was developed. Use of this formula requires the obtaining of "K" factors by impact research on human cadavers. Instrumentation techniques were developed for use in obtaining threshold acceleration cavitation data on human cadavers. Impact experiments were conducted on glass simulated skulls to demonstrate the technique of determining "K" factors.

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Grow, M.C. 1935 RESEARCH IN AVIATION MEDICINE.
Army med. Bull., (32):48-53

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Grow, M.C. & H.G. Armstrong 1941 FIT TO FLY: A MEDICAL HANDBOOK FOR FLYERS.
(New York: D. Appleton Century Co., Inc., 1941)

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Grow, M.C. 1947 FUTURE RESEARCH IN AVIATION MEDICINE
The Military Surgeon 100(3):205-207, Mar. 1947.

ABSTRACT: The basic object in research in aviation medicine is to keep pace with aircraft design and, where possible, to stay out in front. However, there are urgent problems of human physiology which must be solved if powerful new aircraft are to be manned. A few specific problems posed by jet and rocket aircraft is acceleration, deceleration and escape for the pilots.

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Grubin, C & P. Lieber 1954 FURTHER CONSIDERATIONS ON THE THEORY OF THE ACCELERATION DAMPER (Rensselaer Polytechnic Inst., Troy, N.Y.) Rept no. TR AE54021; Contract Nonr-59101; 1 June 1954; ASTIA AD-37 289

ABSTRACT: The 2 steady state solutions previously developed (RPI Aeronautical Laboratory Report No. 1, March 15, 1952) are examined for stability, and only one is found to be correct. A steady state analysis is developed for a damper attached to a 2 degree of freedom system, one of the degrees of freedom being subjected to a simple harmonic force. Numerical results obtained from this work are unsatisfactory and indicate an error in the theory.

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Grumet, W.H. 1960 HORIZONTAL SHOCK APPARATUS
1960 Proceedings of the Institute of Environmental Sciences
(Mt. Prospect, Ill. Inst. of Environmental Sciences, 1960) pp. 447-454.

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Gualtierotti, T. & D. Passerini 1958 SOGLIA CEREBELLARE ALLE ACCELERAZIONI
ROTATORIE E SOMMAZIONE TEMPORALE NEL PICCIONE VIAGGIATORE (The Cerebellar
Threshold of Rotatory Accelerations and Time Circulation in the Passenger
Pigeon)
Accad. Nazl. Lincei (Rome) Ser. 8, 25(1-2):115-118, July-Aug. 1958.
See Also (U.S. Air Force, Office of Scientific Research) Contr. AF 61(052)-
23, Rept. no. TN 59-378.

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Gualtierotti, T., & D. Passerini 1958 RISPOSTE ROTATORIE E POSTROTATORIE
CEREBELLARI E NISTAGMO NUCALE DEL PICCIONE (ROTATORY AND POST-ROTATORY
CEREBELLAR RESPONSES AND NUCHAL NYSTAGMUS OF THE PIGEON) Accad. Nazl.
Lincei (Rome) Ser. 8, 25(3-4):219-233, Sept. Oct. 1958
See also (U. S. Air Force, Office of Scientific Research) Contr. AF 61(052)-
23, Rept. no. TN 59-377

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Gualtierotti, T., B. Schreiber, D. Mainardi & D. Passerini 1959 EFFECT
OF ACCELERATION ON CEREBELLAR POTENTIALS IN BIRDS AND ITS RELATION TO
SENSE OF DIRECTION. Amer. J. Physiol. 197(2):469-474

ABSTRACT: Rotatory and postrotatory cerebellar responses of homing and domestic pigeons and of migratory and sedentary doves have been studied by means of a centrifuge, the speed and plane of rotation of which could be changed at will. No appreciable differences have been found in the rotatory cerebellar responses in all the animals tested. Spindle-like post-rotatory discharges, however, are a peculiar response of nearly all the homing pigeons and all the migratory doves tested; only 6-8% of the domestic pigeons and no sedentary doves showed similar afterdischarges. Of the hybrids, nearly half had the same postrotatory electrical activity in the cerebellum. The threshold value of centripetal acceleration to produce postrotatory discharges in homing and migratory birds has been found to be 0.0004-0.005 g. Postrotatory responses show temporal summation; repetitive stimuli give more numerous and more ample afterdischarges. Nystagmus or, in general, contraction of the neck muscles, does not influence directly the cerebellar afterdischarges. The latter are present in curarized animals, which show no nystagmus and in domestic pigeons, nystagmus is not

accompanied by cerebellar afterdischarges. When coincident in time, however, nystagmus and cerebellar afterdischarges show at times a tendency to synchronization, through physiological factors, which are discussed. The threshold for afterdischarges has been found to be 1000 times higher than changes in possible geodetic forces involved in orientation. This seems to rule out the Ising hypothesis that geodetic forces may be responsible for direction in migration that, notwithstanding the existence of kinesthetic centers of higher sensitivity, is postulated in migratory animals.

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Gualtierotti, T., B. Schreiber, D. Mainardi, & D. Passerini 1959 EFFECT OF ACCELERATION ON CEREBELLAR POTENTIALS IN BIRDS AND ITS RELATION TO THE SENSE OF DIRECTIONS. (Paper, 28th Annual Meeting of the Aerospace Medical Assoc., Denver, Colorado) Amer. J. Physiol. 197(2):469-474, Aug. 1959
See also Schreiber, B., T. Gualtierotti, D. Mainardi, & D. Passerini, (Milan University, Italy) Technical Note 1 June 1956 - 31 May 1957; Rept. No. 1 AFOSR TN-57-519; Contract AF 61(514)968; ASTIA AD-136 601

ABSTRACT: Rotatory and postrotatory cerebellar responses of homing and domestic pigeons and of migratory and sedentary doves have been studied by means of a centrifuge, the speed and plane of rotation of which could be changed at will. No appreciable differences have been found in the rotatory cerebellar responses in all the animals tested. Spindle-like postrotatory discharges, however, are a peculiar response of nearly all the homing pigeons and all the migratory doves tested; only 6 to 8 per cent of the domestic pigeons and no sedentary doves showed similar after-discharges. Of the hybrids, nearly half had the same postrotatory electrical activity in the cerebellum. The threshold value of centripetal acceleration to produce postrotatory discharges in homing and migratory birds has been found to be 0.004-0.005 G. Postrotatory responses show temporal summation; repetitive stimuli give more numerous and more ample after-discharges. Nystagmus or, in general, contraction of the neck muscles, does not influence directly the cerebellar after-discharges. The latter are present in curarized animals, which show no nystagmus and, in domestic pigeons, nystagmus is not accompanied by cerebellar after-discharges. When coincident in time, however, nystagmus and cerebellar after-discharges show at times a tendency to synchronization, through physiologic factors, which are discussed. The threshold for after-discharges has been found to be 1000 times higher than changes in possible geodetic forces involved in orientation. This seems to rule out the Ising hypothesis that geodetic forces may be responsible for direction in migration that, notwithstanding the existence of kinesthetic centers of higher sensitivity, is postulated in migratory animals. (Author)

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Guedry, F. E. 1949 THE EFFECT OF VISUAL STIMULATION ON THE DURATION OF POST-ROTATIONAL APPARENT MOTION EFFECTS. (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. NM 001 110 500.8., 15 Nov. 1949

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Guedry, F.E., Jr. 1950 THE EFFECT OF VISUAL STIMULATION ON THE DURATION OF POST-ROTATIONAL APPARENT MOTION EFFECTS J. Gen. Psychol. 43:313-322

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Guedry, F. E. 1950 AGE AS A VARIABLE IN POST-ROTATIONAL PHENOMENA.
In: U.S. Office of Naval Research, A Symposium: Psychophysiological Factors in Spatial Orientation (Washington, D. C.: 1950), pp. 67-69.

ABSTRACT: In previous studies of post-rotational experiential phenomena (1, 3), it was found that the mean duration of the first post-rotational apparent-motion effect was of the order of 20 seconds on the initial rotation. The subjects used in these studies were between 19 and 24 years of age. In subsequent experiments involving conditions similar to the previous studies, a few older subjects were employed as preliminary observers because of their immediate availability. It was noted that these subjects reported illusions of longer duration than the younger subjects in the previous studies.

The present report is concerned with an investigation of the possibility that the difference noted above may be attributable either to change or to slight differences in experimental conditions.

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Guedry, F. E. 1950 AGE AS A VARIABLE IN POST ROTATIONAL PHENOMENA
(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. NM 001 110 500.
19., 1 Nov. 1950

ABSTRACT: Twenty-four subjects (mean age 38, range: 30-53 years) tended to exhibit longer durations of the post-rotational apparent-motion phenomenon than 24 subjects (ages 19 to 21 yrs.) under identical experimental conditions. Each man was rotated twice in a Link trainer at 20 r.p.m. for 60 sec. Attached to the nose of the plane was a black, perforated box illuminated from within, the box being the only visible object in the room. After rotation, the subjects indicated the cessation of the apparent movement of the box to indicate the duration of the phenomenon. Several suggestions for the results are given: (1) older subjects are more cautious to report actual or apparent responses; (2) older subjects may not habituate to rotation as readily (habituation occurs when the vestibular system becomes subordinate to a central process); (3) there were probably more subjects with poor oculomotor control or poor vision among the older men; and (4) the condition of the semicircular canals may change with age.

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Gubernale, A 1952 RELAZIONE SU UN VOLO A REASIONE (Account of a Jet Flight)
Rivista di Medicina Aeronautica (Roma), 15(4):521-526.

ABSTRACT: Observations and experiences of the author aboard a jet propelled aircraft, F-80, are analyzed. The pressurization of the cockpit (automatically controlled) went into effect at 10,000 ft. and remained unchanged up to 18,000 ft. From this altitude on, the pressure differential was maintained at 2.75 pounds per square inch. During the first part of the flight, up to an altitude of 26,000 ft., no disturbing symptoms were experienced and respiration and pulse were normal. In the second part of the flight, however, acrobatic maneuvers were carried out at an altitude of 13,000 ft. The effects of positive acceleration were a sensation of being nailed to the seat, heaviness of the extremities, and stiffness of the muscles. When 4 g was reached, it felt as if all the organs would be pulled downwards and it was difficult to breathe.

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Guedry, F. E., J. T. Ray & J. I. Niven 1952 THE INFLUENCE OF VISUAL ORIENTATION ON APPARENT BODILY ROTATION FOLLOWING ACTUAL ROTATION.
(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. NM 001 110 500.23
Jan. 14, 1952. ASTIA TIP U21937

ABSTRACT: Three subjects were each rotated in the horizontal plane in a modified Link Trainer for 1-minute periods in alternating illuminated and dark surroundings. The time for acceleration to 20 r.p.m. was 15 seconds; for deceleration, 0.5 seconds. The subjects reported the end of the first postrotational effect and the beginning of the second by pressing a key which flashed a light in the control room. The duration of the first effect was always less under conditions of illumination. The results do not support the concept that postrotational perception of apparent body rotation results from tracking of images over the retina. (TIP abstract)

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Guedry, F. E. 1952 RELIABILITY OF RESULTS PREVIOUSLY REPORTED: THE INFLUENCE OF VISUAL STIMULATION ON HABITUATION TO ROTATION.
(U.S.N. School of Avia. Med. Research, Pensacola, Fla.) Research Rept.
NM 001 110 500.25, June 15, 1952. ASTIA ATI 159 830.

ABSTRACT: The major conditions of an investigation by Brown and Guedry (J. General Psychol. 45:151-161, 1951) were repeated. A Link trainer, rotating about its vertical axis for 60 sec. at 20 r.p.m., was the principal item of apparatus. It carried a black box, faintly illuminated, fastened 2 ft. from the subject's head. The 24 subjects were divided into 2 groups of 13 each. Group I was subjected to 20 trials in which no overhead illumination was used until after the postrotational effect was ended. Group II's trials were similar except that the experimental room was illuminated by an overhead light for a 5-sec. period which started 2 sec. after the cessation of rotation. Group II subjects exhibited more habituation to rotation; this verified the results of Brown and Guedry. A brief period of room illumination interposed during the postrotational period apparently reduced the duration of illusory effects. (TIP abstract)

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Guedry, F. E. 1953 THE TRANSFER OF HABITUATION TO ROTATION WITH RESPECT TO THE MAGNITUDE OF THE VESTIBULAR STIMULUS. (Naval School of Aviation Medicine Pensacola, Fla.) Joint Rept. No. 34; Proj. No. NM 001 063.01.34; Contract N7onr-434, T. O. 1; ASTIA AD-17 609

ABSTRACT: The duration of oculogyral illusion (OGI) of 20 subjects was measured at 2 angular velocities (10 and 22 rpm) before and after a series of 39 rotation trials at 16 rpm. A significant decrement in OGI effects occurred on the unpracticed trials after the habituation series, indicating the transfer of habituation to vestibular stimuli of different magnitude. After the habituation series, the responses also showed a greater sensitivity to differences in vestibular stimuli. A comparison of rotational and postrotational results suggested that the overhead light produced an habituatory effect which did not generalize to vestibular stimuli with opposite directional components.

2,203

Guedry, F. E. 1953 THE RETENTION OF EFFECTS OF 'MASSED' AND 'DISTRIBUTED' VESTIBULAR STIMULATION AS INDICATED BY THE DURATION OF THE OCULOGYRAL ILLUSION. (Naval School of Aviation Medicine, Pensacola, Fla.) Joint Proj. Rept. No. 33; Proj. No. NM 001 063.01.33; Contract N7onr-434, T. O. 1; ASTIA AD-17 532

ABSTRACT: The influence of the distribution of rotational practice trials was studied in relation to (1) rate of habituation to the rotation and (2) retention of the habituation. After preliminary indoctrination, 20 subjects received 39 separate rotational trials and reported the rotational and postrotational durations of oculogyral illusion, a form of apparent motion observed following stimulation of the semicircular canals. One group received rotational trials massed into a single period, while the other group received trials distributed over 4 daily sessions. The rates of habituation of the 2 groups were not significantly different. Results of the tests of retention, given 7 days after habituation, suggested that the massed series produced greater retention. The habituatory effect of visual stimulation did not generalize to a vestibular stimulus with an opposite directional component.

2,204

Guedry, F. E., & J. I. Niven 1954 INTERACTION OF VESTIBULAR STIMULI OF DIFFERENT MAGNITUDES AND OPPOSITE DIRECTIONS. PART I. PERCEPTION OF VISUAL APPARENT MOTION DURING ANGULAR ACCELERATIONS. (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. NM 001 110 500.36., 8 Dec. 1954

ABSTRACT: Where a positive angular acceleration is immediately followed by a negative one, the actual direction of rotation is perceived well into the latter period. This perception is terminated by a clear-cut reversal in direction.

of apparent motion. Theoretically, the time between commencement of deceleration and the point of reversal is indicative of the time of travel of the cupula from a deviated position and also of the cupula's responsiveness to an acting force. An extension of van Egmond's equations permits prediction of the time interval (t_R) where the duration and magnitude of positive and negative angular accelerations are known. Data obtained from three subjects were in good agreement with theoretical curves and displayed a striking degree of consistency between subjects and within subjects.

2,205

Guedry, F.E. & J.I. Niven 1954 INTERACTION OF VESTIBULAR STIMULI OF DIFFERENT MAGNITUDES AND OPPOSITE DIRECTION. PART II. PERCEPTION OF VISUAL APPARENT MOTION AFTER INTERACTING ANGULAR ACCELERATION.
(Naval School of Aviation Medicine, Pensacola, Fla.) Proj. NM 001 110 500.38

ABSTRACT: Three subjects were accelerated to a predetermined level and then braked to a stop to produce positive and negative angular accelerations in quick succession. They reported on the direction and duration of apparent motion of a visual target. The data obtained were in agreement with theoretical equations which had been derived from the standard differential equation for a torsion pendulum. The data showed a high degree of consistency between subjects and within subjects. The striking similarity between theoretical and experimental data tends to confirm the validity of the torsion pendulum analogy for semi-circular canal function.

2,206

Guedry, F. E., & H. Kalter 1956 DESCRIPTION OF HUMAN ROTATION DEVICE.
(Army Medical Research Lab., Ft. Knox, Ky.) Proj. No. 6-95-20-001, Subtask AMRL S-5, Rept.242; ASTIA AD-109 230

ABSTRACT: A turntable was constructed for rotating subjects positioned within a radius of three feet from the center of rotation. Recorded performance of this device indicates that control of angular velocity is excellent. Control of angular accelerations and decelerations below 30 degrees/sec.² is very good and easily obtained with a cam system for driving the speed control potentiometer. Accelerations of 60 degrees/sec.² and decelerations of 50 degrees/sec.² can be obtained with the cam control system. However, to obtain these higher magnitudes the cam must be cut to compensate for a lack in linearity of response. The system provides sufficient range of angular velocities and angular accelerations for conducting a wide variety of experiments in vestibular research. (AUTHOR)

2,207

Guedry, F. E., L. J. Peacock and R. L. Cramer 1956 NYSTAGMIC EYE MOVEMENTS
DURING INTERACTING VESTIBULAR STIMULI
(U.S. Army Medical Research Lab., Ft. Knox, Ky.) Report No. 275, Nov. 2,
1956. Project No. 6-95-20-001. ASTIA AD 129 449

ABSTRACT: This is a study of the ocular nystagmic reaction to angular acceleration followed immediately by angular deceleration. During the deceleration period, nystagmus from the acceleration terminates and shortly thereafter nystagmus in the opposite direction commences. Time from the onset of deceleration to a point midway between nystagmus of opposite directions was measured. Electronic amplification of corneo-retinal potential was the method of recording eye-movement. The results obtained on vestibular nystagmus were essentially the same as those previously obtained where subjective reports were recorded. Both sets of results show close correspondence to theoretical curves but there is a small consistent difference between obtained and theoretical results.

2,208

Guedry, F. E., Jr. 1957 SOME EFFECTS OF INTERACTING VESTIBULAR STIMULI.
(Army Research Lab., Ft. Knox, Ky.) Report no. 261, USAMRL Proj. 6-95-
20-001. 18 March 1957.

ABSTRACT: This is a study of the subjective vestibular reaction to a positive angular acceleration followed by negative angular acceleration without an intervening period of constant angular velocity. One phase of the subjective experience, which theoretically is indicative of the response of the vestibular system while it is being driven, showed systematic change with variation in the independent variable. A second phase of the subject experience, which theoretically is indicative of the recovery of the vestibular system after the stimulus is removed, was more variable, and is much less predictable than the first. It is suggested that the vestibular response is consistent and predictable where stimuli approximate conditions of motion encountered under normal living conditions.

2,209

Guedry, F.E., L.J. Peacock, and R.L. Cramer 1957 NYSTAGMIC EYE MOVEMENTS
DURING INTERACTING VESTIBULAR STIMULI. (Army Medical Research Lab.,
Fort Knox, Ky.) Rept. on Vestibular Motion Problems; ASTIA AD-129 449

2,210

Guedry, F. E., & N. Beberman 1957 APPARENT ADAPTATION EFFECTS IN VESTIBULAR
REACTIONS. (Army Medical Research Lab., Fort Knox, Ky.) ARML Proj. No.
6-95-20-001; Rept. No. 293; ASTIA AD-141 108

ABSTRACT: Twenty subjects received 3 series of 6 angular decelerations of different magnitudes. The duration of each deceleration was calculated to produce a theoretical cupula deviation which would be the same for all decelera-

tions. Since the higher decelerations were applied briefly and the lower decelerations were applied for much longer intervals, it was hypothesized that adaptation effects, if present, would shorten the after-response to the lower decelerations. A systematic shortening of the after-response with the longer applied decelerations supported the hypothesis. This means that either there is an adaptation effect or the torsion pendulum theory is grossly in error. A pilot study in which the magnitude of deceleration was constant but duration of acceleration was varied gives strong support to the notion that an adaptation effect or some process antagonistic to an ongoing vestibular reaction builds up during a prolonged vestibular reaction. (AUTHOR)

2,211

Guedry, F. E., & G. Richmond 1957 DIFFERENCES IN RESPONSE LATENCY WITH DIFFERENT MAGNITUDE ANGULAR ACCELERATION. (Army Medical Research Lab., Fort Knox, Ky.) AMRL Proj. 6-95-20-001; Rept. No. 301; ASTIA AD-146 281

ABSTRACT: Fifteen subjects received a series of 8 angular accelerations during each of 5 sessions. They were required to signal onset of apparent rotation as quickly as possible. The interval between onset of acceleration and the subject's signal of apparent rotation, termed response latency, bears an inverse relationship to magnitude of angular acceleration. This relationship appears very systematic in all subjects in spite of fairly large differences between some individuals in the magnitude of their responses. Discrepancies between the obtained results and predictions, derived from theoretical mechanics of the semicircular canals, are discussed. (AUTHOR)

2,212

Guedry, F. E., R. L. Cramer & W. P. Koella 1958 EXPERIMENTS ON THE RATE OF DEVELOPMENT AND RATE OF RECOVERY OF APPARENT ADAPTATION EFFECTS IN THE VESTIBULAR SYSTEM. (Army Medical Research Lab., Fort Knox, Ky.) USAMRL Proj. 6-95-20-001, Rept. 338, June 1958. ASTIA AD 203 578

ABSTRACT: Two experiments were performed to study the rate of development and rate of recovery of adaptation to angular acceleration. In the first experiment, conditioning stimuli were varied in duration and standard test stimuli were always presented 5 sec after termination of the primary subjective effects from the conditioning stimuli to indicate the rate of development of the adaptation effects. In the second experiment, the conditioning stimulus was always of 50 sec duration and test stimuli were presented at various intervals after the conditioning stimulus to ascertain the rate recovery to normal. Reactions to test stimuli of the same direction as the conditioning stimuli were reduced and indicated a relatively rapid onset of effect and prolonged recovery period. Reactions to test stimuli opposite in direction to the conditioning stimuli were increased and indicated a relatively slow onset of effect and shorter recovery period. (Author)

2,213

Guedry, F. E. & S. J. Ceran 1959 DERIVATION OF 'SUBJECTIVE VELOCITY' FROM ANGULAR-DISPLACEMENT ESTIMATES MADE DURING PROLONGED ANGULAR ACCELERATIONS: ADAPTATION EFFECTS. (Army Medical Research Lab., Fort Knox, Ky.) AMRL Proj. No. 6-95-20-001; Rept. No. 376; ASTIA AD-211 385

ABSTRACT: Subjective estimates of angular displacement of a target light, fixed with respect to the observer, were made during prolonged constant angular acceleration of the entire body in a dark room. These estimates provided an indication of subjective velocity throughout the course of the vestibular reaction. Results obtained from 10 subjects indicated that subjective velocity rises and then declines during the course of a constant angular acceleration. Within the range of stimuli applied (0.5 deg/sec² to 2.0 deg/sec²) rise time to maximum subjective velocity appears constant regardless of stimulus magnitude. The maximum attained and the rate of change of subjective velocity up to this maximum are directly related to the magnitude of the angular acceleration. However, after about 30 sec of constant angular acceleration, the subjective velocity declines even though the angular acceleration remains constant. Implications of certain characteristics of the results for the torsion pendulum theory are discussed. (AUTHOR)

2,214

Guedry, F. E., & A. Graybiel 1960 ROTATION DEVICES, OTHER THAN CENTRIFUGES AND MOTION SIMULATORS: THE RATIONALE FOR THEIR SPECIAL CHARACTERISTICS AND USE. (National Academy of Sciences --- National Research Council, Washington D. C.) Publication 902; ASTIA AD-262 435, Library of Congress Catalog No. 61-60054, April 1960

ABSTRACT: This report deals with rotation devices used in studying the role of the semicircular canals and otolith organs in aerospace flight. Most of these devices have limited capability as flight simulators but are instrumented for controlling and recording the dynamic performance of the rotary structure and for measuring electrophysiological and behavioral responses of the subjects. The greater number are designed primarily to stimulate the semicircular canals, organs uniquely structured to respond to angular accelerations. The otolith organs, which are stimulated by linear accelerations, respond to change in body (head) position with respect to the directional of gravity or any inertial force of sufficient magnitude. (ASTIA)

2,215

Guedry, F. E., W. Johnson, R. Kennedy 1960 ADAPTATION TO BIZARRE STIMULATION OF THE SEMICIRCULAR CANALS AS INDICATED BY THE OCULOGYRAL ILLUSION (U.S.N. School of Aviation Medicine, Pensacola, Fla.) Research Project MR005.13-6001, Subtask 1, Report No. 53, 27 July, 1960.

ABSTRACT: Four healthy male subjects 19 to 23 years of age were exposed to tilt in a specially constructed chair mounted in a rotating room which is built

around the center of a human centrifuge. Determinations of the course of their adaptation to the oculogyral illusion are reported. Also compared are the effects of their voluntary head movements. Information obtained appears to have application to anticipated problems in manned orbiting satellites and to any rotating installation where personnel will be exposed to angular velocities above 2.0 rpm.

2,216

Guedry, F. E., Jr. and E. K. Montague 1960 RELATIONSHIP BETWEEN MAGNITUDES OF VESTIBULAR REACTIONS AND EFFECTIVE CORIOLIS COUPLES IN THE SEMICIRCULAR CANAL SYSTEM.

(U.S. Army Medical Research Lab., Fort Knox, Ky.) Rept. No. 456, Nov. 2, 1960. ASTIA AD 248 885L

ABSTRACT: When a human rider on a rotating structure rotates his head in a plane other than the plane of rotation of the structure, he perceives rotation in a plane approximately orthogonal to the other two. In this experiment, subjects were rotated at rates within the range 0.2 to 1.6 rad/sec. Recordings were made of the angular velocity of the structure, head rotation relative to the structure, vestibular nystagmus, and subjective estimates of angular displacement and velocity. Results indicate that the magnitude of the effective resultant mechanical couples which develop in the semicircular canal system due to Coriolis accelerations are directly related to the magnitudes of the subjective and oculomotor aspects of the vestibular reactions. Changes in spatial orientation indicated by a 'control stick' provide an estimate of the magnitudes of errors to be anticipated in pilots exposed to this source of 'vertigo.'

2,217

Guedry, F. E., & L. S. Lauver 1960 THE OCULOMOTOR AND SUBJECTIVE ASPECTS OF THE VESTIBULAR REACTION DURING PROLONGED CONSTANT ANGULAR ACCELERATION. (Army Medical Research Lab., Ft. Knox, Ky.) Rept. No. 438.

ASTIA AD 244813L

ABSTRACT: The present experiment is designed to determine whether the oculomotor nystagmic reaction rises and declines in magnitude during constant angular acceleration with a time course similar to that previously established for the subjective aspect of the vestibular reaction. The primary objectives however are (1) the determination of psychological and physiological reactions to angular acceleration with a view to increasing the range of predicting such events in any future military situation and (2) determination of the degree to which a physiological parameter might be used as an indicator of the experimental events which would influence the human operator.

Although some subjects occasionally showed a rise and decline in the slow phase velocity of nystagmus during constant angular acceleration, the more typical course of events was the attainment of near-maximum eye velocity in about 30 sec. with little subsequent gain or loss in velocity until the stimulus was terminated. When the stimulation ceased, the eye velocity typically slowed but did not show the rapid decline suggested by previous work, although there

were occasional examples of this pattern. The nystagmic response was routinely of longer duration than the subjective reaction.

Departures from previous results are probably attributable to the "state of alertness" of the subjects which was maintained in the present experiment by requiring continuous estimates and repeated signals of subjective events. This subjective technique serves a dual function of providing estimates of subjective events while preventing replacement of systematic nystagmus by the intrusion of autogenous wandering eye movements.

2,218

Guedry, F. E., Jr. & L. S. Lauver 1961 VESTIBULAR REACTIONS DURING PROLONGED CONSTANT ANGULAR ACCELERATION.

J. Appl. Physiol. 16(2):215-220, March 1961.

ABSTRACT: Stimuli of 2 deg/sec.² for 45 seconds and 1.5 deg/sec.² for 60 seconds was received by six human subjects. Eye movements were recorded by direct-coupled amplification of corneoretinal potential. Generally, near maximum velocity was attained in about 30 seconds with little subsequent gain or loss until acceleration ended. However, some subjects occasionally showed a rise and decline in the velocity of nystagmus during constant angular acceleration. As a rule, nystagmus outlasted the subjective after-reaction. Departures from previous results seem attributable to maintenance of alertness by requiring continuous estimation of subjective events. Theoretical implications of the divergence between the subjective and oculomotor aspects of the reaction are discussed.

2,219

Guedry, F. E., W. E. Collins and P. L. Sheffey 1961 PERCEPTUAL AND OCULOMOTOR REACTIONS TO INTERACTING VISUAL AND VESTIBULAR STIMULATION.

Perceptual and Motor Skills 12:307-324.

See also (Army Medical Research Lab., Ft. Knox, Ky.) Rept. 463; 15 Mar. 1961

ABSTRACT: Six men received repeated vestibular stimulation under several conditions of visual stimulation. Nystagmus, suppressed during brief room illumination, recovered almost completely in a following period of darkness; the subjective response remained suppressed. A small light (or large fixation field) inhibited nystagmus but did not suppress the subjective response. Apparently any visual still fixation field suppresses nystagmus, but the subjective response depends upon visual sensory information denying relative motion between the fixation field and the earth; intellectual information alone is ineffective. Nystagmic and subjective reactions diminish with repeated rotation. Only the subjective reaction recovered after a 9-day rest.

2,220

Guedry, F. E., Jr., W. E. Collins & P. Lynn Sheffey 1961 PERCEPTUAL AND OCULOMOTOR REACTIONS TO INTERACTING VISUAL AND VESTIBULAR STIMULATION (USA Medical Research Lab., Fort Knox, Ky.) Proj. 6X95 25 001, Task 15, Rep. 463, March 1961.

ABSTRACT: To ascertain perceptual and oculomotor effects of interacting visual and vestibular stimuli, six Ss were given a test series of ten clockwise rotations per day for five days. Odd-numbered trials were conducted in complete darkness; even-numbered trials were in darkness except for a five-sec. period of full room illumination two sec. after turntable stopped. A standard series of ten trials of both clockwise and counterclockwise rotation preceded and followed the 50 test trials. Vestibular nystagmus and signals indicating subjective velocity were recorded and analyzed in terms of changes in the stimulation. The use of nystagmus alone as an indicator of perceptual problems arising from vestibular stimulation was discussed. (Tufts)

2,221

Guedry, F.E., & E.K. Montague 1961 QUANTITATIVE EVALUATION OF THE VESTIBULAR CORIOLIS REACTION. Aerospace Medicine 32(6): 487-500, June, 1961

ABSTRACT: The magnitude and direction of the "vestibular Coriolis reaction" nystagmic and subjective aspects, are predictable from analysis of the kinematics of the vestibular endorgan.

During frontal-plane head movements and clockwise turntable rotation, the greatest apparent velocity and discomfort results from head return to upright from right tilt; greatest apparent displacement results from head return to upright from left tilt.

The intensity of nystagmus can be approximately equal in two individuals, or in some individual in several conditions, but the apparent velocity and discomfort experienced may differ markedly. The present experiments suggest that the "Coriolis vestibular reaction" diminishes within even a fairly short series of stimuli. Habituation, which has been demonstrated clearly during prolonged exposure to this kind of stimulation, and the pronounced individual differences noted herein and elsewhere represent two practical solutions to problems which will be encountered when necessity demands that people shall be exposed to this kind of stimulation.

2,222

Guedry, F. E., Jr. & A Graybiel 1961 THE APPEARANCE OF COMPENSATORY NYSTAGMUS IN HUMAN SUBJECTS AS A CONDITIONED RESPONSE DURING ADAPTATION TO A CONTINUOUSLY ROTATING ENVIRONMENT. (USN School of Aviation Medicine, Pensacola Air Station, Fla.) Proj. MR005.13 6001, Subtask 1, Rep. 61, Aug. 1961. ASTIA AD 268 793.

ABSTRACT: To determine the course of adaptation in a slowly rotating room, using vestibular nystagmus produced by controlled head and body movements as indicator of the state of adaptation:

Seven men lived in a rotating room (5.4 RPM) for sixty-four hours. Controlled tests before and during this interval demonstrated that Coriolis vestibular phenomena including Coriolis nystagmus diminished markedly. A compensatory nystagmus, induced by head or whole body movements, was recorded more than one hour after the rotation had ceased. Factors of possible significance in conditioning the compensatory nystagmus are: 1) otolith and proprioceptor sensory influx prior to and during discordant canal input; 2) consistent producing movements; 3) visual inhibition. Contributions of compensatory and arousal factors to vestibular suppression are considered in relation to practical problems of transfer of habituation from one acceleration environment to another. (Author)

2,223

Guedry, F. E., & A. Graybiel 1962 COMPENSATORY NYSTAGMUS CONDITIONED DURING ADAPTATION TO LIVING IN A ROTATING ROOM. J. Applied Physiol. 17(3):398-404, May 1962

ABSTRACT: Seven men were rotated at 5.4 r.p.m. in a room for 64 hours. Controlled tests before and during this interval demonstrated that disorientation and nystagmus attributable to Coriolis acceleration effects diminished markedly. A compensatory nystagmus, induced by head or whole-body movements, was recorded more than 1 hour after the rotation had ceased. Factors of possible significance in conditioning the compensatory nystagmus are: (1) otolith and proprioceptor sensory influx prior to and during discordant canal input; (2) a consistent sensory influx for each stimulus-producing movement; (3) intention in stimulus-producing movements; and (4) visual inhibition. Contributions of compensatory and arousal factors to vestibular suppression are considered in relation to practical problems of transfer of habituation from one acceleration environment to another. (AUTHOR)

2,224

Guedry, F.E., A. Graybiel, and W.E. Collins 1962 REDUCTION OF NYSTAGMUS AND DISORIENTATION IN HUMAN SUBJECTS (Naval School of Aviation Medicine, Pensacola, Fla.) Rept. no. 69, Proj. MR005.13-6001, 19 June 1962, ASTIA AD-282 954

ABSTRACT: The course of adjustment to a rotating environment and the transfer of habituation from one vestibular environment to another were determined. Nystagmus, disorientation, and nausea were reduced in subjects living and moving about for several days in a slowly rotating room. The reduced nystagmus was

not reinstated by assigning 'arousal-tasks' which are ordinarily effective in this respect. After rotation was stopped residual effects were noted for several hours. These included compensatory nystagmus, compensatory illusory reactions, and some motion sickness. Other subjects were exposed to similar circumstances for shorter periods wherein only restricted head movements in a particular plane were permitted. Nystagmus, illusory phenomena, and nausea were reduced by this procedure. However, the habituation did not transfer to forms of vestibular stimulation including head movements in an unpracticed quadrant' which produce reactions similar in direction and plane to those repeatedly experienced during the habituation period. Residual effects from this shorter more restricted exposure were slight. (Author)

2,225

Guedry, F. E., Jr., & A. Graybiel, & W. E. Collins 1962 NYSTAGMUS AND DIS-ORIENTATION REDUCTION IN HUMAN SUBJECTS. (Paper, 33rd Annual Meeting of the Aerospace Medical Assoc., Chalfonte-Haddon Hall, Atlantic City, N. J., April 9-12, 1962)

ABSTRACT: Nystagmus, disorientation and nausea were reduced in most subjects living and moving about for several days in a slowly rotating room. The reduced nystagmus was not reinstated by assigning "arousal-tasks" which are ordinarily effective in this respect. After rotation was stopped, residual effects were noted for several hours. These included compensatory nystagmus, compensatory illusory reactions and some motion sickness. Other subjects were exposed to similar circumstances for shorter periods wherein only restricted head movements in a particular plane were permitted. Nystagmus, illusory phenomena and nausea were reduced by this procedure. However the habituation did not transfer to forms of vestibular stimulation including head movements in an "unpracticed quadrant" which produce reactions similar in direction and plane to those repeatedly experienced during the habituation period. Residual effects from this shorter more restricted exposure were slight.

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Guedry, F. E., A. Graybiel, & W. E. Collins 1962 REDUCTION OF NYSTAGMUS AND DISORIENTATION IN HUMAN SUBJECTS. Aerospace Medicine 33(11):1356-1360, Nov. 1962

ABSTRACT: Nystagmus, disorientation, and nausea were reduced in subjects living and moving about for several days in a slowly rotating room. The reduced nystagmus was not reinstated by assigning "arousal-tasks" which are ordinarily effective in this respect. After rotation was stopped residual effects were noted for

several hours. These included compensatory nystagmus, compensatory illusory reactions, and some motion sickness. Other subjects were exposed to similar circumstances for shorter periods wherein only restricted head movements in a particular plane were permitted. Nystagmus, illusory phenomena, and nausea were reduced by this procedure. However, the habituation did not transfer to forms of vestibular stimulation including head movements in an "unpracticed quadrant" which produce reactions similar in direction and plane to those repeatedly experienced during the habituation period. Residual effects from this shorter more restricted exposure were slight. (AUTHOR)

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Guedry, F.E. Jr., R.S. Kennedy et al 1962 HUMAN PERFORMANCE DURING TWO WEEKS IN A ROOM ROTATING AT THREE RPM. (Naval School of Aviation Medicine, Pensacola, Fla.) NSA joint rept. no. 74; Proj. MR005.13-6001
ASTIA AD-290 496

ABSTRACT: Four men were tested before, during, and after being rotated at 3 RMP for two weeks in the Pensacola Slow Rotation Room. The men also lived in the room preceding the commencement of the rotation. Tests of intellectual and physiological function were included. The principal finding was that no serious psychological or physiological deficit was detected during two weeks of rotation or during the subsequent readaptation to normal environment. The only test showing pronounced deterioration of performance at the beginning of rotation and upon returning to normal environment was the Graybiel-Fregly Posture Test. This means that any task requiring ordinarily difficult locomotion would be disturbed at these critical intervals. Ordinary walking with adequate visual reference was not so obviously affected. Results are discussed in relation to: problems of rotating space stations, the vestibular system, and experiments involving optically distorted visual information. (Author)

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Guignard, J.C. 1959 THE PHYSIOLOGY OF HIGH SPEED FLIGHT. PART I.
Brit. J. Clin. Pract. 13(1):23-30. Jan. 1959.

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Guignard, J.C. 1959 THE PHYSIOLOGY OF HIGH SPEED FLIGHT. PART II.
Brit. J. Clin. Pract. 13(2):116-122. Feb. 1959.

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Guignard, J. 1961 REVIEW OF BRITISH IMPACT WORK AND PLANS.
(Paper, Symposium on acceleration stress, San Antonio, Texas)

2,231

Guignard, J.C. 1962 SOME CURRENT IMPACT STUDIES IN GREAT BRITAIN

(In: Impact Acceleration Stress: Proceedings of a Symposium With a Comprehensive Chronological Bibliography, National Academy of Sciences, National Research Council, Publication No. 977, pp. 301-311)

ABSTRACT: This paper gives a general outline of some of the work which has been done in recent years or is currently in progress in Great Britain in the field of impact acceleration stress. Bearing in mind the sponsorship of this Symposium, it is perhaps important for me to make it clear at the outset that there is as yet no official British manned spaceflight program. There is, therefore, no work on impact or vibration being done in Government establishments which is specifically related to problems in space medicine. Acceleration research at I.A.M., for example, is directed solely to current problems in service aviation medicine.

2,232

Guilbert, E.A. 1952 BACKWARD SEATING

S.A.E. Journal 60(6): 56 June 1952

ABSTRACT: Most passenger fatalities in aircraft accidents result from impact in crash landings and not from burning, according to current medical opinion. Injuries prevent the passenger from escaping a crash fire. Also, the present safety belt is inadequate because it only restrains the lower part of the body, letting the torso act as a weighted lever driving the ten-pound human head forward and subjecting it to an impact force greater than that acting on the aircraft structure at that point. Therefore it became logical for investigators to experiment with a rear-facing seat. The general reaction to this proposal was that "people do not like to ride backwards." However, this was not borne out by investigation. The Military Air Transport Service provided for rearward facing seats in part of its Boeing C-97 fleet, using a seat designed to take a 16 g forward load based on a passenger weight of 225 pounds. With a normal passenger weight of 175 pounds, the permissible forward g load increases to approximately twenty-four. The seat can be folded against the side of the fuselage to make room for cargo. (J. of Aviation Medicine 23(5): 533. October, 1952)

2,233

Guillemin, V., Jr. 1942 INSTRUMENTS OF THE HUMAN CENTRIFUGE AT ROYAL

CANADIAN AIR FORCE NO. 1 INITIAL TRAINING CENTER, TORONTO, CANADA.

(War Dept., Air Corps, Materiel Div., Wright Field, Ohio) EXP-M-49-695-16A, 15 Sept. 1942.

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Guillemin, V., Jr. 1942 MOTOR DRIVE AND CONTROL FOR THE HUMAN CENTRIFUGE.
(U. S. War Dept., Air Corps, Materiel Division, Wright Field, Ohio)
Rept. No. EXP-M-49-695-16; 15 Sept. 1942

ABSTRACT: An AC motor drives a DC generator which drives a DC motor. Two series fields, F1 and F1' are connected in series with each other and with armatures. The motor field F2' is fed by the electronic exciter which generates field F2' under special control from ABC. Before operation the AC motor is turned on "set" and the DC generator is brought up to full speed. The rubes in ABCD are warmed up. The current in F2 is zero and OR is open so current in F1 is zero also. The motor does not turn over although the field F2 is excited. Equipment is "ready".

To start, close OR and start current in F2. The generator produces current larger than but proportional to the current in F2. This gives a proportional torque in the DC motor and a proportional rate of speed increase in the centrifuge. The current for F2 is produced by thyatron unit B, but the output of B is controlled directly by A.

A receives two potentials, Es and Ea, from the centrifuge drive. Es comes from the tachometer generator and is directly proportional to the speed of the centrifuge. Ea is a potential drop across 2 series fields and is directly proportional to the rate of speed increase or acceleration of the centrifuge. Es' produces a counter potential to Es. When Es is equivalent to Es' the safety limit is reached and the current cut off. Ea' opposes Ea and is the safety limit for acceleration. During deceleration the motor feeds the current back to the generator. Thus the current through F1, F1' and the potential Ea are reversed. Ea' opposes this so the rate of deceleration is controlled. This device, A, is not used in an ordinary run because the maximum values are not reached. Instead the present speed control C is used.

A heavily inked graph of the run is drawn through a photoelectric scanning device. The scanner causes the potentiometer to rotate and introduces a varying potential, similar in action to Es, into A. Safety devices automatically open the relay OR and apply emergency mechanical brake if the scanner fails to operate. The scanner also automatically returns the device to "ready" position at the end of the run. The recording "g" meter is actuated by a tachometer generator and draws a record of time variation of "g" on a moving strip of paper. This record is compared with the graph introduced into C to check the performance of the entire equipment.

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Guimaraes, G. 1953 BIBLIOGRAFIA DE MIDICINA AERONAUTICA. (Bibliography of Aviation Medicine)
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Tidsskrift for den Norske Laegeforening, Oslo, 71:762-764, Dec. 1, 1951

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Gurdjian, E. S. and J. E. Webster 1943 EXPERIMENTAL HEAD INJURY WITH SPECIAL REFERENCE TO MECHANICAL FACTORS IN ACUTE TRAUMA.
J. Surg., Gyn., & Obst. 76:623-634.

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Gurdjian, E. S., & H. R. Lissner 1944 MECHANISM OF HEAD INJURY AS STUDIED BY THE CATHODE RAY OSCILLOSCOPE, PRELIMINARY REPORT.
J. of Neurosurgery 1(6):393-399, Nov. 1944

ABSTRACT: Certain aspects of head injury are well suited for study with the aid of the cathode ray oscilloscope. This instrument is particularly useful in connection with measurements of deformation of the skull and intracranial pressure changes that occur at the time of injury, since the element of inertia in the measuring and recording of the phenomena is entirely absent. A preliminary report of our investigations is given in this paper.

2,239

Gurdjian, E. S., & H. R. Lissner 1945 DEFORMATION OF THE SKULL IN HEAD INJURY, A STUDY WITH THE "STRESSCOAT" TECHNIQUE. J. Surg., Gyn., & Obst. 81:679-687, Dec. 1945

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Gurdjian, E.S. and J.E. Webster 1945 EXPERIMENTAL AND CLINICAL STUDIES ON MECHANISM OF HEAD INJURY.
A. Research Nerv. and Ment. Dis., Proc. 24:48-97

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Gurdjian, E. S., & H. R. Lissner 1946 DEFORMATIONS OF THE SKULL IN HEAD INJURY STUDIED BY THE "STRESSCOAT" TECHNIQUE, QUANTITATIVE DETERMINATIONS.
J. Surg., Gyn., & Obst. 83:219-233, Aug. 1946

This brief summary of automobile accident statistics reveals several important factors. One is that the driver gains considerable protection by holding onto the steering wheel, thus preventing his head from being thrown forward into the windshield or instrument panel.

The procedure used to determine the amount of energy necessary to produce fractures of the skull in cadaver heads is presented. As a result of the stresscoat tests it was found that linear fractures are, in general, initiated on the external surface of the skull due to outbending at a considerable distance from the point of impact. The fracture line generally reaches the point of impact since after its initial inbending this area rebounds and becomes a region of maximum tensile stress on the external surface as seen from strain gauge studies.

2,242

Gurdjian, E. S., H. R. Lissner, & J. E. Webster 1950 THE MECHANISM
OF SKULL FRACTURE. Radiology 54:313-339

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Gurdjian, E. S., J. E. Webster, & H. R. Lissner 1953 OBSERVATIONS
ON PREDICTION OF FRACTURE SITE IN HEAD INJURY. Radiology 60(2): 226-235

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Gurdjian, E. S., H. R. Lissner, F. R. Latimer, B. F. Haddad and J. E. Webster 1953 QUANTITATIVE DETERMINATION OF ACCELERATION AND
INTRACRANIAL PRESSURE IN EXPERIMENTAL HEAD INJURY - PRELIMINARY REPORT.
Neurology, 3 (6): 417-423, June 1953

ABSTRACT: In most previous studies in experimental head injury where records of acceleration have been obtained, measurements have been made on the object striking the flow. Due to the error introduced resulting from deformation of the scalp, muscles, skull and striker itself, it appeared more accurate to measure the acceleration of the skull, and this procedure was followed simultaneously with the measurement of the accelerations. Concussive effects were produced by blows resulting in accelerations of 250 g to over 500 g. The intracranial pressure rise measured at the same time ranged from 25 to 95 p.s.i. Concussions of minimal, moderate and severe degree were obtained. The time duration of the pressure and the acceleration appeared to be the significant single factor which explained the clinical effects following impact. It was noted that at the lower values of pressure and acceleration a concussion was produced only if the duration of the acceleration and pressure was of an appreciable length.

2,245

Gurdjian, E. F., H. R. Lissner and J. E. Webster 1947 THE MECHANISM OF PRODUCTION OF LINEAR SKULL FRACTURE. Surg. Gyn., & Obstet. 85:195-210.

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Gurdjian, E. S., & H. R. Lissner 1947 DEFORMATIONS OF THE SKULL IN HEAD INJURY AS STUDIED BY THE "STRESSCOAT" TECHNIC. Amer. J. of Surgery 73:269-281, Feb. 1947

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Gurdjian, E. S., & H. R. Lissner 1947 A STUDY OF THE MECHANICAL BEHAVIOR OF THE SKULL AND ITS CONTENTS WHEN SUBJECTED TO INJURING BLOWS. (Wayne Univ. & Grace Hosp., Detroit, Michigan)

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Gurdjian, E. S., et al. 1947 THE MECHANISM AND MANAGEMENT OF INJURIES OF THE HEAD. J. American Medical Association 134:1072-1076

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Gurdjian, E. S., H. R. Lissner, & J. E. Webster 1948 MECHANICS OF SKULL FRACTURE. (Wayne Univ. & Grace Hosp., Detroit, Michigan)

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Gurdjian, E. S., & J. E. Webster 1948 EXPERIMENTAL AND CLINICAL STUDIES ON THE MECHANISM OF HEAD INJURY. (Dept. of Surgery, Wayne Univ., College of Medicine, The Dept. of Neuro., Grace Hospital, Detroit, Michigan)

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Gurdjian, E. S., J. E. Webster & H. R. Lissner 1949 STUDIES ON SKULL FRACTURE WITH PARTICULAR REFERENCE TO ENGINEERING FACTORS. Am. J. of Surgery 78(5):736-742, Nov. 1949.

ABSTRACT: It is a well known fact that head injury is a frequent cause of death. Head injuries also figure prominently in automobile accidents.

2,252

Gurdjian, E. S. & J. E. Webster 1953 RECENT ADVANCES IN THE KNOWLEDGE
OF THE MECHANISM, DIAGNOSIS AND TREATMENT OF HEAD INJURY.
American Journal of the Medical Sciences 226:214-220, August 1953.

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Gurdjian, E.S., H.R. Lissner, J.E. Webster, F.R. Latimer and B.F. Haddad 1954
STUDIES ON EXPERIMENTAL CONCUSSION--RELATION OF PHYSIOLOGIC EFFECT TO
TIME DURATION OF INTRACRANIAL PRESSURE INCREASE AT IMPACT.
Neurology, 4(9) :674-681, Sept. 1954

ABSTRACT: The experiments show that the shorter the time duration the higher
the pressure necessary to result in a concussive effect. The longer the time
duration the lower can the pressure be in order to effect a concussion.
Concussion resulting from acceleration, deceleration, or compression is caused
by an increase in intracranial pressure at the time of impact.

2,254

Gurdjian, E. S., & J. E. Webster 1955 MECHANISM OF SCALP AND
SKULL INJURIES, CONCUSSION, CONTUSION, AND LACERATION. Proceedings,
2nd International Congress of Neuropathology, London, 1955.

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Gurdjian, E. S., J. E. Webster & H. R. Lissner 1955 OBSERVATIONS
ON THE MECHANISM OF BRAIN CONCUSSION, CONTUSION, AND LACERATION.
Surg. Gyn., & Obst. 101:680-690

2,256

Gurdjian, E. S., J. E. Webster & H. R. Lissner 1956 MECHANISM OF
HEAD INJURY. (Paper, Wayne State University)

Typed paper with charts and photographs.

2,257

Gurdjian, E. S. and J. E. Webster 1958 HEAD INJURIES--MECHANISMS, DIAGNOSIS
AND MANAGEMENT. (Boston: Little, Brown and Co, 1958)

2,258

Gurdjian, E. S., Webster, J. E. & H. R. Lissner 1958 MECHANISM
OF SCALP AND SKULL INJURIES, CONCUSSION, CONTUSION, AND LACERATION.
Symposium on Head Injuries. J. Neurosurg. 15:125-128.

ABSTRACT: (1) Since the effects of mechanical alterations at the moment of impact in head injury must ultimately be reflected by alterations of the properties of neuronal membranes, this has been studied by recording the electrical activity at various levels of the nervous system. (2) Whereas there may be surprisingly little change in the spontaneous electrical activity of the cerebral cortex and many subcortical structures, there is consistent reduction of activity in the reticular formation of the midbrain following a concussive blow. (3) Whereas there is no alteration of conduction of sensory impulses over the classical sensory pathways to thalamus and cortex, evoked sensory responses in the reticular formation are blocked or markedly attenuated by concussion. (4) Since it is known that such sensory driving of the reticular activating system is necessary to maintain consciousness, the genesis of coma following head injury would seem to be on this basis. (5) These alterations of properties of neuronal membranes following concussion may be related to biochemical alterations, including the metabolism of acetylcholine, which are known to follow concussion.

2,259

Gurdjian, E. S. and H. R. Lissner 1961 PHOTOELASTIC CONFIRMATION OF THE
PRESENCE OF SHEAR STRAINS AT THE CRANIOSPINAL JUNCTION IN CLOSED HEAD
INJURY. J. Neurosurg 18:58-60.

2,260

Gurdjian, E. S., H. R. Lissner, F. G. Evans, L. M. Patrick and W. G.
Hardy 1961 INTRACRANIAL PRESSURE AND ACCELERATION ACCOMPANYING
HEAD IMPACTS IN HUMAN CADAVERS
(Paper Symposium on Biomechanics of Body Restraint and Head Protection,
Naval Air Material Center, Philadelphia, Pa., June 14-15, 1961)

ABSTRACT: Heads of human cadavers were permitted to strike glass panels at impact velocities of from 2.5 to 34.8 mph. Average accelerations as high as 125g and 90g measured at the occiput occurred for forehead mid-line blows to tempered and laminated glass. The time duration varied from about 6 to 12 milliseconds. Average temporal pressures reached a maximum of 20.9 psi. with the glass remaining intact and the pressures lasting from about 6 to 12 milliseconds. When the glass broke, the pressures and their time durations remained very low. Parietal pressures were always less than temporal pressures.

Study of the cinephotographs showed that the head oscillated three or four times following impact to the glass panel. The oscillations also occurred when the glass fractured, but were reduced in number to an average of about 2 1/2. Under the conditions of these experiments no fractures of the skull or cervical spine or dislocations of the vertebra were noted when the thinner glass panels were used.

2,261

Gurdjian, E. S. H. R. Lissner F. G. Evans, L. M. Patrick and W. G. Hardy 1961 INTRACRANIAL PRESSURE AND ACCELERATION ACCOMPANYING HEAD IMPACTS IN HUMAN CADAVERS Surg., Gyn. & Obst. 113:185-190, Aug. 1961.

ABSTRACT: Heads of human cadavers were permitted to strike glass panels at impact velocities of from 2.5 to 34.8 mph. Average accelerations as high as 125g and 90g measured at the occiput occurred for forehead midline blows to tempered and laminated glass. The time duration varied from about 6 to 12 milliseconds. Average temporal pressures reached a maximum of 20.9 psi. with the glass remaining intact and the pressures lasting from about 6 to 12 milliseconds. When the glass broke, the pressures and their time durations remained very low. Parietal pressures were always less than temporal pressures.

Study of the cinephotographs showed that the head oscillated three or four times following impact to the glass panel. The oscillations also occurred when the glass fractured, but were reduced in number to an average of about 2 1/2. Under the conditions of these experiments no fractures of the skull or cervical spine or dislocations of the vertebra were noted when the thinner glass panels were used.

2,262

Gurdjian, E.S. 1961 DAMAGE OF THE SKELETON
(Paper, Symposium On Impact Acceleration Stress, Brooks Air Force Base, San Antonio, Texas, November 27-29, 1961)

2,263

Gurdjian, E. S. 1962 EXPERIENCES IN HEAD INJURY AND SKELETAL RESEARCH
Impact Acceleration Stress: Proceedings of a Symposium With a Comprehensive Chronological Bibliography, National Academy of Sciences, National Research Council, Publication No. 977, pp. 145-158.

ABSTRACT: The mechanism of skull fracture and concussion has been outlined. Strength characteristics of various bones in the body have been studied. Effects of embalming on the strength characteristics of bone have been evaluated. Impact tests upon the femur, pelvis and spine have been conducted, and the results summarized. Recent studies on cadaver head impacts into safety glass are briefly analyzed. Proposals for future studies include the careful study of the problem of shiplash injury, clinical studies of minimally, moderately and severely injured humans by electroencephalography, study of chemical and metabolic changes following head injury in the human and analysis of primary shock following human impacts.

2,264

Gurdjian, E. S. 1962 MECHANISM OF BRAIN CONCUSSION, CONTUSION AND LACERATION. In M. K. Cragun, ed., The Fifth Stapp Automotive Crash and Field Demonstration Conference, Sept. 14-16, 1961. Pp. 133-142.

2,265

Gurdjian, E. S., H. R. Lissner, & L. M. Patrick 1962 PROTECTION OF THE HEAD AND NECK IN SPORTS. J. American Medical Association 182:509-512, Nov.3, 1962

ABSTRACT: Existing data on factors at work in athletic injuries to the head and neck are reviewed. Measurements have been made of the energies, accelerations, and changes of intracranial pressure involved in cases of concussion and skull fracture. In the cadaver, linear skull fractures can be produced by energies of 4.6 to 6.9 kg.m. These impart an average acceleration of 112 g and increase the intracranial pressure by about 1,450 mm. Hg. Such figures afford a basis for the construction of protective helmets. The thickness of padding required can be computed from the weight and velocity of the injuring object. If the velocity is doubled, the padding has to be 4 times thicker. (AUTHOR)

SECOND ABSTRACT: Helmets for use in one sport might not be satisfactory for another. Individual design of the helmet for each sport is mandatory if maximum protection is to be obtained. Protection of one part of the body at the expense of another must be avoided. Protection of the face, for example, in some instances has lead to injury in the neck region. Basically, the protection afforded by a helmet is a function of the thickness of the padding and shell construction. For maximum protection, a given thickness and padding characteristics must be chosen to obtain the optimum deceleration. Human cadaver experimental studies indicate that the skull fractures with an expenditure of 400 to 600 in.-lb. of energy. At this level of injury, records of acceleration average 112 g with peaks of 200 g. Studies of intracranial pressure at the time of impact reach the neighborhood of 28 psi. Although in the living these figures may be different for moderate concussion, they represent approximations which may be useful in calculation for human protective devices.

2,266

Gurevick, B. K. H. 1957 ELECTROPHYSIOLOGICAL STUDIES PERFORMED DURING ROTATION OF THE SUBJECT. Fiziol. Zhur. SSSR (Moscow) 43(4):367-370, April 1957

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

ABSTRACT: The effect of rapidly alternating phases of increased and decreased gravitational force on motor coordination and posture was studied in seven human subjects. Experiments were conducted in the elevator of Moscow University, which permits changes in gravity ranging from 2 G to 0.3 G within two to three seconds. Positional changes of body and extremities and motor coordination were recorded graphically. Under the experimental conditions no significant disturbances were registered either in coordination of positioning of the body and limbs or in the adequacy of motor performance. The role of the visual analyzer in maintaining equilibrium does not increase significantly under conditions of subgravity, as shown by analysis of equilibrium reactions of subjects with their eyes closed or open. It is concluded that a 50 per cent increase or decrease in gravity does not materially affect the system which regulates posture and movement on the basis of proprioceptive afferentation. (Authors)

2,268

Gurivich, K. H. & W. G. Miroljubov 1936 THE EFFECT OF ACCELERATION ON MAN DURING FLIGHT Vo-sanit Dyelo. No. 2-3:42-47.

2,269

Gurnee, H. 1931 THE EFFECT OF A VISUAL STIMULUS UPON THE PERCEPTION OF BODILY MOTION. Amer. J. Psychol. 43:26-48

ABSTRACT: Using sine-wave rotary oscillation of the body and sine-wave oscillation of a simple visual object (hexagonal figure, 2½ cm diameter, made by punching holes of 1mm. diameter through a piece of black cardboard at the corners and center of the hexagonal) as stimuli, an attempt was made to obtain quantitative and qualitative data on the effect of a visual situation upon the perception of the movement of the body. The movements of the body and of the visual stimulus, together with a time-line and operator's reports were recorded on a kymograph. Three trained operators were used. Reactions to the independent bodily and visual movement were first taken for comparison purposes, then the bodily and visual movements were observed together. The results show that in rotary oscillation of the body at 2° amplitude, the percentages of correct responses varied directly, and the percentages of negative responses tended to vary inversely, with the average velocity. A higher percentage of correct responses tended to vary inversely, with the average velocity. A higher percentage of correct responses occurred for all operators in the decelerating phase of bodily oscillation than in the accelerating phase.

2,270

Gurovskii, N. N. and M. A. Gerd 1961 IN THE SPACEFLIGHT LABORATORY
Trans. of Nauka i Zhizn' (USSR) 28(10):21-28, 1961.
(Office of Technical Services, Washington, D.C.)
June 8, 1962 62-32301

2,271

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

2,272

Guttwein, G.K. & A.I. Dranetz 1951 SELF-GENERATING ACCELEROMETERS
Electronics, v. 24, pp. 120-123

ABSTRACT: Compression type and bending type accelerometers are described. One of the compression type has a sensitivity of 45 m.v. per g and a natural frequency greater than 6000 c/s. Acceleration ranges of 0.022 g to 600 g can be obtained on a single instrument. Since the accelerometers are self generating, their output does not depend on supply voltages.

2,273

Gwilt, S. R. 1961 TRAJECTORY ANALYSIS IN AIRCRAFT ACCIDENT INVESTIGATION.
(National Research Council of Canada, National Aeronautical Establishment)
Aeronautical Report LR-310: Oct. 1961 ASTIA AD-269 592.

SUMMARY: With the publication of trajectory tables compiled by personnel of the Aerodynamics Section, National Aeronautical Establishment, it has been possible to outline some methods of their application in analyses following aircraft disintegration. Examples are given for the determination of throw-distances and times analysis may be used to determine a region of primary failure and so may form a basis for a more detailed structural analysis.

In addition to the calculation of trajectories, methods are also outlined for the determination of wind vectors, heights and positions of item separation, and also for estimates of drag coefficients and terminal velocities for falling items.

(AUTHOR)

ACCELERATION

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2,274

Haas, E. & J. Matzker 1958 ÜBER DEN EINFLUSS DER LINEARBESCHLEUNIGUNG AUF
DIE ENTSTEHUNG VON VESTIBULARISCHWINDEL (Effect of Linear Acceleration
Etiology of Vestibular Vertigo)
Z. Laryng. Rhinol. (Stuttgart) 37(1):17-21.

2,275

Hass, G. M. 1944 TYPES OF INTERNAL INJURIES OF PERSONNEL INVOLVED IN AIRCRAFT
ACCIDENTS.
J. Aviation Med. 15:77-84.

ABSTRACT: The author comments on internal injuries which offer new problems in pathogenesis, diagnosis and treatment. In the general case, the occupant of a rapidly decelerated aircraft is held securely in his seat by the safety belt and is momentarily subjected to the action of very large forces. The forces may be resolved along the three principal axes. At times, the vertical seat to head forces are very large. At other times, the anteroposterior forces are large. In still other instances, lateral forces directed in the long axis of the wings are large. Whenever one part of the body is decelerated at a rate which is different from that of another part of the body, the connections between the two parts are placed under stress which is proportional to the differences in the rates of deceleration. That difference in rate of deceleration causes injury.

2,276

Haber, H. 1951 ASTRONOMY AND SPACE MEDICINE
In Marbarger, J. P., ed., Space Medicine; the Human Factor in Flights Beyond the Earth (Urbana, Ill.: University of Illinois Press, 1951) pp. 49-61

2,277

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

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

first problem to be dealt with is acceleration. Another problem is weightlessness. Control of cabin temperature and oxygen supply is another consideration. Meteors are a field of real danger for astronauts. The author discusses each of the preceding problems. (CARI)

2,278

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

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

2,279

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

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

2,280

Haber, H. 1952 FLIGHT AT THE BORDERS OF SPACE.
In (School of Aviation Medicine, Randolph AFB, Texas) Epitome of Space Medicine, Item #16.
See also Scientific American 185:20-23, Feb. 1952.

ABSTRACT: Man's conquest of space will not be a single event. Before that time, there will be many other firsts. At the present time, an unmanned two-stage rocket has climbed to 250 miles above the Earth's surface. Naturally most of the data on the performance of the newest rocket craft and planes must remain secret for reasons of national security. Therefore the author discusses the problems of high-altitude and oxygen deficiency, dangerous radiation and meteorites, weightlessness, and acceleration during space flight. (CARI)

2,281

Haber, H. 1952 GRAVITY, INERTIA, AND WEIGHT
In White, C.S. & O.O. Benson, Jr., eds., Physics and Medicine of the Upper Atmosphere (Albuquerque, N. Mex.: University of New Mexico Press, 1952)
Pp. 123-136

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

2,282

Haber, H. 1952 MEDICAL RESEARCH IN DEVELOPMENT OF MANNED ROCKET FLIGHT
Contact, April 1952, pp.30-32

ABSTRACT: A discussion of the medical problems associated with manned rocket flight by a member of the Department of Space Medicine of the School of Aviation Medicine.

2,283

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

ABSTRACT: A tentative schedule of present and future aviation- and space medical research tasks is presented. The establishment of an artificial satellite would be the next step in line, with animal experiments preceding the employment of humans. Future studies will have to concentrate particularly on problems resulting from conditions in an environment without gravity and atmosphere (supply of climate and breathing air, filtering of radiation, and supply of mechanical support).

2,284

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

2,285

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

ABSTRACT: An analysis of psychological, physiological, and physical problems of space travel, presented by the author in an address before the American Society of Mechanical Engineers, is summarized. Meteors constitute a danger above 90 miles; cosmic rays are a health hazard between 13 and 23 miles; and ozone and ultraviolet light require protective measures. Frictional heat and extreme temperature differentials between lighted and shaded parts of the rocket present an additional problem. Weightlessness in free space merely creates slight physiological disturbances; little is known, however, about the psychological consequences of subgravitational flight. (Literatuuroverzicht (Over 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)

2,286

Haber, F. 1953 HUMAN FLIGHT AT THE LIMITS OF THE ATMOSPHERE: G-FORCES AND WEIGHT IN SPACE TRAVEL. J. Brit. Interplanetary Soc. 12:32-34
See also Sky and Telescope 12(4):97-98, 114, Feb. 1953
NOTE: Reel 7, Flash 7, Item 2

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

2,287

Haber, H. 1953 MAN IN SPACE
(New York: Bobbs-Merrill, 1953)

ABSTRACT: This book is primarily concerned with the human problems involved in artificial satellites and space stations.

2,288

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

2,289

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

ABSTRACT: Contents include:

Lippert, S., "Limitations to Noise and Vibration Control"

Haber, H., "The Mechanical Environment in the Future Aircraft"

Roth, H.P., "Impact and Dynamic Response of the Body"

Blockley, W.V., "Combined Physiological Stresses"

All Speakers, Panel Discussion on Frontiers of Man-Controlled Flight.

2,290

Haber, H. 1954 MAN AND MACHINE BETWEEN ATMOSPHERE AND SPACE
Aeronautical Engineering Review 13(11):56-62, Nov. 1954.

ABSTRACT: Problems to be solved before man can survive flight into space.
Extensive bibliography.

2,291

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

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

2,292

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

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

2,293

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

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

2,294

Haber, H. 1957 THE ASTROPHYSICIST'S VIEWS
In Campbell, P. A., K. Dannenberg, W. O. Roberts, H. Haber, A. S. Crossfield,
G. W. Hoover, A. M. Mayo, J. P. Hagen, & H. Strughold, SPACE TRAVEL: A
SYMPOSIUM J. Avia. Med. 28:487-492

2,295

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

2,296

Hack, W. F. 1962 HYGE SHOCK TEST FACILITY AT 6571ST AEROMEDICAL RESEARCH
LABORATORY. (6571 Aeromedical Research Laboratory, Holloman AFB, N. Mex.)
ARL-TDR-62-22; ASTIA AD-286 168

ABSTRACT: The HYGE Shock Tester is a unit produced by the Consolidated Electro-Dynamics Corporation as a test device to generate high acceleration (g) forces

for short duration time periods. The HYG Shock Tester will also accurately reproduce these shock pulses.

A total of 90 preliminary runs was accomplished on the unit installed at the 6571st Aeromedical Research Laboratory during which time a detailed review of system operational characteristics and vibrations throughout the system was studied. On 22 December 1961 the first living subjects were tested. (AUTHOR)

2,297

Hackler, C. T. 1956 EQUATIONS OF MOTION AND COMPUTER SET-UP FOR IM-HEP HUMAN ENGINEERING FLIGHT SIMULATOR. (Bell Helicopter Co., Ft. Worth, Texas)
TR 299-099-043, July 1956

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Haddad, B. F., H. R. Lissner, J. E. Webster & E. S. Gurdjian 1955 EXPERIMENTAL CONCUSSION - RELATION OF ACCELERATION TO PHYSIOLOGIC EFFECT.
Neurology 5(11):798-800, November 1955.

ABSTRACT: In a previous report on measurements of acceleration in experimental head injury, it was found that the values of acceleration varied greatly and the concussive effect was not predictable. Further studies utilizing similar techniques were carried out to gain additional information concerning the relationship between acceleration and concussive effect.

2,299

Haddad, B.F., J.L. Chason, H.R. Lissner, J.E. Webster, & E.L Gurdjian 1956 ALTERATIONS IN CELL STRUCTURE FOLLOWING SUDDEN INCREASE IN INTRACRANIAL PRESSURE. Surgical Forum: Clinical Congress of the American College of Surgeons (Philadelphia) 6:496-498

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Haddon, W. A., Jr. and R. A. McFarland 1957 A SURVEY OF PRESENT KNOWLEDGE OF THE PHYSICAL THRESHOLDS OF HUMAN HEAD INJURY FROM AN ENGINEERING STANDPOINT. (Commission on Accidental Trauma, Armed Forces Epidemiological Board, Dept. of Defense, Wash., D. C.).

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Hadfield, G. and R. V. Christie 1941 CASE OF PULMONARY CONCUSSION (BLAST) DUE TO HIGH EXPLOSIVES
British Medical Journal 1:77-78

2,302

Hagen, J. P. 1957 THE VANGUARD PROJECT
In Campbell, P. A., K. Dannenberg, W. O. Roberts, H. Haber, A. S. Crossfield,
G. W. Hoover, A. M. Mayo, J. P. Hagen, & H. Strughold, SPACE TRAVEL: A
SYMPOSIUM. J. Avia. Med. 28:503-507

2,303

Hahn, R. 1956 RICERCHE SULLE MODIFICAZIONI DELLA SOGLIA Uditiva DOVUTE AL
FENOMENO DI PURKINJE. (RESEARCH ON MODIFICATIONS OF AUDITORY THRESHOLD
CAUSED BY THE PURKINJE PHENOMENON). Rivista di medicina aeronautica (Roma)
19(3):466-475, July-Sept. 1956

ABSTRACT: Four subjects with normal hearing were subjected to vestibular stimulation by rotation. Immediately after cessation of the rotation (in the so-called first post-rotatory phase) the subject's head was flexed abruptly. Audiograms taken after the experiment showed an increase of the auditory thresholds for 500-, 1000-, and 2000-c.p.s. tones amounting to 5-20 decibels. This increase was greatest for the 500-cycle frequency. The threshold value did not return rapidly to the values observed before the experiment, but showed a phasic course with a 15-20 decibel variation between two successive determinations and returned to normal values only 30 minutes after rotation. These threshold variations were not dependent upon the audiometrically studied ear or upon the sense of rotation, but upon central phenomena. The importance of auditory failure in relation to conditions of the pilot in flight is discussed.

2,304

Hale, H. B., J. P. Ellis, Jr., & C. H. Kratochvil 1959 CHANGES IN PLASMA
CORTICOSTEROIDS AND BICARBONATE AS A RESULT OF PILOTING SUPERSONIC
AIRCRAFT. (School of Avia. Med., USAF Aerospace Medical Center, (ATC)
Brooks AFB Texas) Research Rept. No. 59-61, April 1959.

2,305

Hale, H.B., R.B. Mefferd, Jr., G. Vawter, G.E. Foerster, & D. Criscuolo 1959
INFLUENCE OF LONG-TERM EXPOSURE TO ADVERSE ENVIRONMENTS ON ORGAN WEIGHTS
AND HISTOLOGY. (School of Aviation Med., USAF Aerospace Medical Center,
(ATC) Brooks AFB, Texas) Research Rept. No. 59-13, Jan. 1959.

2,306

MOTION PICTURE

Hall, F. G., G. L. Maison, G. A. Hallenbeck & C. A. Maaske 1945 THE HUMAN
CENTRIFUGE - DEMONSTRATION (A MOTION PICTURE)

ABSTRACT: A motion picture with sound track illustrating the construction and use of the AAF Air Technical Service Command Centrifuge. (Fed. Proc. 4(1):29, March 1945)

2,307

Hall, F. G. & J. Salzano 1959 EFFECT OF BODY POSTURE ON MAXIMAL INSPIRATORY AND EXPIRATORY STROKE VOLUME.
(USAF Wright Air Development Center, Wright-Patterson AFB, Ohio)
WADC TR 59-128; March 1959. ASTIA AD 212 319.

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Hall, G. E. 1942 THE EFFECT OF POSITION ON INCIDENCE OF SWING SICKNESS.
(National Research Council of Canada, Toronto) Report No. C-2878, 22 Aug. 1942.

2,309

Hall, G. E. 1943 MEMORANDUM ON AIRCRAFT CRASHES
(National Research Council of Canada, Toronto) C-2347, January 1943.

ABSTRACT: Reference is made to research work in the United States of aircraft accidents and prevention. Three projects are described: (1) survey of type and location of injury, fractures resulting from aircraft accidents, (2) study of the forces on the body in simulated crashes and development of protective features to be incorporated in safety harness and seat control units, (3) investigation into the use of controlled powder charges, ignited by electric current, for the release of various devices for the protection of aircraft occupants.

2,310

Hall, I. A. M. 1961 HUMAN PILOT TRACKING DYNAMICS AS AFFECTED BY CONTROLLED ELEMENT CHARACTERISTICS. (Paper, Panel on Acceleration Stress of the Armed Forces-NRC Committee on Bio-Astronautics, 6-11 March 1961, NASA Ames Research Ctr., Moffett Field, Calif.)

2,311

Hallenbeck, G.A., C.A. Maaske & E.E. Martin 1943 EVALUATION OF ANTI-G SUITS
(Wright-Patterson AFB, Ohio) Rept. No. 2; Eng-49-696-51B; 12 Dec. 1943
See also: National Research Council, Com. on Aviat. Med. Rept. No. 254

ABSTRACT: Centrifuge tests on 32 subjects at Wright Field and the Mayo Clinic show that the Berger Bros. GPS raises the "g" threshold between 1 and 2 "g". To simulate the condition found at high altitudes where the output of the vacuum pump is limited, maximum suit pressures were kept to 4 to 4.5 psi. Protection offered by the suit remained good. Protection offered by the suit summated with that afforded by muscle straining maneuvers. Individuals wearing the suit have a very high threshold for unconsciousness, a valuable feature. Graphs of the performance of the Berger valve when supplied by the B-12 pump are included.

2,312

Hallenbeck, G. A. 1944 THE EFFECT OF REPEATED SHORT EXPOSURES AND PROLONGED EXPOSURES TO INCREASED "G" ON HUMAN SUBJECTS.
(AAF, Aero Medical Lab., Wright Field, Ohio)
Memo Rept. No. ENG.49-696-56, 5 Feb. 1944. ASTIA ATI 13212

ABSTRACT: (a) During 60 second exposures to positive "g", 6 subjects who suffered either PLL or blackout during first 10 to 15 seconds of the run showed varying degrees of improvement thereafter.
(b) When 6 subjects were given 6 rapidly repeated 10 second exposures to 4.2 "g", vision improved during second and following trials. Improvement was consistent when interval between exposures was 10 seconds or less, and was less marked when interval was 15 to 30 seconds.
(c) Thus repeated exposures to "g" are probably not responsible for unfavorable symptoms reported by pilots during rat race maneuvers.
(d) Vision improves even though pulse rate drops on repeated exposure to "g".

2,313

Hallenbeck, G. A. 1944 THE LINDQUIST-RYAN TENSIO METER.
(National Research Council, Committee on Aviation Medicine, Washington, D.C.)
CAM No. 310; 8 April 1944.

ABSTRACT: Description of an apparatus for recording "g" produced in opening shock of parachute jumps by stylus writing on moving clear film.

2,314

Hallenbeck, G.A. 1944 THE MAGNITUDE AND DURATION OF PARACHUTE OPENING SHOCKS AT VARIOUS ALTITUDES AND AIR SPEEDS (Aerospace Medical Div., Wright-Patterson AFB, Ohio) Memo rept. no. ENG-49-696-66, 8 July 1944, ASTIA AD-289 146

ABSTRACT: This publication presents the results of studies of the forces developed during parachute openings at altitudes up to 40,000 feet. Descent time data for 200 pound dummies with 24 foot nylon canopies fitted a calculated rate of descent curve based on a velocity of 25 feet per second at sea level. These data do not provide information regarding actual landing velocity. The total duration of parachute opening shocks was unaffected by altitude up to 40000 feet and true air speeds up to 232 m.p.h., and was in the range of one to two seconds. As the magnitude of force increased, the time from the beginning of impact to the final peak decreased. The magnitude of the parachute opening shock was greater at higher altitudes than at lower altitudes: (a) When the horizontal launching speed was constant at all altitudes. (b) When the horizontal launching speed varied and was the calculated terminal velocity of a falling man at each altitude. When the horizontal launching speed of the dummies was increased at a given density, altitude, the magnitude of the force at opening was increased. The increase in force per m.p.h. increase in launching speed was greater at 26000 feet than at 7000 or 15000 feet. Data collected with these hard rubber dummies can be transferred to the living body with reasonable validity.

2,315

Hallenbeck, G. A. 1944 MEETING OF NATIONAL RESEARCH COUNCIL SUBCOMMITTEE ON ACCELERATION, WASHINGTON, D. C., 7 JUNE 1944 (Wright Field) Memo Rept. Eng.-49-696-51E; 22 June 1944

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Hallenbeck, G. A., E. J. Baldes and C. F. Code 1944 THE EFFECT OF IMMERSION IN WATER ON THE TOLERANCE OF DOGS TO CENTRIFUGAL FORCE. (Mayo Clinic) (National Research Council, Committee on Aviation Medicine, Washington, D.C.) CAM no. 278, 14 Mar. 1944

ABSTRACT:

(a) When dogs are immersed in water to the junction of the second rib with the sternum so that most of the chest is submerged, "g"-tolerance is lowered. All six dogs on which this was tried died at "g" levels they previously withstood with minimal symptoms.

(b) When dogs are immersed in water to the level of the xiphoid process so that most of the chest is above water, tolerance increases up to 3 or more "g".

2,317

Hallenbeck, G. A., & R. L. Engstrom 1944 THE RESPONSE OF NORMAL DOGS TO PROLONGED EXPOSURE TO CENTRIFUGAL FORCE. (National Research Council, Division of Medical Science, Committee on Aviation Medicine) Rept. CAM No. 279, 3 March 1944

ABSTRACT:

(a) The reaction of dogs to "g" is graded as follows:

Grade 1 response: Dog is conscious. Pupils of eyes fail to react to light. Slight ataxia is present. Pulse is 100 to 200.

Grade 2 response: Dog is limp and unconscious. There is a weak, irregular pulse, often bradycardia. Severe ataxia is noted when consciousness returns.

Grade 3 response: Death. Only postmortem pathology is gross distention of the vessels below the heart, occasional hemorrhage into colon.

(b) Unanesthetized dogs withstand exposure to 8 or more "g" for 5 or more minutes with Grade 1 response.

(c) Unlike rats when subjected to 2 to 12 "g" forces, dogs do not respond to "g"-time values of 80 "g"-minutes in a constant fashion.

(d) General nembutol anesthesia does not appreciably lower "g" tolerance.

(e) The work of Holt (reference 79) showing that carotid blood pressure is zero at 5 "g" is questioned because of the survival of dogs exposed to over 5 "g" for 8 minutes. Maybe blood gets to brain some other way than by carotid arteries.

2,318

Hallenbeck, G. A. 1945 EFFECTS ON MAN OF REPETITIVE EXPOSURE TO CENTRIFUGAL FORCE.
Federation Proceedings 4:29-30, March 1945.

ABSTRACT: This study was undertaken to determine the response of subjects to increased "g" when exposures follow one another at time intervals brief enough that the response to one exposure could be conditioned by previous trials. The Air Technical Service Command centrifuge was operated such that six ten-second episodes of 4.2 "g", a level sufficient to produce marked visual symptoms in the chosen subjects in a single test run, were delivered in sequence. Time intervals from the end of maximal "g" in one episode to the beginning of maximal "g" in the next were set at 4.7, 9.6, 19.4, and 29.1 seconds. Continuous exposure for 60 seconds was also imposed.

During continuous 60 second exposures, six subjects who suffered either loss of peripheral vision or blackout during the first ten or fifteen seconds showed varying degrees of improvement in vision thereafter. When exposed to the series of repeated ten second episodes of increased "g", the six subjects showed improvement of vision in the second and subsequent episodes of each series. This improvement was constant and marked when the interval between exposures was ten seconds or less, and less consistent when the interval was 15 or 30 seconds. (Federation Proceedings 4(1):29-30, March 1945)

2,319

Hallenbeck, G.A., et al 1945 THE SYMPTOMS WHICH OCCUR IN MAN DURING EXPOSURE TO POSITIVE ACCELERATION
Fed. Proc. 4: 43.

ABSTRACT: This motion picture illustrates the sequence of the symptoms which develop in normal men when exposed to positive acceleration while sitting in a comfortable physical and mental state, free from undue excitement or muscle tension. Under these conditions there is a definite sequence or pattern in the symptoms. As accelerations of greater magnitude are experienced, symptoms of increasing consequence are encountered. These symptoms are ushered in by dimming or graying of vision which is most noticeable in the peripheral fields and occurs on the average at about 3 g. At still higher accelerations (on the average 5 to 6 g) consciousness is lost. The color changes in the faces of the subjects seen in the motion picture indicates a period of progressive failure during which blood is progressively lost from the face, and a period of compensation during which blood is returned to the face. The motion picture illustrates that if visual symptoms are encountered, they occur during the period of progressive failure and that recovery from visual symptoms often takes place during the period of compensation while the accelerative force is still at maximum.

2,320

Hallenbeck, G., J. Glazier & G. Maison 1946 RADAR MEASUREMENT OF RATES OF
FREE FALL OF ANTHROPOMORPHIC DUMMIES AND MAN.
(Aero Medical Lab., ATSC, Wright-Patterson AFB, Ohio)

ABSTRACT: Problems of parachute escape and present knowledge of high shock forces resulting from parachute opening at high altitudes demand more information on man's rate of free fall for prediction of wind velocities he must withstand and duration of exposure to cold and anoxia. Figures thus far available are based almost entirely on theoretical considerations. To actually measure rates of free fall, anthropomorphic dummies and a man were tracked by radar during free fall from altitudes up to 40,000 feet. Analysis of radar data provided vertical velocities at various altitudes and curves of altitude versus time during descent. A freely falling body reaches terminal velocity when its drag equals its weight. At terminal velocity, drag = weight = $C_D S \rho v^2$ where C_D = drag coefficient, S = drag area, ρ = air density, and v = velocity. The $C_D S$ of a nonsymmetrical object varies with changes of attitude during fall. With weight and velocity known and with air density obtained from standard atmosphere tables, $C_D S$ values for the dummies and the man were calculated thus:

	Dummy weight,		lbs.	Man, lbs.
	180	220	280	240
Number of Drops	8	6	2	1
Means $C_D S$	5.53	6.30	5.99	3.97
Standard Deviation	0.37	0.35	0.29	0.26
No. of Observations	75	59	87	24

More data on rates of free fall of man are needed to discover whether the fact that this man had a lower $C_D S$ and fell faster than the dummies is the exception or the rule. By assuming $C_D S$ values in the range of 3.5 to 7 and various weights, one can draw predictive curves of time required to fall freely at terminal velocity from any given altitude to sea level and calculate wind velocities encountered during fall. (Fed. Proc. 5(1):40, 1946)

2,321

Hallenbeck, G. A., E. H. Lambert, E. H. Wood & M. A. McLennan 1946 EFFECTS
OF POSITIVE G ON SUBJECTS STUDIED AT THE MAYO AND AIR MATERIAL COMMAND
CENTRIFUGES.
(USAF AMC, Engr. Div., Dayton, Ohio) Memo Rept. TSEAA-695-60; 26 Sept. 1946.
ASTIA ATI 123 453

ABSTRACT: Comparison of the responses of 12 subjects to positive acceleration on the Mayo and Air Material Command centrifuges indicated the following:

- a. The average G-tolerance of the group, appraised by assay using visual symptoms and equivalent ear pulse amplitude changes as end points was 0.6 and 0.5 G, respectively, lower on the Mayo than on the Air Material Command centrifuge.

b. The basic pattern of the cardiovascular response of these subjects to acceleration was the same at both laboratories. The sequence of the measured physiological events which occur in response to positive acceleration and, with one exception, the timing of these events, were repeated on the two centrifuges.

The data suggest that the difference in G-tolerance observed on the two machines is related more to differences in psychological factors associated with exposure to G than to any physical differences between the two centrifuges.

2,322

Hallenbeck, G. A., E. H. Wood, E. H. Lambert & S. C. Allen 1946 COMPARISON OF EFFECTS OF POSITIVE G ON SUBJECTS STUDIED AT BOTH THE MAYO AND AIR TECHNICAL SERVICE COMMAND CENTRIFUGES.

(Acceleration Lab., Mayo Aero Medical Unit, Rochester, Minn.; Aero Medical Lab., Engineering Division, AAF Air Technical Service Command, Wright Field, Ohio)

ABSTRACT: G tolerances of twelve men were determined on the ATSC centrifuge (radius 20 feet) and on the Mayo centrifuge (radius 15 feet). At the Mayo laboratory tests were run in an illuminated room; at ATSC, in darkness. The time from 1.5 g to 5 g was 2.6 seconds on the Mayo centrifuge and 1.8 seconds on the ATSC centrifuge. In both laboratories: (a) duration of maximal g was 15 seconds, (b) environmental temperature was 70 to 72 degrees F., (c) subjects were urged to relax, (d) vision was tested using similar light signal systems, (e) the g-time curves, response to light signals, electrocardiogram, heart rate, ear pulse and ear opacity were recorded. Recording methods differed technically in some cases. Average accelerations at heart level at which vision was dimmed, lost peripherally and lost completely were 4.3 g, 4.8 g and 5.3 g, respectively on the ATSC centrifuge. These values were 0.6 g higher ($P < 0.001$) than those obtained on the Mayo centrifuge. (Fed. Proc. 5(1):40-41, Feb. 1946)

2,323

Hallpike, C.S. and G.M. Fitzgerald 1946 FLYING PERSONNEL RESEARCH COMMITTEE OBSERVATIONS OF THE PATHOLOGY OF AIRSICKNESS (RAF, Institute of Aviation Medicine, Farnborough) FPRC Rept. No. 334; Dec. 1946, ASTIA ATI No. 206 440

ABSTRACT: Hot and cold caloric tests of external semicircular canal function were carried out in 17 normal individuals of whom 6 were R.A.F. personnel without flying experience.

A standard technique was used with low intensity stimulation and the responses were measured as the time in seconds between the application of the stimulus and the disappearance of the nystagmus. The results are reported in this publication.

2,324

Hallpike, C. S., J. D. Hood, & G. H. Byford 1952 THE DESIGN, CONSTRUCTION AND PERFORMANCE OF A NEW TYPE OF REVOLVING CHAIR; SOME EXPERIMENTAL RESULTS AND THEIR APPLICATION TO THE PHYSICAL THEORY OF THE CUPULAR MECHANISM. Acta Oto-Laryngologica 42:511-538

SUMMARY: Constructional and performance specifications are given of a new type of revolving chair designed for the investigation of the function of the human horizontal semicircular canals.

The chair is driven by a servo-mechanical system of conventional design and high precision. It provides angular accelerations within the range of 0.1 degrees sec.² to 10 degrees sec.². Any acceleration within this range may be applied for periods limited only by the attainment of an angular velocity of 150 degrees sec.¹, a limitation imposed by certain physiological considerations.

Provision is made for the direct observation of ocular nystagmus occurring during rotation. This is achieved by means of a prismatic viewing system which provides a stationary image of the subject's eye.

Using this equipment, measurements have been made of the durations of the after sensations resulting from the application of accelerations of known magnitude and duration.

The results obtained are found to be in striking agreement with the general theory of the cupular mechanism outlined by Steinhausen and with the physical constants of the system as determined by Van Egmond and his co-workers. (AUTHOR)

2,325

Hallpike, C. S., & J. D. Hood 1953 FATIGUE AND ADAPTATION OF THE CUPULA MECHANISM OF THE HUMAN HORIZONTAL SEMICIRCULAR CANAL: AN EXPERIMENTAL INVESTIGATION. Proc. Roy. Soc. B, 141:542-561

2,326

Hallpike, C. S., & J. D. Hood 1953 A STUDY OF THE FUNCTION OF THE HUMAN SEMI CIRCULAR CANAL WITH ESPECIAL REFERENCE TO ADAPTATION OF THE CUPULA. Proceedings 5th International Congress Otorhinolaryngol. Pp. 2-5

2,327

Hallpike, C. S. and J. D. Hood 1953 THE SPEED OF THE SLOW COMPONENTS OF OCULAR NYSTAGMUS INDUCED BY ANGULAR ACCELERATION OF THE HEAD: ITS EXPERIMENTAL DETERMINATION AND APPLICATION TO THE PHYSICAL THEORY OF THE CUPULAR MECHANISM.
Proc. Roy. Soc. (London) B. 141(903):216-230, April 17, 1953.

ABSTRACT: By means of a newly designed rotating chair, a number of normal human subjects have been exposed to angular acceleration around the vertical axis,

of known magnitude and duration. Evidence from this study supports Graybiel's hypothesis that the oculo-gyral illusion is dependent upon vestibular eye nystagmus. A new technique is described for the quantitative evaluation of the oculo-gyral illusion occurring during known angular accelerations. The technique makes it possible to obtain instantaneous measurements of the speed of the slow component of such vestibular eye nystagmus occurring at any point in the course of application of known angular accelerations and accordingly of the instantaneous magnitude of the corresponding cupular deflexion. It has been possible to substantiate the general theory of the cupular mechanism outlined by Steinhausen and to re-evaluate and confirm the physical constants of the system assigned to it by Van Egmond and his co-workers.

2,328

Ham, G. C. & J. C. Hortenstine 1942 OBJECTIVE DETERMINATION OF CIRCULATORY CHANGES PRECEDING, DURING AND FOLLOWING GREYING, BLACKOUT, AND SYNCOPE ON THE TILT TABLE.
(National Research Council, Committee on Aviation Medicine, Washington, D.C.)
CAM No. 54; 28 May 1942.

ABSTRACT: Thirty tilt table observations were made on 14 male subjects 20 to 30 years of age and on one 41 years old. In 14 cases, sodium nitrite was given in addition to tilting.

It was demonstrated that objective changes do occur in ear opacity, the rate and amplitude of pulse in the temporal artery, and blood pressure in the brachial artery prior to grey or blackout and syncope. As confusion frequently precedes these symptoms, an individual's subjective recollection of blackout is unreliable. Objective criteria should be used in judging protection on the centrifuge or in the plane.

2,329

Ham, G. C. and E. M. Landis 1942 APPARATUS FOR THE STUDY OF CHANGES IN THE PERIPHERAL CIRCULATION DURING ACCELERATION.
(National Research Council, Committee on Aviation Medicine, Washington, D.C.)
CAM No. 48, 23 April 1942.

ABSTRACT: Description of a modification of Millikan's oximeter to record ear opacity and pulse amplitude changes in response to circulatory changes. Duplicates appendix to CAM No. 44.

2,330

Ham, G.C. 1943 EFFECTS OF CENTRIFUGAL ACCELERATION ON LIVING ORGANISMS.
War Med., 3(1):30-56, Jan. 1943

ABSTRACT: This article discusses positive, negative, and angular acceleration and its effects on respiration, mental efficiency, heart rate and blood pressure. Centrifugal effects on animals are also included.

2,331

Ham, G. C. & J. L. Patterson, Jr. 1943 QUANTITATIVE DETERMINATION OF CHANGES IN BLOOD CONTENT OF THE HUMAN EAR WITH A MODIFIED OXIMETER.
(National Research Council, Committee on Aviation Medicine, Washington, D.C.)
CAM No. 140; 26 May 1943.

ABSTRACT:

(a) The oximeter has been modified so that the opacity of the ear tissue and of the blood in the human ear can be measured separately.

(b) Both the opacity of the ear tissue alone and that of the blood alone differ from individual to individual. These two variables would necessitate a large number of curves if all situations were to be covered.

(c) One variable can be eliminated if the effective opacity of the bloodless ear tissue of all individuals is made the same by varying the intensity of the incident light.

(d) A method of obtaining empiric curves with an artificial ear to simulate a decrease or increase in blood content of the human ear has been described. This method can be used to calibrate recording instruments in terms of percentage change in blood content.

(e) The properties of photocells which may produce errors in results are discussed.

2,332

Ham, G. C., J. L. Patterson, Jr. & E. M. Landis 1943 QUANTITATIVE MEASUREMENTS OF CHANGES IN BLOOD CONTENT OF THE HUMAN EAR WITH A MODIFIED OXIMETER.
(National Research Council, Committee on Aviation Medicine, Washington, D.C.)
CAM NO. 188, 10 June 1943.

ABSTRACT:

(a) A modified oximeter ear unit is described which allows separate measurement of both the thickness ("opacity") of the bloodless ear and of the blood in the human ear.

(b) It is calibrated with sheets of tracing paper to represent the bloodless ear and glass chambers of known thickness to represent the blood contained in the ear.

(c) A method for the measurement of percentile changes in the blood content of the ear with the cathode ray oscillograph and this ear unit is described. It is adaptable to use in either the centrifuge or aircraft.

2,333

Ham, G. C. & E. M. Landis 1957 OBJECTIVE MEASUREMENTS OF CIRCULATORY CHANGES IN MAN DURING ACCELERATION IN THE CENTRIFUGE AND IN THE PLANE.
(National Research Council, Committee on Aviation Medicine, Washington, D.C.)
CAM No. 67; 9 Aug. 1957.

ABSTRACT: In 8 plane tests (maximum 2.5 "g" for approximately 5 seconds) and 27 centrifuge runs on 8 subjects it was found that "g" well below the graying level diminishes the blood content of the ear consistently and strikingly. At high "g" this blanching is even more marked at the time that grayout, blackout, and unconsciousness appear. Reactive hyperemia follows short exposures to "g".

When 4 "g" was maintained on the centrifuge for 45 seconds, vascularity of the ear decreased, then increased and, after a brief compensatory rise, stabilized at a level lower than normal but definitely above the minimum. It is though that this reaction was due to a carotid sinus reflex becoming active 11 to 13 seconds after the onset of "g".

Measurements were made by means of a photoelectric ear unit (modified oximeter) and a portable self-contained oscillograph. The apparatus is offered as a safe method for objective study of circulatory adjustment to "g" in the plane and in the centrifuge and for evaluating the protection offered by anti-g devices.

2,334

Hamacher, J.M. 1941 DER KREISLAUF UNTER BESCHLUNIGUNG. ELECTROKARDIOGRAMM BEI KANINCHEN (Effect of Acceleration on Heart Rate: Electrocardiographic Studies in Rabbit)
Luftfahrtmedizin 5: 149-160

2,335

Hamel, G. and C. C. Turner 1914 FLYING: SOME PRACTICAL EXPERIENCES.
(London: Longmans, Green, and Co.)

2,336

Hamilton, J. E., J. S. Lichty, & W. R. Pitts 1932 CARDIOVASCULAR RESPONSE OF HEALTHY YOUNG MEN TO POSTURAL VARIATIONS AT VARIED TEMPERATURES. Amer. J. Physiol. 100:383-393

2,337

Handford, S.W., T.E. Cone, Jr., H.I. Chinn and P.K. Smith 1954 DRUGS PREVENTING MOTION SICKNESS AT SEA. J. Pharmacol. and Exper. Therap., 111 : 447

2,338

Hanks, T. G. 1961 ACCELERATION
In Sells, S. B., & C. A. Berry, eds., Human Factors in Jet and Space Travel
(New York: Ronald Press Co., 1961) pp. 284-295, 327-328

2,339

Hanrahan, J.S. 1958 BIODYNAMICS: DECELERATION AND IMPACT AT THE AIR FORCE MISSILE DEVELOPMENT CENTER. (Holloman AFB, New Mexico) October 1958.

2,340

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

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

2,341

Hansen, A.T. 1949 PRESSURE MEASUREMENT IN THE HUMAN ORGANISM (Copenhagen: Teknisk Forlag, 1949)

2,342

Hansen, H. April 1948 SOME PERFORMANCE CRITERIA FOR THE GIMBAL DRIVES ON THE HUMAN CENTRIFUGE. (McKiernan-Terry Corp., Harrison, N. J.) Device 9-G-1, Navy Contract N6ori-133, 13 April 1948.

2,343

Hansen, H. 1954 GENERAL ENGINEERING REPORT, HUMAN CENTRIFUGE (McKiernan-Terry Corp., Harrison, N. J.) S.O. 4621, Contract N6ori-133, 14 July 1954.

ABSTRACT: This report is intended to supplement the instruction manuals and engineering drawings as a general source of engineering information pertinent to the design of the human centrifuge. It contains a discussion of the basic factors which were considered both in the overall design, and, in the design of selection of components.

It includes a general description of the principles of operation of the control systems.

The report contains, also, a brief description of particularly important or especially interesting phases of manufacturing and erection.

Several unusual features were incorporated in the design. The sandwich construc-

tion for the gondola is a notable example. The description of this construction, aside from its general interest, may be of some value to others working on similar problems.

References are given throughout the text to assist the reader in locating additional information, and a complete list of references is included in the appendix. Information from these reference sources has been freely abstracted or summarized here when pertinent to the discussions in this report.

2,344

Hanson, A. 1961 DEVELOPMENT TEST PROGRAM, GROUND AND WATER LANDINGS.
(Stanley Aviation Corp., Denver, Colo.) Doc. No. 1259; Contract No. AF 33(600)
36200; 4 Jan. 1961

2,345

Harbert, F. and Schiff, M. 1950 MOTION SICKNESS.
U. S. Armed Forces M. J., 1 :979

2,346

Hardacre, L.E. & R.S. Kennedy 1962 A PRACTICAL ISSUE IN THE ADMINISTRATION OF
A MOTION SICKNESS QUESTIONNAIRE TO FLIGHT STUDENTS
Paper: 33rd Annual Meeting of the Aerospace Medical Association, Chalfonte-
Haddon Hall, Atlantic City, N.J., April 9-12, 1962

ABSTRACT: A motion sickness questionnaire was developed and validated on 100 subjects who had been exposed to a reliable test for measuring susceptibility to "canal sickness" on the Pensacola Slow Rotation Room. The reliability of the questionnaire was then ascertained under three conditions. Three forms of the questionnaire were administered to three groups. Forms differed in the kind of assurance given that this questionnaire would influence subsequent career possibilities. The results will be discussed not only in terms of the above variables but also in terms of the reliability of the test items.

2,347

Hardgrove, B. J. & F. L. Warren 1956 ASTRONAUTICS INFORMATION ABSTRACTS.
(Jet Propulsion Laboratory, Pasadena, Calif.)

ABSTRACT: This periodical contains a series of abstracts dealing with astronautics. It is restricted to the subject of spaceflight and to applicable data and techniques. Coverage is given to propulsion when related to specific space travel missions and to meteorology when related to the envelope beyond the stratosphere. Aeronautics, communications, guidance, instrumentation, materials, vehicle engineering, etc., are treated similarly, the intent being to give full coverage to astronautics but to exclude peripheral material.

2,348

Hardy, J. D., & C. C. Clark 1958 THE DEVELOPMENT OF DYNAMIC FLIGHT SIMULATION.
(Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-5817, Dec. 4, 1958
ASTIA AD-216 508
See also Aero Space Eng. 18:48, 1959

ABSTRACT: The development of the Dynamic Flight Simulation Program at the Aviation Medical Acceleration Laboratory is traced. The adaptation of the 50-foot human centrifuge to the demands of closed loop simulation and the computer control involved are explained. Also discussed is the role played by dynamic flight simulation in the training of pilots to fly the X-15 research plane.
(Author)

2,349

Hardy, J. D., C. C. Clark and R. F. Gray 1959 ACCELERATION PROBLEMS IN SPACE FLIGHT.
(USN, Air Development Center, Johnsville, Pa.) Rept. No. NADC-MA-5909, 1 Oct. 1959. ASTIA AD 230 379.

SUMMARY: The problem of man's tolerance to acceleration forces has become of increased importance with the development of aircraft and spacecraft capable of traveling at tremendous velocities. The major problems associated with the effects of acceleration upon man and details of the work which has already been done in this field on centrifuges, rocket sleds, and other simulators are described. The problem of weightlessness is discussed with special reference to Geratowohl's investigation of human tolerance to the weightless state produced during ballistic trajectory aircraft flight. A detailed account is given of advances in high G protection including the use of the contour couch and water immersion in the total immersion capsule and with chest pressurization Gray in a record centrifuge run, recently withstood 31 G for 5 secs with no lasting ill effects. (Author)

2,350

Hardy, J. D. 1959 ACCELERATION PROBLEMS IN SPACE FLIGHT. (Address to XXI International Congress of Physiological Sciences; Buenos Aires, Aug. 1959)

2,351

Hardy, J. D. 1959 REPORT TO ACCELERATION PANEL.
(Armed Forces-NRC Committee on Bio-Astronautics, Woods Hole, Mass., Aug. 1959).

2,352

Hardy, J.D. & C.C. Clark 1960 ACCELERATION TERMINOLOGY IN AEROSPACE MEDICAL RESEARCH
U.S. Naval Air Development Center, Johnsville, Pa. October 1960 (A Report to the North Atlantic Treaty Organization, Advisory Group for Aeronautical Research and Development Conference, preprint of paper given in Turkey)

ABSTRACT: A notation is presented to be used to describe the physiological effects of acceleration on man. The usefulness of a standardized means of describing physiological effects in G environments is detailed by showing the variety of descriptive terms and words now in general use and the need for better and more exact interchange of information on acceleration among scientists. Special emphasis is placed on a notation which would provide a mathematical description of the acceleration environment referred to some convenient point, such as the center of gravity of the man-seat combinations. The physiological acceleration terminology presented in this paper emphasizes the reactive forces on the man rather than on the vehicle.

2,353

Hardy, J. D. 1960 ACTIVITIES OF THE ACCELERATION PANEL.
(Paper, 31st Annual Meeting of the Aerospace Medical Association, Americana Hotel, Bal Harbour, Miami Beach, Fla., May 9-11, 1960)

ABSTRACT: The Armed Forces National Research Council Committee on Bio-astronautics has established as one of its areas of interest the problems of acceleration stress which may be encountered in space travel. The Acceleration Panel of the Committee was organized "to review and report upon the research and development problems concerned with the biological effects of mechanical forces which may be of interest in the area of bioastronautics." Membership of the Panel includes representatives of all of the centrifuge laboratories of the United States as well as those investigating the effects of weightlessness, impact, angular accelerations, oscillatory and random accelerations and noise. At its first meeting, the Panel made a review of the existing devices in the United States for the study of acceleration and concluded with a preliminary discussion of the needed areas of study in the acceleration field which are considered of especial interest to bioastronautics. A brief presentation of the Panel's deliberations will be made.

2,354

Harper, E. D. 1956 AIRCREW RECOVERY FROM AIRBORNE MISHAPS.
Canad. Aeronaut. J. (Ottawa) 2(5):151-153, May 1956

ABSTRACT: The aircrew ejection devices presently in use in Canadian aircraft are considered largely inadequate for the special conditions of high altitude, low altitude, high speed, and low speed flight. The CF-100 possesses the most advanced escape equipment, including an automatic parachute operating system timed for ejections at any altitude above 200-300 feet, a barostatic operating device which opens the parachute at a predetermined altitude, maximum available support and protective devices, and a stabilization parachute to prevent tumbling. The problem

of air blast, violent contortion, and high acceleration during ejection at high speeds has not been solved, and may require the development of an escape capsule.

2,355

Harrington, R.R. 1961 LOWER LIMIT ON BOOSTER REQUIREMENTS TO ORBIT AND SUBSEQUENTLY DE-ORBIT A PAYLOAD. (Air Force Special Weapons Center, Kirtland Air Force Base, N. Mex.) AFSWC TN 61-38, ASTIA AD 265 375

ABSTRACT: A study is presented of a simplified approach to the calculation of minimum booster requirements for a typical earth-launched orbit and subsequent deorbit mission. It is intended primarily as an introduction to the orbital mechanics of such a mission. A two-dimensional inverse square force field centered within a circular nonrotating earth is assumed. The propulsion mechanism is assumed to be 100 per cent efficient and capable of directing thrust into any direction. At any instant the masses present are those of useful payload and unburned propellant with no mass assumed for dead casing weight. Atmospheric losses are neglected. The results establish the lower limit on velocity increments below which the mission cannot be accomplished. (Author)

2,356

Harris, C. S., F. E. Guedry, & A. Graybiel 1962 POSITIONAL ALCOHOL NYSTAGMUS IN RELATION TO LABYRINTHINE FUNCTION. (Naval School of Aviation Medicine, Pensacola, Fla.) BuMed Project MR005.13-6001 Subtask 1, Rept. No. 76; NASA Order No. R-47, 3 Dec. 1962

ABSTRACT: The main objective was to evaluate the use of positional alcohol nystagmus as an indicator of otolith function. Individuals without functional labyrinthine function did not exhibit nystagmus comparable in quality or magnitude to results obtained from a group of normal subjects. Several individuals suspected of having residual otolith function exhibited weak responses reminiscent of PAN, but the "responses" may have been attributable to artifacts. A relationship was found in normal subjects between nystagmus obtained by caloric stimulation and nystagmus obtained by positional alcohol testing. The relationship between nystagmic output and arousal was found to be essentially the same for positional alcohol nystagmus as for nystagmus obtained by other procedures. All labyrinthine-defective subjects tested for alcohol gaze nystagmus exhibited alcohol gaze nystagmus. (AUTHOR)

2,357

Harris, W., R.R. Mackie, and C.L. Wilson 1956 PERFORMANCE UNDER STRESS: A REVIEW CRITIQUE OF RECENT STUDIES. (Human Factors Res., Inc., Los Angeles, Calif.) TR VI, July 1956. ASTIA AD 103 779.

2,358

Harrison, W. E. 1957 WE CHASE THE JETS ON FILM
Popular Mechanics, June 1957, pp. 91-96; 228-232.

ABSTRACT: This is a review of high-speed photography done by the author at Edwards Air Force Base, California. He relates the problems involved in shooting airplane crashes, ejection seat tests, and rocket-sled track tests. The author also discusses the various dangerous assignments that might be expected in work of this type.

2,359

Harsen, Asmus 1937 PROBLEMS OF HIGH-ALTITUDE FLYING (PROBLEME DES HOEHENFLUGS)
ASTIA ATI 22587

ABSTRACT: Problems and recent developments in high-altitude flying are discussed. Advantages of high-altitude flying can be put into three general groups: speed, augmentation of meteorological and navigational security, and military advantages. Practical physiological difficulties in high altitudes have been overcome. Through use of superpressure altitude chamber, human existence has been proved possible in the stratosphere without oxygen respiration or special clothing. A complete report about high-altitude power plants is given and diagrams on high-altitude equipment and performance graphs are shown.

2,360

Hart, E.M. 1961 EFFECTS OF OUTER-SPACE ENVIRONMENT IMPORTANT TO
SIMULATION OF SPACE VEHICLES.
(Aerospace Medical Laboratory, Aeronautical Systems Division, Wright-
Patterson AFB, Ohio) Contract AF 33(616)-6858, ASD TR 61-201,
Project No. 6114, Task No. 60806, August 1961. ASTIA AD-269 014

ABSTRACT: The results of a literature survey undertaken to define the effects of the outer-space environment important to the simulation of space vehicles are presented. The discussion is general, having not been constrained by the inclusion of specific vehicles or trajectories. Only the natural environment of space is considered and the survey is limited to the solar system with particular emphasis on the region in the near vicinity of the earth-moon system and at heights greater than 80 kilometers above the earth's surface. To specify those effects that need to be incorporated into a space training simulator, the exterior environment, its effects on the vehicle and crew, and the malfunctions that may result must be determined. These subjects are treated, along with a consideration of the adequacy of the existing data in the study. Recommendations for further study are presented.

2,361

Hartinger, H. 1951 MOTION AND PERCEPTION OF SPACE
(USAF Sch. Av. Med., Brooks AFB, San Antonio, Tex.)
Spec. Rpt.. Aug. 1951

2,362

Hartkoph, Stewart E. 1960 RUNWAY BARRIER EVALUATION OF THE F-102 ARRESTING
HOOK
(Air Force Flight Test Center, Edwards Air Force Base, California) AFFTC-TR-
60-42, September 1960. ASTIA AD 245529

ABSTRACT: An F-102 aircraft equipped with an arresting hook was tested at the Air Force Flight Test Center to evaluate the compatibility of the hook installation with aircraft arresting barriers. Twelve runs were made into a modified MA-1A Runway Overrun (Chain) Barrier with successful arrestments being achieved 11 times. The unsuccessful attempt was the result of hook bounce. This deficiency was corrected during the test program. Eighteen of the 19 arrestment attempts with the BAK-6/F27A Aircraft Arresting (Water Squeezer) Barrier Absorber were successful. Failure of the runway pendant cable caused the unsuccessful attempt. Aircraft arrestments were demonstrated up to 165 knots (ground speed) utilizing the "Water Squeezer" barrier and up to 112 knots using the "Chain" barrier.

2,363

Hartman, B. 1960 PROBLEMS OF HUMAN RELIABILITY IN SPACE FLIGHT: TIME AND
LOAD FACTORS. (Paper presented at the Symposium on the Psychophysiological
Aspects of Space Flight, School of Aviation Medicine, Aerospace Medical
Center (ATC) Brooks AFB, Texas, May 1960)

2,364

Hartman, B. O., & R. E. McKenzie 1961 SYSTEMS OPERATOR PROFICIENCY: EFFECTS
OF SPEED STRESS ON OVERLOAD PERFORMANCE (School of Aerospace Medicine,
Brooks AFB, Texas) Rept. 61-40; June 1961

2,365

Hasbrook, A. H. 1952 CRASH INJURY STUDY OF THE NORTHEAST AIRLINES-CONVAIR
240 ACCIDENT AT LA GUARDIA AIRPORT ON JANUARY 14, 1952.
(Department of Public Health and Preventive Medicine, Cornell University
Medical College)
Informative Accident Release 14. August 1952.

ABSTRACT: Analysis of an accident involving a Northeast Airlines Convair 240 in Flushing Bay near La Guardia Airport on January 14, 1952, revealed the following facts: (1) the hull and the passenger cabin were exposed to localized peak

forces of over 6 g; (2) all passengers were seated in forward-facing seats designed to resist forward loads up to 6 g; (3) 10 of the 20 seats sustained anchorage failure, (7 seat frames were extensively damaged and 10 seat backs deformed); (4) the C-22a "3,000 lb" safety belts remained intact; and (5) although some passengers struck and dented seat backs, no dangerous injuries resulted from the impacts. It is recommended that a strong cable or ductile wire linkage be used to carry safety belt loads directly to the hull structures, by passing the seats. The safety advantage of light, ductile, well-padded, "de-lethalized" seat-back structures is emphasized.

2,366

Hasbrook, A. H. 1953 CRASH SURVIVAL STUDY: NATIONAL AIRLINES DC-6 ACCIDENT AT ELIZABETH, N. J. ON FEBRUARY 11, 1952.
(Cornell Univ. Medical College, Crash Injury Research, New York, N.Y.)
Oct. 1953. ASTIA AD 30 398

ABSTRACT: Crash survival details of a 140 m.p.h. crash involving a Douglas DC-6 transport aircraft, in which 32 of the 59 passengers survived, are presented and analyzed. Information is given on impact speed and altitude, directions of principal impact force, kinematic behavior of the fuselage, damage to cabin and seats, and injuries sustained in relation to passenger location; photographs and diagrams are shown. Findings are discussed and recommendations are made relative to crash survival design in future transport aircraft.

2,367

Hasbrook, A. H. 1953 CIR RELEASE 15: CRASH SURVIVAL STUDY: NATIONAL AIRLINES DC-6 ACCIDENT AT ELIZABETH, N. J. ON FEBRUARY 11, 1952.
Oct. 1953.

2,368

Hasbrook, A.H. 1954 CRASH SURVIVAL STUDY: DeHAVILLAND DOVE ACCIDENT AT STATEN ISLAND AIRPORT, DECEMBER 9, 1952 (Cornell-Guggenheim Aviation Safety Center, N.Y., N.Y.) Release 3-13

ABSTRACT: Crash-survival details of a 95 mph - 35° nose-down angle crash involving a twin-engine de Havilland Dove transport aircraft, in which two of four occupants survived, are presented and analyzed. Information is given on the impact speed and attitude of the aircraft, and on the magnitude, direction and duration of the principal impact (crash) force. The kinematic behavior of the intact fuselage, the damage to the cabin and seats, and the injuries sustained in relation to occupant location are described. Photographs and diagrams are shown. Findings are discussed and recommendations are made relative to crash-survival design in future transport aircraft.

2,369

Hasbrook, A. H. 1954 CRASH INJURY INVESTIGATOR'S CHECK LIST;
TRANSPORT AIRCRAFT. (For the panel on aircraft accident survival
committee on operating problems, National Advisory Committee for
Aeronautics.)

2,370

Hasbrook, A. H. 1954 CRASH SURVIVAL STUDY OF A SURVIVABLE ACCIDENT INVOLVING
A PIPER PA-11.
(Cornell-Guggenheim Aviation Safety Center, New York, N.Y.) May 1954
Release 1-16

ABSTRACT: Crash survival details of a 90-95 mph vertical impact accident
involving a light training plane in which the lone occupant survived with non-
dangerous injuries are presented and discussed. Information is given on impact
speed and attitude, direction of principal impact force, damage to the aircraft,
and injuries sustained in relation to structure. Findings are discussed and
recommendations are made relative to crash survival design in future light
aircraft.

2,371

Hasbrook, A. H. 1954 CRASH SURVIVAL STUDY: DE HAVILLAND DOVE ACCIDENT AT
STATEN ISLAND AIRPORT DECEMBER 9, 1952.
(Cornell-Guggenheim Aviation Safety Center, New York, N. Y.) Nov. 1954.
Release 3-13.
See also Aviation Age 23(1):16-23.

2,372

Hasbrook, A. H. 1955 AVIATION CRASH INJURY RESEARCH.
J. Aviation Med. 26(3):180-183.

SUMMARY: Crash-injury and crash-survival data on military accidents are needed
so that engineers can, by design, moderate or prevent unnecessary injuries and
deaths in survivable accidents involving future military and civilian aircraft.
To obtain such information, medical officers and accident investigators must
work together in the investigation and analyses of accidents, the injuries sus-
tained, and the causes of injury.

In order to properly identify and catalogue the injuries sustained in accidents,
flight surgeons and pathologists should make detailed examinations of the in-
jured persons and report in detail the results of the medical examinations or
autopsies. The results of the investigations and analyses must be given to
engineers in language they can understand, both from a qualitative and quantita-
tive (statistical) point of view. Classifications and terms that are meaning-
ful to engineers, as well as to safety groups and other medical personnel, should
also be utilized.

2,373

Hasbrook, A. H. & J. T. Parin 1955 AvCIR PHOTOGRAPHIC REPORT:
BRANIFF INTERNATIONAL AIRWAYS CONVAIR 340 ACCIDENT AT CHICAGO,
ILL., 17 JULY 1955. (Aviation Crash Injury Research, Cornell
University) Office of Naval Research Contract #N6onr 264-12,
Release 2P-5-19, October 1955.

2,374

Hasbrook, A.H. 1955 AvCIR CRASH INJURY ANALYSIS OF A DC-6B ACCIDENT AT
IDLEWILD AIRPORT, 19 DECEMBER 1954. (Cornell Aviation Crash Injury
Research)

2,375

Hasbrook, A. H. 1956 CRASH INJURIES IN AIRCRAFT ACCIDENTS
(National Fire Protection Association, Boston, Mass.) Bulletin No. 163
July 1956

2,376

Hasbrook, A. H. 1956 BOEING 707 EVALUATION
(Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc.,
Phoenix, Arizona) Report AvCIR-1-V-65; June 1956

2,377

Hasbrook, A. H. 1956 STUDY OF INJURY RATES IN SURVIVABLE TYPE ACCIDENTS
INVOLVING EIGHT PERSONAL TYPE AIRCRAFT OF VARIOUS MODELS.
(Aviation Crash Injury Research, Cornell U. New York, N. Y.) Sept. 1956

2,378

Hasbrook, A. H. 1956 AvCIR PHOTOGRAPHIC REPORT OF U. S. ARMY BELL H-13
HELICOPTER ACCIDENT, MONMOUTH COUNTY AIRPORT, N. J. (Aviation Crash Injury
Research, A Division of Flight Safety Foundation, Inc., Phoenix, Arizona)
Report AvCIR-5-PR-68; Dec. 1956

2,379

Hasbrook, A. H. 1956 A PROGRESS REPORT ON A PRELIMINARY AvCIR STUDY OF THE
PROBLEMS ASSOCIATED WITH A CRASH INJURY RESEARCH PROGRAM IN THE FIELD OF
HELICOPTER AND STEEP GRADIENT AIRCRAFT, FOR THE U. S. ARMY, FOR THE PERIOD
OF 12/1/55 THROUGH 6/30/56. (Aviation Crash Injury Research, A Division of
Flight Safety Foundation, Inc., Phoenix, Arizona) Rept. AvCIR-46-0-69;
June 1956

2,380

Hasbrook, A.H. 1956 DESIGN OF PASSENGER "TIE-DOWN"
(Aviation Crash Injury Research of Cornell University) Naval Research Contract
Nonr-401(21). Av-CIR-44-0-66, September 1956. ASTIA AD 217660

ABSTRACT: Factors requiring consideration in the design of passenger seats and adjacent attachment structure of transport aircraft are discussed. The four basic causes of injury in accidents, and survivable crash force limits, are outlined. Design factors affecting survival as related to crashworthy cabin and floor structure, safety belts, seats and other interior components are reviewed. The directions and magnitudes of crash loads to be expected in survivable type crashes are given. Static versus dynamic loading is touched on. The controversial subject of aft facing and forward facing seats is discussed. Photographs and diagrams are included with the text. Recommendations are made for improved crash-survival design of passenger tie-down.

2,381

Hasbrook, A. H., S. Macri, & M. Haberman 1956 AN AvCIR PRELIMINARY REPORT ON
A STUDY OF INJURY RATES IN SURVIVABLE TYPE ACCIDENTS INVOLVING EIGHT PERSONAL
TYPE AIRCRAFT OF VARIOUS MODELS. (Aviation Crash Injury Research, A Division
of Flight Safety Foundation, Inc., Phoenix, Arizona) Report AvCIR-4-SS-72;
Sept. 1956

2,382

Hasbrook, A. H., & J. T. Pairn 1956 PRELIMINARY AvCIR PHOTOGRAPHIC REPORT ON
EASTERN AIRLINES MARTIN 404, OWENSBORO, KENTUCKY. (Aviation Crash Injury
Research, A Division of Flight Safety Foundation, Inc., Phoenix, Arizona)
Report AvCIR-4-PR-63; June 1956

2,383

Hasbrook, A. H. 1957 DESIGNING FOR SURVIVAL IN VTOL AIRCRAFT.
(Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc.,
Phoenix, Arizona) Report AvCIR-51-0-83, March 1957
Issued under Office of Naval Research Contract No. Nonr-401(21)
ASTIA AD 217 660

ABSTRACT: The need for crashworthy design and delethalization of VTOL aircraft is discussed in relation to human tolerance to impact force. Crash-injury factors and photographs related to two survivable helicopter crashes are briefly reviewed; recommendations for crash-safety design are proposed.

2,384

Hasbrook, A. H. 1957 CRASH INJURY REPORT FOR U. S. ARMY SAFETY DIVISION.
(Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc.,
Phoenix, Arizona) Report AvCIR-54-0-89, Sept. 1957

2,385

Hasbrook, A. H. 1957 CRASH INJURY RESEARCH. A MEANS OF GREATER SAFETY IN AIRCRAFT ACCIDENTS.
J. Aviation Med. 28(6):541-552.

SUMMARY: The need for crash-injury investigations of survivable type aircraft accidents, in combination with detailed structural, medical and pathologic studies, is reviewed. In addition, the results of past crash-injury investigations, and their use in the design of present propeller driven, and future jet, transports are discussed. Similarly, several recent accident investigations, one, of a helicopter, are reviewed, and pertinent crash-injury findings are shown to illustrate the engineering-medical information which can be extracted from such crashes for the benefit of future design.

2,386

Hasbrook, A. H. 1957 CRASH INJURY RESEARCH A MEANS FOR GREATER SAFETY IN ACCIDENTS.
(Aviation Crash Injury Research, Phoenix, Ariz.) Report No. AvCIR-50-0-82, March 1957.

ABSTRACT: The need for crash-injury investigations of survivable type aircraft accidents - in combination with detailed structural, medical and pathological studies - are reviewed. In addition, the results of past crash-injury investigations, and their use in the design of present propeller driven, and future jet, transports are discussed. Similarly, several recent accident investigation (one, a helicopter) are reviewed, and pertinent crash injury findings are shown to illustrate the engineering-medical information which can be extracted from such crashes for the benefit of future design.

2,387

Hasbrook, A. H., J. T. Pairn, & H. R. Guggenheimer 1957 AvCIR CRASH SURVIVAL STUDY OF U. S. ARMY BELL H-13 ACCIDENT AT MONMOUTH COUNTY AIRPORT, BELMAR, N. J., JUNE 21, 1956 (Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc., Phoenix, Arizona) Report AvCIR-H-5-CSS-81; Feb. 1957
ASTIA AD-129 743

ABSTRACT: Photographs with descriptive captions relating to crash-survival details of a Bell H-13 helicopter crash involving a minimum vertical impact speed of 41 miles per hour and not less than a calculated 28.5 g vertical deceleration - in which two crew members survived without spinal injuries - are presented. An accident diagram and the damage to the cockpit, seats and other components are shown; the injuries sustained by the occupants - and the probable injury causes - are described. The method of calculating the crash forces is demonstrated. In addition, the significance of the lack of spinal injuries in an accident involving heavy vertical crash loads is discussed in relation to the design of aircraft seats.

2,388

Hasbrook, A. H., J. T. Pairn, & H. R. Guggenheimer 1957 AvCIR ANALYSIS AND PHOTOGRAPHIC REPORT - U. S. ARMY BEECHCRAFT L-23 ACCIDENT, COLORADO SPRINGS, COLORADO (Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc., Phoenix, Arizona) Report AvCIR-6-PR-88; Aug. 1957

2,389

Hasbrook, A. H. and W. R. Knowles 1957 A HELICOPTER CRASH-INJURY REPORT FORM. (Cornell-Guggenheim Aviation Safety Center, New York, N.Y.) AvCir 55-0-91 (Office of Naval Research, Washington, D.C.) Contract No. Nonr-401-(21).

2,390

Hasbrook, A. Howard 1958 GROSS PATTERN OF INJURY OF 109 SURVIVORS OF FIVE TRANSPORT ACCIDENTS
(Aviation Crash Injury Research of Cornell University, Phoenix, Arizona)
Office of Naval Research Contract No. Nonr 401(21) Av-CIR-5-SS-96
July 1958 ASTIA AD 218708

ABSTRACT: This report discusses the distribution and seriousness of injuries sustained by the survivors of five survivable transport aircraft accidents. One of the five accidents resulted in a relatively low injury rate and only moderate structural damage; the other four accidents showed higher injury rates, more aircraft damage, and greater impact severity. Comparison of the moderate accident with the four severe accidents indicates that statistical accident data can be misleading unless accidents are classified in a meaningful way - by using "degrees" of severity. For purposes of classifying severity, factors should be used which relate to the impact conditions as well as to the resulting demolition of the aircraft and its major components.

Recommendations following the study are: (1) All aviation medical and rescue personnel be alerted to the frequency of concussion and lower extremity fractures that may be expected among survivors of severe but survivable transport accidents. (2) All non-medical rescue personnel be trained in the proper handling of survivors sustaining the types of injuries which may normally be expected in such accidents. (3) Seat tie-down (anchorage) strength be increased to prevent complete failure of the seats prior to demolition of the basic fuselage structure. (4) All seats and components adjacent to the occupants be adequately delethalized. (5) All possible means of preventing post-crash fires be utilized in order to provide sufficient time to evacuate all occupants.

2,391

Hasbrook, A. H., W. R. Knowles, J. Carroll and H. Roegner 1958 A FIXED-WING CRASH-INJURY REPORT FORM.
(Cornell-Guggenheim Aviation Safety Center, New York, N.Y.) AvCir 56-0-97.
(Office of Naval Research, Washington, D. C.) Contract No. Nonr-401(21).

2,392

Hasbrook, A. H., S. Macri, & M. H. Piazza 1958 PRELIMINARY REPORT - HEADINGS FOR IBM CODING OF CRASH INJURY AND SURVIVAL DATA FROM HELICOPTER AND LIGHT-PLANE ACCIDENTS. (Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc., Phoenix, Arizona) Aug. 1958

2,393

Hasbrook, A. H., H. F. Roegner, & W. R. Knowles 1958 AvCIR ANALYSIS AND PHOTOGRAPHIC REPORT, NEW YORK AIRWAYS SIKORSKY S-58 ACCIDENT, LA GUARDIA AIRPORT, FLUSHING, NEW YORK, NOVEMBER 30, 1956 (Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc., Phoenix, Arizona) Report AvCIR-7-PR-95, Apr. 1958

2,394

Hasbrook, A.H. 1959 MAGNITUDE DURATION AND RATE OF ONSET OF MEAN DECELERATIONS SUSTAINED BY NINE (9) SURVIVORS OF FREE FALLS FROM HEIGHTS OF 55 to 185 FEET (FROM DE HAVEN, 1942). Av-CIR Human Factors Design Data Sheet. Av-CIR of Flight Safety Found.

2,395

Hasbrook, A.H 1959 HUMAN IMPACT SURVIVAL AT 162 G. (Cornell-Guggenheim Aviation Safety Ctr., New York) Rept. Av-CIR-58-0-101, March 1959. ASTIA AD 219 196

ABSTRACT: This report is a condensed version of a report entitled 'Informative Accident No. 7' dated 7 May 1948, written by Hugh DeHaven and Ruth M. Petry of Crash Injury Research, Cornell Univ. Med. College.

A free fall, survived by a man, involving an impact of approximately 162 g for 0.014 second and an onset rate in excess of 22,000 g per second, is reviewed for its significance in the problem of crash safety. His injuries were largely confined to the left side of his body; he sustained fractures of the left ankle, a chip fracture of the right ankle and a linear fracture of the left side of the lower jaw. He also evidenced rigidity of the abdomen, which suggested the possibility of either spinal injury or injury of the abdominal viscera; this rigidity, however, subsided uneventfully in a short time. There were also a few red blood cells in his urine and he coughed up a little blood and complained of pain in the chest for a period not exceeding thirty-six hours. His recovery from all these injuries was rapid.

2,396

Hasbrook, A. H., J. Carroll, H. F. Roegner, G. M. Bruggink, & W. R. Knowles 1959 PRELIMINARY PHOTOGRAPHIC EVALUATION OF OTTER ACCIDENT, FORT CARSON, COLORADO (Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc., Phoenix, Arizona) Report AvCIR-9-PR-104, Sept. 1959

2,397

Hasbrook, A. H. 1959 SEVERITY OF INJURY IN LIGHTPLANE ACCIDENTS; A STUDY OF INJURY RATE, AIRCRAFT DAMAGE, ACCIDENT SEVERITY, IMPACT ANGLE, AND IMPACT SPEED INVOLVING 1596 PERSONS IN 913 LIGHTPLANE ACCIDENTS. (Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc., Phoenix, Ariz.) Report AvCIR-6-SS-105, July 1959

2,398

Hasbrook, A. H. 1960 "CRASH-SAFE" DESIGN CAN MAKE MANY ACCIDENTS SURVIVABLE Space Aeronautics, 34(3):79-87, Sept. 1960.

ABSTRACT: This article reviews some statistics from a ten-year study (1942 to 1952) of approximately 900 lightplane accidents. The main tabulation presents number of people injured and degree of injury as a function of: over-all accident damage, impact speed, cabin damage, and structural damage in the seat area. These figures are related to design for "survivability" and some general recommendations are made. (Tufts)

2,399

Hasbrook, Howard A. 1962 CRASH SAFETY
(Paper, Medical Symposium at C.A.R.I. October 20, 1962)

ABSTRACT: The philosophy of crash safety is based on the understanding that some accidents will occur despite the best efforts of industry and government to prevent accidents. To date, crash survival study has been limited because of two reasons. First, it has taken this length of time to evoke the interest of a sufficient number of scientists, engineers, leaders, and organizations. Second, there has been no public support for crash safety design resulting from research.

The first major group to do crash safety work was the Protection and Survival Branch of the Civil Aeromedical Research Institute. Past research and crash injury investigation has shown that the human body can withstand enormous impact force for a brief period of time (measured in milliseconds) and in many cases can survive - with little injury - forces capable of destroying aircraft structure. In fact, this has led to a broad classification of accidents as survivable or non-survivable. We must develop data defining the explicit and definitive limits of crash tolerance of not only the human body as a whole but of each vital organ.

2,400

Hasbrook, A. H. & J. C. Earley 1962 FAILURE OF REARWARD FACING SEAT-BACKS AND RESULTING INJURIES IN A SURVIVABLE TRANSPORT ACCIDENT.
(U. S. Civil Aeromed. Res. Inst., Oklahoma City, Oklahoma) 62-7:1-11, April, 1962.

2,401

Hasbrook, A. H., J. D. Garner, & C. C. Snow 1962 EVACUATION PATTERN ANALYSIS OF A SURVIVABLE COMMERCIAL AIRCRAFT CRASH. (Civil Aeromedical Research Institute, Federal Aviation Agency, Oklahoma City, Oklahoma) Rept. No. 62-9; ASTIA AD-282 893; May 1962

ABSTRACT: The evacuation pattern of 99 of 106 survivors of a jet transport crash involving a post crash fire is described, factors possibly effecting the suffocation and ultimate death of 16 passengers are listed and photographs and diagrams are presented. (AUTHOR)

2,402

Hass, G. 1943 AN ANALYSIS OF RELATIONS BETWEEN FORCE, AIRCRAFT STRUCTURE AND INJURIES TO PERSONNEL INVOLVED IN AIRCRAFT ACCIDENTS WITH RECOMMENDATIONS FOR SAFER PRINCIPLES IN DESIGN OF CERTAIN TYPES OF AIRCRAFT (School of Aviation Medicine, Randolph Air Force Base, Tex.)
Proj. no. 187 Rept. no. 1 1 Nov. 1943. ASTIA AD 131 867

2,403

Hass, G. 1943 RELATIONS BETWEEN INJURIES DUE TO AIRCRAFT ACCIDENTS AT BROOKS FIELD, TEXAS IN 1942 AND THE CAUSES AND NATURE OF THE ACCIDENTS. (War Dept., Air Forces, Randolph Field, Texas)
#144 (1), 29 April 1943

2,404

Hass, G. M. 1944 INTERNAL INJURIES OF PERSONNEL INVOLVED IN AIRCRAFT ACCIDENTS.
Air Surgeon's Bull. 1:5.

2,405

Hass, G. M. 1944 TYPES OF INTERNAL INJURIES OF PERSONNEL INVOLVED IN AIRCRAFT ACCIDENTS.
J. Aviation Med. 15:77-84.

ABSTRACT: The author comments on internal injuries which offer new problems in pathogenesis, diagnosis and treatment. In the general case, the occupant of a rapidly decelerated aircraft is held securely in his seat by the safety belt and is momentarily subjected to the action of very large forces. The forces may be resolved along the three principal axes. At times, the vertical seat to head forces are very large. At other times, the anteroposterior forces are large. In still other instances, lateral forces directed in the long axis of the wings are large. Whenever one part of the body is decelerated at a rate which is different from that of another part of the body, the connections between the two parts are placed under stress which is proportional to the differences in the rates of deceleration. That difference in rate of deceleration causes injury.

2,406

Hass, G.M. 1944 UNSUCCESSFUL USE OF PARACHUTES AND CASES RESULTING FROM FORCES GENERATED BY AIRCRAFT SPINS. Air Surg. Bull., 1:6-7

ABSTRACT: Fliers should be informed that if they are immobilized by a force of sufficient magnitude to cause blackout on standing they should crawl to the nearest exit keeping the trunk and head parallel to the long axis of the fuselage.

Among the causes of nonuse of parachutes may be (1) limitations of speed and accuracy of physiologic reactions, such as slow perception or reaction to stimulus of a stall abnormal attitude or direction of spin; acute disorientation or vertigo; (2) improper spatial relations between occupants and avenues or facilities of escape; (3) inadequate spatial relations between the aircraft and the occupant or his opening parachute after the occupant has jumped from the aircraft.

2,407

Hass, G.M. 1944 RELATIONS BETWEEN FORCE, MAJOR INJURIES AND AIRCRAFT STRUCTURE WITH SUGGESTIONS FOR SAFETY IN DESIGN OF AIRCRAFT.
J. Aviation Med. 15:395-400

ABSTRACT: Pathological findings in aviators who have been subjected to the barely survivable range of impact are described in detail. The prevention of injuries is of greater importance than their diagnosis and treatment.

Hazardous structures are present in the cockpit and should be eliminated. Collapse of the cockpit structure also causes injury. Emergency escapes are not adequate.

Data concerning the tolerance of the body to impact have not been obtained quantitatively in ranges of impact involving large force and brief time need to be known and is now being studied with animal experimentation.

Above 500 ft. the only chance of survival is by parachute. Corrective measures for emergency escape are needed.

2,408

Hatch, H. G., Jr. 1959 EFFECTS OF WATER LANDING IMPACT ON AN ORBITAL CAPSULE FROM THE STANDPOINT OF OCCUPANT PROTECTION.
(National Aeronautics and Space Administration, Washington, D. C.)
NASA TN D-39, 17 Sept. 1959. ASTIA AD 225 620.

SUMMARY: The terminal phase of the flight on one type of manned orbital capsule consists of a parachute descent through the lower atmosphere with a landing on water. One proposed configuration is a conical-shaped capsule with a segment of a sphere as the bottom. The spherical surface would be used as the landing surface as well as the re-entry surface. A form fitted heat shield would be attached to the bottom to provide protection during reentry and may be jettisoned before landing, if desired. The water-landing characteristics of this type cap-

sule were investigated and it was found that an acceleration onset rate of 25,000 g/sec with an acceleration varying between 20 g and 60 g, depending upon the impact conditions, should be expected for an impact velocity of 30 ft/sec. This velocity is a reasonable parachute descent speed. Literature on human tolerance to rapid acceleration indicates that an acceleration rate of 1,500 g/sec to a 40 g level is about the maximum a human can endure without injury. The duration of the 40 g level should not be more than 0.1 second. For this acceleration, at an initial velocity of 30 ft/sec, the distance required to stop is 8.54 inches. If the capsule were provided with some means (internal or externally) to ease the occupant down 8.54 in. within the tolerable acceleration limits during impact, he could survive the landing. Internally, the cushioning could be achieved with a crushable structure or a mechanical spring system. (Author)

2,409

Haumann, W. 1930 DIE WIRBELBRUCHE UND IHRE ENDERGEBNISSE.
(Stuttgart: Ferdinand Enke, 1930)

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Hausknecht, D. F. & R. P. Vaitys 1961 AN INVESTIGATION OF TWO METHODS
OF ARRESTMENT OF HIGH-SPEED AIRCRAFT. (American Machine and Foundry Co.,
Niles, Ill.) ASD TN 61-128. ASTIA Doc. No. AD-268 378.

ABSTRACT: Two methods of aircraft arrestment are investigated to determine their suitability for aircraft landing speeds far above the capabilities of present systems. One method is preacceleration of components of a present arresting system to reduce the relative impact velocity between the aircraft and preaccelerated components. Energy requirements and tolerances affecting timing of the preacceleration are investigated and illustrated with numerical examples. The other method is the use of an energy-absorbing material in the cable of an arresting system to obviate a separate arresting engine. Basic formulas for interactions of waves in a yielding cable are developed. The formulas are applied in numerical examples for specific arrangements of the cable. Results indicate that both methods offer sufficient promise of success to be worthy of development. (Author)

2,411

Hauty, G. T., & G. R. Wendt 1953 STUDIES OF VESTIBULAR FUNCTION. I. The
Duration of Primary Nystagmus as a Function of Speed of Rotation and of
Acceleration. J. Psychol. 36:143-151

2,412

Hauty, G. T. 1953 PRIMARY OCULAR NYSTAGMUS AS A FUNCTION OF INTENSITY AND DURATION OF ACCELERATION. J. exp. Psychol. 46:162-170, Sept. 1953

ABSTRACT: Three male students were selected after appropriate preliminary examination. One was subjected to five different velocities of rotation, 180°/sec. to 12°/sec., reached by each of six different accelerations, a total range of 360°/sec.² to 1°/sec.². The other two Ss served in spot-checks at critical simulating conditions. The head was fixed so that forward inclination was approximately 15°. The trial consisted of a selected value of acceleration followed by 5 min. of constant rotation at a selected terminal velocity, then, a selected value of deceleration, and following this, a 5 min. stationary period. The entire sequence of nystagmic responses (primary and secondary of positive acceleration and primary and secondary of negative acceleration) were continuously recorded by the mirror recorder for recording eye movements through the closed lids. Two or more trials per stimulating condition were given on widely separated days.

2,413

Hauty, G. T. 1958 HUMAN PERFORMANCE IN THE SPACE TRAVEL ENVIRONMENT
In (Air University, School of Aviation Medicine, Randolph AFB, Texas)
Reports on Space Medicine - 1958, Feb. 1958
See also (Air University, Maxwell AFB, Ala.) Air University Quarterly Review 10(2):

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

2,414

Hauty, G. T. and G. R. Wendt 1960 SECONDARY OCULAR NYSTAGMUS AS A FUNCTION OF INTENSITY AND DURATION OF ACCELERATION
(School of Aviation Medicine, Brooks AFB, Tex.) Rept. no. 60-29; April 1960.
ASTIA AD 241 862

ABSTRACT: Neither intensity nor duration of stimulation was found to be consistently related to the intensity and duration of secondary nystagmus. Yet, total secondary nystagmic output was directly related to the product of intensity and duration of stimulation and, moreover, was roughly one-half that of the total output of the preceding primary phase of nystagmus. These results, interpreted in the light of existing knowledge, suggest that the response characteristics of secondary nystagmus are determined by activity occurring in the vestibular nuclei complex. (Author)

2,415

Hawkins, R. D. 1955 ANALYZING SHOCK AND VIBRATION EFFECTS WITH HIGH SPEED PHOTOGRAPHY.
Machine Design. April 1955, 214-218.

2,416

Hawkes, R. 1956 AEROMEDICINE REINFORCES FRAIL MAN.
Aviation Week 65(6):360-361, 363-365, 6 Aug. 1956

ABSTRACT: An overall view is presented of the basic and applied research carried out by branches of the Aero Medical Laboratory. The current ideas in research and design of oxygen systems, pressure breathing devices, and pressure suits are noted. Studies of the effects of acceleration and deceleration have culminated in the requirement of an escape capsule in all designs capable of supersonic speeds or high-altitude flight. Further, studies in aviation psychology, bioacoustics, vision in an empty visual field, and flight feeding are mentioned.

2,417

Hawkins, W. R., R. R. Hessberg and K. H. Houghton 1961 USAF IMPACT ACCELERATION PROGRAM AND FACILITIES.
(Presented at the Space Science Board Symposium on "Impact Acceleration Stress", 27-29 Nov. 1961).
(Brooks AFB, Tex.)

2,418

Hawkins, Willard R. & Rufus R. Hessberg 1962 USAF IMPACT ACCELERATION PROGRAM AND FACILITIES
(In: Impact Acceleration Stress: Proceedings of a Symposium With a Comprehensive Chronological Bibliography, National Academy of Sciences, National Research Council, Publication No. 977, pp. 313-322)

ABSTRACT: The purpose of the program is to establish criteria for design of manned aerospace vehicles in which accelerations, decelerations, buffeting, impact, and pressure differentials are to be encountered during any normal or emergency phase of flight. Actual determination of human tolerance to each conceivable dynamic complex would be prohibitive in terms of time, cost, and effort. The alternative is the elucidation of sound principles of estimating tolerance to complex biodynamic stress.

Two resources have, to date, permitted testing in areas potentially too dangerous to justify using human volunteers. The large primate has proven an excellent subject for such testing by virtue of his anatomical and physiological resemblance to man. The anthropomorphic dummy has been the second recourse. In short, the perfect dummy will never approach the live primate in anthropomorphism.

The program ahead must be limited to carefully defining fundamental principles of Biodynamic interrelationships. These principles will, when verified, permit

calculations of tolerance estimates when dynamic input data are provided. The accuracy of such estimates depends on the sagacity with which the program is pursued.

2,419

Hawthorne, R. 1951 FLIGHT IN THE AEROPAUSE
Aviation Age 16(6):29-31, Dec. 1951

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Hawthorne, R. 1958 AVIATION AGE RESEARCH AND DEVELOPMENT TECHNICAL HANDBOOK 1957-1958. (Conover - Mast Publications, Inc.)

2,421

Haynes, A. L., R. H. Fredericks & W. J. Ruby 1956 AUTOMOTIVE COLLISION
IMPACT PHENOMENA
(Ford Motor Company, Dearborn, Mich.)

2,422

Haynes, A.L. 1961 IMPACT STUDIES OF THE UNITED STATES AUTOMOBILE INDUSTRY
(Paper, Symposium On Impact Acceleration Stress, Brooks Air Force Base,
San Antonio, Texas, November 27-29, 1961)

2,423

Haynes, A.L. 1962 AUTOMOTIVE IMPACT
In: Impact Acceleration Stress: Proceedings of a Symposium With a Comprehensive Chronological Bibliography, National Academy of Sciences, National Research Council, Publication No. 977, pp. 69-82

ABSTRACT: An outline is presented for some of the techniques employed for obtaining factual data on automotive impacts. These research studies have been conducted as part of an ever-expanding program to develop design features and methods for reducing occupant injuries in actual accidents. Some values of human tolerance to impact forces have been estimated by comparisons of actual accidents and occupant injury with the force and kinematic data obtained in research impact studies. Techniques have been developed for predicting the loading patterns and structural behavior characteristics which can be anticipated under particular crash-impact conditions. However, much less is known about the human response to impact loading. Studies in this field are underway at various medical centers, frequently with the financial sponsorship of automobile manufacturers. Statistical analysis of accidents involving late model cars have demonstrated that at reduction in occupant injuries already has been achieved.

2,424

Haynes, A. L. and H. R. Lissner 1962 EXPERIMENTAL HEAD IMPACT STUDIES.
(In M. K. Cragun, ed., The Fifth Stapp Automotive Crash and Field
Demonstration Conference, Sept. 14-16, 1961) Pp. 158-170.

2,425

Hayum, R. 1959 COMPENSATION OF A DIGITAL INTEGRATING ACCELEROMETER.
(Master's Thesis, Instrumentation Lab., Mass. Inst. of Tech., Cambridge)
(Contract AF 04(647)303) Rept. No. T-209, ASTIA Doc. No. AD-269 249.

ABSTRACT: Compensation of a Digital Integrating Accelerometer, necessitated by the unusual moding behavior of a nonlinear sampled-data system, is presented. With the system compensated, highest frequency limit cycles are established and system errors are minimized. A new configuration is proposed using a conventional torque generator microsyn as both a torquing and sensing device. The microsyn is commanded by a flip-flop. This pulsed microsyn also presents a convenient and easy method for attaining the compensation. REAC simulation is used to demonstrate the effect of the compensation and to illustrate the systems' dynamic behavior. Cross-coupling error is investigated to determine if any appreciable error is introduced. A pure sampled-data approach is presented to show a new method of analysis. The nonlinear difference equation of the compensated system is derived. Acceleration commands are given to the system with and without compensation and the resultant error in the indicated velocity is plotted. (Author)

2,426

Hazel, J.T. 1962 THE EFFECT OF DIRECTION, MAGNITUDE, AND DURATION OF
BODY TILT ON SIZE ESTIMATION WITH VARIED SURROUND CONDITONS.
(Ph.D. thesis, Florida University, Gainesville, 1962)
ASTIA AD 294 567

ABSTRACT: The effect of variations in the direction, extent, and duration of body tilt on the visual estimation of lengths of lines, when the lines are presented with different surrounds, are investigated.

2,427

Head, H. 1920 THE SENSE OF STABILITY AND BALANCE IN THE AIR.
Aviat. Med. Invest. Comm., Special Rept. Series No. 28, Med. Res. Council,
London, 1919.
(Reprinted in The Medical Problems of Flying. [London: His Majesty's
Stationery Office, 1920])

2,428

Headley, R. N., R. F. Managan, J. W. Brinkley, & G. Lokatos 1960 HUMAN FACTOR RESPONSES DURING GROUND IMPACT. (Paper, 31st Annual Meeting of the Aerospace Medical Association, Americana Hotel, Bal Harbour, Miami Beach, Fla., May 9-11, 1960)

2,429

Headley, R. N., J. W. Brinkley, et al. 1960 HUMAN FACTORS RESPONSES DURING GROUND IMPACT. (Wright Air Development Division, Wright-Patterson AFB, Ohio) WADD TR 60-590; ASTIA AD-252 444; Nov. 1960

See also J. Aerospace Medicine 33(2):141-146, Feb. 1962

ABSTRACT: Forty-six vertical impact experiments utilizing a simulated B-70 escape capsule were conducted on eleven subjects in the seated position. Impact velocities ranged from 9.8 ft per sec. up to 30 ft per sec.; a crushable paper honeycomb material was employed as an impact attenuator. Three restraint systems were tested. Accelerometer data from the subjects revealed mean rates of onset of deceleration as high as 1620 g per sec. with maximum g-loadings up to 35 g. After conservative evaluation of the data, it was concluded that impact decelerations of 24 g with a velocity change of 30 ft per sec. and a rate of onset of 500 g per sec. can be tolerated by human subjects in the seated position. This tolerance was attained, however, by using a proper body restraint system with good upper torso support, proper torso and neck positioning, and by eliminating all possible elastic recoil components in the subject-support restraint complex. (AUTHOR)

2,430

Headley, R. N. 1961 HUMAN TOLERANCE AND LIMITATIONS TO ACCELERATION. In Bergeret, P., ed., Bio-Assay Techniques for Human Centrifuges and Physiological Effects of Acceleration. (London, New York, Paris: Pergamon Press, 1961) AGARDograph 48. Pp. 35-41.

ABSTRACT: Human tolerance and limitation to some of the accelerations anticipated in manned space travel have been discussed. Increased knowledge of the physiological and psychological sequence of events occurring during these accelerations is mandatory. Human factors investigation must keep abreast of rocket technology so that problems can be anticipated and remedied on the drawing board and not 500 miles out in space.

2,431

Headley, R. N., J. W. Brinkley, & K. K. Kaiser 1961 ABRUPT ACCELERATION OF HUMAN SUBJECTS IN THE SEMI-SUPINE POSITION. (Paper, 32nd Annual Meeting, Aerospace Medical Association, 24-27 April 1961, Chicago, Ill.)

ABSTRACT: One hundred and twenty experiments have been conducted to determine the salient biomechanics of human protection against the potentially fatal hazard

of abrupt acceleration during aerospace flight. Twenty human subjects have been exposed to acceleration forces (+A_x) of extremely short total duration, brief rise time, and magnitudes about fifty "g's". The acceleration profiles have been controlled by varying impact velocities and rate of attenuation. Numerous configurations of crushable paper and aluminum honey-comb have been utilized to attenuate velocities ranging up to 30 feet per second. Human volunteer subjects have been subjected to transverse impact in the semi-supine position using body support systems incorporating contoured, rigid, urethane couches and ureaformaldehyde sphere mattresses. This research effort has exposed new and unique problem areas and has led to development of new design criteria for protective body support and restraint systems. (Aerospace Medicine 32(3):234, Mar. 1961)

2,432

Headley, R.N, J.E. Brinkley, G. Lokatos and R.F. Managan 1962 HUMAN FACTORS RESPONSES DURING GROUND IMPACT. Aerospace Med., 33(2):141-146, Feb. 1962
ASTIA AD 252 444

ABSTRACT: Forty-six vertical impact experiments, utilizing a simulated B-70 escape capsule, were conducted on eleven subjects in the seated position (+Az). Three drops only are reported "in toto" in this report. Impact velocities ranged from 9.8 feet per second up to 30 feet per second, a crushable paper honeycomb material was employed as an impact attenuator. Three restraint systems were tested in this program: (1) the standard military lap belt-shoulder harness configuration, (2) an experimental nylon full-restraint suit, (3) an early prototype of the Stanley B-58 capsule restraint harness.

Accelerometer data recorded on the subjects revealed mean rates of onset of deceleration as high as 1620 "g" per second with maximum "g" loadings up to 35 "g". Complete pre-test and post-test clinical examinations were performed, and the only noteworthy finding was one episode of microscopic hematuria lasting for one month.

After a conservative evaluation of the data, the authors conclude that impact decelerations of 24 "g" with a velocity change of 30 feet per second and a rate of onset of 500 "g" per second (maximum calculated value) can be tolerated by human subjects in the seated position. This tolerance can only be attained, however, by the employment of a proper body restraint system with good upper torso support, proper torso and neck positioning, and by the elimination of all possible elastic recoil components in the subject-support restraint complex. (Authors)

2,433

Heald, C. B. 1925 SOME MEDICAL ASPECTS OF AIR TRANSPORT
J. Royal Aero. Soc. 29(174):246-268, June 1925

2,434

Healy, F. 1959 NOTES ON THE BASIS OF OUTSIDE SAFETY DISTANCES FOR EXPLOSIVES INVOLVING THE RISK OF MASS EXPLOSION (Interdepartmental Explosives Storage and Transport Committee, Ministry of Works(Gt. Brit.)Rept. no. 3/7 EXPLOS. /43, March 1959, ASTIA AD-221 164

CONTENTS:

Safety distances used previous to post-war review
Information available for post-war review
Analysis of bomb damage
Tabulation of bomb damage and accidental damage in terms of RB
Relationship between actual explosion results and various safety distance curves
Estimates of the risk of verious damage with traversed explosives beyond proposed safety distances
Estimates of the risk of serious damage with untraversed explosives beyond proposed safety distances
Safety distances adopted for category Z explosives
Continuation of analysis of information from accidental explosions

2,435

Hedén, C.-G. 1961 [HORIZONTAL-ROTOR CENTRIFUGE CONSTRUCTION REPORT]

SEE Karolinska Institutet

2,436

Heden, C. G. 1962 FINAL TECHNICAL REPORT UNDER CONTRACT DA-91-591-EUC-2036.
(Karolinska Institutet, Bakteriologiska Institutionen, Stockholm, Sweden)
Nov. 1961 - Nov. 1962. ASTIA AD 299 128

ABSTRACT: The physical and mechanical tests on the machine designed, calculated, and manufactured under this contract revealed that a heavy (112 kg without rotor and liquid) stainless steel rotor, cylindrical in shape, can be spun horizontally as a routine operation at speeds up to 15,000 r.p.m. on water lubricated bearings. The auxiliary devices permitting rapid starting and stopping and preventing heating of the test suspensions functioned very well. The bacterial cells (E. coli B) collected evenly in the cylindrical chambers at the periphery of the rotor, but, unlike in the light miniature rotor tested several years ago, larger amounts of cells tended to immobilize the suspending rods of aluminium. This was done so efficiently that only very violent motions would release them, thus permitting resuspension to take place. Since the situation was not improved by the use of heavier rods (stainless steel), a basic redesign of the rotor seemed necessary. Against this background the improvement of the sedimentation efficiency of the present rotor was only carried so far as was regarded useful to illustrate the main phenomena controlling the performance. Actually the efficiency was not pushed beyond 40 liters of E. coli culture per hour with a 95% sedimentation efficiency. It was strongly influenced by three phenomena;

pumping capacity, turbulence and foaming, each involving a number of parameters.

The experience gained in operating a horizontal rotor has been of great value, and a simplified rotor is now being designed to fit the housing and drive assembly used. It is shaped as a simple bowl, has a much larger sludge space and a single suspending roller retracted towards the center during sedimentation.

2,437

Hedlyn, J. M. 1959 NYSTAGMUS INDUCED BY VISUAL FEEDBACK.
J. Opt. Soc. Amer. 49:729-730, July 1959.

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Hegenwald, J. R., Jr. 1954 HUMAN TOLERANCE TO ACCELERATIONS.
(North American Aviation, Inc., El Segundo, Calif.) Rept. No. NA-54-191
Feb. 1954.

2,439

Hegenwald, J. F., Jr. 1956 THE ROLE OF THE EXPERIMENTAL TRACK IN
EMERGENCY EGRESS SYSTEM DEVELOPMENT. (Paper, Third Annual Supersonic
Track Symposium at U.S. Naval Ordnance Test Station, China Lake,
California, 24-27 September 1956.)

2,440

Hegenwald, J. F., Jr. and W. V. Blockley 1956
SURVIVABLE SUPERSONIC EJECTION, A CASE STUDY TO CORRELATE ANALYTICAL,
EXPERIMENTAL, AND MEDICAL DATA BY RECONSTRUCTION OF AN INCIDENT
(North American Aviation, Inc., Los Angeles, Calif.)
Rept. No. NA-56-452 ASTIA AD 138 762.

ABSTRACT: An anthropomorphic dummy, which was dressed and equipped in the manner of an inspection test pilot, was ejected 4 times from a simulated F-100 airplane cockpit at 533 to 677 kn. The objective was to obtain information which could be used to prevent the recurrence of injuries which were sustained by a pilot who was ejected from an F-100A airplane over the Pacific Ocean. All tests were performed by utilizing the M-5 catapult with an ejected weight of about 350 lb. The standard F-100 ejection seat configuration was employed, except for the incorporation of the drag parachute in later runs. In addition to the photographic coverage, continuous acceleration data were provided by means of a telemetering transmitter mounted within the dummy's torso. The pilot was believed to experience, at the head, (1) a maximal period of 290 msec with an acceleration greater than 20 g, (2) a period of 120 msec

at an acceleration above 35 g, (3) a peak acceleration of 64 g, and (4) a rate of onset of the peak of 700 g/sec; the direction of application was chest to back. The imposition of a single properly directed force vector upon the seat-man unit would benefit ejection seat escape in 3 main aspects: (1) orientation of the seat attitude to produce accelerative forces in physiologically favorable directions; (2) attenuation of acceleration magnitude at the seat occupant's extremities, and (3) improvement of aerodynamic lift characteristics.

2,441

Hegenwald, J.F. & E.A. Murphy 1957 SLED TESTING THE EMERGENCY ESCAPE SYSTEM:
THE HUMAN FACTOR
Paper, ARS Spring Meeting, April 1957, Washington, D.C.

ABSTRACT: During escape from high-performance airplanes, the aircrew may be subjected to hazards of bodily accelerations, windblast, noise, pressure gradients, and equipment disintegration. Rocket-propelled sleds on the experimental track provide a ready medium for determination of the physiological, mechanical, and structural effects of escape unit ejection at all airspeeds. A primary design objective is aerodynamic control of the escape unit's actions after separation from the airplane; pitch-retarding and stabilization devices are investigated in the current program of North American Aviation to attenuate aircrew accelerations during ejection. The reactions of helmets, oxygen masks, parachutes and ejection seats are studied. Methods of securing and recording data are reviewed.

2,442

Hegenwald, J.F., Jr. & E.A. Murphy, Jr. 1957 SLED TESTING THE EMERGENCY ESCAPE
SYSTEM: THE HUMAN FACTOR
Jet Propulsion 27(9): 1025-1028, Sept. 1957

ABSTRACT: Tests were made to assess single items of ejection equipment and also, using instrumented dummies, to determine the forces on the human frame. The test vehicle was designed for 16 standard 2.2 ks solid propellant rocket motors and was run on the Edwards Air Force Base high-speed track.

2,443

Hegenwald, J.F., Jr. & S. Oishi 1957 HUMAN TOLERANCE TO ACCELERATIONS:
A PRACTICAL TOOL FOR THE ENGINEER. (Paper, 28th Annual Meeting of the
Aero Medical Association, Denver, Colo., May 6, 1957)
Rept. No. NA-57-425, 6 May 1957. rev. 13 June 1957. ASTIA AD 256 384

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Hegenwald, J.F., Jr. & S. Oishi 1957 HUMAN TOLERANCE TO ACCELERATIONS:
A PRACTICAL TOOL FOR THE ENGINEER.
(North American Aviation, Inc., Los Angeles, Calif)
Report No. NA-57-425, 6 May 1957. ASTIA AD 256 384

2,445

Hegenwald, J.F., Jr., J.F. Madden & P.R. Penrod 1959 X-15 RESEARCH AIRCRAFT
EMERGENCY ESCAPE SYSTEM
Paper, Joint Meeting of the Flight Test Panel and the Aeromedical Panel of the
Advisory Group for Aeronautical Research and Development, Athens, Greece.
11-15 May 1959 (AGARD Rept. No. 243) ASTIA AD 256 386

ABSTRACT: An extensive survey of alternate escape system types was made. The results indicate conclusively that an open ejection seat in conjunction with a full pressure protective garment best satisfy X-15 emergency escape requirements. An evaluation of available ejection seats which had demonstrated a supersonic capability revealed that modifications required to meet the specific requirements of cockpit compatibility, acceptance of the pressure suit, and use at very high Mach numbers, would be equivalent to complete redesign. A seat tailored to the X-15 offered the most acceptable solution. The completed test program has demonstrated that the aerodynamic, mechanical, structural, propulsive, and survival aspects of X-15 emergency escape system similar in concept to that incorporated in the X-15 will best satisfy escape requirements for currently projected manner orbital vehicles. (Author)

2,446

Hegenwald, J. F., Jr., H. L. Neumann, & E. A. Murphy, Jr. 1960 AERIAL AND
SLED TESTING OF THE B-70 AIRCREW ESCAPE CAPSULE. (Paper, Annual Symposium
of the Society of Experimental Test Pilots at Los Angeles, California, 6-8
October 1960) also (Paper, Physiological Training Officer Symposium, School
of Aviation Medicine, Brooks AFB, Texas, 6-10 February 1961) (Human Factors
Group, Los Angeles Division, North American Aviation, Inc.)

SUMMARY: The test program was arranged to examine mechanical components individually at first and then progressively within complete subsystems. Wind tunnel work was begun early so that the stabilization configuration could be developed in time for full-scale air drop testing. Recovery parachute experiments initiated the hardware field test phase. Characteristics such as deployment sequence, opening shock, tendency toward twisted lines, oscillation and rate of descent were determined. As the program proceeded, supplementary system tests were conducted. Elements of the capsule, the rocket catapult, recovery mechanisms, impact attenuator, ballistic devices, and actuators were evaluated for incorporation in the prototype configuration. These tests were accomplished both by equipment suppliers and by North American Aviation, Inc. in the laboratory and in the field. Included were centrifuge, functional, and ballistic breadboard experiments; flotation,

survival, impact, structural and fatigue testing. Weighted shell air drops, high altitude and minimum velocity ejections have been completed. Major sled testing is scheduled near the end of the program. In the final of two series of sled tests, full-scale ejections of prototype capsules containing anthropomorphic dummies will be effected at air vehicle maximum equivalent airspeed. (AUTHOR)

2,447

Hegenwald, J.F., Jr. 1962 ENVIRONMENTAL ASPECTS OF THE B-70 MACH 3 ESCAPE CAPSULE

Aerospace Medicine 33(8): 951-957, Aug. 1962

ABSTRACT: The first encapsulated seat to demonstrate safe ejection throughout the speed spectrum from 90 knots to supersonic, including ground-level escape at these speeds, the B-70 capsule is entering the qualification phase of the test program. Suitable aerodynamically for very high Mach numbers, the capsule is capable of providing emergency pressure protection for space vehicle crews as well as furnishing intra-atmospheric escape for winged reentry spaceflight.

The aircrew emergency escape system of the B-70 air vehicle provides safe egress at performance levels as high as Mach 3.0 above 70,000 feet and as low as 90 knots at zero altitude. The capsule's influence upon normal and emergency flight operations is discussed. Oxygen and pressurization provisions, as well as crew positioning and restraint devices, are described. The acceleration environment through all escape phases is presented in conjunction with unique communications and survival features.

2,448

Heim, J.W. 1937 A LABORATORY FOR RESEARCH IN AVIATION MEDICINE.
J. Aviation Med. 8(2):75-80

ABSTRACT: Discusses the physiological research laboratory of the Air Corps Materiel Division, Wright Field, Dayton Ohio. Enumerates equipment and apparatus available for research in aviation medicine. Lists projects completed and projects active (in June, 1937). (CARL)

2,449

Heinrich, H.G. 1961 SOME RESEARCH EFFORTS RELATED TO PROBLEMS OF AERODYNAMIC DECELERATION
(Wright Air Development Division, Wright-Patterson AFB, Ohio) WADD TN 60-276;
November 1961; ASTIA AD 272 404

ABSTRACT: The status of research efforts designed to explain physical phenomena associated with the operation of aerodynamic decelerators, in particular textile

type parachutes, is presented. A theoretical approach to calculate the velocity and pressure distribution in the turbulent wake of basic bodies of revolution is outlined and compared to actual test results. The concept of the effective porosity of textile materials is developed, and its influence upon the aerodynamic and opening characteristics of conventional textile parachute canopies is discussed. The results of research efforts to reduce parachute inflation time with a minor increase of opening force are presented. (Author)

2,450

Heim, J.W., G.A. Hallenbeck & J.C. Glazier 1946 RATES AND TIMES OF FREE FALL OF ANTHROPOMORPHIC DUMMIES AND OF MAN.
(USAF, AMC, Aero Med. Lab., Wright Field, Ohio)
Memo Rept. TSEAA-696-100, 1 March 1946.

2,451

Heinecke 1943 CATAPULT SEAT WITH GUNPOWDER PROPULSION
(Messerschmitt AG., Projektbuero, Augsburg) April 1943; ASTIA ATI 32382

ABSTRACT: An investigation is conducted to see if the weight of a jettisonable seat with compressed air propulsion could be decreased by using gunpowder for propulsion. Calculations were made to determine the powder loading, force, speed and acceleration. Results of these computations are shown in a pressure diagram and schematic drawings. Tests were made with the Heinkel air-pressure-propulsed catapult seat weighing 19 kg. It was possible, using gun powder for propulsion, to reduce this weight to 5 kg.

2,452

Heinemann, E. H. 1947 HIGH SPEED AIRCRAFT DEVELOPMENTS.
(Paper, American Society of Mechanical Engineers, National Aviation Meeting, May 28, 1947)

2,453

Heinrich, H.G., T. Riabokin et al 1963 THEORETICAL PARACHUTE INVESTIGATIONS
(Aeronautical Systems Division, Wright Patterson AFB, Ohio) Project No. 6065;
Task No. 60252; Progress Rept. 24; ASTIA AD 405 507

ABSTRACT: This is the twenty-fourth quarterly report covering the time from 1 December 1962 to 28 February 1963 on the study program on basic information of Aerodynamic Deceleration. As in preceding reporting periods, work during this reporting period has been pursued in accordance with the technical program, and is described in the following sections of this report.

2,454

Heldane, J.B.S. 1951 BIOLOGICAL PROBLEMS OF SPACE FLIGHT.
BIS Journal 10:154-158

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

2,455

Hellebrandt, F. A., & E. B. Franseen 1943 PHYSIOLOGICAL STUDY OF THE VERTICAL
STANCE OF MAN. Physiol. Rev. 23:220-255

2,456

Hellems, H.K. and H.R. Bierman 1946 CHARACTERISTICS OF FORWARD MOTION OF
PERSONNEL IN AN F4U-1 COCKPIT.
(Naval Med. Research Inst., Bethesda, Md.) Project X-630(7), 19 June 1946.

2,457

Hemingway, A. 1943 ADAPTATION TO FLYING MOTION BY AIRSICK AVIATION STUDENTS
(School of Aviation Medicine, USAF Randolph AFB, Tex.) Rept. No. 170-4,
Dec. 1943. ASTIA ATI 117 793

ABSTRACT: One hundred and ninety-eight (198) airsick aviation students who had completed ten (10) hours of dual instruction in college training detachments were given a motion sickness swing test and a survey was made of the incidence of airsickness.

It was found that there was a progressive decrease in the incidence of airsickness during the training period of this group. Eighty-four (84) per cent were sick on the first flight and ten and five tenths (10.5) per cent on the last flight. In order to separate the chronic airsick from those who become adapted to flying motion, it is recommended that information on airsickness be obtained by an airsickness record from the instructor in the College Training Detachment.

2,458

Hemingway, A. 1943 EFFECT OF BARBITAL ON SWING SICKNESS (School of Aviation
Medicine, USAF Randolph AFB, Texas) Rept. No. 104-1, January 1943.

2,459

Hemingway, A. 1943 MOTION SICKNESS HISTORY AND RESULTS OF THE SWING TEST OF ONE HUNDRED AND SEVEN AIRSICK ELIMINEES FROM FLIGHT TRAINING (School of Aviation Medicine, USAF Randolph AFB, Texas) Rept. No. 170-2, September 1943

2,460

Hemingway, A. 1943 MOTION SICKNESS AMONG AIR CREW PERSONNEL.
(Com. Aviat. M., U.S. Nat. Res. Council, Washington)

2,461

Hemingway, A. 1943 INCIDENCE OF SWING SICKNESS IN EIGHT CATEGORIES OF ARMY PERSONNEL. (Com. Aviat. M., U.S. Nat. Res. Council, Washington)

2,462

Hemingway, A. 1943 IMPROVEMENTS IN DESIGN AND CONSTRUCTION OF SWING FOR TESTING INDIVIDUALS SUSCEPTIBLE TO MOTION SICKNESS (School of Aviation Medicine, USAF Randolph AFB, Texas) Rept. No. 84-2, February 1943

2,463

Hemingway, A. 1943 THE EFFECT OF ENVIRONMENTAL TEMPERATURE ON MOTION SICKNESS (School of Aviation Medicine, USAF Randolph AFB, Texas) Rept. No. 170-3, November 1943

2,464

Hemingway, A. 1943 EFFECT OF VASANO ON SWING SICKNESS (School of Aviation Medicine, USAF Randolph AFB, Texas) Rept.No. 110-1, March 1943

2,465

Hemingway, A. 1944 COLD SWEATING IN MOTION SICKNESS
Am. J. of Physiol. 141(2):165-171, 1 April 1944.

ABSTRACT: Cold sweating in man caused by motion involving changing linear and centrifugal accelerations has been studied by using a galvanometric device to indicate the onset of sweating. It has been found that the sweating occurs as a result of motion and when the mouth temperature is falling. There appears to be no useful physiological purpose in cold sweating and the mechanism is probably part of a primitive defense reaction.

2,466

Hemingway, A. 1945 CARDIOVASCULAR CHANGES IN MOTION SICKNESS.
J. Aviation Med. 16:417

2,467

Hemingway, A. 1945 INCIDENCE OF AIRSICKNESS IN CADETS DURING THEIR FIRST TEN
FLIGHTS (School of Aviation Medicine, USAF Randolph AFB, Texas) Rept. No. 170-5
January 1945

2,468

Hemingway, A. 1946 ENVIRONMENTAL TEMPERATURE AND SWING SICKNESS.
J. Aviation Med., 17 : 86

2,469

Hendler, E. 1952 DESCRIPTION OF THE HG-1 CATAPULT.
(Paper presented at Conference on "Problems of Emergency Escape in High
Speed Flight", 29-30 Sept. 1952, at Wright-Patterson AFB, Ohio) (Aeronautical
Medical Equipment Lab., Naval Air Experimental Station, Philadelphia, Pa.)
ASTIA AD-14 359

ABSTRACT: The HG-1 catapult is well suited to the study of the effects of abrupt impulsive forces on both biological and structural materials. The HG-1 is a pneumatically energized, hydraulically controlled mechanism. It is capable of accelerating a total load of 3,000 pounds from zero velocity to 80 knots in a distance of about none and one-quarter feet. Pickups measuring force and displacement derivatives with respect to time are mounted on the car and test load; velocity coils and photo-cells transmit signals whenever portions of the car pass specific positions, so that a continuous record of car displacement with time is prepared. Safety is provided by the shielded areas available for close observation of the shots and by continual improvements in operating techniques and equipment modifications. Air pressures required for launching are dissipated during the course of the shot, so that no potential energy remains in the system once the shot is completed.

2,470

Hendler, E. 1955 LINEAR ACCELERATION AS A SURVIVAL HAZARD IN AVIATION.
(Aeronautical Medical Equipment Lab., Naval Air Experimental Station,
Philadelphia, Pa.) ASTIA AD-59 333.
See also J. Aviation Med. 26(6):495-502, Dec. 1955.

ABSTRACT: Tolerance to applied g loads depends on many factors relating to its manner of application. In testing equipment designed to provide crash

protection, a special catapult has been used, and some of its properties are described. Peak accelerations measured in dummies, supported in many positions by various kinds of protective equipment, are significantly higher than the average car accelerations measured in the same direction. Violent movements of unrestrained parts of the dummies occurred during the catapult tests, and equipment failure generally occurred at average levels below 30 g measured on the catapult car. Some findings relating to the measurements and distribution of loads in restraining gear are discussed.

2,471

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

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

2,472

Hendler, E. 1962 BIOMECHANICS OF IMPULSIVE FORCES
(Naval Air Material Ctr., Philadelphia, Pa.) April 1962

2,473

Hendricks, W. & W.M. Bogart 1957 THE DIESEL-POWERED BALLISTIC CENTRIFUGE
(Allegany Ballistics Lab., Hercules Powder Co.) Rept. no. ABL/X-17; Contract
NOrd-16640; Aug. 1957; ASTIA AD-149 006

ABSTRACT: A centrifuge for testing rockets and their components is described. A 500-bhp diesel engine drives a large variable displacement pump which forces oil through 6-in.-diam pipes to drive 2 constant-displacement hydraulic motors. The motors are located in a pit in the center of the centrifuge enclosure. The booms of the centrifuge can be controlled at any desired speed up to 80 rpm. At 80 rpm, a rocket 20 ft from the center post of the device will be subjected to an acceleration of 43 g. The permissible load at the boom tip is governed by the allowable bending moment at the section where the knee brace joins the boom (290,000 lb in.) For this moment, the maximum load at the boom tip is 3000 lb.

2,474

Hendrickson, R.M. 1958 BIBLIOGRAPHY ON SPACE MEDICINE
(Los Alamos Scientific Lab., New Mexico) March 7, 1958

2,475

Henricsson, H. 1957 BIO-MECHANICS AND TRAUMA: A BRIEF GENERAL REVIEW OF
CURRENT PROBLEMS. Svenska Lak.-Tidn. 54(18):1433-1448, May 1957

2,476

Henriksson, N.G., C. Fernandez, and R.I. Kohut 1960 THE CALORIC TEST IN THE
CAT (School of Aviation Medicine, Brooks AFB, Texas) 61-13; Nov. 1960;
ASTIA AD-254 369

ABSTRACT: A simple device for fixing both head and body of the cat was designed so that the nystagmic reaction to caloric stimulation could be investigated. Nystagmographic tracings, relatively free of artificats induced by movements, were obtained of both ordinary and derived nystagmus. In order to produce a caloric reaction in the cat, it was necessary to set the temperature of the irrigating water to, at least 10 C. either below or above the rectal temperature (38 C.). Repetitive caloric stimulation with both cold and hot water was conducted under various conditions and the results were described for each. The data suggested the most appropriate way for obtaining reliable results with the caloric test in the cat. (Author)

2,477

Henry, J.P., et al. 1949 ANIMAL STUDIES OF THE EFFECTS OF HIGH NEGATIVE
ACCELERATION. (USAF, AMC, Engng. Div., Wright-Patterson AFB, Ohio)
Rept. No. 1, Memo Rept. MCREXD 695-74N, 20 Jan. 1949.

2,478

Henry, J. P., O. H. Gauer, E. E. Martin, S. S. Kety, & K. Kramer 1949 FACTORS
DETERMINING CEREBRAL OXYGEN SUPPLY DURING POSITIVE ACCELERATION. Fed.
Proc. 8:73

ABSTRACT: Extraordinarily low mean cephalic arterial pressures of less than 20-30 mm. Hg (blackout) can be endured during positive accelerations lasting as long as 3 minutes without loss of consciousness. When compared with the effects of a comparable drop in pressure during hemorrhagic shock, there is an unexpected retention of mental performance and orientation. In order more clearly to define the mechanisms involved, radial arterial and cerebral venous pressures, and arterial and cerebral venous oxygen saturations were measured in man during acceleration. These parameters were measured two at a time using electrically

operated gauges for the pressures and a Kramer glass cuvette oximeter for the oxygen saturations. The fall in arterial pressure at head level induced by the acceleration was closely followed by a drop in jugular venous pressure. In spite of black-out (4.5 g) one subject still had 60 mm. Hg mean pressure differential across the brain. The venous pressure became less negative as arterial pressure rose during the cardiovascular response to the sharp fall in arterial pressure induced in the carotid sinus by the acceleration. Typical changes in venous oxygen content were from 10.5 vols. % resting to 7.5 vols. % at blackout. Thus arterial as well as venous oxygen content should be known to determine the oxygen supply of the brain during prolonged acceleration. The extent of the fall in cerebral venous oxygen content at blackout points to an inadequacy of cerebral oxygen supply.

2,479

Henry, J. P. 1950 REPORT ON 1950 SYMPOSIUM ON SPACE MEDICINE.
J. Space Flight., 2 :850

2,480

Henry, J.P., J.L. Gamble, R.S. Shaw, O.H. Gauer, E.E. Martin, P.J. Maher,
& D.G. Simons 1950 STUDIES OF THE PHYSIOLOGY OF NEGATIVE ACCELERATION.
(USAF, AMC, Wright-Patterson AFB, Ohio) TR 5953, Oct. 1950.

ABSTRACT: When headward centrifugal forces of 3 g or more last for more than 5 to 10 seconds, they give rise to alarming symptoms including hemorrhages into the soft tissues of the neck and head, confusion, and unconsciousness. Past work is analyzed and fresh experimental data presented to demonstrate that in spite of these symptoms, protection against brain hemorrhage is given by the closed box of the skull. This is so effective that unprotected animals of human proportions can be exposed to 15 negative g without rupture of the blood vessels, and no case of cerebral hemorrhage has yet been demonstrated following negative acceleration uncomplicated by asphyxia or trauma to the head. It is suggested that the danger of cerebral hemorrhage has been over-estimated and that the risks of such an accident following exposure of a human to 5 g are vanishingly small.

Considerable protection against the mechanical and reflex effects of headward centrifugal force can be provided in the upright seated position by applying outer-pressure by means of a neck-sealing helmet. Evidence is presented which suggests that human tolerance to negative acceleration can be increased by this means in the seated posture to at least 5 g for 10 seconds.

2,481

Henry, J. P., O. H. Gauer, S. S. Kety and K. Kramer 1951 FACTORS MAINTAINING CEREBRAL CIRCULATION DURING GRAVITATIONAL STRESS.
J. Clin. Investigation 30(3):292-300, March 1951.

ABSTRACT: Lambert and Wood have shown that the systolic pressure at eye level during exposures to acceleration producing blackout is less than 20 mm. Hg, and they have observed that the pressure often falls temporarily to zero. Rossen, Kabat and Anderson have shown that if the blood supply to the human brain is suddenly interrupted, consciousness is lost in six seconds. The circulation should, theoretically, be halted by an acceleration reducing mean arterial pressure at head level to near zero values. In spite of this, maintenance of consciousness has been reported during a blackout lasting three minutes on the human centrifuge. A survey of clinical experiences with syncope also showed extremely low values. This suggests that compensatory factors are at work. Therefore, to study cerebral circulatory competence during exposure to gravitational fields, measurement was made of the cerebral venous and arterial oxygen saturation during acceleration.

The mean arterial blood pressure at head level fell in direct proportion to the acceleration, attaining 30 mm. Hg at about 4 g. However, the mean cerebral venous oxygen saturation stayed materially unchanged and in two of the three series actually rose slightly in the 2 to 3 g range. Some fall occurs at higher accelerations but never to the critical values expected. Fast records of the behavior of the venous oxygen content during acceleration shows the same picture. Some compensatory effect must cause this constancy, possibly either vasodilation reducing cerebral resistance or a fall in venous pressure increasing the force driving the blood through the capillary bed.

It seemed possible that as a result of acceleration a negative pressure might develop in the intracranial veins which continuously sustained cerebral blood flow (and venous oxygen saturation) by partially compensating for the marked fall in cerebral arterial pressure. Measurements were taken at the superior jugular bulb during both brief and prolonged accelerations. Pressures ranging from 20 to 60 mm. Hg below ambient were found. Brief accelerations of abrupt onset gave the most marked pressure falls. This at no time balanced arterial pressure fall.

There is also evidence that active cerebral vasodilatation may occur during prolonged exposure to gravitational stress in the erect posture. (J. of Aviation Med. 23(2):195-196, April, 1952)

2,482

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

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

2,483

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

2,484

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

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

2,485

Henry, J.P. 1958 SOME CORRELATIONS BETWEEN PSYCHOLOGIC AND PHYSIOLOGIC EVENTS IN AVIATION BIOLOGY. J. Aviation Med. 29(3):171-179

ABSTRACT: There is a new understanding of the role played in psychologic events such as attention, sleep and emotional responses by the reticular activating system and structures in the temporal lobe: the amygdala, hippocampus and pyramiform cortex. The "breakoff phenomenon" in which a sense of isolation is experienced by pilots flying alone at altitude may be related to the disturbances induced by sensory deprivation and these in turn to altered function of the temporal lobe structures. "Freezing," due to intense emotion, and "fainting" are discussed in relation to the influence that various afferent impulses and changes in the internal environment may have on the reticular activating system and hypothalamus. The mechanism of attention is related to the integrating role of the central internuncial system and the occurrence of differential subcortical inhibition. (Author)

2,486

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

ABSTRACT: Outlines the origin and purposes of the animal test program,

details of the Mercury capsule animal program underway at AMFL, HAFB; pre-launch facilities at Cape Canaveral, operational aspects, information anticipated from the animal flights, and future research possibilities of the program. Appendices contain the animal-monitoring and flight-data plans and list the personnel involved in the animal program.

2,487

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

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

2,488

Henry, J. P. & C. D. Wheelwright 1961 BIOINSTRUMENTATION IN MR-3 FLIGHT.
(Paper, Conference on Results of the First U.S. Manned Suborbital Space Flight, June 6, 1961, NASA, Washington, D.C.)

2,489

Hering, H. E. 1927 NERVOUS REGULATION OF BLOOD PRESSURE AND CAUSE OF SYNCOPE IN SUDDEN CHANGE OF POSTURE.
Munchen Med. Wchnschr. 74:1611-1613, Sept. 23, 1927.

2,490

Hermans, T.G. and R.B. Loucks 1947 ANNOTATED BIBLIOGRAPHY ON THE PSYCHOLOGICAL ASPECTS OF ORIENTATION AS THEY RELATE TO AVIATION.
(Aero Med. Lab., Engng. Div., AMC, Wright-Patterson AFB, Ohio)
Memorandum Report No. TSEAA-694-16A, 1 Dec. 1947. ASTIA ATI 115012

ABSTRACT: The purpose of this report is to make available to engineers, aircraft instrument manufacturers, and research personnel, a comprehensive bibliography and abstracts of scientific reports on psychological aspects of human orientation problems. The studies provide some basic information relative to the design of heading, attitude and navigation instruments whose function is to provide orientation or position information.

2,491

Herner and Company, Washington, D. C. 1959 BASIC RESEARCH RESUMES; A Survey of Basic Research Activities in the Air Research and Development Command. (Air Force Research Div., Air Research & Development Command, U. S. Air Force) AFOSR TR 59-204; PB 161291; Dec. 1959; ASTIA AD-232 933

2,492

Herner and Co. 1960 BASIC RESEARCH RESUMES' 1960. A SURVEY OF BASIC RESEARCH ACTIVITIES IN THE OFFICE OF AEROSPACE RESEARCH. (USAF ARDC, Washington, D.C.) AFOSR TR 925. ASTIA AD 268 900.

ABSTRACT: The purpose of this second Basic Research Resumes is to promote the broad accessibility of information about fundamental research projects supported by the Air Research and Development Command. The volume is a by-product of a research project whose purpose is the comparative study of indexing systems for scientific information. The subject index used is a working example of one means of organizing highly technical information for search and retrieval. It utilizes a system involving the permutation of key terms in phrases describing the content of documents, or, as in the present case, project outlines. The descriptive phrases, drawn directly from the texts of the project outlines, gives as specifically as possible the subject of the work done, and where applicable the method used. Since there, as a rule, are as many descriptive phases per project outline as there are major subjects discussed, there is an unusual depth and informativeness of index entry. The effectiveness and look-up flexibility of this form of entry are enhanced by the permutation of key terms within descriptive phrases. (Author)

2,493

Herner and Company 1961 LIST OF FAA AND CAA TECHNICAL DEVELOPMENT REPORTS AND CAA RESEARCH REPORTS. (Library Branch, Federal Aviation Agency, Washington, D.C.) Dec. 1961. ASTIA AD 270 023.

ABSTRACT: Attached are the lists of CAA technical reports that have been indexed arranged by series number with complete title given. There are 421 Technical Development Reports and 95 Research Reports. Also attached is the list of subject headings developed and assigned to the 516 reports listed. Requests for subject searches based on the subject heading list are welcomed by the FAA Library Branch.

2,494

Herrick, R. M., R. F. Gray, & J. L. Brown 1955 POST ACCELERATION EFFECTS ON THE DISCRIMINATORY CAPACITIES OF SMALL ANIMALS. (Naval Air Development Ctr., Johnsville, Pa.) Project NM 001 100 319; 31 Dec. 1955

ABSTRACT: An experimental program has been planed in terms of which sensory capacities and a variety of behavioral indices may be measured in laboratory animals. These measures may afford an index of effects of both chronic and acute exposures to acceleration. Special programming and recording equipment has been procured for this work.

2,495

Herrick, R. M., J. L. Meyers and R. E. Burke 1957 DISCRIMINATIVE BEHAVIOR FOLLOWING REPEATED EXPOSURE TO NEGATIVE ACCELERATION (Naval Air Development Center, Johnsville, Pa.) NADC-MA-5716, 26 Nov. 1957 ASTIA AD 156 852
See also J. Avia. Med. 29(5):343-349, May 1958.

ABSTRACT: Rats were trained to make a simple light-dark discirmination. On successive days the rats were exposed for a three-minute period to a given negative G, and, fifty-five minutes later, tested on the discrimination. After five days at a given negative G level, the negative G level was increased 1 G unit. This procedure was continued until death occurred. After training, but before exposure to negative G, the rats pressed a lever at a median rate of about sixty times per minute in the presence of the positive stimulus (light) and at a median rate of about three presses per minute in the presence of the negative stimulus (darkness). Following repeated exposure to negative G the lever-pressing rate in the presence of the positive stimulus decreased (e.g., to about forty-five times per minute by the time 5.5 G was reached) while the rate in the presence of the negative stimulus did not change. The data indicate that, although the rate at which the rats responded decreased somewhat as a function of exposure to negative G, the discriminative behavior remained relatively unimpaired until death occurred.

2,496

Herrick, R.M. & G.H. Kydd 1959 SIMULATED JUNO II ACCELERATION PATTERN (Naval Air Development Center, Johnsville, Pa.) Appendix to NADC-MA-5913, 21 Sept. 1959.

2,497

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

ABSTRACT: The purpose of the present experiment was to determine how exposure to a simulated acceleration pattern of the Juno II missile system

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

2,498

Herrick, R. M. 1961 ACCURACY OF LEVER-DISPLACEMENT BEHAVIOR OF RATS FOLLOWING EXPOSURE TO POSITIVE ACCELERATIONS. Aerospace Medicine 32(9):844-848, Sept. 1961
See also (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-6111; ASTIA AD-256 261; 19 April 1961

ABSTRACT: Rats were trained to press a T-bar handle of a response lever through an arc of at least 23.62 degrees but no greater than 28.76 degrees (Lever Position 5). This behavior was evaluated immediately following five minutes exposure to each of the following positive G values: 2, 5, 10, 15, 20. The behavior was not influenced at the lower G values. At the higher G values, the lever-pressing rate decreased, but the percentage of lever-presses made to Position 5 remained the same. (AUTHOR)

2,499

Herrick, R.M. 1961 ACCURACY OF LEVER-DISPLACEMENT BEHAVIOR OF RATS FOLLOWING EXPOSURE TO POSITIVE ACCELERATIONS.
(USN Aviation Medical Acceleration Lab., Johnsville, Pa.)
WepTask R36OFR102/2021/R01101001 (6006M), Subtask MR005.15 0002.16,
Rept. 5, Rept. NADC MA 6111, April 1961. ASTIA AD 256 261.

ABSTRACT: To determine how well animals can perform a finely coordinated movement following exposure to positive acceleration, rats were trained to depress a response lever handle through an arc of at least 23.62 degrees but not greater than 28.76 degrees and then to release the lever handle. Then the lever-pressing behavior was evaluated immediately following exposure to positive acceleration levels of 2, 5, 6, 15, and 20 g on successive days. The response data were presented as percentage of lever-presses made to each lever position during a one-hour test period on a control day and on a day immediately following exposure. (Tufts)

2,500

Herrick, R. M. 1961 EFFECT OF EXPOSURE TO THE CALEB MISSILE ACCELERATION PATTERN ON THE SUBSEQUENT BEHAVIOR OF RATS. (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-6112, 14 June 1961

2,501

Herrick, R.M. 1961 PRECISION OF A LEVER-DISPLACEMENT RESPONSE OF RATS FOLLOWING EXPOSURES TO POSITIVE G.
(Paper, 32nd Annual Meeting of the Aerospace Medical Association, Palmer House, Chicago, Illinois, April 24-27, 1961)

ABSTRACT: For a lever-press to an interval between 23.6° and 28.8° of arc (21 min to 25.5 min of arc), rats received a reward. A press to any other distance, i.e., a press between 0° to 23.5° or between 28.9° to 44.0° , was not rewarded. Rats were well trained in this task. Then, this behavior was evaluated immediately following 3 minute exposure to the higher G levels, all lever-pressing behavior stopped temporarily, then resumed at a subnormal rate. Of the total number of presses made during a daily test period, the percentage (about 60 per cent) made to the "correct" interval was the same on the pre-g control days and on the g days. (Aerospace Med. 32(3):234. Mar. 1961)

2,502

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

ABSTRACT: This report describes an animal response lever mechanism which (a) senses the displacement of the lever resulting from each press, (b) requires a constant torque throughout the total excursion of the lever arm, and (c) maintains the same torque characteristics under G. Calibration devices and techniques developed to evaluate the lever mechanism indicate its usefulness as a tool for the study of the effects of acceleration--including zero G--on behavior. Sample data on (a) lever-pressing rate, (b) frequency-displacement distributions, (c) characteristics of individual responses, and (d) the order of occurrence of different responses indicate the variety of data obtainable and the depth of analysis possible with the response mechanism.

2,503

Herrick, R.M. 1962 LEVER DISPLACEMENT DURING CONTINUOUS REINFORCEMENT AND DURING A "DISCRIMINATION"
(Naval Air Development Center, Aviation Medical Acceleration Lab., Johnsville, Pa.) Rept. No. NADC-MA-6209, 23 July 1962. NASA N62-14832.

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

2,504

Herrick, R. M., & J. S. Denelsbeck 1963 A SYSTEM FOR PROGRAMING EXPERIMENTS AND FOR RECORDING AND ANALYZING DATA AUTOMATICALLY. (Naval Air Development Center, Johnsville, Pa.) NADC-MA-6302; 20 Feb. 1963

ABSTRACT: An inexpensive system designed for use in complex operant conditioning experiments is described. Some of its key features are: removable plugboards, time sharing of components, recordings suitable for automatic analysis. Included are flow diagrams of the system and sample logic diagrams for programing experiments and for analyzing data. (AUTHOR)

2,505

Herrington, L. P., H. Lamport, & E. C. Hoff 1942 HUMAN CENTRIFUGE.
(Report of the Yale Aeromedical Research Unit) 30 Oct. 1942

ABSTRACT: A relatively inexpensive, 20-foot radius human centrifuge is described as follows. The centrifuge is driven through a reduction gear by a DC motor receiving power from an AC activated motor generator. If the current fails or the maximum speed is exceeded, the brake stops the centrifuge. The speed is controlled electronically. Radial acceleration is proportional to the square of the rate of rotation. The control keeps the constant rate of change of the electric current proportional to the square of the rate of rotation. (This is a modification of the electric tachometer where the voltage is proportional to the revolutions per minute). A direct reading of the electric accelerometer is thus produced. A more elaborate device permits the duplication of the "g" effect of any air maneuver by means of a photo cell following a "g"-time curve (called programming). The centrifuge gives a radial acceleration of 14 "g" in 5 seconds for the average-wright subject. Manufactured by Frank Hrubitz & Co., Salem, Oregon. Safety factor 12x.

2,506

Herrmann, W., & A. H. Jones 1961 SURVEY OF HYPERVELOCITY IMPACT INFORMATION. (Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge, Mass.) Rept. No. 99-1 (Subcontracted to Lincoln Lab., Mass. Inst. of Tech., Contract AF 19(604)7400); ASTIA AD-267 289

ABSTRACT: In this volume information relating to cratering and penetration in metallic targets has been gathered. Impact of compact particles, microparticles, and rods at normal and oblique incidence on quasi-infinite targets and on thin targets, multiple spaced targets, and shielded targets is considered. Experimental data are presented in tabular and graphical form for ready references. Available theories and semi-empirical theories, as well as empirical correlation equations are summarized and compared with each other and with the experimental data. For normal impact on quasi-infinite targets 2 empirical correlation expressions are deduced which are more generally applicable than previous expressions. A qualitative description of the cratering process is given, and realistic regions of impact are defined. Recommendations for future experimental and theoretical work are made. (AUTHOR)

2,507

Hersey, I. 1959 SOVIET BIOLOGICAL EXPERIMENTS

Astronautics, 4(2): 31, 80-81 Feb., 1959

See also: J. Aviation Med., 29: 781-84, 1958

ABSTRACT: A discussion is presented of Russian biological experimentation in space flight, as reviewed by A.G. Kousnetzov, chief of the physiology department of the Soviet Air Force Scientific Research Experimental Institute of Aviation Medicine in Moscow, in a paper delivered at the Third European Congress of Aviation Medicine, Louvain, Belgium, in September 1958. Soviet investigations of the effects of space flight on the human organism have been in progress since 1949. In the initial phase, animals encapsulated in hermetically sealed cabins were rocket-flown to heights of 100-210 km. and then ejected for return to earth by parachute. In the second phase, the capsule was eliminated, and the animal (in a special high-altitude suit) was separated by catapult from the descending rocket (at heights of 75-85 km. and of 39-46 km.) and parachuted to earth. The third phase of the experiments culminated in animal-rocket launchings to a height of 473 km. No major physiologic changes that could be regarded as resulting from acceleration, catapult launchings, or parachute descent from any of the altitudes studied were observed in the animals. A biological experiment which met all the conditions of space flight was realized with the launching of Sputnik II carrying the dog, Laika. During the crucial period between launching and the time the satellite was placed in orbit, the animal was in such a position as to sustain transverse acceleration. Data about the condition and behavior of the animal were successfully transmitted and received. Included was information on the effects of acceleration upon the frequency of heart contractions; the effects of zero-G conditions and weightlessness; the position of the dog's body in space; changes in the functional state of the nervous system; and changes in blood circulation and breathing. No physiologic manifestations of the effects of cosmic radiation on the animal were discovered.

2,508

Hershgold, E.J. 1959 X-RAY EXAMINATION OF THE HUMAN SUBJECT DURING TRANSVERSE ACCELERATIONS.

(Paper, Meeting of Aero Medical Association, Statler Hilton Hotel, Los Angeles, April 27-29, 1959)

ABSTRACT: Visualization of the thoracic and abdominal viscera by X-ray examination has been accomplished in five human subjects centrifuged in various vectors of transverse acceleration. At 6 G of right sideward acceleration, striking shift of the mediastinum to the left occurs, the heart resting against the chest wall. The right hemidiaphragm is displaced downward and stretched taut beneath over-expanded lung, while the left hemidiaphragm is elevated. The left lung is quite dense. Barium swallowed under these conditions reveals the upper gastrointestinal tract to be flattened against the left wall of the abdomen. Several of the subjects experienced aching abdominal pain. The ECG at this time shows shifting of the transition zone and slight counterclockwise rotation and left axis deviation. Lateral films taken during forward acceleration in both the upright and 25° forward bending postures demonstrate obliteration of the posterior mediastinum by the retrodisplaced heart, and upward displacement of the diaphragm somewhat more marked in the upright subject. Vascular markings are lost in the anterior portions of the lungs, and there is backward displacement of the trachea and bronchi. There is significant contraction of the thoracic cavity in both

the sagittal and anteroposterior diameters, with resulting decrease of the lung area in these planes. This diminution must result in a decreased lung volume, which, together with the visible changes in lung perfusion, could well explain the dyspnea during this acceleration vector.
(J. Aviation Med. 30(3):187)

2,509

Hershgold, E.J. 1960 ROENTGENOGRAPHIC STUDY OF HUMAN SUBJECTS DURING TRANSVERSE ACCELERATIONS.
(Wright Air Development Division, Wright-Patterson AFB, Ohio)
WADD TN 60-209, Aug. 1960. ASTIA AD 243 888.

ABSTRACT: Chest and abdominal roentgenograms of human subjects undergoing forward acceleration at 6 and 12 g, and left and right sideward accelerations at 6 g, demonstrate the sensitivity of the pulmonary circulation to simulated increased gravity and the vulnerability of the mediastinal and abdominal organs to displacement in this state. (Author)

2,510

Hershgold, E. J. 1960 X-RAY EXAMINATION OF THE HUMAN SUBJECT DURING TRANSVERSE ACCELERATION.
Aerospace Medicine 31(3):213-219.

SUMMARY: Chest and abdominal roentgenograms of human subjects undergoing forward acceleration at 6 and 12 g, and left and right sideward accelerations at 6 g, demonstrate the sensitivity of the pulmonary circulation to simulated increased gravity and the vulnerability as the mediastinal and abdominal organs to displacement in this state. (Author)

2,511

Hershgold, E. J. and S. H. Steiner 1960 CARDIOVASCULAR CHANGES DURING ACCELERATION STRESS IN DOGS. J. Appl. Physiol. 15:1065-1068, Nov. 1960.

ABSTRACT: The cardiac output, blood pressure, and heart rate of dogs were measured, and stroke volume and peripheral resistance were calculated during acceleration on a human centrifuge in positive and transverse vectors. During positive (headward) acceleration, the cardiac output and stroke volume were reduced, and peripheral resistance was increased. In the transverse vectors, cardiac output was stable or increased, stroke volume was stable, and peripheral resistance was reduced. The results suggest that the circulatory disturbances associated with positive acceleration may limit tolerance to acceleration, and may be avoided in transverse acceleration. (AUTHORS)

2,512

Hershgold, E. J., S. H. Steiner & L. A. Sapirstein 1960 AN IMPROVED
PROCEDURE FOR THE DETERMINATION OF CARDIAC OUTPUT BY A CONDUCTIVITY METHOD.
J. Appl. Physiol. 15(6):1062-1064.

ABSTRACT: The applicability of the hematocrit dilution technique employing arterial blood conductivity changes to the determination of the cardiac output has been extended by (a) electronic damping of the detecting circuits, which permits greater amplification of the signal without increasing the variability of the base line that occurs during each cardiac cycle, and by (b) development of a solution isoosmolar and isoconductive with plasma that substitutes for autogenous plasma in the procedure. The preparation of the synthetic solution is described. It is shown that this solution gives results indistinguishable from those obtained with plasma. Values are given for the conductivity and osmolarity of dog plasma.

2,513

Hertzberg, H. T. E., Daniels, Gilbert S. 1950 THE CENTER OF GRAVITY
OF A FULLY LOADED F-86 EJECTION SEAT IN THE EJECTION POSITION. (U. S.
Air Force, Air Materiel Command, Wright Field, Ohio) Report No.
MCREXD-45341-4-5: 14 March 1950

CONCLUSIONS: The c.g. of an F-86a Ejection Seat has been measured by suspension in two positions under full load. It has been measured by suspension in two positions under full load. It has been shown that the c.g. varies for each individual according to size, weight, and body build, and also for the position of the subject on the seat. Thus the c.g. of an individual may be thought of as an area rather than a point.

2,514

Hess, J.L. 1956 THE APPROXIMATION OF THE RESPONSE OF THE HUMAN TORSO TO
LARGE RAPIDLY APPLIED UPWARD ACCELERATIONS BY THAT OF AN ELASTIC ROD AND
COMPARISON WITH EJECTION SEAT DATA
(Douglas Aircraft Co., Inc., El Segundo, Calif.) Rept. No. ES 26472;
26 Nov. 1956; ASTIA AD 125 558

ABSTRACT: It has been noticed that when the human body is subjected to very rapidly applied accelerations, the accelerations at points of the body can be considerably larger than the maximum value of the applied acceleration. This paper considers the case when the acceleration is applied along the line of the spine from seat to head as in ejection from aircraft and attempts to approximate the motion of the human torso under these conditions by that of an idealized, one-dimensional, visco-elastic structure. The simple case of a homogeneous elastic rod is discussed in detail and its predictions compared with ejection seat data. The extensions to more complicated visco-elastic structures are discussed. It is concluded that the elastic rod is a fairly good first approximation, but that it is not sufficiently exact to be used in making quantitative predictions. It is also concluded that more complicated structures will require more and better data for their evaluation. (Author)

2,515

Hess, J.L. 1956 STUDIES ON THE ACCELERATION OF A BODY FROM REST
PART I. THE APPROXIMATE CONSTANCY OF VELOCITIES PRODUCED BY TIME-
DEPENDENT ACCELERATIONS HAVING EQUAL MAXIMUMS AND OPERATING OVER EQUAL
DISTANCES. (Douglas Aircraft Company, Inc., El Segundo, Calif.)
ES 26463. 15 Nov. 1956. ASTIA AD 125560

ABSTRACT: By analytical calculations for two representative classes of accelerations, by a discussion of the reasonableness of the conclusions for more general accelerations, and by consideration of experimental data, it is shown that, if a body is accelerated from rest through a fixed distance by accelerations having the same maximum value, the final velocities will differ by very little, regardless of the shape of the acceleration versus-time curve. Conclusions with regard to ejection seat design are drawn from this fact. The result, however, has more general applicability.

2,516

Hess, J. L. 1958 STUDIES ON THE ACCELERATION OF A BODY FROM REST. PART II.
THE DEPENDENCE OF THE DISTANCE TRAVELED AND THE VELOCITY ATTAINED ON THE
SHAPE AND INITIAL VALUE OF THE ACCELERATION CURVE FOR CERTAIN FAMILIES OF
VELOCITY DEPENDENT ACCELERATIONS.
(Douglas Aircraft Co., Inc., El Segundo, Calif.)
Rept. no. ES 26708, 15 Nov. 1958. ASTIA AD 207 213

ABSTRACT: The situation is considered in which a body is being accelerated from rest by forces that are functions of its velocity. The relation between distance traveled, velocity attained, initial acceleration, and the slope and curvature of the acceleration-versus-velocity curve is obtained for 2 families of velocity-dependent accelerations. The results are discussed and exhibited graphically. The distance traveled and velocity attained are seen to be insensitive to changes in the other quantities in many cases of interest. For one of the families of accelerations a simple formula relating distance to velocity is obtained. The results are applicable to any physical situation for which the acceleration of a body is a function of its velocity: the take-off of any type of aircraft, the acceleration of a boat or automobile, hydraulic acceleration, and fluid deceleration such as is used in connection with rocket sleds. (Author)

2,517

Hess, J. L. and C. F. Lombard 1958 THEORETICAL INVESTIGATIONS OF DYNAMIC
RESPONSE OF MAN TO HIGH VERTICAL ACCELERATIONS.
J. of Aviation Medicine 29(1):66-75, January 1958.

ABSTRACT: This article employs the mathematical theory of deformity to determine the safety of higher ejection velocities in the design of upward-ejecting

jettisonable seats for future aircraft. Since the structural strength of the spine is the chief limiting factor, a homogeneous elastic rod was used as a mathematical model to represent the spinal column. Oscillograph records of ejection tests on human subjects were obtained, and the acceleration of the free end of the elastic rod was computed as a function of time, assuming the prescribed acceleration of the other end to be equal to the acceleration of the seat bucket as taken from the oscillograph. Comparisons of experimental and theoretical accelerations are shown in graphs and tables.

2,518

Hessberg, R.R., Jr. 1957 ACCELERATIVE FORCES ASSOCIATED WITH LEAVING AND RE-ENTERING THE EARTH'S GRAVITATIONAL FIELD
American Astronautical Society Proceedings, 3rd Annual Meeting, New York, December 6-7, 1956. Pp. 95-100
See also J. Astronautics 4:6-8, 1957.

ABSTRACT: Accelerative forces associated with leaving and re-entering the earth's gravitational field are considered from the escape, space flight and re-entry approach.

2,519

Hessberg, R.R. Jr. 1957 ACCELERATION FORCES ASSOCIATED WITH LEAVING AND RE-ENTERING THE EARTH'S GRAVITATIONAL FIELD J. Astronautics 4: 6-8

ABSTRACT: Discussion of human experiments under acceleration forces, and presentation of theoretical calculations for these forces.

2,520

Hetherington, A. W., U. C. Luft, L. E. Moses, S. S. Wilks, H. B. Hale, H. G. Clamann, D. W. Aiken, & R. W. Briggs 1951 THE CARDIOVASCULAR AND RESPIRATORY RESPONSES OF PERSONNEL SUDDENLY EXPOSED TO VERY LOW TEMPERATURE WINDBLAST (School of Aviation Medicine, Randolph Field, Texas) Project No. 21-23-028; July 1951; ATI-116 833'

ABSTRACT: Seventy-nine subjects dressed in standard intermediate-weight USAF flying clothing were exposed to a -65 degrees F. windblast traveling 115 to 125 mph for 3 mins. The free-fall situation was further reproduced in some by the simulation of tumbling and introduction of moderate hypoxia. Only 3 minor cases of superficial cold injury were produced, these being due to local inadequacies of insulation. Skin temperatures did not fall to dangerously low levels. Changes in respiratory and heart rates, ECG, and blood pressure were within physio-

logical limits, and no indications of dangerous reactions were elicited. Rewarming at 70 to 85 degrees F. restored comfort quickly. It was concluded that a free-falling flyer could drop from 50,000 ft. without suffering serious harm, provided no skin areas are exposed. (AUTHOR)

2,521

Hetherington, A.W. 1960 A SUMMARY OF THE INFORMATION RECEIVED ON THE SECOND SOVIET BIOSATELLITE -- 1960 LAMBDA 1/SPUTNIK V
(Air Research Development Command, Andrews AFB)

ABSTRACT: This compilation from numerous sources, most of them from Tass and/or Radio Moscow, covering interviews, press conferences, and background interpretive stories released during the period Aug. 19-27, 1960, reports the successful flight of the Arknik to a maximum altitude of 320 km. It traveled 700,000 km, or approximately twice the distance from the earth to the moon. Precision of the guidance and braking system enabled landing the satellite itself, after ejection of the capsule, to within abt. 10 km of the calculated point. The weight of the satellite ship amounted to 4,600 kg. The biological payload contained both animals and plants. The condition of the dogs after landing did not differ from the condition observed during ground operation. It was established experimentally for the first time that animals endure normally the physiological stresses involved in the spaceship's descent from orbit and its landing. Some apparent improvements of Sputnik V upon Sputnik II are listed in this report.

2,522

Hetharington, A. W. RECENT STUDIES OF HUMAN REQUIREMENTS IN HYPERSONIC ESCAPE. (Directorate of Life Sciences Hdq., Air Research and Development Command, Andrews AFB, Washington, D. C.)

2,523

Hiatt, R.W. 1958 ORIENTABLE CENTRIFUGE AND RECORDING EQUIPMENT FOR USE WITH BIRDS AND SMALL MAMMALS.
(Office of Naval Research, London) Technical Rept. No. ONRL-36-58,
23 April 1958. ASTIA AD 159-591.

ABSTRACT: An excellently constructed, highly versatile, orientable centrifuge for studying effects of acceleration on birds and small mammals, together with associated equipment for recording physical parameters and biological effects of rotation, have been built at the laboratory of Physiology, University of Milan, Italy. Brief descriptions of these pieces of apparatus and a diagram of the orientable centrifuge are included in this report. Using this equipment

investigators in this laboratory recently were able to demonstrate what may prove to be important neurophysiological differences in cerebellar potentials during and following tangential and centripetal acceleration in homing vs. non-homing pigeons and migratory vs. non-homing pigeons and migratory vs. non-migratory doves. (Author)

2,524

Hiatt, E.P., S.D. Leverett, & S. Bondurant 1958 COMPARISON OF REFLEX
CONSTRICTION IN LEG AND FOREARM VEINS.
Fed. Proc. 17(1):70, March 1958.

ABSTRACT: Simultaneous observations of pressure changes within isolated forearm (FVS) and saphenous venous segments (SVS) have been used to compare reflex venomotion under various conditions in the 2 areas. The following data are based on 41 observations of pressure change in 4 subjects. Following a standardized Valsalva maneuver, FVS pressure increased by a mean of 10 ± 5 (SD) mm Hg while SVS pressure increased by 13 ± 6 . Following immersion of a contralateral extremity in ice water, FVS pressure increased by 8 ± 9 while SVS increased by 15 ± 17 . During positive acceleration (foot to head) on the human centrifuge, FVS pressure increased by 13 ± 4 while SVS pressure increased by 17 ± 10 after 3 g was attained following each of the stimuli. The large standard deviations reflect the wide range of venoconstrictor activity. Maximum pressure change in the absence of a specific stimulus was 4 mm Hg. Reflex constriction of saphenous venous segments is qualitatively comparable to that observed and previously described in forearm venous segments. Because the saphenous veins appeared to be consistently of greater diameter than the forearm veins, a greater increase in tension of this vein wall is suggested by this study.

2,525

Hiatt, E.P. 1959 BIODYNAMICS OF SPACE FLIGHT
Astronautics, 4(2):24-25, 70-74, Feb. 1959.

ABSTRACT: Acceleration problems attendant to space flight are discussed. Centrifuge studies indicate that man, although limited in position and movement during flight, can withstand the acceleration necessary to enter and return from space. When a man is accelerated headward (positive acceleration), the inertial effect tends to displace every part of his body footward. The physiologic limit to acceleration in this position is caused by difficulties in the circulation of the blood. These difficulties are manifested, first as a dimming of vision, then visual failure (blackout), and finally unconsciousness. The G level at which blackout occurs varies with the rate of increase of acceleration, with the light intensity, and with the psycho-physiologic state of the individual, among other things. Generally, blackout occurs in less than a minute at 4 to 6 G, and subject would lose vision and perhaps consciousness during the boost phase. The wearing of anti-G suit to compress the lower part of the body could add another G-minute or so to his tolerance, but he would still be vulnerable in most rocket

flights. In footward, or caudad acceleration (negative G), the inertial effect exerted on the blood in the longitudinally arranged great blood vessels around the eyes and in the nasal and sinus areas may leak blood. The circulation to the brain is protected in that it is in a water-filled rigid container, but the voluntary tolerance to acceleration in the caudad direction is still limited, being less than half a minute at 2 G and only a few seconds at higher levels. The body position most favorable to resisting the effects of acceleration is that in which the G vector is across one of the transverse axes of the body. The inertial effect is across the columns of blood in the large blood vessels so that gross effects on the circulation do not appear as readily as they do when the vector is parallel to the long, longitudinal vessels of the body. The principal limiting factor in transverse G is respiratory. Above 6 G it is difficult to inspire, so that the duration of tolerance at higher levels is limited to the breathholding time, which is shortened under conditions of acceleration by the involuntary increase in muscle activity (including cardiac muscle) which occurs in this situation. Backward acceleration tolerances may be important for reentry. The chief factor in determining tolerance in this position is the restraint system. Unlike forward acceleration, backward acceleration tends to throw the subject from his seat, with a restraint suit distributing the inertial force over wide surfaces, and with multiple tiedown points combined with good head restraint, the tolerance to backward acceleration of a man seated upright closely approaches that of forward acceleration.

2,526

Hiatt, E. P. 1960 BIODYNAMICS OF SPACE FLIGHT

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. 137-143

ABSTRACT: Man's ability to tolerate the high accelerations anticipated in space flight will be determined in a large part by his position in the rocket vehicle. The acceleration pattern of the launch phase has a variety of sawtooth curves varying in height, duration, and number of stages. Experiences on the large centrifuge have shown that if man is positioned properly he can tolerate exposure to 3 peaks of acceleration up to 12 g's and totaling more than 13.7 g-minutes. The best position for the subject is seated, facing forward, with knees flexed and the body trunk leaning slightly toward the direction of acceleration. When re-entering the atmosphere, re-entry attitude control becomes very critical. The steeper the re-entry angle the greater the forces which exceed the tolerance of man. The forward facing subject will be thrown forward into the restraints. The design of the restraints largely determines man's ability to tolerate such deceleration effects.

Respiration is the chief limiting factor in body positions transverse to the acceleration vector. Other factors involve pain, due to the displacement of body organs,

and abnormal circulatory effects. Human performance diminishes as the weight of the body parts are multiplied by the "g's" of acceleration. Centrifuge experiments, however, have indicated little loss or discrimination and judgment when using finger-tip controls. There will exist aberrant situations where superimposed accelerations will exceed the voluntary tolerance limits of man. It has been shown that subjects immersed in a tank of water can double their tolerance in terms of g-minutes without appreciable impairment of mobility. This method still has not solved either the respiration or body organ displacement problems. Man's present tolerance limits undoubtedly will be extended by improved support and restraint equipment. (AUTHOR)

2,527

Hiatt, E.P. 1961 PRINCIPLES OF SAFETY MONITORING OF HAZARDOUS RESEARCH ON ACCELERATION UTILIZING HUMAN SUBJECTS. In Reports on Human Acceleration (National Academy of Sciences, National Research Council, Washington, D.C.) Publication No. 901, pp. 1-5. Library of Congress Card 61-60055. ASTIA AD 266 077.

ABSTRACT: Since there is an increasing number of devices for studying the effects of various patterns of acceleration on man, the Acceleration Panel has endeavored to consolidate the general principles of human experimentation pertinent to experimental work with these devices. These are as follows: (1) There must be voluntary consent of the subject, who should be made to understand the hazards to which he is exposed. (2) The probable gain in knowledge shall justify the risk. (3) The experiment must be designed to limit hazard with adequate preparation, physiological measurement for medical monitoring, and provision for quick termination in the event of emergency. This principle covers the essence of safety monitoring and will be expanded with more rules. It would be good if definite limits in "G" units could be given for acceleration investigation, but this would vary with each experimental situation, not only with the pattern of acceleration but with the position, support and restraint of the subject, not to mention the variability in subjects. As a capstone to the rules for safety listed above, it must be said that medical monitoring of acceleration experiments involving human subjects must be tailored to each situation and involve the equivalent of good clinical judgment to a large degree.

2,528

Hiatt, E.P., J.P. Meehan, & R. Galambos 1961 REPORTS ON HUMAN ACCELERATION: SAFETY MONITORING, PHYSIOLOGIC ENDPOINTS, PSYCHOLOGICAL TESTING. (National Academy of Sciences, National Research Council, Washington, D.C.) Publication 901; Library of Congress Catalog Card No. 61-60055; ASTIA AD 266 077.

CONTENTS:

Hiatt, E.P., Principles of Safety Monitoring of Hazardous Research on Acceleration Utilizing Human Subjects;
Meehan, J.P., Subjective Endpoints in Acceleration Experiments;
Galambos, R., Psychological Testing of Subjects Undergoing Acceleration Stress.

2,529

Hickam, J. B. and W. W. Pryor 1951 CARDIAC OUTPUT IN POSTURAL HYPOTENSION.
J. Clin. Invest. 30:401-405.

2,530

Hickey, J. L. and V. A. Stembridge 1958 OCCURRENCE OF PULMONARY FAT
AND TISSUE EMBOLISM IN AIRCRAFT ACCIDENT FATALITIES
J. of Aviation Medicine 29(11):787-793, November 1958

ABSTRACT: The incidence of pulmonary fat and tissue embolism as reported in the literature is briefly reviewed. One hundred routine autopsy cases with gross lung tissue available from the files of the Armed Forces Institute of Pathology were examined for pulmonary fat and tissue embolism. In fifty hospital deaths only one instance of fat embolism was found. In fifty forensic pathology cases, eleven showed fat embolism and one bone marrow embolism. No other tissue embolism was noted in this random sample. In 236 cases of aircraft accident fatalities having gross lung tissue available for study, pulmonary fat embolism was found in 120 (50.8 per cent). Bone marrow embolism was noted in seventeen cases, cerebral tissue embolism in three cases and hepatic tissue embolism in two. The occurrence and mechanism of fat embolism in fatal decompression sickness is discussed and a case is presented. Several other cases of aircraft accident fatalities with pulmonary fat and tissue embolism are presented.

2,531

Highly, F.M., G.T. Critz, & E. Hendler 1963 DETERMINATION OF HUMAN TOLERANCE
TO NEGATIVE IMPACT ACCELERATION. PHASE I.
(Paper, 34th Annual Meeting of the Aerospace Medical Association, Statler-
Hilton Hotel, Los Angeles, Calif., April 29-May 2, 1963)

CONCLUSIONS: Human tolerance to tailward impact acceleration is an entity not to be confused with tolerance to prolonged tailward acceleration as the modalities are distinct: with impact, the effect is dependent upon structural strength and visceral shearing stress, whereas with prolonged acceleration, the effect is increasingly dependent upon relative fluid shift.

Voluntary tolerance to acceleration is well below the injury threshold and is influenced by several factors, both human and engineering. In the present study, an attempt was made to define voluntary tolerance by the use of a sled mounted on a platform, rail-directed and pulsed by a controllable hydropneumatic piston.

Favorable factors to the project included healthy human volunteers of above average physical fitness and motivation, adequate restraint capabilities, and a minor attenuation of g by sled angle. Monitoring of the subject by telemetered vectorcardiography and electroencephalography and by high-speed photography aided more conventional pre- and post-run physical examinations.

Unfavorable factors included an open seat angle which favored "submarining" under the torso assembly, a fixed rate of g build-up which increased the jolt out of proportion to the G increase, and a less than ideal two-pulse oscillation in the accelerator.

Under these conditions, a final impact tailward acceleration of 10.5 g with subject acceleration of 17 G, rate of g 8140, was successfully tolerated.
(Author)

2,532

Hill, J.H. 1957 EVALUATION OF THE TORSO-HEAD RESTRAINT SYSTEM AND THE INTEGRATED HARNESS RESTRAINT SYSTEM UNDER CONDITIONS OF ACCELERATION (U.S. Naval Air Dev. Ctr., Johnsville, Pa.) Letter Rept. TED-ADC-AE-5209; Serial 2621; 2 April 1959

2,533

Hill, J.H. 1957 PILOT'S ABILITY TO ACTUATE COCKPIT CONTROLS UNDER G CONDITIONS (U.S. Naval Air Development Center, Johnsville, Pa.) Rept. Ted-ADC-AE-6303.1; NADC-MA-LR21, April 1, 1957.

ABSTRACT: The purpose of this study was to determine the degree to which the omnienviromment high altitude full pressure flying suit, as compared to the summer flight suit, impedes the motor performance of the wearer under G conditions. Actuation of ejection controls was used as the test of motor performance since it is a gross motor task and any limitations of the full pressure suit on performance would be readily apparent. The ejection seat was installed in the centrifuge and the subjects wearing the suits were subjected to five conditions of positive G, v.z., fluctuating--high (max 6.5), constant (3.0), constant full pressure suits: (a) did not allow sufficient flexion of the legs for use of stirrups, (b) permitted adequate flexibility of arm movement to pull the face curtain up to and including 3 G, but restricted arm movement to such a degree that the face curtain could not be reached by any subject at 5 G, (c) did not appear to restrict less extensive movements of arms and legs, and (d) did not reduce the lateral movement of the subject under fluctuating G conditions.

2,534

Hill, J. H. and J. L. Brown 1958 COMPARATIVE EVALUATION OF A STANDARD FACE-CURTAIN AND AN EXPERIMENTAL D-RING LOCATED ON THE SEAT FRONT AS MODES OF ACTUATING EJECTION DURING EXPOSURE TO ACCELERATION. (USN, Air Dev. Ctr., Johnsville, Pa.) Rept. TED-ADC-AE-5205, 5 May 1958.

ABSTRACT: A comparative evaluation is presented of a standard face curtain and an experimental D-ring located on the seat front as modes of actuating

ejection during exposure to acceleration. The results are presented graphically in two forms. The time measures for both the successful and the unsuccessful attempts to eject are considered together in one distribution. The harmonic mean reaction time (the time required to initiate the ejection procedure) are presented for the two ejection controls under each orientation as a function of the G level. The action times, however, are consistently shorter for the D-ring for all the orientations of acceleration. It may be concluded that for ease of access during exposure to sustained accelerations in the orientations which were investigated, an ejection control located on the front of the ejector seat is superior to the standard face curtain.

2,535

Hill, J. H., & M. G. Webb 1959 PILOT'S ABILITY TO ACTUATE EJECTION CONTROLS; FINAL REPORT CONCERNING, (Naval Air Development Ctr., Johnsville, Pa.) Rept. No. MA-8-952; Proj. TED ADC AE 5205(NM 15 01 12.3; ASTIA AD-257 520

ABSTRACT: The purpose of this study was first to determine the effect of acceleration on a pilot's ability to actuate the ejection controls of two makes of ejection seats, the McDonnell-Stanley seat equipped with an experimental torso-head restraint system and the Martin-Baker G-5 seat with the integrated harness restraint system. It was also an objective of the study to determine the degree to which the Mark V exposure flight suit and Mark IV (Goodrich) and the AX-83 (Arrowhead) lightweight full pressure flight suit impeded a pilot in the actuation of the ejection controls when compared to his performance while wearing the summer flight suit. The results indicate that a pilot, under conditions of acceleration may not be able to reach either the face curtain or the D-ring. Any encumbrances such as an exposure suit or a full pressure suit will decrease the probability of his successful ejection. Failure of the canopy to jettison upon operation of ejection control and the subsequent requirement for use of the emergency actuation control will further decrease this probability if he is wearing an inflated full pressure suit. (ASTIA)

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Hill, L. 1895 THE INFLUENCE OF THE FORCE OF GRAVITY ON THE CIRCULATION OF THE BLOOD. J. Physiol. (London), 15:15-53

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Hill, L., & H. Barnard 1897 THE INFLUENCE OF THE FORCE OF GRAVITY ON THE CIRCULATION. PART II. J. Physiol. (London) 21:323-352

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Hill, P.R. & E. Schnitzer 1962 ROTATING MANNED SPACE STATIONS.
Astronautics, 7(9):15-18. Sept. 1962.

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

2,539

Hill, Thomas C. & Harvey E. Savely 1948 TESTS OF T-8 INDOCTRINATION CATAPULT
(Air Materiel Command, Engineering Division, United States Air Force)
Serial No. MCREXD-695-66K, November 2, 1948. ASTIA ATI 123 462

ABSTRACT: The Frankford Arsenal was requested to build a catauplt essentially identical with the T-2 catapult, but chambered to fire the M-28 cartridge and with the provisions for the shear pin eliminated. Two such catapults, designated type T-8, were delivered to Headquarters Air Materiel Command in 1948. To date, 40 ejections have been made with one catapult using the M-28 cartridge. The results are shown in Appendix I. After repeated use the velocity developed by the catapult will begin to decrease. This reduction in velocity is ascribed by Frankford Arsenal to wear on the intermediate tube, which does not affect the reliability or safety of the catapult. From the standpoint of training value it appears that a velocity of at least 44 ft. per second should be produced by the catapult. The performance of the T-8 catapult is essentially the same as that of the T-2 and as such is satisfactory for indoctrination of personnel on test towers.

2,540

Hill, T.C. and R.S. Shaw 1948 PROPOSED TUMBLING STUDIES.
(Wright Field, Dayton, Ohio) AMC Memo Rept. MCREXD-695-66J
18 March 1948. ASTIA ATI 123 463

ABSTRACT: In pilot escape from very high speed aircraft by means of ejection seat or capsule, tumbling is likely to occur from eccentric loading of the ejecting force or aerodynamic instability of the ejected part. This report considers possible limiting factors in human tolerance to tumbling and outlines an experimental program for the study of these factors. In Appendix I, the possible disabilities from tumbling have been outlined and are considered under four main headings: (a) Vestibular symptoms (b) Injury from very high intra-

vascular pressures at the outside of the arc. (c) Unconsciousness from interference with cardiac functions. (d) Structural damage from radial acceleration. The theoretical relationship between rotational velocity and venous pressure in the head has been calculated in Appendix #2. Dangerous magnitudes of venous pressure as established by previous work on negative acceleration may be expected at rotational velocities of approximately 2 r.p.s. and above. (See Appendix #3). A program is outlined in Appendices #4 and #5 for studying on both vertical and horizontal centrifuges the effects of tumbling on the human body. These centrifuges are of short radius and so constructed that the center of gravity may be at, or near, the center of rotation.

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Hillier, G.H. 1962 AIRCRAFT ACCIDENT RECORDING.
(Aeroplane and Armament Experimental Establishment, Gt. Britain)
Rept. No. AAEE/Tech/225, ASTIA AD-333 807

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MOTION PICTURE

Hirsch, A. E. 1961 EFFECTS OF SHIP SHOCK MOTION ON HUMANS AND DUMMIES
(Motion Picture, Symposium on Biomechanics of Body Restraint and Head Protection,
Naval Air Material Center, Philadelphia, Pa., June 14-15, 1961)

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Hirsch, A.E. 1962 A COMPARISON OF THE RESPONSES OF MEN AND DUMMIES TO SHIP SHOCK MOTIONS.
In Impact Acceleration Stress: Proceedings of a Symposium With a Comprehensive Chronological Bibliography, National Academy of Sciences, National Research Council, Publication No. 977, pp. 185-190

ABSTRACT: Tests in which men are exposed to hazardous shock environments are prohibited. With the exception of a few documented cases of accidental exposures to injury-producing accelerations, the bulk of our knowledge of man's response to hazardous shock motions has been derived from dummy or animal work. This is a report on some preliminary findings from tests made to determine the validity of the use of anthropomorphic dummies to simulate the response of man to intense accelerations of short duration, such as those met by shipboard personnel during mine or torpedo attack.

2,544

Hirshfeld, C. F. 1932 DISTURBING EFFECTS OF HORIZONTAL ACCELERATION.
(Electric Railway Presidents' Conference Committee, New York, N. Y.)
Bulletin No. 3, 27 September 1932.

ABSTRACT: The purpose of the investigation was to discover the best form of acceleration curve for the rapid starting of a street car, that is, the form which would cause the least discomfort to standing passengers; and to determine the maximum acceleration thus attainable. The methods used, the results obtained and the conclusions that were reached are reported in the present bulletin.

2,545

Hiss, R. J., G. B. Smith, Jr., & L. E. Lamb 1960 PITFALLS IN INTERPRETING ELECTROCARDIOGRAPHIC CHANGES OCCURRING WHILE MONITORING STRESS PROCEDURES.
Aerospace Med. 31:9 - 18 Jan., 1960

ABSTRACT: This report has served to emphasize the marked lability of the electrocardiogram under certain physiological stresses which do not in fact impose any major stress upon the cardiovascular system. The changes in the electrocardiogram frequently noted as a result of stresses are not dissimilar from those clinical changes noted in the electrocardiograms recorded in the recumbent position in individuals with myocardial disease. The significance of the electrocardiographic changes under simple stresses such as orthostasis, hyperventilation, and pressure breathing prior to utilizing the electrocardiogram as a monitoring tool during experimental stresses is discussed. The influence of decreased ambient pressure alone on the electrocardiogram in individuals demonstrating orthostatic changes at ground level has been reported. No significant difference was detected which could be attributed to decreased ambient pressure.

2,546

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

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

2,547

Hitchcock, F. A. 1956 SOME CONSIDERATIONS IN REGARD TO THE PHYSIOLOGY OF SPACE FLIGHT.
Astronautica Acta Wien 2(1):20-24.

ABSTRACT: The physiological stresses that will be encountered in space flight are considered. Exposure to barometric pressures lower than 47 mm Hg (63,000

feet) will produce all of the harmful effects that would occur in a vacuum. Therefore from a physiological viewpoint any flight above 63,000 feet may be considered as space flight. In such flights sealed-cabins provided with an air conditioned artificial atmosphere must be used. While compressed, liquid or chemical oxygen might be satisfactory for flights of short duration the biological method of providing such atmospheres is probably the best. Thermal stresses accelerative forces and cosmic radiation are some of the factors which must be considered. The physiological responses of living animals to a vacuum are unsurmountable.

2,548

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

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

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Hixson, W. C., C. T. Paludan, & S. W. Downs, Jr. 1960 PRIMATE BIO-INSTRUMENTATION FOR TWO JUPITER BALLISTIC FLIGHTS. IRE Trans. Med. Elect. ME-7:318

ABSTRACT: A description is given of the bioinstrumentation phase of 2 related Army Jupiter ballistic missile flights (BioFlight 1, Dec. 13, 1958, and BioFlight 2, May 28, 1959) involving squirrel monkey passengers (Old Reliable and Baker, respectively), one of which (Baker) was recovered alive and in good physical condition. These flights marked the initial entry into space and successful return of a primate under ballistic flight conditions comparable to those to be encountered by man. The relationship of the instrumentation program to the biocapsule design in terms of the telemetered measurements is described. An outline is presented of the signal conditioning circuits and associated transducers used for the in-flight telemetry recording of the primate's electrocardiogram, respiration rate, chest sounds, and axilla body temperature. Instrumentation related to the recording of the ambient temperature and pressure of the biocapsule, flash temperatures, and cosmic-ray-particle tracks is also described. Data illustrations include: an excerpt from the raw telemetry record received during the free-fall portion of the Old Reliable flight, selected segments from the simultaneously occurring electrocardiogram and respiration rate signals received during the prelaunch, launch, postbooster cutoff, and free-fall periods for each animal, the