

**BIOMEDICAL RESEARCH STUDIES IN ACCELERATION, IMPACT,
WEIGHTLESSNESS, VIBRATION, AND EMERGENCY ESCAPE
AND RESTRAINT SYSTEMS:
A COMPREHENSIVE BIBLIOGRAPHY**

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ACCELERATION

A

1

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

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

2

Abramovitz, M., S. F. Schmidt, and R. D. Van Dyke 1953 INVESTIGATION
OF THE USE OF A STICK FORCE PROPORTIONAL TO PITCHING ACCELERATION FOR
NORMAL-ACCELERATION WARNING
(National Advisory Committee for Aeronautics, Washington, D. C.)
RM A53E21 Aug. 1953 ASTIA AD 15 538

ABSTRACT: The feasibility of providing an additional stick force which leads the normal acceleration, in order to serve as a prior warning of excessive normal acceleration in rapid maneuvers, is investigated both experimentally in flight and analytically. It is determined that large stick forces proportional to rate of change of normal acceleration can be provided without adversely affecting the control-system dynamic stability, and that pilots consider the feel characteristics introduced by such a force to be very desirable. (NACA abstract)

3

Achilich, J.H. 1959 THE HUMAN DISORIENTATION DEVICE -A SIMULATOR OF
ANGULARLY-ACCELERATED MOTION. Ire Trans. Military Electronics.
MIL-3(3):99-104, July 1959

SUMMARY: The Human Disorientation Device has been developed as a research tool in the field of aviation medicine for the generation of angularly accelerated motion to enable the accomplishment of medical research in the field of animal or human responses to angular acceleration.

The device will produce accurately known and controlled values of angular acceleration about two axes of rotation when the subject is seated so that his head is located at the point specified by the intersection of the axes.

The Human Disorientation Device will allow medical research in the field of sensory responses to angular acceleration, vertigo, and similiar phenomena required for an analysis of human behavior and human performance limitations in the rapid maneuvering (spin and tumbling, etc.) of high-speed aircraft and spacecraft. (Author)

4

Acker, L.W., D.O. Black & J.C. Moser 1957 ACCELERATIONS IN FIGHTER-AIRPLANE CRASHES. (National Advisory Committee for Aeronautics, Washington, D.C.) NACA RM E57G11, 4 Nov. 1957. ASTIA AD 145 792

ABSTRACT: Full-scale crashes were conducted with FH-1 jet fighter airplanes under circumstances approximating those observed in the military service. These crashes simulated unflared landings at impact angles of 18°, 22°, and 27°, a ground cart wheel, and a ground loop. The magnitude, duration, and direction of the crash accelerations were measured on the airplane structure and on an anthropomorphic dummy installed in the cockpit. The accelerations measured are compared with existing data on human tolerance to the sudden loads that occur in crashes to see whether the human tolerance had been exceeded.

5

Ackerman, M. 1959 AN INTEGRATED SPACE-FLIGHT SIMULATOR.
IRE Trans. Military Electronics. MIL-3(3):92-98.

ABSTRACT: The application of a flight simulator in the engineering and development of a space cabin or capsule is discussed. Those elements of the space environment which might physiologically or psychologically affect the pilot or crew are reviewed in terms of the following systems: propulsion, flight, internal environment, communication, and navigation. A proposed flight simulator is described which will integrate the physiologic and psychologic effects of these systems and thereby provide a complete environment for experimentation. Early phasing of the integrated simulator with the space vehicle is suggested as a better foundation for design of the space cabin or capsule than sole dependence on feedback from early flights.

6

Adams, C.C. et al. 1958 SPACE FLIGHT.
(New York: McGraw-Hill Book Co.)

ABSTRACT: This book is designed to give a complete, well-rounded account of (1) the history and background of the astronautical sciences, (2) the many subsidiary fields that compose these sciences, (3) detailed information on many of the most important world-wide developments of astronautical significance. It is further intended to offer exceptionally complete coverage of introductory space-flight material, assess the present state of the art, and present a penetrating look into the future potentials of astronautics.

7

Adams, C. R. 1963 LUNAR LANDING VEHICLE HELICOPTER LANDING SIMULATION STUDY.
(Paper, 34th Annual Meeting of the Aerospace Medical Association, Statler-Hilton Hotel, Los Angeles, Calif., April 29-May 2, 1963)

ABSTRACT: A simulated hover-to-touchdown landing by helicopter on the lunar surface was the subject of this study. The dual purpose was to determine the hover-to-touchdown time necessary for the Lunar Landing Vehicle under manual control, and also to define qualitatively on the basis of nominal translational velocities a reasonable value of distance from hover point to suitable landing site. The test vehicle, a Sikorsky S-58 helicopter, followed the planned trajectory as closely as possible. Each of the eight test subjects made eight runs from various directions over a rough type of terrain approximating that thought to exist on the lunar surface. To obtain earth-shine values equivalent to lunar surface illumination these tests were conducted at noon with the subjects wearing dark goggles. The landing area was made clearly visible to the subjects five seconds before the initial hover point was reached so that the landing site could be selected. Time and distance were recorded from hover to touchdown. Test program results indicated that the LLV would be able to land within a specified number of seconds if the first landing site proved suitable, whereas marginal landing time must be allowed if an alternate site had to be selected and traversed. Based on these findings a hover time was recommended for the lunar landing maneuver. (Author)

8

Adams, J.C. 1941 AVIATION MEDICINE AND NEW STRESSES IN FLYING.
J. Tenn. Med. Ass. 34:423-427

ABSTRACT: Because methods of warfare are progressive, it is necessary that medicine in warfare be equally progressive. A historical contrast between the picture of aviation in the last World War with that of today points out the tremendous role aviation has come to play in the present war. At the present time, problems such as those associated with extreme altitudes, high-speed, night operations and personal problems are among those facing pilots. The Navy school of aviation medicine at Pensacola, Florida, will be a center to train flight surgeons on the importance in correct selection and care of pilots.

9

Adamson, D. 1962 THE GRAVITATIONAL FIELD ENVIRONMENT OF AN EARTH SATELLITE. (National Aeronautics and Space Administration, Washington, D.C.) NASA-TN-D 1270 August 1962.

10

Ades, Harlow W. 1961 ELECTROENCEPHALOGRAPHIC FINDINGS IN RELATION TO EPISODES OF ALTERED CONSCIOUSNESS IN AVIATORS

U.S. Naval School of Aviation Medicine, Pensacola, Florida Project MR005.13-3001, Subtask 1, Report No. 3 ASTIA AD 257 274

ABSTRACT: Observations of aviators who had had unexplained lapses of consciousness while piloting aircraft led to the electroencephalographic exploration of these individuals and of the possible relationship between this clinical phenomenon and unexplained aircraft accidents. Four types of EEG deviation from normal were identified as correlating with incidence of unconscious episodes in pilots with or without accident. The occurrence in various groupings of such pilots was compared to the incidence of occurrence in a group of 1375 aviation candidates. The relative significance of the various factors and the future refinement of criteria are discussed in relation to etiology of unconscious episodes and the possible use of electroencephalography as a selection criterion, use of which might reduce the number of aircraft accidents. It is recommended that a baseline EEG be done on each aviation candidate, preferably at the end of the pre-flight phase or during the early phases of flight training. It is further recommended that special procedures for activating abnormal EEG patterns be carried out on aviation candidates whose baseline EEG gives reason for suspicion.

11

Adey, W.R. 1961 ASPECTS OF BRAIN PHYSIOLOGY IN THE SPACE ENVIRONMENT. In Symposium, Brain Functions and Space, I. Cortical Excitability (Brain Research Institute, University of California, Los Angeles, 1961) In press.

12

Adey, W. R. et al 1961 EEG RECORDS FROM CORTICAL AND DEEP BRAIN STRUCTURES DURING CENTRIFUGAL AND VIBRATIONAL ACCELERATIONS IN CATS AND MONKEYS. IRE Trans. Biomed Electronics 8:182-188, July 1961.

ABSTRACT: Electroencephalographic records have been taken from deep regions of the brains of cats and monkeys with chronically implanted electrodes during centrifugal and shaking accelerations comparable to booster forces. Histological and X-ray controls have indicated that displacement of the electrodes does not occur, and that damage to brain tissue is comparable with nonaccelerated animals. A transistorized EEG amplifier suitable for recording in satellite biopack environments has been developed.

In centrifuge tests, transverse accelerations up to 8 G were associated with rhythmic "arousal" patterns of slow waves in hippocampal regions of the temporal lobe during increasing or decreasing acceleration. Longitudinal accelerations between 5 and 6 G produced blackouts after 30 to 40 seconds, with flattening of EEG records, and frequently with induction of

epileptic seizure activity in temporal-lobe leads. Shaking tests suggested that vibrational acceleration may be associated with the intermittent "driving" of the cerebral rhythms, in a fashion resembling photic driving, at shaking rates from 11 to 15 cps, and from 22 to 30 cps.

13

Adey, W.R. 1962 POTENTIAL FOR TELEMETRY IN THE RECORDING OF BRAIN WAVES FROM ANIMALS AND MEN EXPOSED TO THE STRESSES OF SPACE FLIGHT. In Symposium, The Use of Telemetry in Animal Behavior and Physiology (The American Museum of Natural History, New York, 1962) In press

14

Advisory Group for Aeronautical Research & Development, Aerospace Medical Panel. 1959 A GLOSSARY OF TERMS COMMONLY USED IN AVIATION MEDICINE: French-English and English-French. ASTIA AD 242976.

15

Advisory Group for Aeronautical Research and Develop. 1959 PROCEEDINGS OF THE NINTH AGARD GENERAL ASSEMBLY (Proces-Verbal de La Neuvieme Assemblée Generale De L' Agard)
(Advisory Group for Aeronautical Research and Development, Paris, France)
25 Sept. 1961. ASTIA AD 261 836.

CONTENTS:

- Review of Aeronautical Research in Germany
- Space Research
- Communication with Ballistic Missiles and Satellites
- On the Directing of Intense Photonic Beams by Means of Electron Gass Mirrors
- Aero Space Medical
- Avionics
- Combustion and Propulsion
- Flight Test and Instrumentation
- Structures and Materials
- Wind Tunnel and Model Testing

16

Advisory Group for Aeronautical Research & Development 1961 A TABLE OF
EQUIVALENTS OF ACCELERATION TERMINOLOGIES. Rivista di medicina aeronautica
e spaziale (Roma) 24(4):644-651, Oct.-Dec. 1961

ABSTRACT: A Table of Equivalents of Acceleration Terminologies is presented which has been prepared by the Committee on Acceleration of the Advisory Group for Aeronautical Research and Development, Aero Space Medical Panel. In this table the terms are grouped as to the type of acceleration, the body axis concerned, and the physiological consequences of acceleration. The Committee recommends the following: (1) that writers and researchers in the field of acceleration related to mammalian subjects restrict their descriptive terminologies and symbols to those contained in the table; (2) that the table be used as a ready reference for equivalent translation of acceleration terminologies; (3) that large G be used as the unit of physiological acceleration at all times; and (4) that the metric system be used in applying these acceleration terminologies and symbols.

17

Aeronautical Research Council 1953 THE BIOLOGY OF FLYING.
REPORT OF A SYMPOSIUM HELD AT THE BRITISH ASSOCIATION MEETING IN
BELFAST, SEPTEMBER, 1952.
(Aeronautical Research Council, Gt. Grit.)
ARC rept. no. 15,927; Engineering Physics Sub-comm. rept. no. EP 240
21 May 1953 ASTIA AD 23 124

ABSTRACT: The papers which are included deal with (1) the problems encountered in civil flying, (2) the physiological problems in flying high-performance military aircraft, (3) skill and the airman, and (4) the engineering problems of conditioning aircraft for human occupation and control.
(ASTIA)

18

Aerospace Corp. 1961 BIBLIOGRAPHY OF REPORTS PREPARED BY AEROSPACE CORPORATION
FOR PERIOD ENDING DECEMBER 1960 (Aerospace Corp., Los Angeles, Calif.)
ASTIA AD-251 546.

19

Agadzhanian N. A. and A. R. Mansurov 1962 EFFECT ON THE ANIMAL ORGANISM OF
OXYGEN DEFICIENCY AND PROLONGED RADIAL ACCELERATION.
In Biull. Eksp. Biol. Med. 53:42-46, April 1962 (Russian)

Agadzhanian, N.A. & A.R. Mansurov 1962 THE EFFECT OF OXYGEN DEFICIENCY
AND PROLONGED RADIAL ACCELERATION ON AN ANIMAL ORGANISM.
Byull. Eksptl. Biol. I Med. (Moscow) 53(4):42-46
(Joint Publications Research Service, Washington, D.C., JPRS-15346,
19 Sept. 1962). NASA N62-17780

ABSTRACT: Animal studies are conducted to determine the effects of oxygen deficiency on conditioned reflex reactions of respiration and cardiac activity and the effects of acceleration on the organs of the thoracic cavity. Pressure chamber experiments were conducted at ground conditions as well as at simulated altitudes of 2000 to 10,000 meters. The dogs used in the tests were conditioned by the techniques of V.P. Protopopov. The acceleration tests were conducted in a centrifuge with a radius of 3.66 meters. The X-ray equipment was attached to the centrifuge for taking photographs during acceleration.

Agadzhanian, N.A. and Mansurov, A.R. 1962 VLIIVANIE NA ORGANIZM ZHIVOTNYKH
KISLORODNOGO GOLODANIYA I DLITEL'NYKH RADIAL'NYKH USKORENIY (THE EFFECT
OF HYPOXIA AND PROLONGED RADIAL ACCELERATIONS ON THE ANIMAL ORGANISM)
Biulletin' eksperimental' noi biologii i meditsiny (Moskva), 53 (4): 42-46
April 1962.

ABSTRACT: Conditioned motor, respiratory, and cardiovascular reflex reactions were studied in dogs at simulated altitudes ranging from 2,000 to 10,000 m. An X-ray study was also made of the changes in the position of organs in the thoracic area in relation to various g values during acceleration on a centrifuge. In hypoxia at simulated altitudes of 6000-9000m. the vegetative components of the conditioned reflexes were almost completely depressed and replaced by the unconditioned ones as manifested by intensification of the respiratory function and cardiac activity. At altitudes above 9000 m. the cardiac and respiratory functions were markedly disturbed and periodic breathing and cardiac arrhythmia appeared. Action of the centripetal forces in the head-tail direction resulted in a reduction of the size and intensity of the cardiac shadow, as well as a shift in the position and deformation of the internal organs. The character and the extent of the changes in the roentgenological picture of internal organs is a function of the value and duration of the accelerative forces and of the initial functional state of the central nervous system.

AGARD, NATO 1955 COLLECTED PAPERS ON AVIATION MEDICINE.
(Presented at Aeromedical Panel Meetings of the AGARD, Palais De
Chaillot, Paris) (London: Butterworths Scientific Publications, 1955).
AGARDograph No. 6.

ABSTRACT: Contents include the following papers: "La Recherche Aéromédicale et la Technique Aeronautique" ("Aeromedical Research and Aeromedical Technique") by P. Bergeret; "A Brief Survey of Aviation Medicine" by P. B. Lee-Potter; "Aeromedical Interests--Looking Forward" by O. O. Benson; "Les Variations de Tolérance à la Respiration en Surpression" ("The Variations of Breathing Endurances in High Pressure") by R. Grandpierre and F. Violette; "La Vitesse Inspiratoire Dans L'Anoxie Anoxique Comme Méthode D'Exploration De La Fonction Respiratoire" ("The Speed of Inhalation in Anoxia with the Method of Exploration of the Respiratory Function") by T. Lo Monaco; "Medical Tests for Detecting Latent Epilepsia and Fluctuations in the Level of Consciousness by P. M. van Wulfften Palthe; "Arctic Survival Problems by K. Rodahl; "British Theory and Practice in the Layout of Aircraft Cockpits" by H. P. Ruffel Smith; "Physiological Requirements of Pressure Cabins" by H. L. Roxburgh; "Consequences of Loss of Cabin Pressure" by D. I. Fryer; "Recent Advances of Instrumentation of Interest in Aviation Medicine" by C. S. White et al.; "The Nature of Cold-Induced Tissue Injury" by R. B. Lewis; "The High Intensity Noise Problem in the U.S. Navy" by C. P. Phoebus; "Tolerance to Abrupt Deceleration" by J. P. Stapp; "La Vision Nocturne" ("Night Vision") by A. Mercier; "Some Problems in Testing Colour Vision" by M. A. Bouman and P. L. Walraven; "Heterophoria" by G. Ten Doesschate; and "Practical Aspects of Heterophoria in Aviation" by J. C. Neely.

23

AGARD, Committee on Acceleration 1962 TABLE OF EQUIVALENT ACCELERATION TERMINOLOGIES. In M.K. Cragun, ed., The Fifth Stapp Automotive Crash and Field Demonstration, Sept. 14-16, 1961. Pp. 255-258

24

Air Information Division 1960 SOVIET RESEARCH ON GRAVITATION. AN ANALYSIS OF PUBLISHED LITERATURE. (Science and Technology Section, Air Information Division, Washington, D.C.) AID Report. 60-61, Oct. 1960. ASTIA AD 246 700

CONTENTS:

- Correlation of Stanyukovich's public statements on weightlessness with views expressed by other Soviet-area scientists;
- The problem of gravitation;
- Status of Soviet research on gravitation;
- Correlation of Soviet and Western research;
- General references;
- Bibliography - Soviet area;
- Bibliography - Western world;
- Annual total of publications on gravitation in USSR and other Soviet-area countries;
- Biographies;
- Map showing geographic locations of outstanding specialists on gravitation in the Soviet area;
- English translations of articles in the Russian language.

25

Air Information Div. 1961 FURTHER DETAILS ON GAGARIN FLIGHT
Library of Congress, Air Information Div., Science and Technol. Section,
Washington, D. C.
AID rept. no. 61-113, 27 July 1961
ASTIA AD 261 454

ABSTRACT: Three articles have appeared recently which contain information not found in any of the more than 60 Soviet sources published in connection with Gagarin's flight. The first article was written by Professor G. V. Petrovich and published in the Vestnik of the Academy of Sciences USSR. The second is a TASS interview with Professor V. V. Dobronravov, Doctor of Physical and Mathematical Sciences. The third was written by Inna Yavorskaya, whose title is given as Scientific Secretary of the Interplanetary Travel Commission of the Academy of Sciences USSR. This report recounts certain details found in these three articles and discusses their implications. Some of the information presented appears to support certain inferences drawn in previous AID reports.

26

Akesson, S. 1948 ACCELERATIONSPARERKAN OCH HJARNAS BLODFORSORJNING (EFFECT OF ACCELERATION ON BLOOD SUPPLY OF BRAIN)
Nord. Med. 37: 70-76.

27

Akesson, S. 1948 BLOOD SUPPLY TO THE BRAIN DURING ACCELERATION
Acta Physiologica Scandinavica (Stockholm) 15:237-244

ABSTRACT: The possibility that the blood circulation in the brain, in an erect position, particularly under the influence of higher degrees of positive acceleration, is facilitated by a siphonic effect is discussed. A prerequisite for this is that the vessels do not close at any point of the siphon. The weak points are the jugular veins and the small vessels in the brain. Direct measurements of the pressure of the cerebrospinal fluid during compression tests on the neck show that the jugular veins are far more pressure-resistant than was earlier believed. It seems plausible that the small vessels in the brain are, in the first place, protected from collapse by the hydrostatic equilibrium between the blood and the cerebrospinal fluid. In all probability, a local artery-dilating mechanism, at imminent over-pressure in the cerebrospinal fluid, will contribute towards keeping the vessels open. It has been shown in Man that the pressure in the cerebrospinal fluid can be raised to degrees above the probable pressure in the cerebral capillaries without loss of consciousness and without any significant increase of the blood pressure.

28

Akrep, J.P. 1959 THEORY OF THE LIQUID COLUMN ACCELEROMETER (Quartermaster Food and Container Ins. for the Armed Forces, Chicago, Ill.) Technical report no. 195.

ABSTRACT: A new principle of accelerometer construction for evaluating non-vibratory phenomena employs a liquid column as the reacting mass and utilizes the apparent change in density of a contained liquid as a means of measuring acceleration. Basic advantages appear to be simplicity, elimination of frequency response problems in the sensing element, self-powering of the information pulse, and wide flexibility in range due to ease of changing liquid densities, column height, and transducer ranges. A design study is outlined for a low cost accelerometer for package testing. (Author)

29

Alakseev, A.P. 1957 KANALIZU PARASHIUTNOGO TRAVMATIZMA.
(The Analysis of Parachute Trauma) Voennomed Zh. 2:76-77, Feb. 1957

30

Alandarov, N.S. 1936 UEBER UEBUNGSFESTIGKEIT AM VESTIBULAR APPARAT.
(Value of Training the Vestibular Apparatus.) Voenna san Delo. 2(3):94-95,

ABSTRACT; One hundred and twenty persons were trained by Kulikovskij's method for two months and then re-examined after a lapse of five months. It was shown that the condition of the vestibular apparatus was not so good at this period as immediately after training. The results of training are therefore unstable. Examination five months after the training period showed improvement in 59.2 percent, exacerbation in 17.5 per cent and no change in 23.3 per cent. Training of the vestibular apparatus has therefore a certain practical value and should be given shortly before actual flying exercises.

ABSTRACT: Journal of Aviation Medicine 7(4): 214-215, December 1936

31

Albay Cemal Ispahi 1940 CONSIDERATIONS MEDICAUX SUR LE PARACHUTISME (Turkisch)
(Medical Considerations on the Parachutist)
(Askeri Sihhiye Mecm. 69:105-107)

32

Alderson, Samuel W. June 1961 ANTHROPOMORPHIC TEST DUMMIES IN CRASH INJURY RESEARCH
(Paper, Symposium on Biomechanics of Body Restraint and Head Protection, Naval Air Material Center, Philadelphia, Pa. June 14-15, 1961)

ABSTRACT: Anthropomorphic test dummies are essential for crash research studies because of unacceptable hazards to live subjects. To be valid test subjects, anthropomorphic test dummies must duplicate the dynamic response of the human and must develop internal stresses similar to those of the human. Although mathematical models of spring-mass systems may describe some human responses, such an approach is inadequate in assessing the potential for injury. It is believed that the most valid basis for determining human survivability under conditions of high acceleration is to find thresholds of injury by cadaver testing. Although there are significant differences between the injury thresholds of cadavers and living men, cadaver data may be extrapolated to the living by considering similar relationships observed experimentally between dead and living animals. Present anthropomorphic test dummies are capable of providing gross and crude data but cannot give the quantitative information needed to guide the design and development of protective devices to minimize injury under violent dynamic conditions.

33

Aldman, B. 1960 PHOTOGRAMMETRIC METHOD FOR DETERMINATION OF SHORT-TIME DECELERATIONS. Svensk lantmäteritidskrift 3:2-5

34

Aldman, B. 1961 SEATBELTS: THE VALUE OF THE AUTOMOBILE SAFETY BELT.
(A Series of Lectures given on Behalf of The Swedish National Council for Road Safety Research, Stockholm, Sweden)
International Road Safety and Traffic Review (London) 9:43-46.

35

Aldman, B. 1962 BIODYNAMIC STUDIES ON IMPACT PROTECTION
Acta Physiologica Scandinavica (Stockholm) Vol. 56, Supplementum 192.

SUMMARY: In the introduction the significance of the stretching properties of the straps in a body restraint is indicated and it is also pointed out that this problem has been very little discussed in the literature. The difficulties involved in the study of effects of short-term, high peaks of deceleration are mentioned and the importance of such studies for the biodynamics of trauma is stressed. The review of earlier investigations includes the more important research activities in this field and some theories about the human tolerances to impact acceleration stress in the short-duration impact zone and that different opinions exist about the decisive physical quantity for injuries in this zone, indicating the need for more accurate recording methods.

A critical analysis is made of the recording methods used in earlier work and the accuracy of high-speed photography is evaluated. The background to and the planning of the present investigation are described in order to explain the procedure used in solving the problems.

The duration of the deceleration period and the time lag between the deceleration of vehicle and occupant, using different restraining devices in European-built cars, were verified in car-barrier impact tests. The experience from these tests showed the necessity of studying the elongation process in the straps under standardized laboratory conditions and also the need for better recording methods. The photogrammetric method for this study is presented, the accuracy and usefulness of this method is discussed, and the results from the study of dynamic testing of textile straps are presented.

A method of recording strain waves in the straps is described. An equipment for the study of deforming waves in bone structures is described and some results from such studies reported. The disc stereocamera, a new application of photogrammetric principles for recording the deformation in various materials under dynamic load, is briefly described and a test on the accuracy of this recording method is presented as a comparison with that of the high-speed film technique.

An apparatus called the steering-wheel catapult is described. It was designed for a study of the extent to which the human body is decelerated by the contact with the vehicle of arms and legs. This catapult has also been found useful for investigating desirable qualities in the design of steering-wheel assemblies. High-speed film technique was used for the recording of the effect of different types of body restraints on anthropometric dummies under standardized conditions. Results from these tests are given, illustrating the necessity of testing dynamically the effect of different strap arrangements in judging how effectively the load from the straps is distributed over structures suitable for taking up such high loads. A roentgen technique for displacement studies of internal organs during deceleration of the whole body is described, and its usefulness and accuracy are exemplified by the presentation of a resonance curve for the heart of a test animal, obtained by this method. In order to stimulate the collection of data, now lacking, on human tolerance to acceleration stress in the short-duration impact zone, this publication is mainly concerned with the presentation of methods for such studies; it reports a limited number of results only to prove the usefulness of the described methods. The interrection (sic) between the safety belt and the seat of the car is discussed and the necessity of properly designed seats for optimal protection of car occupants in case of an accident is emphasized. (Author)

36

Aldman, Bertil 1962 INVESTIGATIONS ON LONG-STRETCHING BODY RESTRAINTS
In Impact Acceleration Stress: Proceedings of a Symposium With a Comprehensive Chronological Bibliography, (National Academy of Sciences, National Research Council) Publication No. 977, pp. 355-362

ABSTRACT: It has been demonstrated by several investigators that in experimental car collisions there is a time delay for the deceleration of the restrained dummy relative the car. That time delay was verified for European cars in an experimental series of car-barrier impacts made in Sweden in 1958. In my investigations I have chosen another way which is necessary if the space in the vehicle is so limited that an upper torso restraint is desired and that is to use long-stretching straps for the restraint.

37

Aleksandrov, A. 1957 MAN AND THE COSMOS
Trans. of Meditsinskii Rabotnik (USSR) 20(105):3, 1957
(Office of Technical Services, Washington, D.C.)
Sept. 1960 61-27432

ABSTRACT: Some of the physiological aspects of space flight are discussed in "popular" terms.

38

Aleksandrov, A. 1958 CHELOVEK I KOSMOS (MAN AND COSMOS)
Med. rabot. No. 105, p. 3, 31 Dec. 1957
English translation: U. S. Central Intelligence Agency, Foreign Documents Division, Scientific Information Rept. No. 1, pp. 83-85, 27 Feb. 1958

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Aleksandrov, S. G. and R. Ye Fedorov 1959 BIOLOGICAL STUDIES ON SPUTNIKS II AND III.
Trans. of mono. Sovetskiye Sputniki i Komicheskaya Raketa (Soviet Sputniks and Space Rocket) Moscow, p. 157-160, 1959.
(Office of Technical Services, Washington, D.C.)
Dec. 9, 1959 60-13205

40

Aleksandrov, N. 1960 RETURN FROM SPACE
Sovetskaya aviatsiya P. 3; 30 August 1960.

41

Alekseyev, S. M., Y. V. Balkind, A. M. Gershkovich, V. S. Yeregin, A. S. Povitskiy, & N. L. Umanskiy 1961 SOVREMENNYYE SREDSTVA AVARIYNOGO POKIDANIYA SAMOLETA (MODERN FACILITIES FOR THE EMERGENCY ABANDONMENT OF AN AIRPLANE) (Moscow: Oborongiz, 1961)

ABSTRACT: Based on non-Soviet sources, the book reviews briefly the development of flyers' escape equipment, describes the construction of ejection seats, and gives design and calculation data for ejection seats and ejection-seat parachutes. Information is included on the calculation of the trajectory of the ejected seat, its stabilization, and the aerodynamic loads involved. Attention is given to methods of escaping from aircraft flying at high speeds and at high and low altitudes. Information on problems connected with oxygen equipment, protective clothing, and testing facilities is also included. No personalities are mentioned (CARI)

42

Alekseyev, S.M., Y.V. Balkina et al. 1962 ELEMENTS OF THE MOVEMENT OF A PARACHUTIST AND DESIGNING THE PARACHUTE. (Translated by Foreign Tech. Div., Air Force Systems Command, Wright-Patterson AFB, Ohio.) Trans. No. FTD-TT-61-466. From Sovremennyye Sredstva Avariynogo Pokidaniya Samoleta (Moscow: Oborongiz, 1961), Chapter 3. Pp. 69-122.

ABSTRACT: The basic principles of the working of safety parachutes were investigated to determine the basic elements of their design and construction. Parachute fabrics, aerodynamic loading during the parachute opening and the length of the parachute risers are considered. (Author)

43

Alexander, C. B. J. 1956 MEDICAL ASPECTS OF PARATROOPER TRAINING. Aero Med. Soc. J. (New Delhi) 3(1):38-47, April 1956

ABSTRACT: A brief description is presented of the history of parachuting in India and of the Indian Air Force program for the selection and training of paratroopers. Injuries encountered during training are discussed and classified by their occurrence during ground training and during jumping (at exit, during parachute development, and during landing). Data concerning the occurrence of various types of injuries in the years 1950 and 1951 are presented, and data from 1950 are compared with the injury rates of American, British, and French paratrooper schools.

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

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

45

Alexander, G. 1961 NASA DEVELOPS HIGH-MOBILITY SPACE SUIT.
Aviation Week and Space Technology 75(1):57-59, July 3, 1961.

ABSTRACT: Support and restraint suit for space pilots, light and mobile enough so that it can be worn as personal equipment and adjustable to any individual's form, has been developed and centrifuge-tested by the National Aeronautics and Space Administration's Ames Research Center, Calif. The system's design requirements called for a high degree of pilot mobility; adaptability to a variety of pilot sizes and shapes; and adequate support against high g forces applied posteriorly, anteriorly, or vertically along the spinal axis. This article gives a detailed description of the space suit. (CARI)

46

Alexander, Leo 1945 MISCELLANEOUS AVIATION MEDICAL MATTERS
ASTIA ATI 12814

ABSTRACT: Various aviation-medical data are given of German experiments on animals and humans concerning rapid and low descent from great altitudes comparable with free fall and descent by parachute. Special problems are discussed pertaining to the patho-physiological effect of low temperatures, method of resuscitation necessitated by accidents, anoxia, altitude tolerance, and decompression, as well as safety and rescue.

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Alexander, S. J., M. Cotzin, C. J. Hill, Jr., E. A. Ricciuti, & G. R. Wendt 1945
WESLEYAN UNIVERSITY STUDIES OF MOTION SICKNESS: I. THE EFFECTS OF VARIATION
OF TIME INTERVALS BETWEEN ACCELERATIONS UPON SICKNESS RATES. J. Psychology
19:49-62

INTRODUCTION AND SUMMARY: This is the first of a series of investigations designed to discover the physical and physiological conditions of motion sickness so that a rational preventive procedure may be devised. This first experiment was designed to test the hypothesis that the time interval elapsing between the acceleration

phase and deceleration phase of a cyclic vertical movement is a factor in production of sickness. Using a "wave machine" similar to an elevator subjects were exposed to waves having a period of constant velocity during the up and down motions. This constant velocity was always 400 feet per minute reached in approximately 0.33 secs. The duration of the period of constant velocity was 0.2 secs., 0.7 secs., 1.1 secs., or 1.6 secs. (approximately) for different groups of subjects. Other significant variables were controlled or counter-balanced. The result was in accordance with our prediction; the wave with a 0.2 sec. period of constant velocity produced very little sickness; the wave with a 1.1 sec. period of constant velocity produced the most sickness. The correctness of the result was supported by internal analysis of the results, by results of a preliminary experiment, and by results of check experiments. It is concluded that time interval between accelerations is a factor in production of motion sickness. The paper includes a general statement of the purposes and procedures of this series of experiments, and will serve as a reference for all. (Author)

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Alexander, S. J., M. Cotzin, C. J. Hill, Jr., E. A. Ricciuti, & G. R. Wendt 1945
WESLEYAN UNIVERSITY STUDIES OF MOTION SICKNESS: II. A SECOND APPROACH TO THE
PROBLEM OF THE EFFECTS OF VARIATION OF TIME INTERVALS BETWEEN ACCELERATIONS
UPON SICKNESS RATES. J. Psychology 19:63-68

INTRODUCTION AND SUMMARY: In Report I (1) we showed that when wave cycle duration is increased by insertion of a period of constant velocity in the wave, sickness rates increase. Maximum sickness was found with a 16-cycles per minute wave having a 1.13 second period of constant velocity. In the present experiment the wave cycle duration was held constant at approximately 22 cycles per minute while varying the duration of a period of constant velocity in the wave for different groups of subjects. Peak values of acceleration were held constant. Time intervals between accelerations were controlled by varying the length of time of application of the acceleration, and thus the velocity. Three durations of the period of constant velocity were used: 0.68 seconds, obtained when the constant velocity reached was 400 ft. per min., 0.82 seconds at 300 ft. per min., and 1.12 seconds at 200 ft. per min. It was found that the first of these conditions produced the greatest sickness, the last the least sickness, in approximately the ratio of 3:1. It was therefore concluded that when cycle duration is held constant, the time interval between accelerations is a less potent condition of motion sickness than is the total wave energy. (Author)

Alexander, S. J., M. Cotzin, C. J. Hill, Jr., E. A. Ricciuti, & G. R. Wendt 1945
WESLEYAN UNIVERSITY STUDIES OF MOTION SICKNESS: III. THE EFFECTS OF VARIOUS
ACCELERATIONS UPON SICKNESS RATES. J. Psychology 20:3-8

INTRODUCTION AND SUMMARY: This investigation was designed to discover how motion sickness rates on our vertical accelerator are affected by acceleration level. Four acceleration values were used, 0.20, 0.25, 0.36, and 0.65 "g" while keeping total energy per wave at a constant value such that the motion had a mid-wave velocity of 400 feet per minute. By this means wave frequencies of 13, 16, 22, and 32 cycles per minute were obtained; these are the same frequencies as were used in the first study of this series, where time interval between accelerations was varied. Other significant variables were counterbalanced or controlled. The results on 120 subjects showed that a moderate acceleration value produced maximum sickness; the highest acceleration value produced the least sickness. The obtained sickness rates were: 40, 43, 53 and 13 per cent in going from the lowest to the highest acceleration. The corresponding "sickness indices" (giving a double weight to vomiting and single weight to lesser sickness) were: 53, 63, 77, 20. (Author)

Alexander, S. J., M. Cotzin, C. J. Hill, Jr., E. A. Ricciuti, & G. R. Wendt 1945
WESLEYAN UNIVERSITY STUDIES OF MOTION SICKNESS: IV. THE EFFECTS OF WAVES
CONTAINING TWO ACCELERATION LEVELS UPON SICKNESS. J. Psychology 20:9-18

INTRODUCTION AND SUMMARY: This investigation was designed to discover how motion sickness rates on our vertical accelerator are affected by waves whose top and bottom halves are at different acceleration levels, in comparison with waves where top and bottom are of the same acceleration. The primary purpose of this comparison was to discover whether sickness is a function of over-all wave frequency or of duration or magnitude of component accelerations. Two sets of data were taken, using a total of five wave-types. All waves were of the same total energy, reaching a mid-wave velocity of 400 feet per minute. In the first experiment on 99 subjects sickness rates of a symmetrical 16-cycle per minute wave with similar half-waves (acceleration = 0.65 and 0.17 g), each by itself relatively non-nauseating (when used in equal acceleration waves). The obtained sickness rates were: equal acceleration, 48%; low acceleration in bottom half of wave and high acceleration in top half, 9%; low acceleration in top half of wave and high in bottom half, 21%. Corresponding "sickness indices" (giving double weight to vomiting and single weight to lesser sickness) were: 82, 15, and 30. In the

second experiment on 48 subjects sickness rates of two asymmetrical 21-cycle per minute waves were compared, made up of a relatively non-nauseating half-wave (acceleration =0.65g) and a nauseating half-wave (acceleration =0.25g). With 0.25 g at the bottom, 29% were sick; with 0.25 g at the top, 33% were sick. Sickness indices were 38 and 42. The sickness rate with the four unequal acceleration waves are about what would have been expected if the duration or magnitude of component accelerations were the primary condition of sickness. Acceptance of this view and of its apparent implication that response of some resonant mechanical system is involved in motion sickness should be deferred until it is developed in further experiments, because there is no independent evidence that such a slow period mechanical system is present. Other implications of the results are presented. (Author)

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Alexander, S. J., M. Cotzin, C. J. Hill, Jr., E. A. Ricciuti, & G. R. Wendt 1945
WESLEYAN UNIVERSITY STUDIES OF MOTION SICKNESS: V. INCIDENCE OF SICKNESS AT
VARIOUS HOURS OF THE DAY. J. Psychology 20:19-24

INTRODUCTION AND SUMMARY: In two series of experiments, one with 330 naval aviation cadets and one with 120 naval officer-candidate trainees, the incidence of motion sickness resulting from 20 mins' exposure of blindfolded subjects on a vertical accelerator was analyzed for any relationship to hour of the day. All other known important variables were counterbalanced or controlled. The analysis revealed no reliable evidence of a relationship of incidence of sickness to meal-time or to the period of the day. The variance among hours was such as might have been expected by chance. There was some consistency among experiments in the amount of sickness at different hours, but there are no obvious hypotheses to account for the obtained distributions of sickness rates. (Author)

52

Alexander, S. J., M. Cotzin, C. J. Hill, Jr., E. A. Ricciuti, & G. R. Wendt 1945
WESLEYAN UNIVERSITY STUDIES OF MOTION SICKNESS: VI. PREDICTION OF SICKNESS
ON A VERTICAL ACCELERATOR BY MEANS OF A MOTION SICKNESS HISTORY QUESTIONNAIRE
J. Psychology 20:25-30

INTRODUCTION AND SUMMARY: In a series of five experiments using a total of 477 naval officer-candidates, the incidence of motion sickness resulting from a 20-minutes' exposure of blindfolded subjects on a vertical accelerator was analyzed for its relationship to previous history of motion sickness as determined by questionnaire. The experimental groups were so counterbalanced that each of three sus

ceptibility categories, according to the questionnaire, was equally represented with each of the 14 wave-types used. All other known important variables were counterbalanced or controlled. The over-all results showed a reliable and moderately high relation between sickness history and experimentally produced sickness. The obtained over-all rates of sickness on the vertical accelerator in each group of subjects divided according to past history were: susceptibles, 45%; intermediates, 24%; non-susceptibles, 14%. The corresponding 'sickness indices' (giving a double weight to vomiting and single weight to lesser sickness) were: 65, 35, and 21. The results are interpreted as indicating that machine sickness has factors in common with other forms of motion sickness. It is also suggested that a questionnaire might yield a useful prediction of sickness in military situations and might be used as an elimination or selection device. (Author)

53

Alexander, S. J., M. Cotzin, C. J. Hill, Jr., E. A. Ricciuti, & G. R. Wendt 1945
WESLEYAN UNIVERSITY STUDIES OF MOTION SICKNESS: VII. THE EFFECTS OF SICKNESS UPON PERFORMANCE. J. Psychology 20:31-39

INTRODUCTION AND SUMMARY: Certain performance tests have been administered to subjects before and after exposure to motion on our vertical accelerator. The data were analyzed to determine whether those who become motion sick showed deficit in performance. Of the four tests used only one, the Mashburn Complex Coordinator, showed a statistically reliable harmful effect of motion sickness, the obtained deficit being about 4%. The deficit in a test of running through sand and weaving around obstacles was 0.4% and in a 60 yard dash the deficit was 0.5%. Neither of these is statistically reliable. In a dart-throwing test the deficit was approximately 7%, but due to the unreliability of this test (reliability coefficient = +.43) this result is not proof of a true deficit. These results are interpreted as indicating that a brief exposure to motion (20 mins or until vomiting occurred) probably, has no important effects upon laboratory motor performance tests. Other analyses showed that neither susceptibility to machine sickness nor past history of sickness bears any relation to normal motor performance ability on any of the tests administered before exposure to motion. (Author)

54

Alexander, S. J., J. S. Helmick, J. H. Taylor, & G. R. Wendt 1946 STUDIES IN MOTION SICKNESS: II. EXPERIMENTAL COMPARISON OF VARIOUS AUTONOMIC RESPONSES IN INDIVIDUALS SUSCEPTIBLE AND NONSUSCEPTIBLE TO MOTION SICKNESS. (Civil Aeronautics Administration, Washington, D. C.) Rept. No. 66, Aug. 1946

SUMMARY: This is one of a series of studies in which certain physiological reactions in individuals susceptible and non-susceptible to motion sickness were compared experimentally. In the present experiment five susceptibles and five non-susceptibles served as subjects on each of six days during which their reac-

tions to epinephrine (adrenaline), to acetyl-beta-methyl-choline (mecholy1), to hyperventilation, to breath holding, and to immersion of the foot in ice water were studied. The experiment constituted an indirect approach to the problems of whether susceptibility is a matter of blood chemistry, of abnormal sensitivity to one or another of the substances released at autonomic nerve endings, or of vasomotor instability.

All of the measures employed in this study have been used by the authors and other investigators in previous or subsequent studies. For this reason it seems wise to withhold conclusions about the present data and to refrain from presentation of reliabilities of differences, since the results of all studies taken together are negative for each of the measures employed. The data available from the present study for comparison of susceptibles and non-susceptibles are as follows: resting respiration, blood pressures, pulse rate, perspiration and salivation, response of the same variables to mecholy1 and to adrenaline, and response of the circulatory and respiratory measures to immersion of the foot in ice water, to breath holding for twenty seconds, and to hyperventilation for three minutes. Various observational data such as dermatographia, abdominal noises, etc., were recorded but none yielded data which were methodologically adequate for use. (CAA)

55

Alexander, S. J., J. S. Helmick, C. J. Hill, & G. R. Wendt 1946 STUDIES IN MOTION SICKNESS: III. A SECOND EXPERIMENTAL COMPARISON OF AUTONOMIC RESPONSES IN INDIVIDUALS SUSCEPTIBLE AND NON-SUSCEPTIBLE TO MOTION SICKNESS. (Civil Aeronautics Administration, Washington, D. C.) Rept. No. 66; Aug. 1946

SUMMARY: This is one of a series of studies in which certain physiological reactions in individuals susceptible and non-susceptible to motion sickness were compared. It differed from previous studies in that experimental conditions were more carefully controlled, more objective recording of responses was employed, and certain new measures were investigated. Eleven susceptibles and twelve non-susceptibles served as subjects on each of two days during which the following were studied: dermatographia, cold pressor test, breath holding test with positive and then with negative pressure, reaction to injection of mecholy1, and reaction to tilt on the tilt table. Data on respiration, pulse rate, variability of pulse duration, blood pressure, skin temperature, forehead sweating and salivation were recorded. The findings presented include means and standard deviations of response and changes in response from day 1 to day 2, test reliabilities, test intercorrelations, and differences between susceptibles and non-susceptibles. Reliabilities and intercorrelations are in many respects lower than would be expected from tests so commonly used clinically. None of the measures served to distinguish between susceptibles and non-susceptibles, either as single tests or as a whole, with the possible exception of pulse duration variability and day 1 to day 2 changes from habituation to the conditions of the experiment.

Alexander, S.J., M. Cotzin, J.B. Klee, and G.R. Wendt 1947 STUDIES OF MOTION SICKNESS: XVI. THE EFFECTS UPON SICKNESS RATES OF WAVES OF VARIOUS FREQUENCIES BUT IDENTICAL ACCELERATION. J. Exp. Psychol., 37:440-448

SUMMARY: This is the last of a series of investigations done by means of the vertical accelerator at Westeyan University. It was designed to discover how motion sickness rates are affected by wave frequency when the accelerations in the waves are held fixed. Usine waves with a constant acceleration of 0.20 g, frequency was controlled by control of the duration of application of upward and downward accelerations. By this means wave frequencies of 13, 16, 22 and 32 cycles per min. were obtained, having amplitudes of 9 feet, 5 feet 4 in., 2 feet 6 in., and 1 foot 1 in. These frequencies are the same as were used in previous studies in this series, where time between accelerations, level of acceleration and other aspects of the waves were varied. Other significant variable s were counterbalanced or controlled. The results on 120 Ss showed that sickness varied with the energy per wave; the biggest wave produced the most sickness, the smallest wave the least. The obtained sickness rates were 37, 37, 10 and 7 percent in going from the large slow wave to the small fast wave. The corresponding 'sickness indices' (giving double weight to vomiting and single weight to lesser sickness) were: 53, 47, 10 and 7. The results of the entire series of studies of the dependence of motion sickness on wave-characteristics are reviewed and certain tentative conclusions drawn. It is shown that some waves were 20 times as nauseating as others, per unit of energy, and that such variations depended on at least four factors: wave-duration, acceleration-level, distribution of accelerations and energy per wave.

Data are presented showing the relationship of sickness to hour of the day and to previous history of sickness.

57

Allard, A. 1952 LE MAL DE L'AIR (Air Sickness)
Bruxelles médical (Brussels) 32: 327-334

58

Allen, G., & C. Fernandez 1959 EXPERIMENTAL OBSERVATIONS IN POSTURAL NYSTAGMUS: Extensive Lesions in Posterior Vermis of the Cerebellum. (School of Avia. Med., USAF Aerospace Medical Center, (ATC) Brooks AFB Texas) Research Rept. No. 59-74, Aug. 1959. ASTIA AD 226 822

Ablation of the posterior vermis of the cerebellum was performed in the cat. Histologic controls showed that the lesion included the pyramis, uvula, and nodulus, but tuber vermis and nuclei fastigii may be encroached upon. The result was a syndrome characterized by disequilibrium and postural nystagmus during the unstabilized period of cerebellar deficiency, followed by compensation.

The postural nystagmus was a "benign paroxysmal type", which was consistently vertical toward the nose and which appeared mainly when the animal was in a supine position. It was fatigable after several repeated tests and disappeared within a few days or weeks. It could not be reproduced in bilateral labyrinthectomized animals.

It was indicated that (1) the term paroxysmal identified the clinical syndrome but not the location of the cause which may be peripheral or central. (2) The term benign is confusing because it may imply that this type of postural nystagmus is limited to peripheral lesions which follow a mild course. (3) Disappearance of postural nystagmus after destruction of the vestibular organ by operation or disease does not necessarily mean that the positional nystagmus was caused by a lesion in that organ.

Our experiments supported the concept that the paleocerebellum plays an important role in the regulation of vestibular reflexes. Some lesions of this area seemed to release the vestibular centers from cerebellar inhibition. It was postulated that this loss of inhibition, together with the existence of incoming signals from the peripheral receptors, carrying the information of position change of the head, were the primary conditions that elicited the postural nystagmus in our animals. The neural mechanism of the disturbance is still obscure.

(DACO)

59

Allen, R. 1961 QUICK WAY OUT.
Aeronautics, 43(3):24-27

ABSTRACT: History of the ejection seat and a description of the several types developed by Martin Baker.

60

Alvarez, J.Z. EFECTOS DE LA ACELERACION. (Effects of Acceleration)
(Servicios De Medicina De Aviacion)

61

Ambler, R., J.R. Berkshire, and W.F. O'Connor 1961 THE SELECTION OF
POTENTIAL ASTRONAUTS.
Aerospace Medicine 32(3):218, March 1961.

ABSTRACT: Since June 1959 all naval air trainees have been given the opportunity to volunteer for astronaut training. This study compares the aptitudes and abilities of those who volunteer with those of the Mercury

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Astronauts, with the final group of 31 from which the Mercury Astronauts were drawn, and with men who did not volunteer. Of 1350 trainees studied 330 volunteered. On tests of intellectual and technical ability 24 per cent of the volunteers scored within the range of abilities displayed by the Mercury Astronauts, and 48 per cent scored within the range of the 31 man Mercury group. The volunteers were superior to the non-volunteers on parameters of aptitude, pre-flight performance, flight, and motivation. The advantages of early selection and implications for longitudinal study are discussed.

63

Ambler, R., J. R. Berkshire, & W. F. O'Connor 1961 THE SELECTION OF POTENTIAL ASTRONAUTS. (Paper, 32nd Annual Meeting of the Aerospace Medical Assoc., Palmer House, Chicago, Illinois, April 24-27, 1961)

64

Amelar, R. D. & C. Solomon 1954 THE WAGES OF BOXING IS TRAUMA. DETECTION OF RENAL INJURY AFTER FIGHTS. J. Urology, 72:145, August 1954

ABSTRACT: Blows to the kidney region, in addition to the strenuous exercise, produce trauma to the kidneys, according to findings from examination of boxers' urine soon after their bouts. The interesting problem of the effect of repeated trauma producing scarring in the kidneys and an eventual decrease of the renal function remains to be studied. This could be done in retired boxers too old to fight in the ring.

65

American Machine and Foundry Co., 1960 FEASIBILITY STUDY FOR AN ADVANCED DEVICE FOR STUDYING THE EFFECTS OF ACCELERATION ON MAN.
(American Machine and Foundry Co., Alexandria, Va.) WADD TR 60-187,
ASTIA AD-236 044, March 1960

CONTENTS:

- Basic technical considerations
 - Radius of vehicle path
 - Acceleration tolerances
- Vehicle concepts
 - Selection of vehicle configuration for six degrees of freedom motion
 - Vehicle description
 - High g vehicle
- Support concepts
 - Peripheral support system
- Drive concepts
 - Rocket drive
 - Momentum principle
 - Operating requirements

- Jet drive
- Steam jet drive
- Electric motor peripheral drive
- Direct current drive
- Alternating current motor drive

Arm concepts

- The active cantilever
- The semiactive torsion arm
- The passive arm
- The facility complex
- The pit structure
- The control center

66

American Seating Co. n.d. INERTIA LOCKING REEL (The O-3903 Inertia Locking Reel Shoulder Harness Take-up). (The American Seating Co., Grand Rapids, Mich.)

ABSTRACT: The #O-3903 type inertia locking reel is a safety device which restrains the forward movement of pilot or passenger in the event of abrupt deceleration of an airplane in which it is installed. It is intended to be mounted on the back of the seat or on some part of the air frame directly behind the seat with the base of the mechanism in a vertical position, the mounting plate toward the front of the plane, and the attachment end of the harness cable pointing upward.

67

Ames, S.W., S. Rosenfeld & C.F. Lombard 1951 DIRECT MEASUREMENT OF RENAL VESSEL PRESSURES UNDER STRESS OF ACCELERATION.
J. Appl. Physiol. 3(7):399-403. Jan. 1951.

ABSTRACT: The renal arteries and veins of young goats (kids) were cannulated and blood pressures measured under the stress of repeated 15-second exposures to both positive 2 and 3 G and negative 2 and 3 G. The sequence of blood pressure changes and alterations of pulse rates are described in oscillographic photographs, figures 1 and 2, and the data are summarized in table I. The findings are discussed. These experiments indicate that sufficient change occurs in renal blood pressures under both positive and negative G to depress renal function and probably to reduce urinary output.

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Ames, S. W., S. Rosenfeld and C. F. Lombard 1951 DIRECT MEASUREMENT OF
RENAL VESSEL PRESSURES UNDER STRESS OF ACCELERATION
(Office of Naval Research, Washington, D. C.)
January 1951 Contract N6ori77
Also see J. Applied Physiol. 3(6), January 1951.

SUMMARY: The renal arteries and veins of young goats (kids) were cannulated and blood pressures measured under the stress of repeated 15-second exposures to both positive 2 and 3 G and negative 2 and 3 G. The sequence of blood pressure changes and alterations of pulse rates are described in oscillographic photographs, figures 1 and 2, and the data are summarized in table 1. The findings are discussed. These experiments indicate that sufficient change occurs in renal blood pressures under both positive and negative G to depress renal function and probably to reduce urinary output.

69

Ames, W. H. 1947 TOLERANCE TO ACCELERATION IN THE AUTOMATIC PILOT EJECTION
SEAT. Bulletin of U. S. Army Medical Dept. 7(9):776-786, Sept. 1947

ABSTRACT: The development of the jet-propelled aircraft with speeds in excess of 550 mph made it mandatory that some type of powered ejector be provided which could catapult the pilot from the cockpit with sufficient velocity to clear the tail structure of the airplane. The Aero Medical Laboratory's interest in this project was in the determination of the tolerance of the human body to the accelerative force required to eject a pilot and seat from an airplane traveling at 600 mph. In essence, the problem presented to the Laboratory was: Can the body be treated as a projectile that must be subjected to the acceleration required to achieve a terminal velocity of 60 ft. per second in the stroke length available in a standard aircraft cockpit. The figure of 60 was based on calculations showing that this velocity would be required for a pilot and seat to clear the vertical stabilizer of an airplane traveling at 600 mph. This article reports the results of the investigations conducted by the Aero Medical Laboratory. (CARI)

70

Ames, W.H., H.M. Sweeney & H.E. Savely 1947 HUMAN TOLERANCE TO
ACCELERATION IN PILOT EJECTION. J. Aviation Med. 18(6):548-553

ABSTRACT: In view of individual variations, it is apparent that the accelerations applied to the subject should be kept to the minimum required to

achieve the desired terminal velocity and that the rate of application of the g forces be kept as low as possible. The present ejection seat equipment developed by the Army Air Forces and the Ordnance Department provides a terminal velocity of 60 feet per second with a maximum of 14 to 16 g on the subject at a rate of application of 175 to 200 g per second. This system provides a means of emergency escape from high speed aircraft with a maximum g well under what is considered the physiological tolerance to high linear acceleration.

In service use, it is evident that a thorough indoctrination should be given all pilots of aircraft equipped with ejection seats so that they may become conditioned to the sequence of events prior to ejection and appreciate the necessity of assuming the proper body position. This indoctrination should consist of a demonstration of the equipment, movies of actual live ejections, such as the two made in August, 1946, at Wright Field, and an ejection on the 100-foot ejection seat test tower.

71

Ames, W.H. 1948 HUMAN TOLERANCE TO HIGH LINEAR ACCELERATIONS OF SHORT DURATION. Military Surgeon, 103(2):96-99, Aug

ABSTRACT: The results of the studies conducted by the Air Materiel Command on the factors involved in human tolerance to high accelerations of short duration as applied from head to foot.

72

Ames, W.H., and H.E. Savely 1948 MOTION OF THE HEAD DURING SIMULATED SEAT EJECTION. (Engineering Division, Air Materiel Command, U.S. Air Force) MCREXD 695-661, 6 Jan. 1948. ASTIA ATI 67688.

ABSTRACT: This report contains the results of studies to determine the effects of fore-aft adjustment of the head rest on motion of the head during simulated ejection on a test tower. After completion of the tests, it was concluded that the danger of injury to the neck during simulated seat ejection on a test tower can be effectively controlled by proper fore-aft position of the head rest and the assumption of the proper body position. If hyperflexion of the neck occurs during accelerations of approximately 12 g or over, some degree of injury to the neck can be expected. No experimental methods are available for assessing the degree of injury which may occur.

73

Ammons, R.B. 1947 ACQUISITION OF MOTOR SKILL: II. ROTARY PURSUIT
PERFORMANCE WITH CONTINUOUS PRACTICE BEFORE AND AFTER A SINGLE REST.
J. Exp. Psychol. 37:393-411

SUMMARY: Undergraduate women (N = 510) were given 1/3, 1, 3, 8, or 17 min. continuous practice on pursuit rotors, rested 1/3, 2, 5, 10, 20, 60, or 360 min., then practiced eight min. more. The data obtained were analyzed to show the effects of duration of pre-rest practice and length of interpolated rest on several variables defined in terms of the rotary pursuit performance curve.

The conclusions confirm, give quantitative value to, and extend generalizations and predictions made in a previous paper. Further experimentation aimed at obtaining exact mathematical equations might well lead to a precise theory of rotary pursuit learning.

74

Amtmann, H.H. Oct. 1948 PROPOSAL FOR A HIGH PERFORMANCE PRONE POSITION
TEST AIRPLANE. USAF Aero Med. Lab., Memo Rept. MCRXED-695-72-D.

75

Amtmann, H.H. 1948 PROPOSAL FOR A NEW AIRCRAFT CONTROL SYSTEM FOR
CONVENTIONAL AND PRONE POSITIONS. AAF Memo Report TSEAA-695-72C

76

Ananoff, Alexandre 1950 L'ASTRONAUTIQUE (ASTRONAUTICS)
(Paris: Librairie Arthème Fayard, 1950)

ABSTRACT: According to a review in Rocket-Science 4:48, June 1950, two-thirds of this book is devoted to space flight and such things as the space station, step rockets, manned space flights, astrogation and the numerous chemical and physical problems of space flight.

77

Anderson, B. 1958 SPACE TRAVEL
(California Inst. Of Technology, Jet Propulsion Lab., Pasadena, Calif.)
Literature search no. 66; 18 April 1958.

ABSTRACT: A compilation of unclassified references associated with the problems of space travel with special emphasis on the physiological aspects.

78

Anderson, C. H., M. McCally, and G. L. Farrell 1959 THE EFFECT OF ATRIAL STRETCH ON ALDOSTERONE SECRETION. Endocrinology 64:201.

ABSTRACT: A study was carried out to determine whether the secretion rates of aldosterone and of hydrocortisone are subject to regulation by receptors located in the atria of the heart. In dogs, the right or left atrium was stretched with sutures which extended from the atrium to the thoracic wall. Adrenal venous blood was collected and analyzed for aldosterone and hydrocortisone. Following right atrial stretch the aldosterone secretion rate was significantly reduced. However, stretching the left atrium was without effect on the secretory rate of aldosterone. These findings strongly suggest that the secretion of aldosterone may be regulated in part by stretch receptors located in the right atrium.

79

Anderson, G. V., B. Fruchter, H. T. Manuel, & P. Worchel n.d. SURVEY OF RESEARCH ON SPATIAL FACTORS. AFPTRC-TR-54-84

80

Anderson, H. G. 1919 MEDICAL AND SURGICAL ASPECTS OF AVIATION. (London: Oxford Univ. Press, 1919)

81

Anderson, J.B., Jr. & H. Liebewitz 1958 FIRST INTERNATIONAL CONGRESS ON AERONAUTICAL SCIENCES, MADRID
(Office of Naval Research, London, England) Technical Report ONRL-97-58

ABSTRACT: Technical papers were presented which dealt with problems involved in high-speed flight in the fields of aerodynamics, structures, navigation and guidance, power plants, human engineering, and space flight. This report presents a list of the papers and abstracts the material.

82

Anderson, R. G. 1947
THE MOTIVATIONS OF THE FLYER AND HIS REACTIONS TO THE STRESSES OF FLIGHT J. Aviation Med., 18:18-30

ABSTRACT: Each individual who flies is subjected to the same specific and cumulative stresses in varying degree and intensity. Stress produces anxiety and the end result of anxiety is largely determined by the personality and previous experiences of the individual concerned. The amount of resistance to anxiety which a given individual has is dependent

upon the type and intensity of his motivation. Motivation of sufficient strength may overcome the most serious predisposition. On the other hand, a weak, unhealthy motivation may yield to anxiety when there is little or no predisposition. This suggests that instead of concentrating on eliminating the allegedly predisposed, as has been done in the past without valid statistical support, those interested in the selection of flying personnel should attempt to estimate and evaluate resistance.

83

Anderson, R.S., F. W. Stemler, R.F. McHugh, Jr., & E.B. Rogers 1959
AIR BLAST STUDIES WITH ANIMALS (Biophysics Division, U.S. Army Chemical Warfare Laboratories, Army Chemical Center, Maryland)
CWLR 2288, AFSWP-1110, Subproject 4-08-02-023-03, July
ASTIA AD-225 403

ABSTRACT: Goats, rabbits, and mice have been exposed to air blasts in a shock tube. Translation seemed to be the major cause of injury except for damage in the ears. Correlation have been made between the air pressure, velocity, and distance traversed by the animals.

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Anderson, R.S., F.W. Stemler, & E.B. Rogers 1961
AIR BLAST STUDIES WITH ANIMALS II
(Biophysics Division, U.S. Army Chemical Research and Development Laboratories, Army Chemical Center, Maryland)
CRDLR 3049, DASA-1193, April
Project 4C99-02-002. ASTIA AD 255 305.

ABSTRACT: Goats (under Nembutal) and mice were exposed in a shock tube modified to give longer-duration overpressures and equipped with ports for photography. Except for ear damage, displacement still seemed to be the major cause of injury in goats in the 4-foot section of the tube. However, it was found that mice were killed, apparently by pure blast, in a particular position in a particular type of side chamber attached to the higher-pressure, smaller-diameter, section of the tube. The relation between maximum velocity of displacement and the distance animals were thrown was fairly regular. The probability of injury over different terrains is discussed.

85

Anderton, D.A. 1952 WILL PRONE FLIGHT LICK HIGH-G LOADS?
Aviation Week, 57(26):21-22,24-25

ABSTRACT: Advantages of prone flight are discussed: G-tolerance would be increased (up to 12 G for half a minute); cockpit configuration would reduce aerodynamic drag; pilot would feel more secure in the face of enemy fire; canopy problems (eg., sealing) are reduced; instrument visibility is improved by elimination of conventional control column.

Disadvantages are pointed out: G-suits and stall characteristics of modern aircraft reduce the argument of increased G-tolerance; lack of canopy necessitates some other means of providing visibility---mirror, television, or radar, all adding weight and new complications; lack of canopy might aggravate claustrophobia. Attempts to use prone-position are reviewed: Horton brothers in Germany; Northrop Aircraft, Inc. (in the MX-324, and the Xp-79); Stanley Aviation Corp. (in a modified F-80E); and Beecraft Associates (in the Wee Bee and a delta-wing trainer). AMC Aero Medical Laboratory's experiments are briefly reviewed; developments of nylon bed, and control system, studies in weightlessness and high-G loadings in airplane and on centrifuge. (CARI)

86

Andes, G. M. and J. E. McNutt 1962 CAPILLARY PHENOMENA IN FREE FALL
J. Aerospace Sci. 29:103-104, January 1962.

The authors of this article question the recently published results on the behavior of freely falling liquids by Benedikt and Reynolds. The authors report their own experimental result that sessile drops, even of nonwetting liquids, remain attached to their substrates when allowed to enter free fall.

87

Andina, F. 1937 ÜBER "SCHWARZSEHEN" ALS AUSDRUCK VON BLUTDRUCKSCHWANKUNGEN BEI STURZFLUGEN (Visual Disturbances "Seeing Black" As Sign of Variations of Cerebral Blood Pressure in Aviators Following Abrupt Changes of Speed During Flight)
Schweiz. med. Wschr. (Basel) 67: 753-756, Aug. 1937.

ABSTRACT: The author, with a military flier as pilot, observed and recorded his own experience with reference to seeing black while the plane made the loop, half-loop, and sudden long drop. According to intensity, the visual disturbances may be divided into three phases. The first may be termed "seeing darkly," with the reading matter looking dark but still legible. At first there is no scotoma. In the second phase a black curtain appears in front of the eyes, beginning at the nasal side, with the portion of the field of vision completely eliminated. In the third phase there is completely blackness, total amurosis. The three phases can hardly be said to follow strictly one after the other because they merge so quickly. Even during the last phase there are no signs of impaired consciousness. The eye seems to be more sensitive after the subject has been flying on his back with head down. In this experimental flight the pilot's reactions were the same as those of the author.

88

Andina, F. 1937 LA VISION NOIRE, EXPRESSION DES VARIATIONS DE LA PRESSION SANGUINE DANS LES ACROBATICS AERIENNES (DARK VISION, EXPRESSION OF BLOOD PRESSURE VARIATIONS IN AERIAL ACROBATICS)
Schweiz. Med. Woch. 67: 753-756

89

Andrews, A. H. 1945 ACCELERATION TOLERANCES OF THE HUMAN BODY.
(Combined Intelligence Objectives Sub-Committee)
Item No. 24, File No. XXXII-83. ASTIA ATI 59 705.

ABSTRACT: Acceleration tolerances of the human body were investigated in order to obtain information on aircraft crashes and design as related to protection of personnel, design of ejection seats, and design and tactical use of aircraft for mid-air ramming. Tests are described and the various positions of the pilot used in this study are shown diagrammatically. It is stated that an accelerative force of 10 g of 0.01-second duration against the head causes symptoms of cerebral concussion. However, an acceleration of 34.3 g with the body properly supported is the maximum tolerance without causing symptoms of cerebral concussion; therefore, cockpit, seat, seat belt, and harness should be designed to withstand during crashes at least 34 g. (ASTIA)

90

Andrews, W.H. & E.C. Holleman 1960 EXPERIENCE WITH A THREE-AXIS SIDE-LOCATED CONTROLLER DURING A STATIC AND CENTRIFUGE SIMULATION OF THE PILOTED LAUNCH OF A MANNED MULTISTAGE VEHICLE.
(National Aeronautics and Space Administration, Washington, D.C.)
NASA TN-D-546, Nov. 1960. ASTIA AD 246 060

ABSTRACT: An investigation was conducted to determine a human pilot's ability to control a multistage vehicle through the launch trajectory. The simulation was performed statically and dynamically by utilizing a human centrifuge. An interesting byproduct of the program was the three-axis side-located controller incorporated for pilot control inputs. This method of control proved to be acceptable for the successful completion of the tracking task during the simulation. There was no apparent effect of acceleration on the mechanical operation of the controller, but the pilot's control feel deteriorated as his dexterity decreased at high levels of acceleration. The application of control in a specific control mode was not difficult. However, coordination of more than one mode was difficult, and in many instances, resulted in inadvertent control inputs. The acceptable control harmony at an acceleration level of 1 g became unacceptable at higher acceleration levels. Proper control-force harmony for a particular control task appears to be more critical for a three-axis controller than for conventional controllers. During simulations in which the pilot wore a pressure suit, the nature of the suit gloves further aggravated this condition.

91

Andrus, E. C., E. Day, E. Nichols, & S. Scherlis 1941 STUDIES ON THE EFFECTS OF ABDOMINAL PRESSURE UPON THE FLOW AND DISTRIBUTION OF BLOOD. CAM No. 21; 18 Aug. 1941

ABSTRACT: Effect of Spencer type belt inflated at pressures up to 100 mm Hg was studied on 30 male subjects, 16 to 29 years of age. With subject at rest, supine inflation of belt is accompanied by 5 to 6 mm Hg rise in diastolic blood pressure in arms and legs. Venous pressure in arms is not significantly affected, but in legs it usually rises when the belt is inflated, especially if it is adjusted low on the body. Arm volume is unchanged but leg volume increases. Circulation time is not significantly affected. Cardiac output (ballistocardiograph) undergoes transient increase during inflation of belt. Blood flow in arm and calf may increase but usually decreases, particularly with higher belt pressures. This is probably due to peripheral vasoconstriction reflexly provoked by application of pressure to abdomen.

Observations on tilt table. Inflation of belt has no consistent effect on immediate fall of arterial pressure in arms and rise in legs produced by a change from the supine to the erect posture. In over half of subjects, inflation of the belt prevents or lessens progressive fall in brachial arterial pressure during tilting. Increased leg volume on tilting is to some degree prevented by previous inflation of belt. The hypotension produced by sodium nitrite may be very favorably influenced by inflating the belt before or even while tilting. It is concluded that abdominal pressure belts might be valuable in circumstances where pooling of blood in the abdomen occurs.

Effects of inflated belt on respiration. The level of respiration is displaced upward into the complemental air. Tidal air, respiratory rate, and minute volume are little affected. In 13 subjects, vital capacity increased in one, decreased 100 cc in 6, 200 to 500 cc in 5, and 1100 cc in one.

Effects of inflated belt on heart. Upward displacement of the diaphragm raises the heart to a more transverse position. Consequently, the ECG shows shift of electrical axis to the left and a concomitant change in the amplitude of T waves. No significant change in size is apparent on fluoroscopy.

92

Andrus, E. C. & S. Scherlis 1943
STUDIES ON THE INFLUENCE OF PNEUMATIC LEGGINGS UPON THE FLOW AND DISTRIBUTION OF BLOOD
CAM Rept. no. 115, February

93

Andrus, E.C., et al. 1948 ADVANCES IN MILITARY MEDICINE.
Vol. 1 (Boston: Little, Brown, & Co., 1948)

CONTENTS:

Part III - Aviation Medicine

The effects of acceleration and their amelioration, E.M. Landis
Visual problems, W.R. Miles & D.W. Bronk
Motion sickness, P. Bard

94

Annenskii, F. D. 1961 SPACE PSYCHOLOGY (Kosmicheskaya Psikhologiya)
Trans. of Nauka i Zhizn' (USSR) 28(2):33-39, 1961.
(Joint Publications Research Service, New York, N. Y.)
Aug. 19, 1961 JPRS: 9916

95

Annenskiy, F.D. 1961 [SPACE PSYCHOLOGY]
Nauka i zhizn' (2): 33-39

ABSTRACT: The article investigates the various psychological problems and stresses which future astronauts will probably have to face. Experiments with animals in the second and third Soviet space ships indicate that the body can withstand the physical stresses of space flight and weightlessness. Man may find it more difficult to orientate himself in space and time during space flight because of the lack of succession of day and night and because of the absence of an "up" or a "down" in a state of weightlessness. At first the astronaut will have difficulty in judging the duration of an occurrence. The experience of the space dogs, however, indicated that they preserved some sense of time and rapidly adjust themselves to the situation. An aiding factor here would be the "time metronome" in the brain, i.e., the regular rhythm of 12 oscillations a second in the bioelectric activity of the brain. The astronaut will not be conscious of motion, noise or (except during the active phase of the flight) vibration. Prolonged isolation of this sort can cause various psychic disturbances and hallucinations. The author feels, however, that an astronaut will be assisted by the routine instrument readings and observations he will have to make. Drugs may also be used to combat tiredness or insomnia. The general conclusion is that man is sufficiently adaptable to overcome any foreseeable psychological difficulties of space flight.

96

Anthony, A. and P.A. Danner 1955 CYTOLOGICAL AND CYTOCHEMICAL
CHANGES IN THE SKIN OF HAIRLESS MICE EXPOSED TO HIGH INTENSITY SOUND.
J. Invest. Dermat. 24:435-446. April 1955

ABSTRACT: The results of an investigation of abdominal skin changes in hairless mice following exposures to subthermal (no rise in skin temperature) and thermal (increase in skin temperature) levels of high intensity air-borne sound can be summarized as follows:

1. Subthermal sonic vibrations have no observable effects on the histological structure or functional activity of the skin. Failure to produce tissue injury or cytochemical changes in skins irradiated daily for 3 months is evidence that mechanical effects of sound, at the intensity levels employed, are negligible.

2. Tissue damage produced by very high energy thermogenic sound is primarily the result of local overheating produced by absorption of sound in the skin. Little heat transfer occurred in the skin laterally from the site of exposure as evidenced by the absence of heat damage in glandular and fibrous elements of adjacent regions.

3. Sound-induced skin erythema is followed by a depletion of skin lipids and a diminution in size of cystic elements in the integument.

4. In skin burns produced with intense sound, there is an obliteration of sebaceous and corneal cysts associated with a marked hypertrophy of dermal collagen.

5. The sequence of histological and cytochemical changes following thermogenic sonic irradiation was found to be in complete accord with the response known to occur following ordinary skin burns.

97

Apaix, A., Stringlioni 1959 VERTIGO OF SINUSOID ORIGIN, APROPOS OF
A CASE. Rev Otoneurooptal 31:438-9

98

Apenchenko, Ol'ga 1961 A HARD ROAD TO THE SKY. A REPORTER'S ACCOUNT
OF COSMONAUT TRAINING.

Trans. of mono. Truden Put' Do Tebya, Nevo, Moscow, 1961.

(Office of Technical Services, Washington, D.C.)

March 16, 1962 62-24952

99

Archangielskiy, A. 1939 PILOTS AND ACCELERATION. Vo-sanit Dyele

100

Arima, C.L. 1958 BIBLIOGRAPHY OF HUMAN RESOURCES REPORTS 1947 to 1957,
PART "A" (Defence Research Board of Canada, Directorate of Scientific
Information Service) ASTIA AD-204 501

101

Armament Research Dept. 1946 PILOT EJECTION, RESULTS OF PHYSIOLOGICAL
TESTS AT A.R.D. BALLISTICS (L.P.D.) (Armament Research Dept., White Lea)
Note No. 130, Sept. 1946.

Armed Services Technical Information Agency 1960 BIO-ASTRONAUTICS: AN
 ASTIA REPORT BIBLIOGRAPHY (Armed Services Technical Information Agency,
 Arlington, Va.) Feb. 1960 ASTIA AD 233 000 (Suppl. to ASTIA AD 211 775).

ABSTRACT: Previous bibliographies have covered the literature on bio-astronautics through 1958. This supplemental bibliography brings the subject matter up to date through 1959 insofar as report literature represented by ASTIA holdings, is concerned.

103

Arment, D.E. & Ralph C. Lenz 1946 KINETIC MEASUREMENTS ON A PILOT DUMMY
 EJECTED FROM A P-61 AIRPLANE IN FLIGHT, DETAILED ANALYSIS OF DATA
 Air Materiel Command, Wright Field, Dayton, Ohio Serial No. TSEAC12A/4303-45-1,
 Add. 1 October 17, 1946 ASTIA ATI 186 676

ABSTRACT: This report presents the data and the analysis thereof, relative to the forces acting on the pilot-dummy during the ejection-seat tests conducted with the P-61B-5 airplane during the period from 27 February 1946 to 1 April 1946. Detailed studies of the kinetic measurement data resulted in the following conclusions: (a) The ejection velocity (57.6 f.p.s.) obtained in the tests closely approximates the velocity (57 f.p.s.) for which the catapult was designed. (b) At airplane velocities greater than 235 mph indicated airspeed, the horizontal acceleration caused by the airstream exceeds 3 g. The horizontal acceleration becomes physiologically negative if the ejected pilot should rotate to a head-forward position. (c) The increased horizontal acceleration at the higher airspeeds makes reduction of the ejection velocity inadvisable because the pilot's trajectory might approach too close to the tail of the airplane. (d) The vertical acceleration, as recorded for the peak values (27 to 31 g for 0.015 second), exceeds the present-known physiological tolerance of a human subject. (e) The peak "vertical" accelerations were caused by the compressibility of the parachute packs between the seat and the dummy, and probably can be eliminated or reduced by corrective modification of the cushioning components.

104

Armour Research Foundation March 1955 STUDY OF THE EFFECT OF ORIENTATION ON
 DYNAMIC LOADING AND RESPONSE OF STRUCTURES. Armour Research Foundation
 Rept. No. 3, Contract No. AF 33(616)-166, 1 March, 1955

105

Armour Research Foundation July 1957 COMPENDIUM OF AIR BLAST EFFECTS, VOL.
II, LOADS. (Armour Research Foundation) Contract AF 33(600)-25734

106

Armour Research Foundation 1959
INVESTIGATION OF EMERGENCY ESCAPE UNDER CONDITIONS OF EXTREMELY HIGH
ALTITUDE AND VELOCITIES.
(Armour Research Foundation) March

107

Armstrong, H.G. Oct 1935 SUBJECTIVE MENTAL AND PHYSICAL REACTIONS TO
FREE FALL IN SPACE
(The Journal of the American Medical Association, 105: 1107-1110)

ABSTRACT: From a study of the subjective reactions to a free fall of
approximately 1,200 feet in space, made by means of a delayed parachute jump,
it may be concluded that:

1. In a free fall in space the mental reactions are normal, except as
influenced by fear, excitement or other factors not attributable to the fall
per se.
2. In a free fall in space there is produced only one abnormal physical
sensation and this consists of a very gentle, evenly distributed generalized,
superficial pressure on the downward surface of the body.
3. There is an apparent diminution of hearing acuity from an undetermined
cause.
4. Position in space and motion through space are recognized solely by
means of vision.
5. Depth perception acuity is such that a speed of approximately 100 feet
per second at a distance of 1,900 feet from an object is required to recognize
motion toward that object.
6. Delayed parachute jumps are entirely practical means of avoiding certain
highly hazardous aerial situations.

108

Armstrong, H.G. and J.W. Heim 1937 THE EFFECT OF ACCELERATION ON
THE LIVING ORGANISM. (Engineering Division, Air Materiel Command,
Wright-Patterson AFB, Ohio) Report No. 2362, Dec. 1, 1937.
ASTIA ATI 25622

ABSTRACT: An investigation was conducted concerning the effect of linear
and centrifugal accelerations on the living organism with special reference
to military aviation. A series of experimental determinations were made
during which accelerations of 1 to 7 times the force of gravity were
experienced in flight as well as accelerations of 1 to 16 g produced by

laboratory methods. Synchronous blood pressure-accelerations of 1 to 16 g produced by laboratory methods. Synchronous blood pressure-acceleration recordings were obtained on large animals during accelerations in the 3 coordinate axes of the body and for the positive and negative direction in each of these axes. The tolerance of the average individual is determined, the physiological changes occurring with each acceleration explained, and the possible means of minimizing deleterious effects are described. Recommendations are made for limiting accelerations in flight to a safe limit.

109

Armstrong, H.G., & J.W. Heim 1938 THE EFFECT OF ACCELERATION ON THE LIVING ORGANISM. J. Aviation Med. 9(4):199-215.
See also (Army Air Corps., Wright Field, Dayton, Ohio) TR 4362,
1 Dec. 1937. ASTIA ATI 25 622

ABSTRACT: Positive accelerations, directed thru the long axis of the body and acting in the direction seat to head, result in a shifting of the blood away from the head region to the lower portions of the body. This shifting of the blood away from the head produces a cerebral anemia in the average normal young male adult. 5 seconds are required from the time any given acceleration is reached until the full physiologic effect is obtained. As a consequence the shorter the duration of any acceleration (under 5 secs.) the less the physiologic effect. There is a wide variation in individual susceptibility to positive accelerations which is probably due to the variations in vascular tone and vasomotor control in different individuals. Tolerance is decreased by rapidly repeated exposures but increased by repeated daily exposures. Acceleration of +12.2 G's in flight and +16 G's in the laboratory have been tolerated without evidence of permanent injury. Negative accelerations, directed thru the long axis of the body from head to seat, cause a shifting of the blood away from the lower portion of the body to the head region results in a high intracranial blood pressure. There is little time-lag in negative accelerations. Transverse accelerations, directed thru the body perpendicular to its long axis and in any direction, are relatively well tolerated up to 12 times the force of gravity.(CARI)

110

Armstrong, H. G. 1939 PRINCIPLES AND PRACTICE OF AVIATION MEDICINE.
(Baltimore: Williams and Wilkins, 1939)

111

Armstrong, H. G. 1940 MEDICAL PROBLEMS OF HIGH ALTITUDE FLYING.
J. Lab. Clin. Med. 26:263-271.

ABSTRACT: The current medical problems of high altitude flying depend principally on the altitude attained. As a consequence, the problems of commercial air transport operations are fewer and less serious than those in military aviation, since the former is limited to 18,000 feet. In either instance all the deleterious effects of altitude flying are brought about by the decrease in atmospheric temperature and pressure with ascent.

In spite of winter-flying clothing, personnel begin to suffer at about -10° C. The solution to the problem of cold in high altitude flight is to close and heat the cabin. This has been satisfactorily accomplished in civil aircraft and to a certain extent in military aviation.

During ascent another problem appears when the composition of the atmospheric air remains constant but its total pressure and partial pressure of its component gases decrease. This decrease in turn brings about a decrease in the alveolar oxygen tension and in the oxygen saturation of the arterial blood. This results in a tissue anoxia to which, in aviation, the term "altitude sickness" has been given.

Still another problem in high-altitude flying is the decrease of atmospheric pressure with ascent which may produce five different pathologic states in the body. Three of these are brought about by expansion of the gases contained in the body cavities.

112

Armstrong, H.G. 1943 PRINCIPLES AND PRACTICE OF AVIATION MEDICINE.
(Baltimore: Williams and Wilkins Co., 1943) 2nd. Ed.

113

Armstrong, H.G. 1943 SPEED AND ACCELERATION.
In Principles and Practice of Aviation Medicine. 2nd ed.
(Baltimore: Williams & Wilkins, 1943). Pp. 406-435

114

Armstrong, H.G., H. Haber, & H. Strughold 1949 THE AEROMEDICAL PROBLEMS OF SPACE TRAVEL. In USAF School of Aviation Medicine, Randolph AFB, Texas, Epitome of Space Medicine, Item No. 11, Pp. 383-401
See also J. Aviation Med. 20(6):383-402, 402-417-Discussion. Dec. 1949.

ABSTRACT: Each of the articles discusses specific problems involved in space travel. Dr. Haber discusses the physical and astronomic problems while Dr. Strughold is concerned with the physiological problems. (CARI)

115

Armstrong, H. G. 1951 SPACE MEDICINE IN THE UNITED STATES AIR FORCE.
In Marbarger, J. P., ed., Space Medicine; The Human Factor in Flights Beyond
The Earth (Urbana, Ill.: University of Illinois Press, 1951). Pp. 11-13.

116

Armstrong, H.G. 1952 PRINCIPLES AND PRACTICE OF AVIATION MEDICINE.
(Baltimore: Williams and Wilkins Co., 1952) 3rd Ed.

117

Armstrong, H.G. 1952 SPEED AND ACCELERATION.
Ch. XXI of Principles and Practice of Aviation Medicine, 3rd ed.
(Baltimore: The Williams and Wilkins Co., 1952) Pp. 353-380.

118

Armstrong, H.G., ed. 1961 PRINCIPLES AND PRACTICE OF AEROSPACE MEDICINE.
(Baltimore, Md.: The Williams and Wilkins Co., 1961)

ABSTRACT: The successor to an earlier book entitled "The Principles and Practice of Aviation Medicine," It is the only complete treatise in existence at present on the subject of aerospace medicine. A great array of diverse subject matter is arranged in an orderly, logical sequence of 32 chapters written with the highly specialized knowledge and experience of 21 contributing authors. The information contained has been culled from some 1100 scientific journals, periodicals, and technical reports, many of which are published in foreign languages. This volume has been written primarily for the use of the student and the practitioner of aerospace medicine.

119

Armstrong, N. A and E. C. Holleman 1962 A REVIEW OF IN-FLIGHT SIMULATION
PERTINENT TO PILOTED SPACE VEHICLES
(Advisory Group for Aeronautical Research and Development, Paris, France.)
AGARD-403 July 1962

ABSTRACT: This report shows how the environment of actual flight may be used to simulate many phases of manned space exploration. A number of simulations using conventional, modified, and specially built aircraft are discussed in relation to the portion on spaceflight to which they are generally applicable, that is, the launch, orbital, entry, or the landing-approach phase. Inasmuch as this is a survey, only the scope of the investigations is indicated; no detailed descriptions of, or conclusions from, the research programs are given. Quantitative results may be extracted from the papers mentioned in the references. (Author)

120

Armstrong, R.C. 1959 THE EFFECTS OF POSITIVE PRESSURE BREATHING ON TRANSVERSE ACCELERATION TOLERANCE.

(Convair Aviation, Space and Radiation Medicine Group, San Diego, Calif.)
Rept. No. ZM-AM-001, 14 Jan. 1959.

ABSTRACT: The intent of this paper is to define the basic physics of acceleration in terms of Biological effects, to apply these definitions to techniques for attenuating acceleration stress, and to provide experimental data to support the theoretical conclusions.

121

Armstrong, R.C. and W.L.S. Wu. 1960 EFFECTS OF ZERO "G" ON LIFE SUPPORT SYSTEM DESIGN (Convair Astronautics Div., San Diego, Calif.)
ZM-AM-003, 27 April 1960.

ABSTRACT: It is important to consider the probably consequences of both short and protracted exposures to near or absolute weightlessness in order to establish design guide lines for life support systems and personal equipment to attenuate any adverse responses that are anticipated.

122

Armstrong, R.C. 1961 MARS-SPACE TRAVEL SIMULATOR
Interavia (Geneva), 16 (12): 1983. Dec. 1961.

ABSTRACT: The Manned Astronautical Research Station (MARS) mockup vehicle is capable of taking three astronauts 200 miles into space for three weeks of scientific study. MARS, which is 24 ft in diameter and contains three rooms, can simulate all of the biological environments of orbit except those of hard radiation, zero g, the internal stress of apprehension, the hyper-gravity encountered during launch and re-entry, or the vehicle's dynamic sound pressure levels. It does simulate the normal background noise of orbital flight. As an experimental platform for life science research it will be useful in: determining the physical reactions and operational capabilities of man during flight; conducting physiological and sociological experiments in a confined environment; conducting biological experiments varying the atmospheric pressure, temperature, and humidity; providing for the design and test of apparatus and equipment for advanced space vehicles; and determining the types of testing and training program necessary for space crews.

123

Arno, R. 1960 DIGITAL COMPUTER PROGRAM FOR ACCELERATION PERFORMANCE, TRACKED VEHICLES (Detroit Arsenal, Center Line, Mich.) Rept. no. RR-8, Contract DA 20-089-ORD-39246, Proj. 5510.11.270 and 5W72-01-001; 25 Jan 1960. ASTIA AD-239 330

ABSTRACT: A general computer program was written for the Electrodata 204 "Datatron" Digital Computer to calculate acceleration performance and related characteristics of tracked vehicles. Vehicle performance is determined at prescribed time interval during acceleration from standstill to maximum velocity. Other additional data supplied by the program are vehicle speed, distance traveled, time of travel, sprocket torque, tractive effort, rolling resistance, drawer pull, and acceleration (Author)

124

Arnold, A. 1955 LONG RANGE UPWARD EJECTION SEAT TRAJECTORY ANALYSIS. (Stanley Aviation Corporation, Denver, Colo.) Report #326 Feb. 16, 1955. ASTIA AD 140 727

ABSTRACT: A brief analysis is presented in memorandum form to define the methods used in trajectory analyses for the long range ejection seat. First the equations of motion are established and then a correlation is shown between them and the tabular calculation with the introduction of an error control which determines the allowed length of time interval for the step-by-step integration procedure. Only pitching motion is considered, thus motion is confined to the plane of symmetry.

125

Arnold, J. S., T. D. Witherly and C. T. Vincent 1959 THE STUDY OF ROCKET SLED SLIPPER WEAR PROBLEMS. (US Air Force Missile Development Center, Holloman AFB, New Mexico) AFMDC-TR-59-38 ASTIA AD 228 444

Abstract: The use of track coatings and wear-resistant slipper materials to reduce the wear of the slipper of rocket propelled track vehicles is discussed. Four metal coatings (aluminum, lead, zinc, and tin babbitt) were tested with stainless steel and molybdenum sliders. Zinc coating was the most effective. Molybdenum disulfide and calcium hydroxide (non-metallic) coatings were tested. Calcium hydroxide proved useful in wear reduction. Molybdenum disulfide cannot be evaluated until adherence to the track can be solved. An effort to produce a ductile molybdenum alloy was unsuccessful. On the basis of a few runs, vanadium may be a useful slipper material. Inertial forces and accelerations of considerable magnitude and short duration play an important role in the overall slipper wear problem.

126

Arnoult, M.D. 1949 POST ROTATIONAL AUDITORY LOCALIZATION
(U.S. Naval School of Aviation Medicine and Research, Naval Air Station,
Pensacola, Fla. and Tulane University of Louisiana) Joint Project Report
No. 2. Report No. 1. 13 May 1949. ASTIA ATI 69 635.

ABSTRACT: In this investigation an attempt was made to determine the effect of rotation upon the auditory localization of sound. Four Ss were rotated ten revolutions at the rate of 30 rpm and allowed to make judgments of the position of an auditory stimulus following the cessation of rotation. In the total number of trials 80 percent reported displacement in the direction of rotation; 8% showed displacement in a counterrotatory direction, and 12 % reported no displacement. The amount of angular displacement one second after the cessation of rotation was of the order of from 10^0 to 20^0 . The duration of the displacement ranged from two to 27 seconds with a mean value of 14 seconds.

127

Aronow, M.L. 1959 STEADY-STATE ACCELERATION TEST EQUIPMENT.
In 1959 Proceedings of the Institute of Environmental Sciences, Annual Technical Meeting, April 22-24, 1959, La Salle Hotel, Chicago, Illinois
Mt. Prospect, Ill. Institute of Environmental Sciences, 1959.
Pp. 206-208

ABSTRACT: Among the many physical simulators currently in use for environmental testing and dynamic instrument calibration, the rotary accelerator is the only one capable of subjecting a test object to a constant and indefinitely sustained acceleration. This device is becoming increasingly important in the dynamics laboratory for the calibration of seismic instruments and for certain environmental tests particularly important on missile and aircraft components. The basic rotary accelerator is a centrifuge generally equipped with a variable speed drive, operator controls, a rotating arm arranged for mounting test objects and slip rings for connecting power and instruments to the test objects. It exists in a number of specialized forms. Several of these forms will be described and their use briefly considered. (Author)

128

Arsen'eva, M.A., V.V. Antipov et al 1961 ISMENENIYA V KROVETVORNYKH ORGANAKH
MYSHEI POD VLIANIEM POLETA NA KORABLE-SPUTNIKE (CHANGES IN THE HEMATOPOIETIC ORGANS OF MICE UNDER THE INFLUENCE OF FLIGHT IN A SPACESHIP)
Iskusstvennye sputniki zemli (Moskva) 10: 82-92, 1961

ABSTRACT: The effect of space flight conditions was studied on the hematopoietic organs of 40 black S-57 strain mice and white mice sent up in the 2nd sputnik. An attempt was made to differentiate between the action of vibration, acceleration, and radiation. All animals were returned to earth in good condition. Chromosome disintegration during mitosis in the bone marrow cells was significant.

ly increased in the experimental animals as compared to controls. The findings differed from the results of x-ray studies in that the frequency of chromosome destruction did not decrease prior to the end of the experiment and mosaicism in chromosomal changes was almost completely absent. Thirty days after the return to earth myelopoiesis increased sharply, manifested in an increased number of myeloblasts, promyelocytes, and myelocytes. Three days after the return the number of megacaryocytes in the spleen decreased. Certain other changes noted in the hematopoietic organs are presumed to be caused by vibration and other adverse factors in flight. (J. Aerospace Medicine 33(11): 1395-1396, Nov. 1962)

129

Arskiy, Kh. T. 1940 ZUSTAND DER CORTICALEN FUNKTIONEN IM ZUSAMMENHANG MIT DEM ABSPRUNG VOM FALLSCHIRMTURM (Condition Of The Cortical Function In Connection With Jumping From The Parachute Tower)
Vo.-sanit. Dyelo (7):90-96. 1940

130

Arslan, M. 1961 THE CORIOLIS ACCELERATIONS IN VESTIBULAR STIMULATION.
(ELECTRONYSTAGMOGRAPHIC INVESTIGATIONS)
In Confin.Neurol. 21:403-411, 1961 (France)

131

Arulpragasam, A.C. 1960 THE EFFECT OF DIVISION OF THE CHORDA TYMPANI NERVE IN A CASE OF PERSISTENT POSITIONAL VERTIGO AND SOME OBSERVATIONS AND COMMENTS. J. Laryng. 74:119-20, February 1960

SUMMARY: 1. Division of the appropriate chorda tympani nerve had a curative effect on a case of positional otolith vertigo, which was persistent.

2. The disordered reaction of the otolith organ in positional vertigo, appears to be mediated through the chorda tympani nerve.

3. Division of the chorda tympani nerve in this case, resulted in an immediate disturbance of the vestibular system.

4. It is suggested that the temporary vertigo sometimes observed, after Rosen's operation for stapes mobilization, may in some instances be due, to division or damage to the chorda tympani nerve.

5. Facial palsy can be a complication of division of the chorda tympani nerve.

132

Aschan, G. 1952 CUPULOMETRIEN SOM FLYGEMEDICINSK UNDERSOKNINGSMETOD.
(Cupulometry as an Aeromedical Testing Method)
Meddelanden fran flgyoch navalmedicinska namnden (Stockholm) (1):4-6,
1952.

ABSTRACT: The cupulometric method constitutes an improvement over the old rotating-chair methods (such as the Barny test) in which the stimuli surpass qualitatively and quantitatively those encountered under normal circumstances. Cupulometry is carried out in such a way that the speed of rotation does not exceed 50 degrees - 60 degrees per seconds. Instead of the subject being rotated on a chair within a room, he is placed in a rotating chamber. The acceleration is controlled so as not to exceed the stimulus threshold of the cupular organs (about 0.5 degrees per sec.²). Only when the rotation chamber is brought to a sudden stop will the subject perceive a sensation of rotation and show post-rotative nystagmus opposite to the direction of rotation. The first applications of this method gave surprising results. A test carried out on a number of normal, healthy flying cadets revealed that none of them had a "normal" cupulogram. Stimulus thresholds were substantially raised, and subjective as well as objective time values were lowered markedly. All these data point at a reduced vestibular sensitivity. An asymmetric right and left response was frequently observed, a phenomenon which jibed with reports from the pilots that all their planes had a tendency to roll more easily to one side.

133

Aschan, G., C. O. Nylen, J. Stahle, & R. Wersall 1952 THE ROTATION TEST:
CUPULOMETRIC DATA FROM 320 NORMALS. Acta Oto-Laryngologica 42(6):451-459,
Dec. 1952

SUMMARY: With a method largely the same as that van Egmond et al. have developed from findings by Buys, Fischer, etc., 320 adults of both sexes with negative otoneurological histories and normal audiograms were examined for post-rotatory nystagmus and "after-sensation". The acceleration was constantly 0.5 degrees per sec.², the speed of rotation never exceeded 52 degrees per sec. and the deceleration was always 20--30 degrees per sec.². The following results were obtained. 1) Statistical analysis confirmed van Egmond et al.'s finding that, under given conditions, postrotatory phenomena and speed are correlated, a fact illustrated graphically by so-called cupulograms. 2) There is considerable individual variation, manifested simply as displacement up or down of the cupulogram and by the range of threshold speeds and their means: Nystagmus-inducing speed threshold: range, 1.5-12 degrees per sec.; mean, 4.5 degrees per sec. 3) Paired observations for left and right stimuli highly facilitate the detection of cupulographic "Nystagmusbereitschaft", i.e. directional preponderance. 4) When rotation to the right precedes rotation to the left at all the various speeds, the nystagmus cupulogram will display a systematic directional preponderance to the left.

Conversely, when the initial rotation is to the left, the resulting preponderance will be in the opposite direction. This is not applicable to sensation. 5) A single pair of observations for nystagmus duration following contradirectional stimulation which differ by more than 12-13 seconds might indicate abnormality. A consistent unidirectional difference over 6 secs. at 4-6 speeds must be considered pathological. 6) The statistical results and experiences to date of "clinical cupulometry" strongly suggest that clinical usefulness of the method will spring from the nystagmus cupulogram, particularly as it provides a means of detecting directional preponderance. The sensation cupulogram does not seem equally valuable. 7) The test produced no symptoms of nausea in any of the test subjects. (AUTHOR)

134

Aschan, G. 1954 RESPONSE TO ROTATORY STIMULI IN FIGHTER PILOTS
Acta oto-Laryngologica 115:24-31
NOTE: Reel 7, Flash 6, Item 18

ABSTRACT: One hundred fighter pilots were examined oto-neurologically in order to determine whether their profession influenced their oto-neurological status. A tangible relation to their actual flying duties is demonstrable. Fully trained fighter pilots in good trim, with practically daily ascents, show a sensation cupulogram with a higher threshold value and slighter inclination (lower γ/Δ) of the curve of the sensation cupulogram than do pilots with a smaller training. Pilots flying to a very limited extent did not differ in any way from the control material consisting of non-aviators.

The nystagmus cupulograms show the same. In these, there is often directional preponderance, and in 26 out of 33 cases this corresponds to case histories saying that the pilots concerned more easily rotate their aircraft--carry out rolls --in agreement with this directional preponderance.

Absence from flying for a long period (months) leads to a normalization of the status.

Significant oto-neurological changes in the calorigrams could not be demonstrated except in a few cases. These have been accounted for separately, with unmistakable oto-neurological diagnoses.

In discussing the results, it is maintained that the genesis of this vestibular fatigue, adaption or habituation demonstrated in "normal" fighter pilots must probably be sought, not peripherally in the cupula itself, but in the nervous part of the vestibular apparatus. (AUTHOR)

Aschan, G. 1955 THE MECHANISM OF THE CUPULA AMPULLARIS IN MAN.
Acta Societates Medicorum Upsaliensis 60:77-88.

SUMMARY: Rotary stimulation of the semicircular canals with well-defined stimuli ($1-4^{\circ}/\text{sec}^2$) during varying periods were carried out using "normal" test subjects. The results of vestibular stimulation were gauged by recording nystagmus with as little ocular interference as possible. The speed of the slow component of nystagmus was used as an indicator of the cupular movement in accordance with Steinhausen's hypothesis.

The tests showed that, when angular acceleration ceased, there was an immediate reduction of speed in the slow component of nystagmus. An explanation of this change of speed is offered by the postulation of a double movement of the cupula ampullaris when the subject experiences angular acceleration. Dohlman and Vilstrup, in their experiments on animals, have shown that at angular accelerations the cupula as a whole is distorted but also slides over the surface of the crista ampullaris. The tests described here should provide grounds for the assumption that the mechanism of the cupula ampullaris in man is of a similar nature.

Aschan, G., M. Bergstedt, & J. Stahle 1955 NYSTAGMOGRAPHICAL OBSERVATIONS
ILLUSTRATING THE CUPULAR MECHANISM IN RABBITS AND PIGEONS Acta Societatis
Medicorum Upsaliensis 60:89-122

SUMMARY: When nystagmus in the rabbit and the head-nystagmus of the pigeon are recorded, both animals being subjected to angular accelerations, an immediate reduction of the speed in the slow component of nystagmus is noted. This reduction occurs at the transition from acceleration to a constant speed of rotation and at deceleration when rotation ceases.

A plausible explanation of this phenomenon would be a double movement of the cupula ampullaris with angular acceleration, as demonstrated by Dohlman and Vilstrup. The two facets of this movement are a torsion of the actual cupula and a sliding of the cupula as a whole along the surface of the crista.

When weak angular accelerations are experienced, we obtain the first type of cupular movement, but with stronger accelerations, the resultant post-acceleratory nystagmus indicates that the second facet of cupular movement has taken place. The tests on pigeons, where the structure of crista ampullaris in the vertical and horizontal semicircular canals is different, appear to offer evidence for the assumption that the mechanism of all ampullae is identical. (Author)

Aschan, G., & M. Bergstedt 1955 THE GENESIS OF SECONDARY NYSTAGMUS INDUCED
BY VESTIBULAR STIMULI. Acta Societatis Medicorum Upsaliensis
60(3 & 4):113-122

SUMMARY: The caloric tests were carried out by irrigating either one or both ears. The double irrigations were of three types; hot/hot, cold/cold, hot/cold. The results of these tests demonstrated a central nervous process able to add and subtract the impulses released by peripheral vestibular stimulation. Judging by the speed of the slow component of nystagmus, ampullo-petal or ampullo-fugal cupular deflection in corresponding ampullae in both labyrinths cancel each other out. Ampullo-fugal stimulation of one and ampullo-petal of the other are added, giving rise to a much higher speed of the slow component than when only one ear is stimulated.

The secondary phase of nystagmus induced by calorization was only observed after hot/cold double irrigation. Rotary tests were carried out using small angular accelerations. The periods during which these accelerations were administered were chosen so that the theoretical cupular deviation in each test was approximately of the same magnitude (1.8 degrees---1.9degrees). A secondary phase of nystagmus was not dependent on the theoretical cupular deviation but on the total duration of the primary rotary nystagmus. Even rather weak stimuli such as 1 degree/sec.² during a sufficiently long period can give rise to a secondary phase of nystagmus.

After nystagmus and turning sensation following opto-kinetic stimulation have been demonstrated, the former by objective recording. In these tests every kind of influence is excluded from the cupula ampullaris.

The secondary phases of nystagmus and turning sensation due to vestibular stimulation appear to have a central nervous genesis. Further evidence of this is the occurrence of secondary phenomena due to opto-kinetic stimuli where all vestibular stimuli were excluded. (AUTHOR)

Aschan, G. and J. Stahle 1956 CUPULOMETRIC STUDIES ON THE PIGEON.
Acta Oto-laryngol. 46(2):91-98

SUMMARY: An account is given of a cupulometric study on pigeons done to ascertain whether any physiological difference exists between the ampullae of the horizontal and the vertical semicircular canals. The duration of the post-rotatory nystagmus and the number of beats were noted after rotation in the horizontal, right-lateral, and left-lateral positions, deceleration throughout being $12^{\circ} \text{ sec}^{-2}$. Photo-electric-cell nystagmography was carried out in addition.

The duration of nystagmus and the number of beats were significantly greater from the horizontal canals than from the vertical.

On rotation the pigeon spontaneously places one pair of semicircular canals in the plane of rotation. The subsequent post-rotatory nystagmus oscillates in this plane in accordance with the Flourens-Ewald law.

The possible reasons for the difference between the reactions of the vertical and horizontal canals are discussed. Phylogenetic and anatomical considerations are thought to be responsible.

139

Aschan, G., M. Bergstedt, B. Drettner, C. O. Nylen, & J. Stahle 1957 THE EFFECT OF HEAD MOVEMENT ON POSITIONAL NYSTAGMUS - ELECTRO-NYSTAGMOGRAPHY WITH AN ELECTRIC DRIVEN POSTURE TABLE. Laryngoscope 67:884-893

SUMMARY: The use of a posture table should facilitate the differentiation of the significance of head-movement and head-position in the release of positional nystagmus. An electrically driven posture table is described. With this it is possible to rotate the patient at a constant rate following initial subliminal acceleration.

Experiments in an electric posture table, on patients with persistent and transitory positional forms of nystagmus, are described. Nystagmus was recorded instrumentally with the patient's eyes closed. This precaution eliminates the source of error due to visual stimuli. In addition, nystagmus can be assessed both qualitatively and quantitatively, and comparisons can be made between records obtained under different test conditions.

The investigation indicates that in persistent forms of positional nystagmus the position of the head is the determining factor. In transitory and transitional forms, on the other hand, movements of the head also play a significant part in the releasing mechanism.

To avoid overlooking cases with transitory forms of positional nystagmus, the most suitable way to perform the standard posture-test, therefore, is to let the patient perform a fairly rapid turning from one position of the head to another. It corresponds on the whole to the old fashion of testing on a couch.

140

Ascroft, P. B. 1943 BLAST INJURY OF THE LUNGS WITH A CURIOUS LESION OF THE CEREBRUM.
The Lancet 1:234-235, Feb. 20, 1943.

SUMMARY: In a fatal case of multiple injuries due to the explosion of a hand grenade at very short range, the external injuries were not in themselves fatal. There was extensive hæmorrhagic infiltration of the lungs, typical of the kind due to blast. An unexpected finding at autopsy was a peculiar discoloration of large areas of the cerebral hemispheres, due to great numbers of minute hæmorrhages confined to the grey matter of the cortex.

141

Askren, W.B. 1959 MAN FUNCTIONS IN SPACE FLIGHT.
(Wright Air Development Division, Wright-Patterson AFB, Ohio)
WADC TR ASTA AD-238 480

ABSTRACT: The hypothetical activities of a three-man crew of an earth-to-moon flight were analyzed with respect to some of the following subsystems: navigation, flight control, energy management, environment control, secondary

power management, communications, escape reconnaissance, offense and defense. The following selection criteria were suggested: (1) sensory abilities, such as vision, hearing; (2) mental abilities such as general intelligence, computational skills, problem solving ability; (3) motor skills, such as tracking skill, response times; (4) tolerance to physiological stress, such as high g, heat, cold; and (5) adaption to new experiences (psychological stress) such as confinement, new food forms, and crew interaction.

142

Asmussen, E., E. H. Christensen & M. Nielsen 1940 THE REGULATION OF CIRCULATION IN DIFFERENT POSTURES.
Surgery 8:604-616.

ABSTRACT: Our experiments indicate that the circulation rate in quiet standing is on the lower limit of what is really desirable and that, even if the fast pulse rate in the standing position in itself is no sign of insufficiency, it indicates on the other hand that some extra stress is put onto the pressure-regulating mechanism.

A diminished cardiac output during quiet standing has to be looked upon as a sign of insufficiency, even if the O_2 consumption and the arterial blood pressure remain normal. The vessels of the lower extremities are distended by hydrostatic forces; a large amount of blood remains there and consequently the filling and pressure of the central veins get too low to secure an adequate filling of the heart and a normal cardiac output. Through an increased heart rate and through compensatory contractions of the vessels in certain organs (e.g., in the intestines) a normal arterial blood pressure might be obtained. However, it must be remembered that a diminished circulation rate to these organs with partly contracted vessels locally may have an unfavorable effect. It may be of great importance that circulatory insufficiency due to a peripheral dilation of the vessels or to a loss of blood can be counteracted by an elevation of the lower extremities. The autotransfusion of blood that can be made in this way may be of great significance. In cases where a circulatory insufficiency due to a disproportion between the total blood volume and the capacity of the vessels is obvious, any posture where hydrostatic forces can induce an increased filling of the vessels of the lower extremities should be avoided. Even a small decrease in cardiac output may mean a rather severe insufficiency of the circulation of certain organs. The beneficial effect of the reclining position to a great extent may be due to the abundant blood supply to the different organs obtainable in that position. (Author)

143

Asratyan, E. A. 1961 ACADEMICIAN ASRATYAN STATEMENT
FBIS Far East, Nr. 72, April

ABSTRACT: This article is an extract of an interview with Alternate Member of USSR Academy of Sciences, E. A. Asratyan. In the interview, Asratyan discussed the value of the Sputnik flights in preparing for Gagarin's space flight. One of the greatest problems studied during the Sputnik flights was great acceleration.. Scientists found how highly sensitive the blood circulation system is to change in flight conditions. From this the scientists were able to conclude that it is essential to create conditions for maximum diminution of the effect of overload on the cosmonaut. Account was also taken of the fact that this influence can affect not only the vegetative functions of the human organism, but also the higher levels of the central nervous system. (CARI)

144

Astashenkov, P. and B. Zhukov 1958 COMBAT HELPMATES OF THE FLIERS.
(Trans. of mono. Boevye Pomoshchniki Letchikov, Moscow, 1956)
(SLA Translation Center, Chicago, Ill.) 59-14099.

145

Astbury, A.K. 1952 PROGRESS IN MILITARY MEDICINE IN BRITAIN Military Surgeon 110(2): 132-133.

ABSTRACT: Recent advances in aviation medicine are briefly summarized. Among the specific items mentioned are the development of anti-g equipment, control of body temperature by proper clothing, prevention of motion sickness, and evacuation by helicopter.

146

Atria, N. F. 1951 IL MEDICO D'AERONAUTICA ED ALCUNI PROBLEMI DI MEDICINA AERONAUTICA RELATIVI AL VOLO A REAZIONE (The Flight Surgeon And Problems of Aviation Medicine Relative to Jet-propelled Flight)
Rivista di Medicina Aeronautica, Rome, 14:183-189, April-June 1951.

147

Atria, N. F. 1952 AEROMEDICAL PROBLEMS OF JET FLYING.
U. S. Air Force Medical Service Digest 3(2):30-32.

ABSTRACT: The medical problems encountered in jet plane flight are different from those of propeller-driven flight. The main problems concern bailout, high altitude, and noise. As to bailout from jet planes, the USAF uses an ejection seat which is catapulted by an explosive charge along two guide rails. The effects of high altitude may be prevented in one of three ways: wearing a pressure suit (this has been discontinued as it makes the operation of the plane difficult); the use of pressurized cabins (without pressurization, the average flyer may be able to fly at 46,000 feet for about 25 minutes, beyond this time the blood would pool or filter into the tissues); and pressure breathing (this requires a revision of the pilot's breathing habits and may induce chest pains because of the stretching or rupture of alveoli). These methods may also be combined, e.g. pressure breathing in a partially pressurized cabin. High-intensity noise may induce a temporary hearing loss, e.g. a loss of 20 decibels in a sound field of 120 decibels within 30 minutes.

148

Austin, F. H. 1959 PHYSIOLOGICAL INSTRUMENTATION OF PILOTS FOR TEST AND OPERATIONAL FLIGHTS IN NAVY HIGH PERFORMANCE JET AIRCRAFT. PHASE I. PRELIMINARY INVESTIGATIONS. (Paper, Fourteenth Meeting of the Flight Test Techniques and Instrumentation Panel, May 11-15, 1959, Athens, Greece) (Advisory Group for Aeronautical Research and Development, Paris, France) AGARD Rept. No. 240. ASTIA AD-248 343.

ABSTRACT: Information is presented on the electrocardiogram and respiratory rate during spin tests of a supersonic carrier fighter airplane. Also presented are the accelerations encountered by a pilot, measured concurrently on the airplane seat frame and on his helmet during catapult launch, rapid accelerations and decelerations and rolls and under actual instrument flight conditions. Analysis of accelerations during actual instrument approaches may lead to better understanding and solution of the vertigo accident problem. An oximeter pick-up based on a new concept of operation and packaged with a miniaturized tape recorder for in-flight data link, now under development for flight test, is described. (AUTHOR)

149

Australian Flying Personnel Research Committee 1942 BLACKING-OUT RESEARCH AT SYDNEY UNIVERSITY DURING 1941 FPRC No. 358-h; 8 Jan. 1942

ABSTRACT: Dr. Cotton has been able to withstand 9.5 "g" for 30 seconds in his suit on two occasions.

Cotton suit may be pressurized by (1) hydrostatic system which is too cumbersome for plane use, (2) a column of pistons, (3) Meyer's differential pistons (like U. S. Berger Bros. design), (4) Stevens' ball valve which has not yet been tested.

Detailed description of electric drive centrifuge at Sydney. Subject's seat is shot out from center of centrifuge to periphery which is revolving at desired speed to obtain very quick acceleration. Radius is 18 feet, maximum speed 60 rpm, maximum force 10 "g".

150

Australian Flying Personnel Research Committee 1942 REPORT NO. 2 ON "BLACKOUT"
WORK AT SYDNEY UNIVERSITY. FPRC No. 358-j

ABSTRACT: It is reported that Robinson's ball valve device for regulating pressure admitted to pneumatic suits under "g" is unsatisfactory because "hunting" of balls causes fluctuation in pressure and gross wastage of air.

Meyer's differential pistons are satisfactory, providing 3 to 4 "g" protection to trained subjects on the centrifuge. However, the tight fit of the pistons means that the air used must be filtered free of dust.

Pneumatic suits offer good protection but provision must be made for (1) ventilation, (2) reduction in weight.

151

Australian Flying Personnel Research Committee 1942 NOTE ON PROGRESS OF THE
PNEUMODYNAMIC SUIT (EXTRACT FROM THE AUSTRALIAN FLYING PERSONNEL RESEARCH
COMMITTEE) Rept. No. FR27 dated Dec. 1942; FPRC No. 407a

ABSTRACT: Six subjects tested the Cotton suit in the Kittyhawk plane in October 1942. Five were protected up to 7.5 to 8.5 "g" and one was protected to 10 "g" but buckled his plane during the test. Fatigue was diminished and pilots were able to read their instruments with ease during high "g" maneuvers although dragging effects on the face and heaviness of the limbs were not affected.

152

Automotive Crash Injury Research 1957 ANNUAL REPORT, AUTOMOTIVE CRASH INJURY
RESEARCH FOR THE PERIOD 1 APRIL 1956 TO 31 MARCH 1957.
(Automotive Crash Injury Research, Cornell University Medical College,
New York)

Automotive Crash Injury Research 1960 ANNUAL REPORTS 1954-1960.
(Automotive Crash Injury Research of Cornell University, New York)

154

Autonetics 1961 GRAVITY ANOMALIES: A SELECTIVE BIBLIOGRAPHY (Autonetics, Downey, Calif.) 4 April 1961, ASTIA-255 309.

155

AVCO Research Laboratory 1958 AVCO PROPOSES MANNED RE-ENTRY SYSTEM
Missiles and Rockets, 3(2):156. Feb. 1958.

ABSTRACT: AVCO Research Laboratory is said to have solved the design problems of the re-entry parachute and of the environmental capsule to carry a man many times around the earth and then protect him as he returns through the atmosphere. The parachute is not the usual cloth umbrella, but a metal device more like a drag brake.

156

Avery, J. P. 1962 STRENGTH ANALYSIS OF CARRIAGE ATTACHMENT FITTING ON CREW SEATS, HU-1 AIRCRAFT, AND RECOMMENDATIONS FOR IMPROVEMENT.
(Aviation Crash Injury Research, Phoenix, Arizona) AvCIR 62-11, Oct. 1962.
ASTIA AD 290 467

SUMMARY: The crew seat of the HU-1A aircraft has failed frequently in survivable type accidents, with the primary failure occurring in the carriage attachment fitting (Part Number 204-070-742-1). The most recent accident occurred at Fort Carson, Colorado, 7 May 1962 (reference TCREC Tech. Rept. 62-87). Analysis discloses that occupant inertia load of the order of 11 G could have caused these failures.

A simple field modification is presented which would reduce stresses in the fitting by a factor of approximately two. No new parts need to be manufactured; two AN bolts and one NAS spacer are the only new parts required.

157

Aviation Crash Injury Research 1956 FINAL PROGRESS REPORT, OFFICE OF NAVAL RESEARCH CONTRACT #N6ONR 264-12, COVERING PERIOD FROM 7/1/48 THROUGH 9/30/55
(Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc., Phoenix, Arizona) Report AvCIR-47-0-71; Sept. 1956

158

Aviation Crash Injury Research 1956 HELICOPTER ACCIDENT AND INJURY REPORT FORM AC (PRELIMINARY). (Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc., Phoenix, Arizona) Report AvCIR-5-F-64, May 1956.

159

Aviation Crash Injury Research 1957 AvCIR HELICOPTER CRASH INJURY REPORT FORM (Aviation Crash Injury Research, A Division of Flight Safety Foundation Inc., Phoenix, Arizona) Report AvCIR-7-F-86, Nov. 1957

160

Aviation Crash Injury Research 1957 DESIGNING FOR SURVIVAL IN VTOL AIRCRAFT. (Aviation Crash Injury Research, Cornell University) Av-CIR-51-0-83.

161

Aviation Crash Injury Research 1958 AvCIR FIXED-WING CRASH-INJURY REPORT FORM (Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc. Phoenix, Arizona) Report AvCIR-8-F-92, Aug. 1958

162

Aviation Crash Injury Research 1958 PRELIMINARY REPORT - BAR CHARTS OF MC BEE-IBM DATA. (Aviation Crash Injury Research, A Division of Flight Safety Foundation Inc., Phoenix, Arizona) Nov. 1958

163

Aviation Crash Injury Research 1959 AVIATION CRASH INJURY RESEARCH, OCTOBER 1, 1955 THROUGH SEPTEMBER 15, 1959; FINAL REPORT (Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc., Phoenix, Arizona) Office of Naval Research Contracts Nos. Nonr-401(21 and Nonr-2883(00). ASTIA AD-234 030

164

Aviation Crash Injury Research 1960 ARMY AVIATION SAFETY. (Aviation Crash Injury Research, Phoenix, Arizona) TREC Tech. Rept. 60-77, December 1960.

165

Aviation Crash Injury Research 1960 EXPERIMENTAL RESEARCH - U.S. ARMY
H-25 HELICOPTER DROP TEST 22 OCTOBER 1960.
(Aviation Crash Injury Research, Phoenix, Arizona) AcCIR 1-TR-124,
TREC Tech. Rept. no. 60-75, December 30, 1960

SUMMARY: This report presents the results of an analytical study to establish methods of conducting the first exploratory tests, followed by a presentation of the methods used in the first experimental crash test. A Piasecki Model H-25 helicopter has been employed in recreating a typical accident approximating an unsuccessful attempt to attain autorotation from a low altitude power failure.

The instrumentation and research techniques used in (1) the measurement of the impact forces and accelerations, (2) the determination of the feasibility of the utilization of on-board recorders, and (3) the evaluation of certain problems inherent in the dynamic crash testing of full-scale VTOL aircraft are presented. Tentative results and the technical problems encountered are discussed and recommendations for subsequent testing are made. (Author)

166

Aviation Crash Injury Research 1961 UNITED STATES ARMY AVIATION CRASH
INJURY RESEARCH FINAL REPORT, 16 DECEMBER 1960 TO 15 SEPTEMBER 1961.
(Aviation Crash Injury Research, Phoenix, Arizona) AvCIR 61-20,
TREC Tech. Rept. 62-13, September 1961. ASTIA AD 275 184L.

ABSTRACT: A final report is prepared by Aviation Crash Injury Research, a division of the Flight Safety Foundation, Inc. (FSF) under the terms of Contract DA-44-177-TC-707. All work was accomplished between 16 Dec. 1960 and 15 Sept. 1961 and is reported under individual work items listed as follows:

1. Crash injury investigations of selected accidents;
2. Collection and coding of accident data;
3. Review of specifications and crash safety evaluation of aircraft;
4. Feasibility studies of dynamic testing devices;
5. Study of crash safety equipment and procedures;
6. Statistical and clinical analyses of mass accident data;
7. Liaison with groups and agencies on crash safety;
8. Training programs in crash injury investigation;
9. Feasibility study for remote control of an H-21 helicopter;
10. Dynamic crash tests of four helicopters; and
11. Post crash fire studies.

167

Aviation Research & Development Service, Federal Aviation Agency 1961 REPORT
OF THE PROCEEDINGS OF THE FIRST ANNUAL INTERNATIONAL AVIATION RESEARCH
AND DEVELOPMENT SYMPOSIUM April 10-14, 1961
(Aviation Research & Development Service, Federal Aviation Agency) ASTIA AD
275 888

ABSTRACT: The first annual aviation research and development symposium was convened to bring together representatives of all those groups, Government and non-Government, national and international, interested in advancing or improving the scientific aspects of air transportation. Twenty-two foreign countries, three international organizations, all U.S. military services, and many private industry companies responded. A total of 690 persons attended one or more of the 4 days devoted to the presentation of technical papers and panel discussions. All the papers are reprinted here, as well as a summary of each of the panel discussions pertaining to recent research and development accomplishments in the fields of air traffic control, communications, navigation aids, data processing and display, airport lighting and marking, and related technical subjects.

168

Awaji, E. 1943 PHYSIOLOGICAL EFFECTS OF HIGH-SPEED
(Air Documents Division, AMC, Wright Field, Dayton, Ohio) Microfilm No.
RC-1075 F272; ATI-27294

ABSTRACT: The effect of high-speed flight upon pilots is described, as well as the safety measures to be taken during high speed. The velocity limit of airplanes, the problem and effect of acceleration, and straight-line centrifugal and rotary accelerations are discussed. Precautionary measures are outlined for the protection of the pilot, and reasons for avoiding a sudden change in speed are covered. The degree of stimulation, vibration sense, the effect of vibration on the body, injuries which may result from vibration, and research methods and test apparatus used while carrying on experiments on vibration effects are included (ASTIA)

169

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

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

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Baba, A.J. 1959 PERFORMANCE TESTS ON FOUR POTENTIOMETER TYPE
ACCELEROMETERS. National Bureau of Standards Report No. 6300.

ABSTRACT: The instruments tested were Genisco, Inc., Model GMO 309, Serial Nos. 7593 and 7594; and Model GMO 972, Serial Nos. 41954 and 41955. They comprise a rectangular leaf spring, a potentiometer coil, a double-contact brush attached to the seismic mass, and damping plates. The damping plates are fixed to the frame of the gauge at only one end, and are "backed up" by a plate of bimetal. The damping fluid is a silicone oil. The instruments have a nominal range of $\pm 15g$, with stops provided.

171

Baba, A.J. 1960 PERFORMANCE TESTS ON DASHPOT-DAMPED POTENTIOMETER-TYPE
ACCELEROMETERS. National Bureau of Standards Report No. 6633

ABSTRACT: The instruments tested are potentiometer-type accelerometers, manufactured by Humphrey, Inc. Model LA03-0304-1, Serials 1 and 2. They consist of a seismic mass potentiometer pickoff, double-ended air-dashpot and four leaf springs. The instruments are calibrated over a range of $\pm 5 G$ on a rotary accelerometer powered by a d.c. compound-wound motor. Dynamic calibrations made at around 155 deg. F. differed by only about 0.1g from those made at room temperature.

172

Babushkin, V.I., V.V. Malkin & V.V. Usachev 1956 A FEW DATA ON THE ADAPTABILITY
OF THE HUMAN ORGANISM TO THE EFFECTS OF RADIAL ACCELERATION

Voyenno-meditsinskiy Zhurnal 4: 1019, 1956

See also: AF Technical Intelligence Trans., AFOIN Rept. AF 1083820,
20 March 1957

173

Babushkin, V. I., V. V. Malkin, & V. V. Usachev 1957 NEKOTORYYE DANNYYE O
PRISPOSOBLENII ORGANIZAMA CHELOVEKA K DEYSTVIYU RADIAL'NYKH USKORENIY.
(A FEW DATA ON THE ADAPTABILITY OF THE HUMAN ORGANISM TO THE EFFECT OF
RADIAL ACCELERATIONS). Voyenno-meditsinskiy Zhurnal (Military Medical
Journal) 4:10-19, 1956 (Translation in USAF Air Intelligence Information
Report "Acceleration and the Human Organism". IR-1282-57, 20 March 1957).

Babushkin, V. I., P. K. Isakov, V. B. Malkin & V. V. Usachev 1958 RESPIRATION AND RESPIRATORY EXCHANGE IN MAN SUBJECTED TO RADIAL ACCELERATION. Fiziol. Zh. SSSR Sechenov 44:308-314.

ABSTRACT: (1) During exposure to the action of radial acceleration, increases in pulmonary ventilation, oxygen consumption and CO₂ elimination were observed regularly, and a considerable increase in energy expenditure was noted. These changes were associated with the development of compensatory reactions—mainly with the reflex increase of skeletal muscle tonus.

(2) The smaller expenditure of energy during acceleration when anti-gravity clothing was worn is evidence of its relatively high efficiency, the wearing of such clothing being responsible for a lessening of "tension" in compensatory mechanisms and thus promoting increase in the potential reserves of the body.

(3) Energy expenditure determinations during the action of acceleration constitute one of the general indices characterizing "tension" in the compensatory reactions, directed to the adaptation of the body to the altered conditions attaching to the action of mechanical energy (gravitational force).

Babushkin, V.I., P.K. Isakov, V.B. Malkin, and V.V. Usachev 1958 IZUCHENIE BIOELEKTRICHNESKOI AKTIVNOSTI SKELETNOI MUSKULATURY U CHELOVEKA PRI DEISTRII RADIAL NYKH USKORENIY. (BIOELECTRIC ACTIVITY IN THE SKELETAL MUSCLES IN MAN EXPOSED TO RADIAL ACCELERATION. Fiziol. Zh. SSSR Sechenov 44(1):10-13

ABSTRACT: Noting that much research in regard to the effects of head-to-foot acceleration had been concerned with the activity of the heart and blood vessels, the authors wished to "throw light on the activity of the skeletal muscles during acceleration. Ten healthy male subjects between 20 and 30 years of age were used. The subject was placed in a laboratory centrifuge in which head-to-foot acceleration of various intensity could be produced. Electromyogram recordings of reactions of various muscles of the abdomen, hips, and chest were made before, during and after the centrifuge was halted. Respiration, pulse, and arterial blood pressure were also recorded simultaneously in some experiments. Intensification of bioelectric activity of skeletal muscles was observed in all the subjects. The greatest increase in amplitude of muscle currents was observed when acceleration was increased from 2 g to between 4 and 5 g. Further increase in amplitude either ceased or decreased at higher levels. Duration of exposure was found to be important, and use of pressure suits resulted in a sharp drop in the amplitude of current in the muscles of the hips and abdomen. The authors conclude that increase in the bioelectric activity of skeletal muscles, observed during acceleration, depends upon an increase of muscular tonus. They suggest that the natural changes in the tonus of the skeletal muscles may be used as a unique index for evaluating the effectiveness of various anti-g devices. (CARI)

176

Babushkin, V. I. 1959 [THE INFLUENCE ON MAN OF RADIAL ACCELERATION OF GREAT DURATION]
Voenno-meditsinskii Zhurnal 8:50-54 (Russian)

177

Babushkin, V. I., P. K. Isakov, V. B. Malkin, & V. V. Usachev 1961 SOME CHANGES IN HIGHER NERVOUS ACTIVITY UNDER ACCELERATION. Voyenno-meditsinskiy Zhurnal 1961(6):54-58

ABSTRACT: Because of the effects of acceleration in flight on the brain the author's studied the functional state of the higher sections of the central nervous system under radial acceleration. Radial acceleration was effected in a centrifuge with a seat equipped for recording motor reflexes and studying the structure of certain special volitional movements. The first series of tests studied the state of conditioned motor reflexes to light and sound stimuli under varying degrees of acceleration. The results showed that under relatively low acceleration of 3-4 g a slight increase in the latent period of the motor conditioned response was noted. As the experiment was repeated, the difference in the latent period became less marked. At greater accelerations of 5-6 g the picture was different. To check the pilot's work capacity under acceleration a second series of tests studied the effects of acceleration on motor actions simulating working movements that a pilot has normally to make. (CARI)

178

Bachman, K.L. 1961 REPORT ON EVALUATION OF KEARFOTT INTEGRATING ACCELEROMETER. (Aeronautical Instruments Laboratory, U.S. Naval Air Development Center, Johnsville, Penn.) Report No. NADC-AI-6127.
14 Dec. 1961. ASTIA AD-280 1861L

ABSTRACT: Performance tests have been made on the Kearfott Integrating Accelerometer #430348-1A-402-X. A wide variation in scale factor and null repeatability was noted in all tests in the range from 0 to 0.01 g. The non-linearity of the instrument from $+1.745 \times 10^{-2}$ g to ± 1 g is no better than 2.2×10^{-3} g and is apparently not affected by extremes of temperature. A threshold sensitivity of 1.45×10^{-4} was observed. The random drift characteristics degraded from 3.9×10^{-4} in a zero g field to 5.9×10^{-3} g in a 1 g field.

179

Bachman, K. L. 1962 EVALUATION OF THE BELL AEROSYSTEMS COMPANY MODEL III-B LINEAR ACCELEROMETER (U) (Naval Air Development Ctr., Johnsville, Pa.) NADC-AI-6253; Proj. RAV35J003/2021/F002-13-003. ASTIA AD-331 407L.

180

Backenstoe, G.S. 1959 PROCHLORPERAZINE IN AIRSICKNESS
Pennsylvania M. J., 62 (9): 1341-1343, Sept. 1959

ABSTRACT: Prochlorperazine (a phenothiazine derivative) was administered to 396 persons known to be susceptible to airsickness, and of whom, 261 had been previously treated with little success with other drugs. Good or excellent results were obtained in 307 of the total number of cases; prochlorperazine produced more satisfactory results in 165 of the 261 persons previously treated with other agents. The preferred dosage was one 5-mg. tablet one hour before flight. The author states that the drug appears to be a highly effective anti-emetic, anti-nauseant, and psychotherapeutic agent, and as such, is especially useful for the treatment of airsickness, where psychic factors often play a major causative role.

181

Backman, M.E. 1959 IMPACT: THERE'S MORE TO IT THAN MEETS THE EYE (Naval Ordnance Test Station, China Lake, Calif.) Rept. no. NOTS TP 2367, Nov 1959, ASTIA AD231-041

ABSTRACT: The scientist can determine the penetration, vibration, and wave motions that occur during the event called "impact" even when highspeed photographic equipment is not available or is inadequate. By applying certain equations, it is possible for him to make calculations that are more precise than a photographic record of the event. (Author)

182

Backman, Marvin E. 1960 IMPACT: THERE'S MORE TO IT THAN MEETS THE EYE U.S. Naval Ordnance Test Station, China Lake, Calif. NOTS TP 2367 ASTIA AD 231 041

ABSTRACT: In this generalized treatment of the importance of vibration and wave motion, the concepts presented have been merely outlined, and all variations in the examples have not been covered. The extent of the application of these concepts is obvious without such detail. Certain ranges of cone angle and projectile length should follow the formulas given here, and more complicated shapes may be treated by straightforward applications of the same techniques. In all these cases the rejection of rigid-body concepts introduces symmetry in the interaction of target and projectile. Both target and projectile are influenced in the same way: both deform, both are stressed, both change motion. There are only differences in degree because of differences in the properties of these bodies. The fact that the target may undergo primarily a change of shape while the projectile undergoes primarily a change in motion is the result of asymmetry in the properties of these bodies and not due to fundamentally different modes of action. The idea that changes of motion and stress travel from place to place at a finite rate makes a definite contribution to the study of projectile impact. Most important, it provides the most precise description of non-rigid body acceleration. For changes brought about by impact, this idea may provide the only descriptive terms that are appropriate.

183

Baessler, U. 1962 ON THE INFLUENCE OF GRAVITATION AND LIGHT ON THE RESTING
STATE OF CARAUSIUS MOROSUS.
In Z. Naturforsch (B) 17B:477-480, July 1962 (German)

184

Baevskii, R. 1961 BIOTELEMETRY AND SPACE FLIGHT
Trans. from Ekonomicheskaya Gazeta (USSR) no. 167(1020) p. 3, 1961.
(Joint Publications Research Service, New York, N. Y.)
Sept. 1, 1961 JPRS: 10,000.

ABSTRACT: Radiotelemetry is the basic means of investigation in space
medicine. (Author)

185

Baker, C.A. 1960 MAN'S VISUAL CAPABILITIES IN SPACE (Presented at the Seventh
Annual East Coast Conference on Aeronautical and Navigational Electronics,
Wright-Patterson AFB, Ohio, October 1960.)

186

Baker, H.C. 1960 READING OF GEOREF FROM UNUSUAL POSITIONS.
(RAF, Inst. Av. Med., Farnborough). FPRC Memo 130. January 1960.

187

Baker, N.L. 1957 MISSILE AGE. MANNED RE-ENTRY: A TECHNICAL BARRIER OF THE
PAST?
Missiles and Rockets 2:59, Dec. 1957

ABSTRACT: Spotlights advances made by industry and government research centers
in the field of missile and satellite recovery.

188

Bakh, I., O. Gorlov, V. Yakovlev, & Ye. Yogov 1959 MAN IN SPACE: MEDICAL BIOLOGICAL PROBLEMS IN SPACE FLIGHTS. Vses. Obshe. Raspr. Polit. i Nauch. Znani (USSR) Ser. 8, 1(20): , 1958
(Air Technical Intelligence Ctr., Wright-Patterson AFB, Ohio, Rept. No. ATIC-1256169, Oct. 7, 1959)

ABSTRACT: The pamphlet describes in a popular vein problems such as acceleration, weightlessness, radiation, meteoric danger, lowered barometric pressure, hypoxia, sealed cabins, space suits, temperature, water and food, re-entry and demands on future astronauts. Ample data are included on Sputnik 2 and the dog Layka.

189

Bakulev, A. 1959 THE COSMIC ERA
Meditsinskiy Rabotnik 81(1829):2 , Oct. 9, 1959

ABSTRACT: The author of this article states that the Soviet Union has successfully launched into space three artificial earth satellites and three cosmic rockets. He considers this an immense contribution to world science and a genuine revolution in such fields of science as astronomy, geophysics, and biology. The radiotelemetric apparatus placed in the hermetic cabin with Layka transmitted to earth the dog's pulse frequency, respiration, arterial pressure, and electrocardiogram. On the basis of data received, it was concluded that the experimental animal tolerated accelerations and subsequent weightlessness well. Experiments in the space medicine field showed that systematic training, the use of an anti-G suit, and the position of an astronaut in the rocket make it possible for a human to tolerate for several minutes accelerations which are 12-15 times greater than the force of gravity of the earth. The results of numerous experiments showed that the human organism can easily tolerate weightlessness for 30-45 seconds. A human being repeatedly exposed to conditions of weightlessness usually becomes acclimated to weightlessness in space and can carry on coordinated muscular movements. (CARI)

190

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

ABSTRACT: Experimental research has shown that man can tolerate acceleration 12 to 15 times greater than the force of the earth's gravity for seven minutes without ill effects if he is conditioned by systematic training, equipped with a special anti-gravity suit to prevent disturbances in cerebral blood circulation and seated in the rocket so that the mechanical forces act perpendicularly to the longitudinal axis of his body. Other experiments have shown that the human organism can easily endure a state of weightlessness

lasting 30 to 45 seconds. It has been ascertained that with recurrence of weightlessness man adjusts himself to this state, retains orientation in space and may coordinate his movements accurately. The author also discusses the sealed cabin, oxygen supply, and radiation encountered during a space flight. (CARI)

191

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

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

192

Balakhovskii, I. S., & V. B. Malkin 1957 BIOLOGICAL PROBLEMS OF INTERPLANE-TARY FLIGHTS. In Krieger, F. J., A Casebook on Soviet Astronautics. Part II (Rand Corp., Santa Monica, Calif.) pp. 81-96
(USAF Project Rand) Research Memo RM-1922, 21 June 1957
Priroda 45(8):15-21, Aug. 1956
German Translation: Naturwissenschaft. Rundschau 10:173-177, 1957

ABSTRACT: Among medical problems discussed in regard to space flight is a general consideration of current knowledge of the effects of weightlessness and acceleration on the human body. The author notes that "the influence on the human organism of the mechanical forces resulting from accelerations depend on one hand, on their magnitude, time of action, rate of increase, and direction relative to the longitudinal axis of the body, and on the other hand, on the functional condition of the organism". The problems of circulation, blood pressure, weight of the internal organs, strain of connective tissues, and "irritation of the receptors of the internal organs" are discussed. The author states "that centrifuge investigations indicate "that, in the vertical position a man can withstand the action of 4 to 5 times the force of gravity, but only for a few minutes. Overloads are best withstood when they are directed perpendicular to the longitudinal axis of the body. In such a position, an man can withstand, for a few minutes, forces that exceed his "earth" weight 10 to 12 times." (CARI)

193

Baldes, E.J. & A.N. Porter 1945 HUMAN CENTRIFUGE FOR USE IN STUDIES OF MAN'S REACTION TO ACCELERATION. Fed. Proc. 4(1):4

ABSTRACT: Occupants of high speed aircraft are often subject to forces which produce pronounced physiologic effects. These forces may arise from linear acceleration as in catapult or rocket assisted take-offs and in the decelerative forces of crash landings. The more common type of accelerative force which causes blackout and unconsciousness in aviators is that arising from motion in a curved path, i.e. sharp turns and dive pull-outs. In order to study the latter problem under accurately controlled conditions it has been necessary to develop the human centrifuge. To simulate centripetal acceleration as it is experienced in aircraft the dimensions of the centrifuge must be as large as practically possible. Likewise, the onset of force must be rapid to be comparable with the onset of acceleration as it may occur in aircraft.

A small animal (pilot model) centrifuge have been in operation since 1942. The operation of both centrifuges is based on the use of flywheels, the r.p.m. of which is preset so that the requisite energy of rotation is at any given time immediately available to accelerate the superstructure. The rate at which the superstructure is accelerated is limited only by the rate at which the rotational energy of the flywheels can be transferred to the superstructure. This type of construction is relatively simple and low in cost since a low rate energy source is sufficient to accelerate and preset the flywheels to any required r.p.m.

194

Baldes, E. J. et al. 1945 PROTECTION AGAINST THE EFFECTS OF ACCELERATION AFFORDED THE HUMAN BY ASSUMPTION OF THE PRONE POSITION. (National Research Council, Committee on Aviation Medicine, Washington, D.C.) CAM Rept. 158.

195

Baldes, E. J. 1945 MINUTES OF CONFERENCE ON ORGANIZATION OF JOINT NRC-NAVY-AAF PROGRAM TO INVESTIGATE EFFECTS OF CRASH FORCES ON MAN AND MATERIEL.(DECELERATOR HISTORY). (Aero Medical Laboratory, Wright Field) 5 May 1945.

196

Baldes, E. J. et al 1945 SUGGESTIONS ON CRASH PROJECT. (Copies of Correspondence) 28 Feb. 1945.

197

MOTION PICTURE

Baldes, E.J., & A.N. Porter 1946 HUMAN CENTRIFUGE OPERATION. (Acceleration Lab., Mayo Aero Medical Unit, Rochester, Minn.)

ABSTRACT: The motion picture illustrates the principles and the mechanism involved in the operation of the human centrifuge at the Acceleration Laboratory, Mayo Aero Medical Unit. The centrifuge has two essential parts: a superstructure or carriage and a pair of rotating flywheels. The superstructure and the flywheels rotate in the horizontal plane about a common axis. The flywheels are driven by a Chrysler automobile motor powered by natural gas. The rotating flywheels, which weigh approximately 20 tons apiece, provide the energy for the rapid development of accelerative forces in the superstructure. The superstructure is set in motion by clutching to the flywheels and is brought to a standstill by declutching from the flywheels and braking on a rigid foundation. The speed of rotation of the superstructure is controlled by the clutch and the speed of the rotating flywheels. With this control the exact acceleration desired may be delivered rapidly or slowly for any required period in the superstructure. At one end of the superstructure is a gondola or cockpit so suspended that it swings outward when the centrifuge is in motion and in which the subject or pilot may sit, stand or lie. The other end of the superstructure is closed by a solid partition, sufficient space being provided for a variety of experiments under various accelerations. (Fed. Proc. 5(1):3. 1946)

198

Baldes, E.J., C.F. Code, E.H. Lambert & E.H. Wood 1946 HUMAN CENTRIFUGE AND
STUDIES OF BLACK-OUT
The Journal of Physiol., April 15, 1946, 104: 39-40

ABSTRACT: Human centrifuges have been built in an attempt to reproduce under controlled conditions in a laboratory the accelerations to which aviators may be exposed during sharp turns, pull-outs, spins or other manoeuvres in aircraft. Two such devices have been built in Rochester: a small pilot model suitable for animals in 1941, and a larger one for human work in 1942. Both operate in a similar manner. They consist essentially of a carriage or superstructure below which one or more heavy flywheels rotate. The heavy flywheels, weighing in the case of the human centrifuge a total of 40 tons, provide the energy for the rapid development of accelerative forces in the super-structure. The super-structure may be quickly or slowly set in motion by clutching to the rotating flywheels, and may be stopped rapidly or slowly by declutching and applying a brake.

199

Baldes, E. J. 1952 CRASH-WORTHINESS OF AIRCRAFT AND CRASH INJURY
PREVENTION
J. of Aviation Medicine 23(5):433-438, October 1952

ABSTRACT: In the case of aircraft accidents involving excessive speed, as in the case of jet transports, the forces and stopping distances will exceed present maximal tolerable limits. The problem then is not only to summarize safety measures that might be considered for airplanes of today but also to suggest possible modifications for the planes of the future if we are to anticipate accidents within the limits of human tolerance. First of all, it is important to be able to reconstruct the events leading up to aircraft destruction. Hence, it is necessary to stress the importance of adequate instrumentation to record the flight path of the aircraft at all times. Secondly, certain design factors must be included in airplanes to increase the chance of survival. These include design changes in the fuselage, passenger seats, and landing gear.

200

Baldwin, J. A. and A. Wainwright 1962 RADIOLOGICAL WARFARE AND NUCLEAR
EXPLOSIONS. AN ASTIA REPORT BIBLIOGRAPHY
(Armed Services Technical Information Agency, Arlington, Va.)
1 July 1962. ASTIA AD 277 900

ABSTRACT: This bibliography was prepared by ASTIA in response to frequent inquiries on the hazards and safety aspects of radiological warfare and nuclear explosions. Citations are included for reports cataloged by ASTIA from 1953 through June 1962, and are restricted to unclassified, unlimited references. References are arranged alphabetically by subject areas pertaining to blast effects, civil defense, fall-out patterns and prediction, nuclear warfare, protection, radiation effects, radiation meters, radiobiological effects, sampling thermal radiation and fire, and weapons. These subject areas are further subdivided into more specific topics. The classified section of this bibliography appears as a secret document, identified as AD 330 030. (ASTIA)

Balke, B. 1952 CORRELATION OF STATE AND SHYSICAL ENDURANCE
(Air Force School of Aviation Medicine, Randolph AFB, Tex.)
Rept. no. 1, April 1952.

202

Balke, B. 1962 HUMAN TOLERANCES
(Federal Aviation Agency, Aeronautical Center, Civil Aeromedical Research
Institute, Oklahoma City, Oklahoma) Report 62-6, April 1962

ABSTRACT: The ultimate limitations in flight performance and in future civil air carrier equipment are the limitations imposed by what may be termed "human tolerances." This is particularly applicable to the matter of the supersonic transport. The discussion of man's maximum adaptive capacities for the majority of stresses potentially encountered in atmospheric and transatmospheric flights points to the weakest links in the man-machine complex of air and space transportation. An attempt is made to point out the means by which the human tolerances can be maximally adapted to the advanced technology. (AUTHOR)

203

Ballhaus, W. F. (Chm.) 1960 VISTAS IN ASTRONAUTICS--1960. VOLUME
III. PROCEEDINGS OF THIRD AFOSR ASTRONAUTICS SYMPOSIUM, LOS ANGELES,
CALIF., OCTOBER 12-14, 1960.
(Society of Automotive Engineers, Inc., New York, N. Y.)

ABSTRACT: These proceedings include the papers and discussions presented at a symposium on astronautics research. There are six functional areas represented: 1) astronautic vehicle utilization, 2) astronautic propulsion, 3) bioastronautics, 4) planetary and space environment, 5) astronautic communications, and 6) astronautic guidance. A subject matter index is included. (Tufts)

204

Ballinger, E.R. 1952 HUMAN EXPERIMENTS IN SUBGRAVITY AND PROLONGED
ACCELERATION. (Paper presented at Aero Medical Association, Washington,
D.C., March 1952) Technical Data Digest 17(5):10-12
See also J. Aviation Med. 23:319-321, 373

ABSTRACT: In the summer of 1951 a series of jet flights were carried out which exposed the human occupants to varying periods of zero-gravity. These runs, averaging 15 sec each, gave no indication of motion sickness, vertigo, or incoordination.

A second series of experiments exposed human volunteers to varying degrees of acceleration. Conclusions drawn from these experiments were: 1) Vertigo appears to be the result of head movement rather than any particular position of the head during exposure to acceleration. 2) Giddiness following exposure to acceleration was related more to the duration of the run rather than its intensity. 3) Accelerations up to 10 g can be tolerated in the semisupine position. However, accelerations below 8 g are probably more acceptable physiologically. (DACO)

205

Ballinger, E.R., and C.A. Dempsey 1952 THE EFFECTS OF PROLONGED
ACCELERATION ON THE HUMAN BODY IN THE PRONE AND SUPINE POSITIONS.
(Wright Air Development Center, Wright-Patterson AFB, Ohio)
WADC TR 52-250. July 1952. ASTIA AD-5352.

SUMMARY: Physical tolerance to various periods of acceleration while in supine, semisupine, and semiprone positions was determined by use of a human centrifuge. The run durations ranged from 15 min at 3 g to 2 min at 10 g. With a well-constructed bed and a head-supporting helmet, 23 subjects, in all positions, were able to tolerate 10 g for 2 min with only a small degree of discomfort. Proper modifications of the positions would eliminate physical discomfort and leave marked hypoxia as the limiting factor above 12 g. (ASTIA)

206

Bambenek, R. A. and J. D. Zeff 1961 BIOENGINEERING OF ADVANCED LIFE-
SUPPORT SYSTEMS
J. of Aerospace Medicine 32(3):219, March 1961.

ABSTRACT: Circumlunar vehicles and space stations of the near future will contain new types of life-support systems in order to minimize take-off mass. Because of their relative complexity, these systems will require extensive development efforts to obtain the optimum man-machine system. This paper describes the system considered best for mission durations of one or more months, and the status of our development efforts. Experimental models of (1) a compressions distillation water recovery system, (2) reduction-electrolysis oxygen regeneration system, (3) cabin gas conditioning system, (4) waste collection and storage system and (5) vacuum distillation water recovery system have been constructed and preliminary tests performed. Primary emphasis in these developments has been placed on determining the control and maintenance problems. The systems as described are automated to the fullest extent possible, and contain displays for trouble shooting and manual operation. Future development efforts will require the use of an environmental system simulator so that tests of the man-machine complex can be performed for prolonged durations. This paper describes such a simulator capable of sustaining three men for duration of one or more months, which is now under development in our laboratories.

207

Bamford, H. E., L. F. Hanes, M. L. Ritchie, & S. E. Wilson 1958 THE OPERATION OF MANNED SPACECRAFT. (Wright Air Development Ctr., Wright-Patterson AFB, Ohio) WADC TR 58 225, June 1958

ABSTRACT: In an effort to expose the essential interconnectedness of the contributions of many technological specialties to the control of manned spacecraft, a survey is made of problems involved. Three categories of problems are distinguished. (1) The elements of space travel - vehicle, propulsion system, and energy source - are examined in relation to requirements for escape, deep-space operations, and descent. (2) The environmental needs of protection from hazards of space and ecological interactions required for survival are discussed. (3) Allocating the control function between crew and residual system is held to be the central design problem.

208

Bancroft, J.E., O. de Lalla & J.W. Gofman 1958 LIPOPROTEINS IN FRACTURES. (Letterman Army Hospital, San Francisco, Calif.) Project No. 6-60-01-002, "Clinical Investigation" (AF 18(600)-1250(7756-76), June 1957-June 1958. ASTIA AD 219 543.

ABSTRACT: An investigation was made of the effect of traumatic injury in the form of major fracture upon serum lipoprotein and cholesterol levels in humans both for short and long-term post injury periods significant effects upon low-density lipoproteins were observed, but only for the period up to 6 months post-injury. No significant long-term effects upon low density lipoproteins or serum cholesterol were found. The results indicate that human atherosclerosis is not expected to be appreciably influenced by trauma in the form of fracture.

209

Bancroft, J. E., O. de Lalla, & J. W. Gofman 1958 RELATIONSHIP OF TRAUMATIC INJURY TO SERUM LIPOPROTEINS AND TOTAL SERUM CHOLESTEROL (Letterman Army Hospital, San Francisco, Calif.) Repts. Control Symbol CSCRD-16; Subtask No. LAH R-54. ASTIA AD-219 543.

ABSTRACT: An investigation was made of the effect of traumatic injury in the form of major fracture upon serum lipoprotein and cholesterol levels in humans both for short and long-term post injury periods. Significant effects upon low-density lipoproteins were observed, but only for the period up to 6 months post-injury. No significant long-term effects upon low density lipoproteins or serum cholesterol were found. The results indicate that human atherosclerosis is not expected to be appreciably influenced by trauma in the form of fracture. (AUTHOR)

210

Banghart, F.W. 1958 BIOLOGICAL PAYLOADS IN SPACE FLIGHT (Univ. of Virginia, Division of Educational Research) ARDC-TR-58-58, ASTIA AD 204 761

ABSTRACT: Reports of the joint efforts of a working group assembled at the Univ. of Virginia, Sept. 2-5, 1958, to discuss useful biological payloads and desirable bioscience experiments to be carried on in vehicles capable of space flight. The major objective of the working group centered around biological experiments which would provide data from which the feasibility of a manned space flight could be determined. This document summarizes the accomplishment of that objective, and is presented under four major categories: (1) behavioral factors, (2) instrumentation factors, (3) ecological factors, (4) physiological effects.

211

Banghart, Frank W. 1958 BIOLOGICAL PAYLOADS IN SPACE FLIGHT 2 - 5 SEPTEMBER, 1958
Air Research and Development Command, Hdqs. ARDC-TR-58-58 ASTIA AD 228 785

ABSTRACT: The main document of the working group is presented under four major categories: (1) behavioral factors, (2) instrumentation factors, (3) ecological factors, (4) physiological effects.

This format presents the results of the working group in terms of (a) the specific set of experiments to be performed (behavioral factors), (b) the proposed instrumentation for handling the information processes (instrumentation factors), (c) factors involving atmospheric provisions, food and water supplies, and atmospheric regeneration must be taken into consideration and solved in order that a manned flight be feasible (ecological factors), and (d) certain effects of gravity and radiation must be met (physiological factors).

212

Barach, A.L. 1942 PRINCIPLES OF AVIATION MEDICINE.
J. Ass. American Medical Colleges, 17:283-299.
NOTE: Reel 7, Flash 7, Item 61.

ABSTRACT: The fact that engineers have built planes that climb above 55,000 feet and travel faster than 7 miles a minute has confronted the physiologist and physician with four major problems; (1) oxygen want: (2) air bends (aero-embolism); (3) pressure disturbances in the ear, nasal accessory sinuses and abdomen; (4) the effects of centrifugal force.

The effects of centrifugal force were mentioned briefly. A disturbance in consciousness and impairment of vision are apt to be the 2 most frequent symptoms. The limit of human endurance is a centrifugal force which has been described as 5 G's lasting for 3 seconds. Failure of the heart to fill with blood is one of the most important results of the forces produced by positive acceleration. Wearing a special belt which causes increased pressure on the abdomen for a limited period of time appears to be of considerable help.

213

Barach, A. L., and G. Besson 1943 EXPERIMENTS WITH HUMAN SUBJECTS ON
SIMULATED FREE-FALL WITH PARTICULAR REGARD TO ACTUAL PARACHUTE DESCENTS
FROM HIGH ALTITUDES AND OBSERVATIONS ON THE INCIDENCE OF AEROEMBOLISM.
(Report, Com. Aviat. M., U. S. Nat. Res. Council)

214

Barach, A.L. 1955 MOTION SICKNESS.
In Cecil and Loeb, ed., A Textbook of Medicine.
(Philadelphia: W.B. Saunders, pp. 510-516, 1955) 9th Edition

215

Barber, A.B. 1962 HUMAN PROBLEMS OF SUPERSONIC AND HYPERSONIC FLIGHT.
(Proceedings of the Fifth European Congress of Aviation Medicine)
(New York: Pergamon Press, 1962)

216

Barber, E.L. 1954 ENGINEERING PROPOSAL FOR HUMAN RESCUE EQUIPMENT (CAPSULE
TYPE) (Radioplane Div., Northrop Corp., Van Nuys, Calif.)
Radioplane Report No. 990, Dec. 1954.

217

Bard, P. 1945 PHYSIOLOGICAL INVESTIGATIONS OF CAUSE AND NATURE OF
MOTION SICKNESS. (National Research Council, Canada)
Com. Med. Res., Report No. C485, September 1945

218

Barer, A.S. 1958 VLIANIE TSENTROSTREMITEL'NYKH USKORENII NA SODERZHANIE V
KROVI ZHIROTN'YKH ATSETILKHOLINA, ADRENALINA, ADRENALINOPODOBNYKH
VESHCHESTV, KALIIA I NATRIIA (EFFECT OF CENTRIFUGAL ACCELERATION ON
BLOOD CONTENT OF ACETYLCHOLINE, ADRENALIN, ADRENALIN-LIKE SUBSTANCES,
POTASSIUM AND SODIUM. *Biull. Eksp. Biol. Med.* (Moscow) 46(7):56-59.
July 1958.
(Eng. Trans.: Bulletin of Experimental Biology and Medicine)

Barer, A.S. and E.V. Iakovleva 1960 THE EFFECT OF CENTRIFUGAL ACCELERATIONS UPON SODIUM AND POTASSIUM ION LEVELS IN URINE AND SALIVA (VLIIANIE TSENTROSTREMI -TEL 'NYKH USKORENII NA SODERZHANIE IONOV NATRIIA I KALIIA V MOCHE I SLIUNE) Vop. Med. Khim. (Moscow) 6(6):615-618. Nov. - Dec. 1960

ABSTRACT: Sodium and potassium ion levels in urine and saliva before and after repeated exposure to positive acceleration (head to seat) were studied by flame photometry. The sodium ion concentration tended to decrease and the potassium ion concentration to increase under acceleration. These changes were greater in individuals with low acceleration tolerance.

220

Barer, A.S. 1962 VLIIANIE ODNOKRATNO I MNOGOKRATNO DEISTVUIUSHCHIKH TSENTROSTREMITEL'NYKH USKORENII NA VYSSHUIU NERVNUIU DEIATEL'NOST' ZHIVOTNYKH V POSLEDEISTVII (THE AFTER-EFFECT OF SINGLE OR REPEATED CENTRIPETAL ACCELERATIONS ON THE HIGHER NERVOUS ACTIVITY OF ANIMALS (Zhurnal vysshei nervnoi deiatel'nosti (Moskva), 12 (2): 332-337. March-April, 1962. in Russian, with English summary pp. 337)
English Translation: U.S. Joint Pub. Research Serv. (Washington), no. 14, 796 (OTS: 62-11732), p. 16-30. Aug. 10, 1962

ABSTRACT: Ninety-one rats were subjected to accelerations on a centrifuge at 4 g for 15 seconds, 7 g for 1 minute, and 10 g for 1 minute. Some animals were subjected to repeated accelerations. Their higher nervous activity was studied by means of complex food-conditioned motor reflexes. Disruption of the conditioned reflex activity was related to the magnitude and direction of acceleration. The greatest changes were caused by accelerations in a head-pelvis direction, the least changes by accelerations acting in a transverse direction. This is in accord with the hypothesis that the effect of accelerative forces on the organism is determined by the change in the hemodynamics affecting the blood supply to vital organs. Central nervous system adaptation to repeated accelerations was noted.

221

Barker, C. L., Jr. 1961 SPACE FLIGHT ACCELERATION SIMULATOR.
Planetary and Space Science 7:335-344. July 1961

ABSTRACT: Discusses a ground-based training and research facility which would simulate the acceleration-time history of rocket flight or the gravitational fields of the moon and planets. Proposes a horizontal circular track 1,000 feet in diameter leading to a vertical track almost a mile in height. The vehicle would be a multi-place capsule or an equipment capsule which is programmed to duplicate conditions of boost, zero-g, or re-entry, or any combination of the three.

Barmack, J. E. 1948 A METHOD OF INCREASING THE MANEUVERABILITY OF HIGH SPEED AIRCRAFT WITHIN THE LIMITS OF HUMAN TOLERANCE TO G FORCES
(Office of Naval Research, Special Devices Center, Washington, D. C.)
Proj. 20-M-1B, Report no. 151-1-11, 28 Feb. 1948. ASTIA AD-41 255.

ABSTRACT: Several flight paths are explained, including the method of entrance, by which it is expected to reduce the "g" moment exerted upon a pilot. The "g" moments which act upon a pilot of an aircraft utilizing the normal seating arrangement are: (+g) radial forces acting from head to seat; (-g) radial forces acting from seat to head; (Tg) forces acting from front to back, and vice versa. A pilot may withstand anywhere from 4 to 5 times as many g's when the force is exerted in the Tg plane. It was considered, that by rapid deceleration before entry into a turn or before the first 25% is completed, the +g would be greatly reduced. By placing the pilot in a prone position, a turn of small radius could be executed in which 12-15 g's may develop and be withstood, aircraft permitting.

223

Barnes, A. C., Jr., J. J. Carroll & L. W. Gregg 1962 HANDBOOK FOR AIRCRAFT ACCIDENT INVESTIGATORS. (Aviation Crash Injury Research, Phoenix, Arizona) April 1962

ABSTRACT: Emphasizes the importance of adequate visual records of aircraft accidents, with careful descriptions of each photo. "No significant improvement in the crash safety design of an aircraft can be achieved unless engineers and manufacturers know what structures and objects within the occupiable area cause injuries in accidents."

224

Barnes, R.W. 1946 PILOT EJECTION SEAT ACCESSORIES.
(Army Air Forces Air Technical Service Command)
Memorandum Report No. TSEAP-7-9-482, 25 September 1946.
ASTIA ATI- 179496

ABSTRACT: Tests were conducted on pilot ejection seat accessories for the following purposes:

1. To determine a method to prevent tumbling of the ejection seat.
2. To determine a method for insuring positive separation of occupant and ejection seat at a certain point on the seat trajectory.
3. To determine a method for decreasing the minimum safe bailout altitude in aircraft equipped with an ejection seat.
4. To determine a method for the interim use of standard parachutes with an ejection seat, at all altitudes, and at speeds up to 600 miles per hour.

As a result of the tests, it was found that the design used was capable of preventing tumbling of the ejection seat and insuring positive separation between occupant and seat upon release of safety belt and shoulder straps. That particular design could also decrease the minimum safe bailout altitude at 600 miles per hour in less than 170 feet true altitude. It will make possible the safe interim use of standard parachutes with the ejection seat to speeds of at least 600 miles per hour.

Barr, E.O. 1943 FLYING MEN AND MEDICINE: THE EFFECTS OF FLYING UPON THE HUMAN BODY. (New York; London: Funk & Wagnalls Co.)

226

Barr, G. M. 1956 "QUICK LOOK" DATA REVIEW FOR SLED TEST RUN NO. A103LA-16, 17, AND 18, DATED 21, 27, AND 30 NOV. 1956. (Thompson Ramo Wooldridge, Inc., Los Angeles, Calif.) Report no. GM 43.9-66; WDD Document no. 7-2248; ASTIA AD-217 306.

ABSTRACT: The purpose of this document is to present a quick-look data review of the immediate data gathered from a dynamic sled run at NOTS. This report contains pertinent sections of the multi-channeled oscillograms made at NOTS and comments fro Aerojet and NOTS at a quick-look data review meeting. This information will be used to evaluate vibration and instrumentation data. In addition studies will be made to determine instrumentation performance, separate effects due to vibration and acceleration, allow laboratory simulation of sled vibration environment, and compare the sled vibration environments with expected missile environments and specifications. (Author)

227

Barr, J. S., R. H. Draeger, and W. W. Sager 1946 SOLID BLAST PERSONNEL INJURY: A Clinical Study. Milit. Surg. 98:1-13.

ABSTRACT: Fifty cases of solid blast injury have been carefully studied and the data obtained have been analyzed from the clinical standpoint.

Solid blast injury is a definite clinical entity, caused by the shock wave from an explosion transmitted through solid material, usually steel, to personnel in contact with that material. The typical case has fractures of the lower extremities with marked soft tissue damage. Amputation because of gangrene is necessary in some of the cases but prompt first aid, proper early surgical management and late reconstructive procedures will restore the majority of the limbs to useful function.

228

Barr, N. L. and R. B. Voas 1959 TELEMETERING PHYSIOLOGICAL RESPONSES DURING EXPERIMENTAL FLIGHTS. In: L. E. Lambe, Ed., The First International Symposium on Cardiology in Aviation. (School of Aviation Medicine, Brooks AFB, Texas) November 1959. ASTIA AD-244 389.

ABSTRACT: Modern technology has provided means for transmitting to remote locations nearly all physiological responses which involve external electrical, mechanical, or thermal changes. These developments have made it possible to make precise physiological measurements under operational conditions of the type that only a short time ago were limited to the laboratory. Since transmission of these responses is possible, the pilot's physiological reactions may

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be monitored from the ground in order to protect him from environmental hazards to which he is insensitive. A major problem which arises in connection with this procedure is that emotional responses obscure physiological reactions, resulting in reactions beyond what are normally considered safe and producing large individual differences in reactions. To overcome these problems, careful studies of each individual to be monitored must be made prior to the actual experiment flight. Telemetering also permits experimental study of stratosphere and space flights. Here again control data are essential since in many cases it will not be possible to return experimental animals to the earth and therefore information on their status in space must be gathered by comparing telemetered physiological recordings with control data collected on the ground.

229

Barr, P. O., H. Bjurstedt, & J. C. G. Coleridge 1958 REFLEX CONTROL OF RESPIRATION IN THE ANESTHETIZED DOG DURING PROLONGED EXPOSURE TO POSITIVE RADIAL ACCELERATION. (Reports from the Lab of Avn. and Naval Med., Karolinska Institute, Stockholm, Dec. 1958)

ABSTRACT: The ventilatory response of anaesthetized dogs to prolonged exposures to accelerative forces in the head-to-tail direction was investigated using a large centrifuge. An initial apnoea was observed, which could be prevented by abdominal counterpressure or bilateral vagotomy. Hyperventilation sometimes followed the apnoea and predominated when the vagi had been cut prior to the exposure. Evidence was obtained for a pulmonary stretch reflex origin of the apnoea, and for a predominantly chemoreflex drive resulting from reduced flow through the carotid bodies, etc.

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Barr, P. O., H. Bjurstedt and J. C. G. Coleridge 1958 REPORT FROM THE LABORATORY OF AVIATION AND NAVAL MEDICINE. (Karolinska Instit., Stockholm). Dec. 1958

231

Barr, P. O., H. Bjurstedt, & J. C. G. Coleridge 1958 RESPIRATORY CHANGES IN THE ANESTHETIZED DOG DURING PROLONGED POSITIVE ACCELERATION. J. Physiol. (London) 142:60P

ABSTRACT: In the course of an investigation of the pulmonary gas exchange during prolonged gravitational stress, experiments were carried out to determine the effects of positive acceleration on the ventilation of the anaesthetized dog. The dogs were placed in a centrifuge (radius 24 ft.) in the supine position with the long axis of the body parallel to the radius of rotation and the head towards the centre of rotation.

With the animal breathing air an initial apnoea was always observed followed by either subnormal ventilation, recovery or hyperventilation. The initial apnoea was considerably prolonged by oxygen breathing. Since the apnoea was reduced or even abolished by inflation of a cuff placed around the abdomen, and never occurred after bilateral vagotomy, it was attributed to activation of the Hering-Breuer reflex mechanism, brought about by the stretching of the pulmonary receptors when the diaphragm was displaced caudally.

The post-apnoeic respiratory changes seemed to depend mainly on the extent to which the arterial blood pressure fell at the carotid sinus level. After vagotomy, exposure to positive acceleration at 2 or 3 g produced very marked hyperventilation, and the pH of the arterial blood was shifted to the alkaline side by up to 0.4 unit within 2 min. Bilateral denervation of the carotid sinus regions prevented the occurrence of this hyperventilation; hence it may be due to a reduction of flow through the carotid bodies. After bilateral vagotomy and denervation of the sinus regions, respiratory failure commonly occurred during positive acceleration.

232

Barr, P. O., H. Bjurstedt, and J. C. G. Coleridge 1959 BLOOD GAS CHANGES IN THE ANESTHETIZED DOG DURING PROLONGED EXPOSURE TO POSITIVE RADIAL ACCELERATION. Acta. physiol. scand. 47:16-27.

ABSTRACT: Anesthetized dogs were exposed to increased gravitational stress in the head-to-tail direction and arterial O_2 saturation and acid-base balance changes studied. Simultaneous, direct and continuous recordings were made of arterial O_2 saturation and pH as well as respiratory minute volume in centrifuge runs. Application of moderate g forces over several minutes produced severe hypoxemia although 100% O_2 was breathed and hyperventilation was present, indicating a great alveolar-arterial O_2 difference, and accordingly, a large intrapulmonary shunt.

233

Barr, P. O., H. Bjurstedt, & J. C. G. Coleridge 1959 REFLEX CONTROL OF RESPIRATION IN THE ANESTHETIZED DOG DURING PROLONGED EXPOSURE TO POSITIVE RADIAL ACCELERATION. Acta physiol. scand. 47:1-15

ABSTRACT: The ventilatory response of anesthetized dogs to accelerative forces in the head-to-tail direction was investigated using a large centrifuge. An initial apnea was observed, which could be prevented by abdominal counter-pressure or bilateral vagotomy. Hyperventilation sometimes followed the apnea and predominated when the vagi had been cut prior to the exposure. Evidence was obtained for a pulmonary stretch reflex origin of the apnea, and for a predominantly chemoreflex drive, resulting from reduced flow through the carotid bodies, when hyperventilation occurred. Thus, reflexogenic control of respiration was prepotent during gravitational stress, whether manifested by inhibition or stimulation of respiration.

234

Barr, P. O. 1961 HYPOXEMIA IN MAN INDUCED BY PROLONGED ACCELERATION.
(Laboratory of Aviation and Naval Medicine, Dept of Physiology,
Karolinska Institutet, Stockholm, Sweden.) August 1961

235

Barr, P. O. 1962 HYPOXEMIA IN MAN INDUCED BY PROLONGED ACCELERATION.
In Acta. Physiol. Scand. 54:128-137, Feb. 1962.

236

Barr, P. O. 1963 HYPOXEMIA IN MAN INDUCED BY PROLONGED +G ACCELERATION
(Biomedical Lab., 6570th Aerospace Medical Research Lab.,² Aerospace
Medical Division, Air Force Systems Command, Wright-Patterson AFB, Ohio)
Technical Documentary Report No. AMRL-TDR-62-137, April 1963.

ABSTRACT: Changes in the arterial oxygen saturation were recorded in healthy subjects on the human centrifuge by continuous cuvette oximetry before, during and after prolonged exposures to positive acceleration. With the subjects breathing air and wearing an automatically inflated anti-G suit, an immediate fall in the arterial O_2 saturation was observed upon exposure to +4.5-5.0 G_z .

After one minute of the first exposure the O_2 saturation ranged between 95 and 81 per cent, the arterial pH remaining essentially unchanged. At the time the respiratory minute volume had increased, indicating gross deterioration in the efficiency of pulmonary function. Repeated exposures caused the arterial O_2 saturation to fall at a faster rate and to a lower level with each consecutive run. The rate of resaturation on returning to normal gravity was usually slow, and markedly so after several exposures. The last-mentioned observations are interpreted as being mainly the result of residual atelectasis in dependent regions of the lungs. The potential dangers of acceleration-induced hypoxemia in high performance flight missions are discussed.

237

Barr, Per-Olof 1963 PULMONARY GAS EXCHANGE IN MAN AS AFFECTED BY PROLONGED GRAVITATIONAL STRESS
Acta Physiologica Scandinavica (Stockholm) Vol. 58, Supplement 207

ABSTRACT: The present investigation is an experimental study of certain effects of prolonged gravitational stress on the principal function of the pulmonary circulation, i.e. the exchange of O_2 and CO_2 between the alveolar spaces and the blood. The present experiments were performed exclusively on human subjects. While exposed to strong gravitational fields for periods up to 2 minutes, with the G force acting in the head-to-foot direction, the subjects displayed drastic alterations in the pulmonary gas exchange as revealed by continuous and simultaneous recordings of ventilatory and blood chemical variables. It became evident that the pulmonary circulation is highly susceptible to inertial forces; there is probably no influence, environmental or of other origin, that is capable

of exerting a reversible effect on pulmonary function which is so profound. The extent to which such forces were found to affect the pulmonary gas exchange in standardized exposures was investigated on the basis of relatively recent concepts pertaining to the ventilation-perfusion relationships of the lung.

In this text, a short review of earlier findings pertaining to the effects of inertial forces on the pulmonary circulation and gas exchange is given. In view of the special, and sometimes adverse, experimental conditions involved in the methodological approach to the problems, a relatively comprehensive account of the techniques and experimental procedure is given, before the results are described and their physiological significance discussed. A commentary is included on certain applications of the results to problems involved in operator performance and flight safety.

238

Barr & Stroud Ltd. 1955 TWO-COORDINATE ACCELEROMETERS
Instruments in Industry 2:67, May 1955

ABSTRACT: Incorporates two accelerometer elements accurately positioned with axes at 90 degrees. The accelerometer is designed for use at vibration frequencies up to 15 c/s. It provides a convenient means of resolving the acceleration to which it is subjected, into two coordinate components in a plane, and could be used in vibration or impact testing or as a servo element.

239

Barron, C. I. 1957 NAVAL AVIATION SAFETY OFFICER COURSE - OUTLINE OF AVIATION PHYSIOLOGY. (Aviation Safety Division, Univ. of Southern Calif.)

240

Barrow, D. W. & H. T. Rhoads 1944 BLAST CONCUSSION INJURY.*
J.A.M.A. 125:900-902, 29 July 1944.

SUMMARY: 1. Detailed observations and complete follow-up studies were made on a group of 200 men exposed to "blast" due to the detonation of high explosives.
2. Those nearest the explosion were, in general, most seriously injured, but capricious choice of victim was noticeable.
3. Death was almost instantaneous when it occurred and was due to multiple injuries in most instances.
4. Those patients who survived six minutes recovered.
5. Damage to the ears by blast and to the eyes from foreign bodies occurred in a high percentage of those who recovered. Periods of unconsciousness, convulsions, chest pain, pulmonary complications and abdominal distress were minimal in this group. Intestinal perforation did not occur. Shock, bradycardia, hypotension, decreased psychomotor activity and slow respiration were the outstanding clinical signs and symptoms of this group.

Barrow, D. W. 1945 BLAST INJURY.
Air Surgeons Bulletin 2:206-207, July 1945.

ABSTRACT: From exact determination of the position of those injured and the probable blast pressures at these points, it was calculated that blast pressures of 100 to 200 pounds per square inch are required to produce death.

Exposure to blast produced a characteristic clinical picture, one of the serious implications of which is easily missed by the superficial or uninitiated observer. Decreased psychomotor activity was constant. The pulse was characteristically slow and full; the respiratory rate was decreased. Patients were in definite shock, with hypotension, increased sudomotor activity and subnormal temperature, and demanded the supportive measures that have been found helpful in the treatment of patients in shock from other causes. Activity must be restricted to the minimum in patients suffering from blast injury. Bleeding is aggravated by activity, and fatalities, which might otherwise be avoided, may occur where rest has not been enforced.

242

Barshev, P. and V. Peskov 1961 FIVE HOURS WITH YURII GAGARIN (REPORT
 FROM OUR SPECIAL CORRESPONDENTS ABOARD THE AIRPLANE "IL-18" 757 17)
 Trans. from Komsomol'skaya Pravda (USSR) no. 90(11030) p. 4, 1961.
 July 27, 1961 ASTIA AD 261 825

243

Bartlett, F. C. 1949 THE EFFECTS OF FLYING UPON HUMAN PERFORMANCE.
L'Année Psychologique 50:629-638.

ABSTRACT: During World War II, it became necessary for workers of the Cambridge Psychological Laboratory to turn their attention to a study of the changes in the performance of a variety of skills when that performance must continue without interruption for long periods, often under stress. The types of activity most involved rarely required excessive physical or muscular effort at any stage. But they did require accuracy and usually considerable speed in manipulation. The essential problems conformed in general to the familiar fatigue problem. But it very soon appeared from observation that the results did not agree very well with any familiar fatigue picture. Skill "fatigue" has characteristics of its own. Its experimental study demands special methods and the measures needed are special measures. One of the particular cases selected for special study was the case of changes of human activity accompanying prolonged air flights. Very broadly speaking there are two sets of problems: fatigue in aircrew, and fatigue in the passenger. This paper is limited to remarks about fatigue in aircrew. The author lists the characteristics and conditions of fatigue in aircrew including the threshold of indifference, awareness of discomfort, anticipation span, and speed, load, and anxiety. The author then lists the principles of diagnostic examination for fatigue.

244

Bartlett, F.C. 1950 HUMAN TOLERANCE LIMITS.
Acta Psychol. 7:133-141

ABSTRACT: There may be an essential difference between incentives that are tacked on to a task, all systems of reward and punishment, for example, and incentives that operate within the prosecution of the task itself. The former can raise the amount and efficiency of performance for short periods but can do nothing at all to push up the ceiling of tolerance, when this is imposed by objective environmental conditions. The latter can raise the level of efficiency in the learning stage and can maintain this level when mastery is reached. In one respect at least it can push up the ceiling of tolerance, for it can prolong the effective working spell without imposing any increase of strain.

245

Bartlett, F.C. 1951 THE EFFECTS OF FLYING UPON HUMAN PERFORMANCE
(CONTRIBUTION TO L'ANNEE PSYCHOLOGIQUE 50IEME VOL. JUBILAIRE, PRESSES
UNIVERSITAIRES DE FRANCE. IN HONOUR OF HENRI PIERON)
(Flying Personnel Research Committee, Air Ministry) F.P.R.C. Rept. 765
August 1951

246

Bartlett, F. 1956 EFFECTS ON HUMAN PERFORMANCE OF VARIOUS STRESS
CONDITIONS. (RAF Inst. Av. Med., Farnborough) FPRC Rept. 961.
ASTIA AD 96 383

ABSTRACT: The following three reports summarize very briefly the main important conclusions that can be drawn from a large amount of work upon the effects on human performance of exposure to: (a) Noise (b) Heat and humidity, and (c) Sleeplessness.

It will be seen that all three forms of stress may, unless special precautions are taken, seriously affect human behavior when great accuracy and speed are required. It will also be seen that in all three cases, the main need now is for further experimental work especially directed to two main points: (1) The further effects that may be produced when work has to be continued under these forms of stress for a relatively long period and under environmental conditions which are apt to change suddenly and unexpectedly. (2) The further effects which are almost certainly associated with sudden changes of stress conditions, such as a very rapid increase or decrease of noise, temperature, and humidity.

It was hoped to add something about these rapid changes, especially as regards to temperature and humidity, but nothing is known about their effects upon human performance with sufficient certainty to make it possible to put forward conclusions with confidence at present. It was also hoped to be able to deal similarly with the effects upon human performance of vibration, but here again existing knowledge is too uncertain to warrant anything definite being said. (Author)

247
Artual Pastor, J. 1962 NEUROPHYSIOLOGICAL ANALYSIS OF THE CENTRAL INTEGRATING SYSTEM OF SPACE ORIENTATION IN MAN BY RECORDING OF THE OCULAR REACTIONS AFTER PERIODIC OPTOKINETIC AND VESTIBULAR STIMULATION.
Rev. Esp. Otoneurooftal. 21:373-386 Jul-Aug. 1962 (Sp)

248

Barwood, A.J. 1962 THE MAINTENANCE OF CORRECT EJECTION POSTURE
Paper: 33rd Annual Meeting of the Aerospace Medical Association, Chalfonte-Haddon Hall, Atlantic City, N.J., April 9-12, 1962

ABSTRACT: The high incidence of mild back injury during otherwise successful ejections, and the increasing incidence of such back injury with the improvement of ejection capability, prompted investigation into the probable cause of such injury. The geometry of harness systems was studied and the techniques for adjusting such harnesses were investigated. The typical back injury in the region of T-10--L-2 indicated that posture appeared to have a direct relation to such injury. Means of maintaining an acceptable posture were therefore investigated and ultimately modifications for all types of harnesses were proposed. Initially these were tried experimentally and have produced marked improvement in whole body restraint, and have, at the same time, made the harness system more comfortable. The moulding of the seat top and back to the mean anatomical profile of aircrew has also been attempted, resulting in the maintenance of an improved ejection posture and very considerable improvement in comfort and acceptability -- a factor which might well be applied to conventional seat design.

249

Basler, V. E. and L. E. Morehouse 1948 THE EFFECTS OF G ON MAXIMUM GRIP STRENGTH
(Office of Naval Research, Washington, D. C.)
May 1948 Contract N6ori77

SUMMARY: A comparison of the grip strength at 1 G with 2, 3, 4 and 5 positive G shows that the strength of man seated in aircraft is not weakened in direction proportion with increasing forces of positive G. A decrease in grip strength is observed at 3 G, but the loss in strength is recovered at 4 and 5 G.

Bates, G. 1961 A BIBLIOGRAPHIC INDEX FOR CATALOGING THE ACCELERATION LITERATURE (National Academy of Sciences, National Research Council, Washington, D.C.) Publication No. 913, Pp. 1-6. ASTIA AD 266 076

ABSTRACT: As a considerable volume of literature on acceleration research is now available, with more literature being generated at an increasing rate, the Panel on Acceleration Stress believes that it is highly desirable for such information to be indexed and catalogued in a uniform manner so that pertinent information can be readily located by users. Various abstracts of acceleration literature are now available; however, most of these use an open ended, non-systematic indexing system, so that the user must scan all of the reports in order to find desired references. This index is offered as a solution to that problem.

251

Bates, H. J. 1963 DESIGN STUDY FOR AN ACCELERATION RESEARCH DEVICE
(FINAL REPORT).
(Rucker Co., Oakland, Calif.)
Contract AF 33(616)-7536 AMRL-TDR-62-113 May 1963 N63-19160

ABSTRACT: This report introduces an advanced centrifuge design which may be built, utilizing present-day engineering and manufacturing techniques. The report (1) presents a tentative configuration and performance of a centrifuge and facility that best fits present and anticipated weapons system; (2) evaluates and adjusts the centrifuge design with respect to the research value of a specific performance requirement and its associated cost; (3) presents a design which can be built with present-day knowledge and with assurance of meeting performance requirements; (4) presents a design complete enough in detail to show its feasibility and to establish an estimated cost; and (5) recommends staging of construction and the staff personnel necessary to maintain and operate the facility. (Author)

252

Bauder, D. W., & D. L. Krenz 1961 WATER ENTRY TESTING USING ROCKET SLEDS
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, 1961). Pp. 75-80.

Bauer, L.H. 1930 SYMPOSIUM ON BLIND FLYING.
J. Aviation Med. 1:127-132

ABSTRACT: By blind flying is meant flying without a horizon for guidance. The exact physiological phenomenon has been a source of great dispute among otologists but is generally agreed now that the cause is a change of tension in the fluid in the otolith canals. During vertigo, the pilot must disregard his sensations and fly by instruments. Ocker and Crave have devised an instrument known as a flight integrator which combines the necessary instruments in one instrument. (CARI)

254

Bauer, L.H. 1933 AIR SICKNESS.
J. Aviation Med. 4:41-44

SUMMARY:

Air sickness belongs to a group of motion-sicknesses: swing, train, seasickness, etc.

Its causes are physiological or psychological reactions to unaccustomed motion.

The vestibular mechanism is the chief physical factor responsible for air-sickness.

Its frequency is perhaps about 5 per cent.

Its prevention lies in properly ventilated cabins; in taking the passenger's mind off of himself; in eliminating any causes of fear; and prompt treatment. If the individual is susceptible to motion sickness he should fly only in good weather and in smooth air.

255

Bauer, L. H. 1933 AVIATION MEDICINE
Oxford Medicine 1:545-585.

ABSTRACT: Out of a mass of experience, research and statistics a subject known now as aviation medicine has developed as a distinct specialty. This specialty is really a branch of preventive medicine, as its sole basis is the prevention of aircraft accidents from the human standpoint. It has drawn to itself portions of other specialties, namely, physiology, internal medicine, ophthalmology, otology, neuropsychiatry and psychology. It is a correlation of certain parts of these specialties as they relate to flying. The specialist in aviation medicine is known as the flight surgeon.

256

Bauer, L.H. 1942 MEDICINE AND AVIATION.
Trans. Amer. Acad. Ophthal. Oto-laryng. Jan-Feb : 43-46

ABSTRACT: The specific standards for flying cannot be gone into in detail in a brief article, but in general they are as follows: military pilots must have visual acuity, normal visual fields, and normal color fields. A pilot must have sufficient accommodative power to read a map or instrument pane. The ability to judge distance or depth perception is very important. Obstructive lesions of the nose and throat are disqualifying for a prospective pilot. Hearing, sufficient to detect radio signals, is essential. The labyrinth is not the most important factor in maintaining equilibrium in the flyer, vision is the most important factor. Pilots suffering from fatigue after long hours of flight are susceptible to a condition known as aeroneurosis. Pilots are also subjected to intense cold, low barometric pressure, lack of oxygen, and high speed resulting in violent g forces. All of these conditions induce fatigue, low resistance, and may cause casualties.

257

Bauer, Louis Hopewell 1943 AVIATION MEDICINE.
(New York: London: Oxford University Press, 1943)

258

Bauer, L. H. 1952 SPACE MEDICINE
West Vir. Med. J., 48(11):326-327. Nov. 1952

ABSTRACT: A review of space medicine and the problems that man faces in space flight.

259

Bauer, R.C. 1958 TRANSONIC WIND TUNNEL DYNAMIC STABILITY TEST OF
A SMALL - SCALE SATELLITE AEROMEDICAL RESEARCH VEHICLE.
(Arnold Engineering Development Center, Air Research and Development
Command) AEDC-TN 58-78, Dec. 1958. ASTIA AD 223 468-L

ABSTRACT: A one degree of freedom dynamic test of the GE-SARV nose cone was conducted in the 1-FT Transonic Tunnel of the Propulsion Wind Tunnel Facility at the Arnold Engineering Development Center.

The pitch damping coefficient, $(C_{mq} + C_{ma})$, and the static stability parameter, C_{ma} , were obtained from free-oscillation tests at Mach numbers from 0.7 to 1.5 about a pivot location 0.499 diameters from the nose. The Reynolds numbers based on the maximum model diameter varied from 0.63 to 0.76 x 10, and the reduced frequency parameter, $\frac{wd}{2V}$, ranged from 0.016 to 0.027.

The model was dynamically stable throughout the Mach number range 0.7 to 1.5 about a pivot location 0.499 diameters from the nose.

Baumker, A. 1944 A HISTORY OF GERMAN AERONAUTICAL RESEARCH
(German Air Ministry, Munich, 1944). Translation by R.A.E., Farnborough.
R.A.E. Translation No. 87.

261

Beach, Smiley Powell & N.C. Russell 1962 SUCCESSFUL PREDICTION OF AIR SICKNESS
IN AIRCREW TRAINEES
Paper: 33rd Annual Meeting of the Aerospace Medical Association, Chalfonte-
Haddon Hall, Atlantic City, N.J., April 9-12, 1962

ABSTRACT: Work done in 1953 by one of the authors suggested that successful prediction of air sickness could be made by taking a careful history and subjecting the individual to square wave head movements while seated in a rotating chair. Starting in 1960 one hundred and fifty pilot trainees were assessed by this method and also given a psychiatric assessment before undergoing primary flight training. The failure rate in this primary training due to air sickness was seven per cent. The combined history assessment and rotation test predicted half of this number with no false predictions. The assessing psychiatrist predicted failure of half of the remainder because of poor motivation or anxiety. This threefold attack can be usefully employed to remove the incurably airsick individual before he attempts expensive flying training.

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Beals, L. S., Jr. 1951 SOME CONSIDERATIONS OF AEROMEDICAL RESEARCH
Ann. New York Academy of Sciences 51:1159-1165, Jan. 1951

ABSTRACT: War, for all its amlignancy and degradation, chaos and waste, makes one contribution to the progress of mankind--its effectiveness in pushing forward the frontiers of knowledge at a faster rate than during peace. Research with military applications has developed a system of operation through government-sponsored study in universities and foundations. Planning and co-ordination thus have become channelized under headings not blatantly military, but pointed toward national security. Medical research has been less affected by any of the co-ordinating research plans than nay other branches of science. During the war there was some joint effort by individual laboratories and foundations. Two significant committees, the Vision Committee and the Committee on Aviation Medicine, still function. In aviation medicine team co-operation became vital in research. Work was not oriented around the physiology or endocrinology of a piece of a man, but about the total function of the whole human organism. Supersonic flight imposes not only aeromedical problems of the first order but also those that can only be completely embraced by a human-engineering approach. The major problems of the aviator in the supersonic cockpit are (1) the acceleration environment (2) visual performance (3) thermal surround (4) ultra-sonic environment (frequencies above 20 kc.) and (5) pilot escape. These problems cannot be solved by aviation medicine alone. The role of the flight surgeons, in assuring the continued survival of this nation, would clearly appear to be the reorientation of the research program around the broadest interpretations of human engineering principles.

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Beard, M.G. 1961 FIRE LESSONS FROM LA GUARDIA AIRPORT ELECTRA CRASH
(Paper, 65th Annual Convention, American Airlines, Inc., Detroit, Michigan,
May 15, 1961)

ABSTRACT: For many years, there has been controversy regarding the relative safety between kerosene as a possible safety fuel and aviation gasoline. Since the start of jet transport operation, the controversy seems to have switched to a comparison between kerosene and JP-4. The Electra accident of Sept. 14, 1960, at LaGuardia Field where seventy-two passengers plus four crew members escaped from an inverted fuselage, has received an unusual amount of comment crediting the use of kerosene for this rather remarkable accomplishment.

After a thorough investigation of the accident, it does not appear that there would have been a holocaust when the airplane came to rest if it had been fueled with JP-4 or Avgas. All of the fuel in the ruptured wing tanks close to the fuselage was spilled on the runway and glass along the skid wake of the airplane and this fuel was not available to burn at the location where the airplane came to rest. Because of the unique conditions surrounding this accident, it is not a good one to prove whatever difference there is between kerosene, JP-4 and Avgas with respect to crash fire survivability. It does prove that there are few injuries if decelerations are low and impact "g's" are mild.

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Beard, P. J. & W. F. Gantvoort 1938 STUDIES ON THE BIOLOGICAL EFFECTS OF
SUPERSONIC VIBRATION.
J. Bact. 35:5.

ABSTRACT: Apparatus for the generation of supersonic vibrations is described. It consists of an oscillator with two 500-watt tubes which can be used singly or in parallel. It follows in principle the apparatus described by Wood and Loomis, but with certain modifications. The wave length can be varied between 300 and 1000 kilocycles and the power can be adjusted by means of a variable resistance in the primary circuit. The energy is transmitted to a piezo-active quartz crystal submersed in a dielectric. The latter flows through a cooling system at a rate of 5 gallons per minute and the temperature can be held at any desired level.

On applying energy to the crystal the dielectric becomes so violently agitated that it builds up a fountain about 5 cm. in height. Objects suspended in this fountain are subjected to the effects of the vibrations.

Double-distilled water containing triple-distilled mercury developed, with 600 kilocycles, a turbidity lasting over several hours. Exposure for 4 minutes was lethal for mice. Exposure for 15 minutes reduced a culture of *Escherichia coli* from 70,000,000 to 20,000 cells per cubic centimeter.

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Beaton, J. L. and R. N. Field 1959 DYNAMIC FULL SCALE TESTS OF MEDIAN BARRIERS. (Div. of Highways, Materials and Res. Dept., Sacramento, Calif.) May 1959.

266

Beauchamp, G.T. 1961 ADVERSE EFFECTS DUE TO SPACE VEHICLE ROTATION. Astronautical Sci. Rev., 3(4):9-11. Oct- Dec. 1961.

ABSTRACT: In a satellite rotated to create an artificial gravitational field, the effects of Coriolis forces are considerable upon occupant movements, his performance at the controls, and on the operation of machinery. Careful consideration of the vehicle size, magnitude of the simulated gravity, and deliberate slowing of movements will lessen the adverse effects of Coriolis forces. The following recommendations are made: (1) The optimum vehicle radius at floor level should be from 45 to 50 feet, since smaller radii are conducive to intolerable Coriolis forces and gravity gradients. (2) At low simulated gravity levels the rotational radius of the vehicle for satisfactory human performance should be extended to several hundred feet to balance the Coriolis forces. (Aerospace Medicine 33(5):645, May, 1962)

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Beauchamp, G.T. 1961 DISTURBING FORCES PRESENT IN A ROTATING SPACE STATION. J. Environmental Sci., 4(5):12-13,21.

ABSTRACT: The effects of Coriolis forces may be reduced by carefully considering vehicle size and strength of simulated gravity field, and by allowing for slower movement. Some suggestions for design are given: (1) optimum vehicle radius at floor level is 45 to 50 feet; smaller radii increase intolerable Coriolis effects and gravity gradients; and (2) gravity levels of 0.10 g require large spin radii (such as that proposed for nuclear vehicles) to overcome coriolis forces. The location of functional machinery, controls, and consoles is considered, since the effects of Coriolis forces may affect their operation.

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Beck, A.I. & B. Cooper 1959 PROBLEMS INVOLVED IN PROVIDING PROTECTION FOR AIRCREWMEN DURING ESCAPE. (Paper, 30th Annual Meeting, Aero Medical Association, Statler Hilton Hotel, Los Angeles, April 27-29, 1959)

ABSTRACT: The problem areas concerned in providing adequate protection for aircrewmens prior to and during escape sequences from high performance aircraft are complicated by the physiologic considerations and the physical nature of the escape itself. The human limitations to imposed forces, both initial and sustained, and the method used to eliminate and/or reduce them will be presented.

Pertinent data resulting from sled test runs and crew escape studies will be discussed using actual filmed sequences of research effort. The presentation will consider the present state-of-the-art of crew escape systems and will present the problems yet to be solved to produce reliable escape potential for proposed new weapons systems. Factors such as positioning, restraints, time sequences, personal equipment, altitude and speed and related problems will be reviewed and possible solutions offered to meet the demands arising from the ever expanding flight envelopes of the most modern weapons systems.

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Becker, K.R., R.W. Watson and F.C. Gibson 1962 HYPERVELOCITY IMPACT PHENOMENA. (U.S. Army Ordnance Ballistics Research Lab., Aberdeen Proving Ground, Maryland). ASTIA AD-280 208.

ABSTRACT: The purpose of this investigation is to study the parameters governing the failure of thin metal plates under the impact of high-speed fragments; special emphasis is placed on the lightweight structural alloys. The geometrical features of the perforations, together with the spatial, mass, and velocity distributions of the ejecta produced in the perforation process, are of immediate interest. Since these variables are strongly dependent on the characteristics of the impacting projectile as well as the physical properties of the target material, a variety of experimental approaches to the problem are clearly evident. In an effort to systematize the approach and at the same time gain information that will be of immediate practical value, a few select target materials are currently being investigated under impact conditions that involve the same projectile geometry but different impact velocities.

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Beckman, E.L. n.d. SOME PHYSIOLOGICAL AND PSYCHOLOGICAL CHANGES RESULTING FROM WATER IMMERSION THAT MAY BE SIGNIFICANT IN SPACE FLIGHT. (U.S. Navy)

ABSTRACT: In preparing man for space flight aeromedical investigators have simulated the conditions of space and tested the human response under these conditions. The zero G state can only be realized on earth during aircraft flights in Keplerian trajectory which produces a zero G condition on the occupant of the aircraft for 30 to 60 seconds. The hypogravic state resulting from water immersion has been used to simulate certain aspects of the gravity free state. Water immersion creates a physical state which is similar to the zero G state for certain sensory modalities.

Studies on humans immersed in water for 6 to 18 hours revealed some alteration in physiological function and psychomotor performance which may be significant in space flight. These findings will be discussed.

Beckman, E.L. 1949 PROTECTION AFFORDED CEREBROVASCULAR SYSTEM BY CEREBRO-
SPINAL FLUID UNDER STRESS OF NEGATIVE G.
(U.S. Naval Air Development Center, Johnsville, Pa.)

ABSTRACT: Eleven goats were subjected to negative G exposures varying from 1.2 to 8.9 G with random selection of the G level on the 17-foot centrifuge at the University of Southern California. Arterial, venous and CSF pressures and, in some cases, intracardiac pressures, were measured through cannulae attached to Statham strain gauges and recorded oscillographically with Heiland Type A galvanometers. Complete post-mortem examinations were performed on all animals. The results of these studies indicate that within the limits of the experimental procedure, normal intracranial vessels are adequately protected against sudden changes in intravascular pressures by simultaneous changes in the cerebrospinal fluid pressure. Two explanations for the mechanism of intracranial hemorrhage reported in the literature are proposed: (1) Torsional stress applied to meningeal vessels by relative motion between the brain and its meninges produced by rapid acceleration of the head under negative G forces with resultant hemorrhage. (2) Rupture of abnormal (aneurysmal) intracranial vessels subjected to increased A-V pressure differences.

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Beckman, E. L. 1950 THE INFLUENCE OF FOOTWARD ACCELERATION UPON THE FLUID
SYSTEM OF THE INTRACRANIAL CAVITY. (U. S. NADC, AMAL, Johnsville, Pa.)
Rept. No. NM 001 060.02.0, Dec. 1950.

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Beckman, E.L. 1951 THE INFLUENCE OF FOOTWARD ACCELERATION UPON THE FLUID
SYSTEM OF THE INTRACRANIAL CAVITY.
(U.S. Naval Air Development Center, Johnsville, Pa.)
Rept. No. NM 001 060.02.01. NADC-MA-5101 8 March 1951.

ABSTRACT: A series of experiments was carried out in which the stress of graded magnitudes of accelerative force was applied to goats for controlled time periods. As a result of these experiments, it was demonstrated that the cardiac output of goats under the conditions of stress investigated was moderately decreased when measured by the method of Hamilton. The arterial-venous pressure differential was found to be maintained approximately at control level during exposure to g of the magnitude used in these experiments so long as cardiac arrhythmias or severe bradycardia did not develop. The intracranial vascular system was found to be adequately protected against high intravascular pressures by a counter-balancing pressure increase in the cerebrospinal fluid. It may be inferred that the cerebral blood flow was adequately maintained under the conditions of this experiment.

Beckman, E.L. 1951 THE INFLUENCE OF FOOTWARD ACCELERATION UPON THE FLUID SYSTEMS OF THE INTRACRANIAL CAVITY.
(U.S. Naval Air Development Center, Aviation Medical Acceleration Lab., Johnsville, Pa.) Report No. NADC-MA 5102, Sept. 1951. ASTIA ATI 119 261

ABSTRACT: The effects of negative G upon the central nervous system were studied upon ten goats by pathological techniques. The animals were exposed for fifteen-second periods to 5 or 8 negative G repeated one to twenty times. Central nervous system tissue was prepared for study by perfusion in situ with 10 per cent neutral formalin in physiological salt solution and subsequent removal of the enveloping cranial vault leaving the dura intact. After formalin fixation, the brain and brain stem specimens were examined grossly for evidence of hemorrhage.

One animal (Goat Number 3) was found to have a subdural hemorrhage covering the left lobe of the cerebellum and the left lateral aspects of base of the brain. Goat Number 1 was found to have ring hemorrhages in both the temporal lobe and mesencephalon. Routine tissue sections from fifteen areas of the brain and brain stem were prepared by cyanin, and hematoxylin and eosin staining techniques. These tissues were studied microscopically for evidence of hemorrhage and pathological changes. Neuropathological findings of increased perivascular spaces and packing of the red blood cells in the cortical vessels were observed which were suggestive of increased capillary filtration.

Beckman, E.L. 1952 EFFECTS OF ACCELERATION UPON THE CEREBRAL METABOLISM AND CEREBRAL BLOOD FLOW- PHASE IV -SOME OBSERVATIONS ON NEGATIVE G DEVELOPED IN AEROBATICS. (U.S. Naval Air Development Center, Aviation Medical Acceleration Lab., Johnsville, Pa.) Report No. NADC-MA 5203, 23 April 1952. ASTIA ATI 149915.

ABSTRACT: This study demonstrated that standard maneuvers of the type performed by Mr. Jocelyn developed negative G loads of 2 1/2 to 3G for durations of up to 32 seconds. In some maneuvers, peak accelerations of 5 negative G were reached, but in these maneuvers the magnitude of the acceleration was increased gradually to the maximum and then decreased over shorter time intervals of from 8 to 16 seconds.

One pilot was studied who is able to execute negative G maneuvers without undue discomfort, and without subjective or objective evidence of injury.

The use of negative G maneuvers of magnitude and duration measured in these experiments should be evaluated for use in offensive and defensive tactics.

Beckman, E. L., L. H. Peterson, & J. Parness 1953 DEVELOPMENT OF BIOLOGICAL RESEARCH APPARATUS FOR USE IN ACCELERATION AND DECELERATION STUDIES. PHASE I. THE EVALUATION OF PRESSURE TRANSDUCER SYSTEMS (U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-5206, Jan. 15, 1953. ASTIA AD 1061

ABSTRACT: In Phase I of this investigation, comparison measurements were made of the electrical output of various commercially available pressure transducers. These transducer systems were tested utilizing various coupling systems (catheters and needle combinations) which are currently being used for physiological measurement. Measurements obtained were then compared with the amplitude versus frequency response of these same systems as measured by absolute calibration methods. The facilities of the Navy Underwater Sound Reference Laboratory at Orlands, Florida were used to obtain absolute response measurements. Graphs showing the amplitude versus frequency response of the various systems measured as well as the comparison curves to demonstrate the reliability of the conventional methods of response measurements are included in Appendix B. In Phase II of this investigation, the theory of transducer response for lumped systems (considered in Phase I) was extended to a consideration of a transducer system having more than one degree of freedom (distributed system). For this purpose, the capacitance type transducer with a very long polyvinyl catheter was used as the test system. Theoretical consideration was given to the effect of varying physical constants upon the response of the system. These effects are shown in graphs included in the text of this report. A damping segment was designed, based upon the theoretical concepts. This unit was found satisfactory for producing variable damping in a transducer system and thereby improving the amplitude versus frequency response of the system and reducing acceleration artifacts.

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Beckman, E.L., T.D. Duane, J.E. Ziegler, & H.N. Hunter 1953 HUMAN TOLERANCE TO HIGH POSITIVE G APPLIED AT A RATE OF 5 TO 10 G PER SECOND (U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-5302 June 3, 1953 ASTIA AD 20 520

ABSTRACT: Investigations were made to determine more accurately the voluntary human tolerance to high positive G loads applied at the rate of 5-10 G/sec. Measurements were made on 5 adult human males at 15, 12, 10, and 6 G and upon 7 subjects at 8 G. Subjects were safely exposed to accelerative loads of 15 G for durations of 1 - 1.8 seconds if the loads were applied at a maximum rate of 8 - 10 G/sec. When the subjects were exposed to 15 G loads applied at 8 G/sec, unconsciousness was sometimes produced if the maximum load duration was greater than 0.5 sec. The visual symptoms of graying, peripheral vision loss, and blackout were not considered to be premonitory signs of impending unconsciousness when the load was 8 G or more applied at 7 G/sec or more. Unconsciousness produced as a result of loads of 8 - 15 G applied at 7 - 9.6 G/sec did not produce clinically demonstrable sequelae.

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Beckman, E.L., J.E. Ziegler, T.D. Duane & H.N. Hunter 1953 HUMAN TOLERANCE TO COMBINED ACCELERATIONS. PHASE II. PRELIMINARY STUDIES ON PRIMATES SUBJECTED TO MAXIMUM SIMPLE ACCELERATIVE LOADS.
(Naval Air Development Center, Johnsville, Pa.) NADC-MA-5301
22 May 1953. ASTIA AD 15 117

ABSTRACT: A survey was made of the literature regarding human tolerance to simple and combined accelerative stress. The tolerance of chimpanzees to simple positive, negative, and transverse g loads was measured, and applications were made to human tolerance levels. No demonstrable pathophysiological changes occurred when the animal was subjected for 15 sec to 40 transverse g or to 40 positive g. Unconsciousness was produced with approximately the same positive g load as for humans, but this level in chimpanzees was well below the level necessary for the rupture of tissue. Irreversible changes in the central nervous system and general tissue occurred after 15 sec of 40 negative g. Calculations indicated that safe human tolerance levels to positive and transverse g could be maintained with gradually increasing increments of magnitude up to 15 g and gradually increasing durations up to 5 sec maximum. Human tolerance to negative g was not considered safe with greater than 3 g for 1 sec until further investigation is made. (ASTIA)

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Beckman, E.L., J.E. Ziegler, T.D. Duane, & H.N. Hunter 1953 PRELIMINARY STUDIES IN PRIMATES SUBJECTED TO MAXIMUM SIMPLE ACCELERATIVE LOADS.
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-5301,
22 May 1953. ASTIA AD 15117.

ABSTRACT: An analysis of the problem of determining the human tolerance to simple and combined accelerative stress has been undertaken from a review of the literature on the subject. On the basis of the analysis presented, an experimental program has been undertaken which would provide the data necessary to define the human tolerance to acceleration in the part of the spectrum which has not been adequately studied, i.e., in the period from 1/2 to 5 seconds duration and of accelerative stress loads up to 15G. Preliminary experimentation has been carried out to study the tolerance of the chimpanzee to loads calculated to give a safety factor of greater than 2.5 for human work. From these studies, it has been possible to extrapolate and to predict that transverse accelerative stress of 15 G for 5 seconds in either the prone or supine position is below the human tolerance and the ultimate rupture points for the various mechanical systems of the body. From a study of the effects of 40 positive G for 15 seconds upon the chimpanzees, it was found that

severe accelerative shock was produced, but that there was no rupture of the skeletal, visco-elastic or vascular systems which was irreversible. From the study of the effects of 40 negative G applied to a chimpanzee for 15 seconds duration, it was found that a comatose state was produced which persisted for approximately three days, and that pathological numbers of leucocytes and red blood cells were demonstrated in the cerebrospinal fluid. Small sub-arachnoid and sub-cortical hemorrhages were found from microscopic examination of the brain tissue. The damage was of such severity that it was not believed to be completely reversible. Pathological changes in the liver, myocardium, and thyroid were also observed. A condition of accelerative shock was produced in the animal and the stress load was such as to produce evidence that the rupture point for the vascular system had been reached with production of irreversible damage to the brain, heart, and liver. On the basis of these findings, it is recommended that studies be carried out to determine the human tolerance to an accelerative stress of 15 G applied for a duration of up to 5 seconds with the force acting in the transverse and positive G directions. Further animal studies on the effects of negative G are recommended.

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Beckman, E.L. 1953 OBSERVATIONS OF HUMAN TOLERANCE TO ACCELERATION STRESS:
PHASE II. (U.S. Naval Air Development Center, Johnsville, Pa.)
NADC-MA-5302. June 1953.

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Beckman, E. L., J. E. Ziegler, T. D. Duane and H. N. Hunter 1953
SOME OBSERVATIONS ON HUMAN TOLERANCE TO ACCELERATIVE STRESS PHASE
II. PRELIMINARY STUDIES ON PRIMATES SUBJECTED TO MAXIMUM SIMPLE
ACCELERATIVE LOADS
J. of Aviation Medicine 24(5):377-392 October 1953

ABSTRACT: Preliminary experimentation has been carried out to study the tolerance of a chimpanzee to loads calculated to give a safety factor of greater than 2.5 to 3.0 for human work. From these studies, it has been possible to extrapolate and to predict that the human tolerance to transverse accelerative stress of 15 G for five seconds in either the prone or supine position is below the ultimate rupture points for the various mechanical systems of the body. From a study of the effects of 40 positive G for fifteen seconds upon the chimpanzee, it was found that severe accelerative shock was produced -- which was irreversible. There was no rupture of the skeletal, visco-elastic or vascular systems. It is believed that accelerative stress of 15 negative G applied for a duration of up to five seconds is in excess of the safe human tolerance limit.

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Beckman, E. L., T. D. Duane, J. E. Ziegler, & H. N. Hunter 1953 SOME OBSERVATIONS ON HUMAN TOLERANCE TO ACCELERATIVE STRESS. IV. HUMAN TOLERANCE TO HIGH POSITIVE G APPLIED AT A RATE OF 5 TO 10 G PER SECOND. (Naval Air Development Ctr., Johnsville, Pa.) NADC MA-5302, ASTIA AD-20 520.
See also J. Aviation Med. 25(1):50-65, Feb. 1954

ABSTRACT: 11 subjects were exposed to high positive accelerations (3-5 g) on the centrifuge, and the durations of the loads required to produce unconsciousness were measured. The time required to produce unconsciousness was longer at low levels and shorter at high levels of acceleration. The mean value for the time above 3 g during the runs which produced unconsciousness was 4.2 secs. After unconsciousness had been produced, the subjects returned to consciousness within 5-10 secs. Unconsciousness was not preceded by loss of peripheral vision and blackout usually experienced when the exposure is to loads of less than 8 positive g. Unconsciousness did not occur until the arterial pressure at the base of the brain had dropped to zero (at a mean level of 5 g). From the data obtained it was assumed that stasis of the cerebral circulation was produced by accelerations of 3, 4, or 5 g. There was no significant difference between the duration of the acceleration required to produce unconsciousness at 8, 10, 12, or 15 g, if the time was measured as the duration of the load above 3, 4, or 5 g.

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Beckman, E. L., J. E. Ziegler, T. D. Duane & H. N. Hunter 1954 SOME OBSERVATIONS ON HUMAN TOLERANCE TO ACCELERATIVE STRESS. PHASE IV. HUMAN TOLERANCE TO HIGH POSITIVE G APPLIED AT A RATE OF 5 TO 10 G PER SECOND. J. Aviation Medicine 25(1):50-66.
See also: (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-5302.

ABSTRACT: Eleven volunteer human subjects were exposed to high positive G loads and the durations of the loads required to produce unconsciousness were measured. The data obtained in these experiments were analyzed on the basis of the assumption that stasis of the cerebral circulation was produced by accelerative loads of either 3, 4 or 5 G. On this basis, it was found that: (a) the duration of the stasis of the cerebral circulation which produced unconsciousness was shorter by two to three seconds than the mean time required to produce unconsciousness by 1 G by occlusion of the vertebral and carotid arteries with a cervical cuff, reported by Rossen, and (b) that there was no statistically significant difference between the duration of the acceleration required to produce unconsciousness at 8, 10, 12, and 15 positive G, if the time was measured as the duration of the load above 3, 4, or 5 G. The shorter duration of cerebrovascular stasis required to produce unconsciousness at 8, 10, 12, and 15 positive G was explained on the basis that the high positive G loads cause the capillary bed to be partially drained of blood. The total quantity of blood entrapped within the brain after cerebrovascular stasis has been produced by high accelerative loads would be smaller than the quantity of blood entrapped within the brain by occlusion of the carotid and vertebral arteries. If the oxygen content of the bloods were approximately the same in both cases, then the time to unconsciousness when circulatory stasis of the brain was produced by high positive G loads would be shorter than when stasis was produced by occlusion of the vessels by a cervical cuff because of the difference in the quantities of the entrapped blood.

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Beckman, E.L. & H.L. Ratcliffe 1955 A POST-MORTEM STUDY OF RHESUS MONKEYS (MACACA MULATTA) AT INTERVALS AFTER SINGLE OR REPEATED EXPOSURE TO NEGATIVE ACCELERATION. (U.S. Naval Air Development Center, Johnsville, Pa.) Rept. No. NADC-MA-5504, 26 May 1955. ASTIA AD 67 387
See also J. Aviation Med. 27(2):117-130. 1956.

SUMMARY: Twenty-two monkeys, with appropriate controls, were subjected to one or more exposures of negative acceleration (12, 32, or 40 G) and killed 15 minutes to 90 days later. The results of these experiments suggest that current histological techniques offer little promise of explaining the effects of negative acceleration upon the functions of the brain. Scattered capillary hemorrhages and, occasionally, edema were the only lesions that might be related to acceleration. Thrombus formation, especially in the vessels of the lungs, commonly followed negative acceleration, and can account for the development of edema and repeatedly to negative acceleration developed increased tolerance, and in them the adrenal cortex was hypertrophied. (AMAL)

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Beckman, E.L., and H.L. Ratcliffe, 1956 A POST-MORTEM STUDY OF RHESUS MONKEYS AT INTERVALS AFTER SINGLE OR REPEATED EXPOSURE TO NEGATIVE ACCELERATION. J. Aviation Med. 27(2):117-130.
See also NADC-MA-5504, ASTIA AD 67 387

SUMMARY: Twenty-two monkeys were subjected to one or more exposures of negative acceleration (12, 32 or 40 g) and killed fifteen minutes to ninety days later. Their tissues were compared to those of four normal monkeys and of five monkeys that had received equivalent exposures to positive acceleration. These examinations suggest that current histological techniques offer little promise of explaining the direct effects of negative acceleration upon the functions of the brain.

In terms of survival, however, edema and hemorrhage into the lungs seemed more important than changes in the functions of the brain. Moreover, escape of fluid and blood into the alveolar spaces of the lungs became more conspicuous thirty to ninety-six hours after acceleration, and may be attributed to the effects of thrombi that developed in the vascular tree of the lungs during and immediately following exposure. Repeated exposure to negative acceleration was followed by the development of increased tolerance, as indicated by lessening edema and hemorrhage into the extra-cranial tissues of the head and face as the series of exposures progressed. The adrenal cortex of these animals was hypertrophied.

Beckman, E., D.C. McNutt, & J.S.P. Rawlins 1958 USE OF THE STANDARD EJECTION SEAT SYSTEM AS A MEANS OF ESCAPE FROM SUBMERGED AIRCRAFT. (RAF, Institute of Aviation Medicine, Farnborough) FPRC Rept. 1049, May 1958. ASTIA AD 201 166.

ABSTRACT: The feasibility of using the standard Martin-Baker ejection seat system was assessed. Results indicated that when the canopy is open or off, escape from submerged aircraft can best be accomplished by climbing out, inflating the Mae West, and making a free ascent. The forces which act upon the aircrew in using either the 60 or 80 fps ejection seat system (type 1, 2a, 3, and 4 guns) for escape from a submerged aircraft are tolerable. The hazards involved in ejection through a Seahawk type canopy when submerged are within the acceptable limits of a survival procedure.

The present standard seat ejection guns will neither fire after the firing head has been submerged in water for more than a few seconds nor will it fire properly after the barrel of the gun has been immersed in water for half a minute. The escape from a sinking aircraft should be carried out before the aircraft sinks to 100 ft. although safe escape is theoretically possible down to depths of 300 feet.

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Beckman, E.L. 1959 ESCAPE FROM DITCHED AIRCRAFT: Evaluation of the factors which affect survival in a ditching accident in current operational aircraft with recommendations for increasing the rate of survival. (RAF, Institute of Aviation Medicine, Farnborough) FPRC 1094 iv, Mar. 1959. ASTIA AD 243 788

ABSTRACT: The probability of aircrew making a safe escape after a ditching accident by using "manual" escape procedures is assessed; these procedures are shown to be inadequate for escaping from modern jet aircraft; and the use of the ejection seat to assist escape from a sinking aircraft is evaluated and recommended. A research programme is proposed for accumulating data on ditching accidents; this includes the measurement of accelerations to which the aircrew are subjected during ditching and the measurement of the sinking characteristics of aircraft when subjected to realistic ditching conditions. The results obtained should permit an accurate evaluation of the effectiveness of the present methods of escape from ditched aircraft. An engineering development programme is proposed for providing a buoyancy system for the entire airframe in some cases, for the ejection seat in others, and for modifying the ejection seat firing system so as to ensure that it functions under water in addition to providing a slower ejection velocity, when used for escape from a ditched aircraft.

Beckman, E. L. 1960 ESCAPE FROM DITCHED AIRCRAFT: TIME REQUIRED BY AIRCREW FOR ESCAPE FROM A DITCHED AIRCRAFT WHILE USING THE AIRCRAFT OXYGEN EQUIPMENT FOR BREATHING. (RAF, Institute of Aviation Medicine, Farnborough) FPRC 1074 Jan. 1960. ASTIA AD 239 037

Summary: Tests to evaluate problems of pilot escape from ditched aircraft were carried out, using a Meteor Mk 9 fuselage with subjects wearing flying clothing and using Mk 17 D oxygen regulators and both the Al3Al and P type oxygen masks. The times required by aircrew subjects to escape from the cockpit in air were compared with the times required to escape from the cockpit when upright and inverted in 8 feet of water. The subjects required 51% more time to escape from the aircraft when upright in water and 87% more time to escape when the fuselage was inverted in water than when the same escape procedure was carried out in air. The 17D type pressure demand regulator when switched to 100% oxygen, coupled with the oxygen pressure reducer and Al3Al oxygen mask were found to function adequately for underwater breathing in all tests. All subjects were able to carry out normal respiration when the cockpit was in the upright position. When the cockpit was inverted it was necessary for the subjects to augment the supply of oxygen from the regulator by depressing the emergency button. In this manner respiration was adequate for all subjects with the cockpit in the inverted position.

The most significant finding was that all subjects required a short familiarisation and training period on the use of the oxygen equipment underwater before they could satisfactorily utilize the equipment. After the subjects had mastered the breathing technique for using the demand oxygen systems underwater, the escape procedures were efficiently and safely carried out.

Some subjects fouled on the parachute harness, restraint harness or personal survival pack in the process of escape. It was found that when the dinghy pack was attached to the life saving waistcoat by the long lanyard alone, the dinghy pack invariably became fouled on the parachute harness so that the dinghy had to be detached before the escape could be completed.

On the basis of these findings, the problems of escape from a ditched aircraft have been re-evaluated and recommendations are made as to the procedure for escape with regard to various conditions of the aircraft in water. (AUTHOR)

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Beckman, E.L., T.D. Duane & K.R. Coburn 1961 LIMITATION OF OCULAR MOTILITY AND PUPILLARY DILATATION IN HUMANS DUE TO POSITIVE ACCELERATION. (Naval Air Development Center, Johnsville, Pa.) Rept. No. NADC-MA-6140, 12 December 1961. ASTIA AD 270 281

ABSTRACT: In a search for a reproducible and objective endpoint for measurement of reaction to positive acceleration, it was observed that volitional ocular motility disappeared at approximately the same magnitude of acceleration that produced a loss of peripheral vision. It was disclosed that trained centrifuge subjects could rotate their eyes after losing peripheral vision but in an ataxic manner. The optokinetic reflex seemed to disappear concomitantly with limitation of ocular motility (LOMA). The ability to follow a moving

target was also lost after peripheral vision failed. Progressive pupillary dilatation was observed. The phenomena were also tested while 30-35 mm Hg negative pressure was applied over the eyes by use of a modified underwater swimmer's mask. With this technique, vision after blackout (loss of central and peripheral vision) during acceleration was restored almost to normal. The volitional eye movements likewise returned to normal. The optokinetic reflex was likewise returned to normal. The optokinetic reflex was likewise restored as was the target following reflex. Target following reflex. The pupils, however, remained dilated. It is concluded that there is a cerebral cortical dysfunction which occurs during exposure to positive acceleration at levels which cause blackout. (Author)

290

Beckman, E. L. 1962 BIODYNAMIC PROBLEMS OF HUMAN SPACE FLIGHT
In Barbour, A. B. & H. E. Whittingham, eds., Human Problems of Supersonic and Hypersonic Flight (New York, Oxford, London, Paris: Pergamon Press, 1962), pp. 113-128

291

Beckman, E.L., et al. 1962 LIMITATION OF OCULAR MOTILITY AND PUPILLARY DILATATION IN HUMANS DURING POSITIVE ACCELERATION.
In Armand Mercier, ed. Visual Problems In Aviation Medicine
(New York: Pergamon Press, 1962) pp. 17-25.
See also (U.S. Naval Air Div. Ctr., Johnsville, Pa.) NADC-MA-6140
ASTIA AD 270 281

ABSTRACT: An objective test to determine the functional state of the central nervous system during positive acceleration was evolved, based on the limitation of ocular motility (LOMA). Normal subjects demonstrated LOMA during positive acceleration on a centrifuge at a g level between the subjective sensations of greyout and blackout. At this point, which varied from 3.5 to 7.0 g in individual subjects, the eyes came to rest in the primary position. Trained centrifuge subjects could overcome LOMA by voluntary effort, indicating that the lower motor neurons to the extraocular muscles remain functional. However, these voluntary movements were ataxic, probably because of a loss of sensory feedback from the retina. As positive acceleration increased, the pupils dilated with concomitant loss of peripheral vision, reaching a maximum with loss of central vision. Vertical nystagmus was observed during high rates of change of acceleration, and the optokinetic response did not continue during blackout. When negative pressure was applied to the orbit (using a modified skin-divers mask) during LOMA, vision and optokinetic responses were restored, the voluntary ataxic movements became coordinated, and the pupils remained partially dilated. The usual pupillary dilation during blackout was prevented by local application of pilocarpine, but not by morphine. These results indicate that LOMA is due to cerebral hypoxia which causes a dysfunction of normal oculomotor and pupillary control systems. Therefore, the observations of LOMA and pupillary dilation can be used to objectively evaluate cerebral response to positive acceleration.

92

Becks, Chester C. 1945 ACCELERATION TRANSVERSE. (Natl. Research Council, Div. of Medical Sciences) Rept. No. 418.

293

Becks, C. C. 1958 MAN'S ABILITY TO WITHSTAND TRANSVERSE ACCELERATION IN THE SITTING POSITION
(Mayo Aero Medical Unit, Rochester, N. Y.) ASTIA AD 204991

294

Beeding, Capt. Eli L., Jr. 1957 DAISY TRACK AND SUPPORTING SYSTEMS
(Air Force Missile Development Center, Holloman AFB, New Mex.)
HADC TN 57-8, June 1957. ASTIA AD 113 038

ABSTRACT: The equipment design and function, and the test sequence of the Daisy Track, a 120 ft catapult sled track and braking system, are described. The results of a test run, the details of the construction, and photographs of the Daisy Track are appended.

295

Beeding, E. L., Jr. 1957 DAISY TRACK TESTS, 18 APRIL - 11 JUNE 1957.
(USAF Missile Development Center, Holloman AFB, N. Mex.) Proj. 7850,
Test Rept. No. 6, 10 Sept. 1957.

ABSTRACT: The purpose of the program being conducted on the Daisy Track is to determine human tolerances to linear decelerative forces in all planes of body orientation. This is a continuing program due to the many possible combinations of magnitude, rate of application, and duration of force with changes in body orientation. Complete evaluation of these variables using human and animal subjects will provide necessary criteria used in the design of aircraft. The series of tests described in this publication was conducted in order to determine the effect of impact forces of 15 g magnitude applied at the rate of 200 g/sec per second on volunteer human subjects oriented at various degrees with respect to the acceleration-deceleration vector. Subjects were lying on their right side.
(CARI)

296

Beeding, E.L., Jr. 1957 TEST REPORT ON AMFL SHORT TRACK FACILITY.
(Holloman Air Development Center, Holloman AFB, N. Mex.) Proj. No. 7850,
Task No. 78503, Jan. 1957

ABSTRACT: The purpose of the program being conducted on the Short Track Facility is to determine human reactions to linear decelerative forces 15 to 200 G in magnitude in the range of 200 to 5000 G per second rate of application, for durations of from .010 to .200 seconds for all planes of body orientation.

The series of tests described in this publication was conducted in order to determine the effect of impact forces of the 15 G magnitude applied at the rate of 200 G per second on volunteer human subjects oriented at various degrees with respect to the acceleration-deceleration vector. Subjects were lying on their right side and facing aft. (CARI)

297

Beeding, E.L., J.P. Stapp, and R.R. Hessberg 1957-59 DAISY TRACK TEST.
(Complete series of reports, Air Force Dev. Center, Holloman AFB,
New Mexico) April 1957 - Dec. 1959

298

Beeding, E. L., Jr. 1958 DAISY TRACK TESTS, 13 JUNE 1957 - 17 DEC. 1957
(USAF Missile Development Center, Holloman AFB, N. Mex.) Project No. 7850,
Test Rept. No. 7, March 1958

ABSTRACT: The purpose of the program being conducted on the Daisy Track is to determine human tolerances to linear decelerative forces in all planes of body orientation. This is a continuing program due to the many possible combinations of magnitude, rate of application, and duration of force with changes in body orientation. Complete evaluation of these variables using human and animal subjects will provide necessary criteria used in the design of aircraft. The series described in this publication was conducted in order to determine the effect of impact forces up to 40 g magnitude applied at rates of onset up to 3000 g/sec on volunteer human subjects oriented at various degrees with respect to the acceleration-deceleration vector. (CARI)

299

Beeding, E.L., Jr. & R.R. Hessberg, Jr. 1958 DAISY TRACK TESTS 271-337;
RUN: 4 FEB. - 19 MAY 1958. (USAF Missile Development Center, Holloman AFB,
N. Mex.) Proj. No. 7850, Test Rept. No. 8, Nov. 1958.

ABSTRACT: The program conducted on the Daisy Track is designed to determine human tolerances to linear-deceleration forces in all planes of body orientation. This is a continuing program because of the many possible combinations of magnitude, rate of application, duration of force, and changes in body orientation. Complete evaluation of these variables, obtained by testing human and animal subjects, will provide necessary criteria for use in designing aircraft and space vehicles. The series of tests reported in this publication was conducted to determine the effects of up to 80 g impact forces being applied to volunteer human and animal subjects at onset rates of up to 4000 g per second, while the subjects were oriented to the acceleration-deceleration vector at various degrees. (CARI)

300

Beeding, E.L., Jr. 1959 DAISY TRACK TESTS -TEST NUMBERS: 338 - 519
22 MAY 1958 - 9 JULY 1959. (USAF Missile Development Center, Holloman
AFB, N. Mex.) Project 7850, Task 78503, Dec. 1959.

ABSTRACT: The program conducted on the Daisy Track is designed to determine human tolerances to linear-deceleration forces in all planes of body orientation. This is a continuing program because of the many possible combinations of magnitude, rate of application, duration of force, and changes in body orientation. Complete evaluation of these variables, obtained by testing human and animal subjects, will provide necessary criteria for use in designing aircraft and space vehicles. The series of tests described in this publication was conducted to determine the effects of up to 80 g impact forces being applied to volunteer human and animal subjects at rates of onset up to 10,000 g per second, while the subjects were oriented to the acceleration-deceleration vector at various degrees. (CARI)

301

Beeding, E. L., Jr. 1960 DAISY DECELERATOR TESTS, 13 JULY 1959 - 13 APRIL 1960
(USAF Missile Development Center, Holloman AFB, N. Mex.) MDW Test Rept. 60-4,
July 1960

ABSTRACT: The program conducted on the Daisy Decelerator is designed to determine human tolerances to linear-deceleration forces in all planes of body orientation. This is a continuing program because of the many possible combinations of magnitude, rate of application, duration of force, and changes in body orientation.

Complete evaluation of these variables, obtained by testing human and animal subjects, will provide necessary criteria for use in designing aircraft and space vehicles. The series of tests described in this publication was conducted to determine the effects of up to 80 G impact forces being applied to volunteer human and animal subjects at rates of onset up to 10,000 G per second, while the subjects were oriented to the acceleration-deceleration vector at various angles. (CARI)

302

Beeding, E.L., Jr. and J.D. Mosely 1960 HUMAN DECELERATION TESTS.
(USAF Missile Development Center, Holloman AFB, N.Mexico)
AFMDC-TN-60-2, Jan. 1960. ASTIA AD 234 148

ABSTRACT: A series of deceleration tests were conducted to determine human tolerance to impact forces with the subject seated in the backward-facing position. For healthy males seated in the backward-facing position, restrained with shoulder straps, lap belt and inverted "V" strap, the tolerance limit to G forces of .04 second duration seems to be in the area of 83 G at 3800 G/ second.

303

Beeding, E. L., & J. D. Mosely 1960 HUMAN TOLERANCE TO ULTRA HIGH G FORCES
(Paper, 31st Annual Meeting of the Aerospace Medical Association, Americana Hotel, Bal Harbour, Miami Beach, Fla., May 9-11, 1960)

ABSTRACT: Using the Daisy Track at the Aeromedical Field Laboratory, Holloman Air Force Base, New Mexico, as a test facility, human volunteer subjects were exposed to forces of short duration while seated in the backward facing position. Subjects received from 50 G to 83 G without suffering any apparent permanent damage. Experimental parameters such as peak G, rate of onset of G and duration of G are given for several of these experiments. Subjective reaction to these various force level is discussed accompanied by pertinent comments on the influence on human tolerance of subject position and harness.

304

Beeding, E. L., Jr. 1961 HUMAN FORWARD FACING IMPACT TOLERANCE
J. of Aerospace Medicine 32(3):220, March 1961.

ABSTRACT: A total of fifteen human tests were done on the Daisy Decelerator in this series, in which the subjects experienced "eyeball out" decelerations. Force levels ranged from 30-40 G at rates of onset from 500-1100 G per second for total durations on the order of .075 seconds. The series was terminated at the 40 G level when a subject suffered three vertebral compression fractures. This series of experiments is discussed in detail and comments made as to possible causes of this rather low tolerance limit.

305

Beeding, E.L. 1961 HUMAN FORWARD FACING IMPACT TOLERANCES.
(Preprint of paper presented at 32nd Annual Aerospace Medical Association
Convention, Chicago, Ill., 24-27 Apr. 1961)

ABSTRACT: A series of tests with the subject seated in the forward facing (eye-balls out) position were conducted on the Daisy Decelerator in an effort to obtain tolerance data for this position. The tests were terminated when a subject suffered three vertebral compression fractures at a peak of 39.8 G.

CONCLUSIONS: 1) That human tolerance to forward facing decelerations lies above the 40 G level. 2) That testing in this position should be done with relatively loose shoulder straps, as suggested by Colonel Stapp's experience, in an effort to find this tolerance limit. 3) That the human can be considered, as engineers do, as a simple mass-spring system, but this consideration does not answer the question of human tolerance with regard to internal organs, as suggested by the heart difficulties (nodal rhythm) of the last subject described. (AUTHOR)

306

Beeding, E.L. 1961 HUMAN IMPACT STUDIES BEING CONDUCTED AT HOLLOMAN AFB,
NEW MEXICO
(Panel Discussion -- Symposium on Impact Acceleration Stress, Brooks AFB, Texas,
Nov. 27-29, 1961)

ABSTRACT: Present work is primarily designed to answer the vexing question of which factors should be considered in the prediction and establishment of end points. Methods being used in these investigations will be discussed.

As is always the case, adequate test equipment is prerequisite to the obtaining of finalized data. Equipment in use, being procured, and envisioned will be discussed.

An outline of the support being given to the Aeromedical Field Laboratory and other organizations in the form of advice and/or testing will be given.

A listing of key personnel at the Aeromedical Field Laboratory and of appropriate publications will be furnished.

307

Beeding, E.L., Jr. & J.E. Cook 1962 CORRELATION TESTS OF ANIMALS AND HUMANS
In Cragun, M.K., ed., The Fifth Stapp Automotive Crash and Field Demonstration
Conference, Sept. 14-16, 1961 (Minneapolis, Minnesota: University of
Minnesota, 1962) Pp. 125-129

ABSTRACT: Tests were conducted on swine, dogs, bears, and chimpanzees to determine the correlation between tests of animals and humans. The choice of test animal obviously depends on many factors--subject position, harness, size and weight limitations, test equipment available, need for performance decrement testing,

cost, etc. In general it can be concluded that: (a) Sophisticated test program requiring both performance and proper weight distribution--chimpanzee. He is an excellent composite subject for preceding man into a previously unexplored and potentially hazardous area. (b) Anatomical and physiological results sought--American Black Bear. (c) Small animal size dictated by test equipment--dog. (d) Swine--Isolated studies of various visceral components. As an example, specific studies of trauma to the liver or kidneys can be done.

308

Beeler, D. C. 1942 DATA ON ACCELERATIONS FOR MEDICAL RESEARCH.
(Memo Rept. for Aero Med. Lab., Wright Field (NACA, Langley Field, Va.)
23 July 1942

ABSTRACT: Discussion and series of graphs showing the time history curves of several aircraft during various maneuvers. Graphs were compiled from NACA flight tests from 1927 to 1942. A formula is given by which approximate time histories can be constructed for turns of various amounts performed at varying speeds and angles of bank.

309

Beeler, D. E. 1942 DATA ON ACCELERATIONS FOR MEDICAL RESEARCH.
(Aero Medical Research Laboratory Army Air Forces, Materiel Command)
ASTIA ATI 16 147.

SUMMARY: A series of graphs is given showing the time-history curves of accelerations of several airplanes during various maneuvers, namely, dive pull-outs, push-downs from level flight, pull-ups from level flight and 180° banked turns. The graphs have been compiled from a number of reports of flight tests conducted by the National Advisory Committee for Aeronautics at Langley Field, Virginia, during the period from 1927 to 1942.

The data of the 180° banked turns have been analyzed in some detail and a formula is given by which approximate time histories can be constructed for turns of various amounts performed at varying speeds and angles of banks.

310

Beer, M., R.M. Jayson, V.E. Carter, and F.H. Kresse 1961 SURVEY OF
ESCAPE TRAINING IN THE AIR FORCE. (USAF, Wright-Patterson AFB, Ohio)
WADC TR No. 60-792. ASTIA AD 255917.

ABSTRACT: The present state of the Air Force ejection training was studied and its contribution to the overall ejection problem was considered. Relevant information was obtained from the literature on ejection training, training films, aircrew personnel, aircrew personnel who have ejected, accident statistics, and escape training instructors. The results showed that ejection

training is inadequate in content and frequency. There is a lack of standardized regular training programs. Furthermore, training media, such as ejection seat trainers and films, leave much to be desired in both quantity and quality. Even more important, training to reduce fear of and anxiety about ejection is needed. In general, aircrew personnel "know" when to eject; but hesitate to take action because of an inadequate knowledge of procedures and an anxiety produced by unfamiliarity with the ejection experience. Ejection training in the Air Force is inadequate and needs to be improved. (Author)

311

Behague, P. and Mothon 1937 TROUBLES DE LA VISION LORS DES ACCELERATIONS DURANT LE VOL: "L'ANOPSIE DES AVIATEURS" (Visual disturbances following accelerations during flight: "Anopsia of aviators.")
Rev. neurol., 67:197-201, See also: Pr. Med. 45:752, 1937

ABSTRACT: The authors are concerned with "black vision" of aviators, a transient blindness occurring only with rapid variations in speed in either direction. High speed alone is not sufficient to produce the condition; the accelerations, most often negative, must be of the order of 5 to 6 g. at least, as below that nothing happens. The unit of acceleration of a free-falling body being 9.81 meters per second, it is necessary that the speed pass from zero to 49.05 or 58.86 m. per second (or better that it be reduced from this figure per sec.) to cause "black vision."

The authors quoted statements of six or more pilots. racers, or stunt fliers, who have experienced this condition. Close turns also cause it, and the authors stated that centrifugal force also is an element in the problem. They believe this anopsia of aviators is due to circulatory disturbance and cite the experiments conducted by Broca and Garsaux in centrifuging dogs. In order to produce their death it was necessary to have accelerations of 84 to 97 g., and at autopsy the mesenteric vessels were found distorted and dilated to the size of the little finger while the brain was exsanguinated.

The authors stated that as pilots they are going to continue their studies to determine whether the condition is one of cerebral ischemia or disturbance of the retinal circulation.

312

Behnke, A.R. 1947 CONCEPTS DERIVED FROM INVESTIGATIONS PERTAINING TO HIGH ALTITUDE FLIGHT.
The Journal of the American Medical Association, Vol. 133, No. 7, Feb. 15, 1947.

ABSTRACT: The paper is an enumeration of some of the concepts and conclusions derived from extended research programs of the National Research Council. The subjects include: selection tests and evaluation of performance, body composition, decompression, anoxia and respiration, acceleration, and protection against injury.

313

Behnke, A. R. 1950 TRAUMA DUE TO STRESS AND PHYSICAL AGENTS.
(Mimeographed paper, with references) 16 Sept. 1950.

ABSTRACT: The purpose of this paper is to provide physicians with authoritative references concerning the traumatic state induced by a variety of physical agents and conditions. An outline is made of the following subjects: inter-relationships, and common pathologic and functional derangements induced by various agents; tolerance limits and the range of compensation or adaptation in the face of the operative stress prior to injury; and preventive and therapeutic measures.

Preventive measures, remarkable often in their simplicity, as the protection against flash burns and crash injury, await application to decrease needless disability and death. Against many of the types of injury therapy is ineffectual or lacks specificity. On the other hand widely different stresses and physical agents induce similar gross physiologic and pathologic alterations. The treatment of the "shock state" whatever the cause requires preparation and materials that can be provided for well in advance by judicious planning. Meanwhile the search must continue to find the specific cellular and tissue changes that underlie definitive therapy.

314

Behr, K., L. Preber, & B. P. Silfverskiöld 1955 RECORDING OF THE SKIN RESISTANCE IN THERMAL AND ROTATORY STIMULATION OF THE LABYRINTH. Acta Psychiatrica et Neurologica (Scand.) 30(5):741-748

ABSTRACT: The present investigations were designed by graphic recording of the variations in skin resistance to throw further light on the nausea associated with sweating, etc., that may attend rotatory and thermal vestibular stimulation. A specially designed apparatus was employed for recording. About fifty patients were investigated.

Vertigo induced by slight rotatory stimulation (cupulometry) was sometimes accompanied by a fall in skin resistance that was difficult to distinguish from nonspecific falls due to emotional factors.

Thermal stimulation often, after a latent period of 2-3 minutes produced a pronounced fall in skin resistance coincidentally with nausea. The fall sometimes appeared without demonstrable sweating or other objective signs of nausea. The causes of this evidently characteristic fall in skin resistance are briefly discussed. The method employed here seems to be serviceable as a simple means of recording vegetative vestibular reactions. (AUTHOR)

315

Beischer, D.E. 1956 EFFECT OF SIMULATED FLIGHT STRESSES ON THE CONCENTRATION OF SERUM CHOLESTEROL, PHOSPHOLIPID AND LIPOPROTEIN
J. Aviat. Med. 27(3): 260-266

ABSTRACT: Summarizing the findings of other authors and the results of the present study, two interesting conclusions can be drawn. (1) No considerable increase of blood cholesterol could be observed under stress conditions likely to occur in routine flying. The main reaction was a slight continuous increase of blood cholesterol under the influence of some stresses. (2) The hypothesis of the general-adaptation-syndrome, introduced by Selye, proved to be only of limited help in the interpretation of the extended experimental material. In most cases the sequence of shock, countershock, and resistance phases could not be recognized in the form of noticeable changes of the blood cholesterol concentration. This experience demonstrates that the merits of a general principle cannot replace a careful experimental study of each single case of stress.

316

Beischer, D.E. 1958 LIVING MATTER UNDER HIGH GRAVITATIONAL STRESS.
(Paper, 1958 Meeting, The Biophysical Society, M.I.T., Cambridge, Mass., Feb. 5-7, 1958)

317

Beischer, D. E. 1958 POTENTIALITIES AND RAMIFICATIONS OF LIFE UNDER EXTREME ENVIRONMENTAL CONDITIONS
J. of Aviation Medicine 29(7):500-503, July 1958

ABSTRACT: When man ventures into space, he must take with him certain environmental conditions necessary for life. One factor essential to life is temperature. At low temperature, the rate of life's chemical reactions is too sluggish. At high temperature the protein of the enzyme molecules is irreversibly denatured. Other physical factors which assert an influence on the processes of life should be considered also, and the limitations of life under the influence of these forces collected and determined. Magnetic, electric, and gravitational forces are of great interest in this respect. Time, as a parameter of life, must also be investigated. Not only physical conditions but the chemical environment also exercises a deep influence on the potentialities of life.

318

Beischer, D. E., & A. R. Fregly 1962 ANIMALS AND MAN IN SPACE: A CHRONOLOGY AND ANNOTATED BIBLIOGRAPHY THRU THE YEAR 1960. (Naval School of Aviation Medicine, Pensacola, Fla.) ONR Rept. ACR-64; USNSAM Monograph 5, ASTIA AD-272 581.

ABSTRACT: A bibliography has been compiled of literature in the field of bio-astronautics. This work brings together for the first time a listing of all available reports relating to biological experiments conducted during balloon and rocket flights, with plants, animals, and humans as subjects. This compilation includes a listing of pertinent bibliographies, monographs, technical publications, and periodicals. Detailed tabulations are given of all known balloon and rocket flights, including such information as flight designation, location, type of experiment, experimental subjects, height, duration, success or failure, investigators, and cross-references to literature. A selective subject index is included, listing experimental material and giving cross-references to literature. Most of the citations are annotated. (AUTHOR)

319

Bell, H. S., 1962 SUMMARY AND EVALUATION OF USAF AIRCRAFT ACCIDENTS AND FATALITIES DURING THE PAST FIVE YEARS. (Paper presented at the Aerospace Med. Assoc. Conf., Atlantic City, N. J., 11 April 1962.)

ABSTRACT: A summary and evaluation of all USAF aircraft accidents for five years are reviewed. In addition, aspects of these accidents will be analyzed in terms of the cause factor, fatalities, major injuries, escape and survival. (Aerospace Med. 33(3):327, March 1962)

320

Bell, R.C. 1944 ANALYSIS OF 259 OF RECENT FLYING-BOMB CASUALTIES. British Medical Journal 2:689-692, 25 Nov. 1944.

ABSTRACT: This is an attempt to present a picture of the recent flying air-raids as seen in a small E.M.S. hospital. Those people admitted to the hospital required treatment that rest centers could not give. Air-raid casualties may be divided into two great groups: (1) those who require surgical treatment, and (2) those who do not. Those requiring surgery include the following cases: (1) flying glass; (2) bomb splinters; (3) blast; (4) falling masonry; and (5) burns. Those non-surgical cases included the following ones: (1) cases transferred from other hospitals and requiring food, clothes, and a wash. (2) crippled and infirm; (3) hysteria, fear, and other psychological states; (4) dust; (5) oil.

321

Belleville, R.E., F.H. Rohles, Jr., M.E. Grunzke & F.C. Clark 1960 COMPLEX AVOIDANCE BEHAVIOR IN THE CHIMPANZEE AND ITS APPLICABILITY TO THE STUDY OF SPACE ENVIRONMENTS. (AF Missile Development Center, Air Research and Development Command, Holloman AFB, New Mexico) AFMDC-TR-60-27. September 1960. ASTIA AD 245 444

ABSTRACT: This report describes the concurrent development of two types of avoidance behavior in the chimpanzee in which a discrete avoidance task was superimposed on a schedule requiring continuous avoidance behavior. The rationale for using these tasks for measuring the behavioral effects of space flight is presented.

322

Belleville, R. E., F. H. Rohles, Jr., and M. E. Grunzke 1961 BEHAVIOR OF THE CHIMPANZEE ON A COMPLEX MULTIPLE SCHEDULE (Air Force Missile Development Center, Holloman AFB, N. Mex.) Rept. no. AFMDC-TR- 61-27, Aug. 1961.

ABSTRACT: This report describes chimpanzee behavior on a four component, three lever multiple schedule. The component schedules included the Sidman avoidance procedure with a concurrent discriminated avoidance feature on a second lever; fixed ratio performance for food, differential reinforcement of low rate for water requiring a dual response chain, and a symbol discrimination task for continuous food reinforcement using three levers. The advantages of employing this type of schedule for evaluating the effects of exposure to space flight conditions are discussed.

323

Benchimol, R. 1952 THE HUMAN EYE AT HIGH SPEEDS.
Revista medica da aeronautica (Rio de Janeiro) 4(2):113-118

ABSTRACT: High altitude flight involves various problems concerning the human eye. In flight at supersonic speed, a compressed air wave precedes the plane, which disturbs visibility; any visual deficiency of the pilot would become aggravated during high-speed flight. In space flight, the vibration of the engine may have a certain inhibitory effect on visibility. - The delay in visual perception, i.e., the time between stimulation and perception, varies between 35 and 150 milli-seconds, and thus induces a latent scotomic perception period. This phenomenon may be responsible for certain accidents. - Another limiting factor of vision is the environmental temperature. When a plane is flying at 2000 miles per hour, the temperature on the surface of the plane is nearly 600 degrees C.; the human eye can tolerate 110 degrees C. for 23 minutes. - Visual tolerance in bailout has not yet been determined, but, above a speed of 530 miles per hour, the facial tissues are presumably liable to rupture. (ASTIA AD-227 817).

324

Bender, M.B. & F.H. O'Brien 1946 THE INFLUENCE OF BARBITURATE ON VARIOUS
FORMS OF NYSTAGMUS.
Amer. J. Ophthal. 29:1541

ABSTRACT: Intravenous injections of barbiturate (sodium amytal 0.5 gm.) produces in the normal individual: (a) coarse nystagmus and inability to maintain gaze on voluntary deviation of the eyes in any one direction, and (b) abolition of opticomotor nystagmus as elicited by rotation of a striped drum upon which the patient fixates. Intravenous injection of barbiturate also alters or decreases the nystagmus due to disease of the brain stem and abolishes such types of nystagmus as: (a) latent (b) positional (c) voluntary, and (d) various forms of so-called congenital nystagmus. Intravenous injection of barbiturate restored eye movements in patients with hysterical ocular palsies and temporarily corrected an ocular squint of unknown origin. It is suggested that barbiturate in mild doses interferes with ability to control eye movements and ocular fixation by its action on the cerebral cortex, brain stem, and intermediate neuronal structures. Eye movements which do not necessarily involve a cortical component might be altered by barbiturate as a result of its action on the brain stem.

325

Bendig, A. W. 1958 SUPPLEMENTAL BIBLIOGRAPHY ON SPACE MEDICINE
(Pittsburg Univ., Dept. of Psychology, Pittsburg, Pa.)

ABSTRACT: This bibliography contains references, particularly in the area of behaviorla sciences, that were omitted from the most recent and complete bibliography of articles on space medicine: C. Roos, Bibliography of Space Medicine.

326

Bending, G.C. 1959 SPATIAL DISORIENTATION IN JET AIRCREWS.
J. Aviation Med. 30(2):107-112.

COMMENT: These cases illustrate the seriousness of these problems and the value of a spatial disorientation indoctrination course in their management. On the threshold of space, it is certain that these and other problems will become more serious and more complex. A fresh, analytical attitude is essential if these and even more disturbing problems are to be recognized and solved.

327

Benes, P. and J. Schindler 1961 AVIATION TODAY AND TOMORROW. (SELECTED PARTS).
(Aerospace Technical Intelligence Center, Wright-Patterson AFB, Ohio)
Trans. no. MCL-938. ASTIA AD 261 788.

328

Benjamin, J.D. 1926 AN ANALYSIS OF AVIATION CRASHES,
U.S. Nav. M. Bull., 24:72-75

ABSTRACT: The cause of any crash should come under one of the following four headings: (1) faulty piloting; (2) mechanical; (3) unavoidable (collisions, weather conditions) and (4) unknown.

329

Benneche, R. A. 1948 PILOT EJECTION CAPSULE -- INVESTIGATION OF DESCENT CHARACTERISTICS.
(Consolidated Vultee Aircraft Corp., San Diego Div., Calif.)
Rept. No. ZA-115-004, June 1948. ASTIA ATI 54181

ABSTRACT: Investigation has been made to determine the descent characteristics of the pilot ejection capsule of the XF-92 fighter. This report is concerned with the magnitude of the limit release speed and terminal velocity. Release at very high speeds will subject the pilot to excessive decelerations. Assuming that six "g" is the maximum safe deceleration, the limit release speed is determined to occur between 400 and 700 mph IAS, depending on the point of attachment and reefing of the stabilizing parachute. Terminal velocity of the capsule has been estimated to be between 175 and 230 mph IAS, depending on the point of attachment of the unreefed chute. These speeds are greater than the 115 mph terminal velocity of the pilot (before opening chute); and the capsule should fall past him after he is out. The variation of pilot deceleration versus time for the escape patterns are plotted.

330

Bennett, C. V. & J. V. Burkhard 1957 A SUMMARY OF CRASH FIRE AND INJURY RATES IN HELICOPTER ACCIDENTS. (CAA Technical Development Center, Indianapolis, Indiana) Technical Development Report No. 313, June 1957.

331

Bennett, J. B. 1951 HAMMOCK-TYPE PLANE SEAT MAY PROVE CRASH SAFETY AID.
Technical Data Digest March 1951.

ABSTRACT: The entire seat swings freely between two large teardrop-shaped springs whose function is to absorb some of the shock of turbulence. The hammock is suspended from these springs which form the outer panels of the seat.

Back and bottom of the seat are formed by horizontal tubular members spaced by coil springs. The entire seat is covered by an easily removable cushion, while two coil springs hold the seat erect. Part of the frame forms a foot rest which moves with the seat.

Seat position is controlled by the passenger shifting his weight. But regardless of seat position, the passenger's center of gravity is always below the hammock's pivot point. Any sudden increase in g's which would come about as the result of a crash would cause the chair to flip backward, throwing the entire weight against the chair seat.

This feature puts the passenger in the position where he can stand the maximum impact load.

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Benson, A. J. 1959 EFFECT OF LABYRINTHINE STIMULATION ON REFLEX AND POSTURAL ACTIVITY IN GASTROCNEMIUS - SOLEUS MUSCLE GROUP IN MAN.
J. Physiol. (London) 146:37-38P

ABSTRACT: Changes in reflex activity and the integrated electromyogram of the gastrocnemius-soleus muscle group following a simple labyrinthine stimulus were examined in twenty-five normal subjects. The subject sat, knelt or lay on a turn-table which could be rotated in a horizontal plane. The head was upright or tilted forward some 30° and supported in position; opaque goggles were worn.

Deceleration of the turn-table from a constant angular velocity to rest in 0.5-1.0 sec was found to increase the amplitude of the repetitively elicited ankle jerk response. This facilitation was maximal in the first 2 sec after deceleration.

With the subject standing on the turn-table, electromyographic activity was recorded from the gastrocnemius soleus muscle group and integrated over 1 sec periods. After deceleration the pattern of increased activity was found to be similar to that of the myotatic reflex response. A functionally labyrinthectomized subject failed to show a corresponding change in the myotatic reflex response and only a small and comparatively brief increase in electromyographic activity was seen consequent to deceleration.

The monosynaptic response did not change significantly in amplitude with labyrinthine stimulation.

It is therefore concluded that in man the labyrinth exerts its influence on the somatic musculature via the γ efferent system rather than by a pathway acting directly upon the α motoneurons. The compensatory movement consequent to an angular acceleration in the horizontal plane would appear to be brought about by an asymmetrical increase in muscle tone rather than by a reciprocal pattern of activity in which it is increased on the one side and decreased on the other.

333

Benson, A.J. 1959 SOME EFFECTS OF ANGULAR ACCELERATION ON POSTURAL MECHANISM. (Paper, Aero Medical Association, Statler Hilton Hotel, Los Angeles, April 27-29, 1959)

ABSTRACT: Labyrinthine stimulation giving rise to inappropriate sensations is one mechanism of disorientation in flight; reflex movements of the limbs consequent to such labyrinthine stimulation may contribute to loss or impairment of control. In human subjects changes in stretch reflex excitability and in the integrated electromyogram of the gastrocnemius-soleus muscle group produced by a simple labyrinthine stimulus, were investigated. Deceleration from an angular velocity of 95° per second to 0° per second in 1 second, caused an increase in the amplitude of the ankle jerk response ranging from 50 to 400 per cent; this facilitation was maximal during the first 3 seconds and underwent a decay which did not follow a simple exponential law but showed subsidiary peaks of facilitation at intervals from 5 to 10 seconds. A similar pattern of activity was seen in the integrated electromyogram records. The magnitude of the initial peak was linearly related to the angular velocity of the turntable prior to deceleration, but differed according to the direction of rotation. Labyrinthine stimulation failed to alter the size of the electrically elicited H. reflex response. It is thus inferred that the labyrinth exerts its influence upon the somatic musculature via the γ efferent system acting on the muscle spindles rather than by the more direct pathway to the α motoneurons.

(J. Aviation Med. 30(3):175, March 1959)

334

Benson, A. J., J. L. Gedyne and G. M. Jones 1961 GENERALISED MUSCULAR TENSION IN A PILOT SUFFERING DISORIENTATION IN FLIGHT DUE TO A COVERT VESTIBULAR DISORDER.

(R.A.F. Institute of Aviation Medicine, Farnborough)

Memo No. 157:13p August 1961

335

Benson, A. J., & B. F. Tindall 1961 ACCEPTABILITY OF SPIN DURING STABILIZED FALL FOLLOWING EJECTION IN A FULLAND 4-G SEAT. (RAF, Institute of Aviation Medicine, Farnborough) FPRC Memo No. 169, Nov. 1961

ABSTRACT: A pattern of rotation (simulating that which subjects experience in the Fulland 4-g ejection system from about 38,000 feet) is investigated as it relates to nausea and vomiting. Twenty-eight subjects (11 aircrewmen, 1 experienced parachutist, and 16 laboratory staff members) were subjected to the simulated pattern in the laboratory on a turntable. All subjects kept their heads still during the experiment. None of the subjects vomited, four had symptoms of nausea--only two of these severe. Aircrewmen using this ejection seat system should be instructed to move their heads as little as possible during the angular motion. (J. Aerospace Medicine 33(11):1404, Nov. 1962)

336

Benson, A.J. and T.C.D. Whiteside 1961 THE EFFECT OF LINEAR ACCELERATION ON THE RESPONSE TO ANGULAR ACCELERATION IN MAN. J. Physiol. (London) 156(1):6P-7P, April 1961.

ABSTRACT: Eight subjects each experienced four runs (two near the center and two at the end on a human centrifuge wherein a reproducible rotational stimulus could be combined with different linear accelerations. It was observed that angular velocity of the slow phase of horizontal nystagmus rose during angular acceleration, then decayed exponentially. For this decay, the regression equation was calculated for each angular stimulus. The rate of decay of the nystagmus was significantly increased only in the presence of high linear acceleration (3.1 g). Possible explanations of this reduced response are presented briefly.

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Benson, A. J., et. al. 1961 GENERALISED MUSCULAR TENSION IN A PILOT SUFFERING DISORIENTATION IN FLIGHT DUE TO A COVERT VESTIBULAR DISORDER. (RAF Instit. of Aviat. Med., Farnborough) FPRC/Memo. 157. Aug. 1961.

338

Benson, O.O. 1941 EFFECTS OF CENTRIFUGAL FORCE ON POSTURE, VISION AND CONSCIOUSNESS. (Wright Air Development Ctr., Wright-Patterson AFB, Ohio) Memo Rept. EXP-M-54-653-41B; 6 Sept. 1941. ASTIA ATI 159 411

ABSTRACT: The purpose of this report is to summarize the available information on centrifugal forces as it affects the posture, vision and consciousness of airplane crew members. During the experiments it was found that the average trained young pilot sitting nearly erect has a "G" threshold of approximately 5 - 5.5 G when the stress is applied for 4 seconds. An extension of the time the force is applied disturbs the all important G-time relationship and lowers the force (G) value at which visual disturbances occur. Greater forces can be tolerated for 1-2 seconds without visual disturbance. The posture of the air crew members at the time the force is applied is very important in determining the blackout threshold. The prone position elevates the threshold whereas the erect position lowers it. The hydrostatic suit appears to raise the blackout thresholds considerably above those now considered within the normal physiological range.

339

Benson, Otis O., Jr. 1941 EFFECT OF CENTRIFUGAL FORCE ON POSTURE, VISION AND CONSCIOUSNESS AND APPENDIX I (Air Materiel Command, Engineering Div., Dayton, Ohio) Memorandum Report No. EXP-M-54-653-41B, 6 Sept. 1941. ASTIA ATI 159 411.

ABSTRACT: The average trained young pilot sitting nearly erect has a "G" threshold of approximately 5 - 5.5 G when the stress is applied for 4 seconds. An extension of the time the force is applied disturbs the all important G-time relationship and lowers the force (G) value at which visual disturbances occur. Greater forces can be tolerated for 1-2 seconds without visual disturbance.

The posture of the air crew members at the time the force is applied is very important in determining the blackout threshold. The prone position elevates the threshold whereas the erect position lowers it.

The hydrostatic suit appears to raise the blackout thresholds considerably above those now considered within the normal physiological range.

340

Benson, O.O., Jr. 1941 EFFECT OF CENTRIFUGAL FORCE ON POSTURE, VISION, AND CONSCIOUSNESS. (US AAF Exp. Engng. Sect.) Dept. Commerce PB No. 5112, 1946.

ABSTRACT: The posture of the air-crew members at the time the centrifugal force is applied is very important in determining the blackout threshold. The

average trained young pilot sitting nearly erect has a "G" threshold of approximately 5-5.5G when the stress is applied for 4 sec. An extension of the time force as applied disturbs the all-important G-time relationship and lowers the force (G) value at which visual disturbances occur. The hydrostatic suit appears to raise the blackout thresholds.

341

Benson, O. O., Jr. 1960 LECTURES IN AEROSPACE MEDICINE; INTRODUCTION.
In Lectures in Aerospace Medicine, 11-15 January 1960. (School of
Aviation Medicine, USAF Aerospace Medical Center (ATC), Brooks AFB,
Texas)

342

Benson, O. O., & H. Strughold, eds. 1960 PHYSICS AND MEDICINE OF THE
ATMOSPHERE AND SPACE (New York: John Wiley & Sons, 1960)

CONTENTS:

Strughold, H., & O. L. Ritter, The Gravitational Environment in Space;
Ehrlicke, K. A., Manned Orbital and Lunar Space Vehicles;
Chapman, D. R., Deceleration During Entry Into Planetary Atmosphere;
Gerathewohl, S. J., & J. E. Ward, Psychophysiology and Medical Studies of
Weightlessness;
Lovelace, W. R., II, and A. S. Crossfield, Biomedical Aspects of Orbital Flight;
Stapp, J. P., Human Tolerance to Accelerations of Space Flight;
Campbell, P. A., Introduction to the Problem of Escape and Rescue During
Space Operations;
Stanley, R. M., Escape at Launching and in the Atmosphere From a Space
Vehicle;
Mayo, A. M., Survival in Space. The Vehicle-Combined Requirements;
Strughold, H., Interplanetary Space Flight From the Viewpoint of the Physician

343

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

ABSTRACT: Twelve members of Underwater Demolition Team No. 21 used underwater breathing equipment while completely immersed in water for 18 hours. Their response to positive acceleration was determined by observing the G level at which the limitation of ocular motility under acceleration (LOMA) occurred.

This G level is approximately the same as when loss of peripheral vision or grey-out occurs when subjects are exposed to positive acceleration. The period of immersion was well-tolerated. A small but statistically significant decrease in the G level at which LOMA occurred was found following the period of immersion.
(Author)

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Benson, V. G., E. L. Beckman and K. R. Coburn 1961 EFFECTS OF PROLONGED TOTAL BODY WATER IMMERSION ON HUMAN TOLERANCE TO POSITIVE ACCELERATION
J. of Aerospace Medicine 32(3):220, March 1961.

ABSTRACT: Experimental data abailabel suggests that tolerance to the accelerations of space vehicle re-entry is decreased following a period of weightlessness. The weightless or zero "G" state encountered in orbital flight can be simulated in a laboratory to a degree by completely immersing the subject in water. A study of this nature was undertaken at the Aviation Medical Acceleration Laboratory, utilizing the assistance of twelve divers from the Underwater Demolition Team Number 21, Amphibious Forces, Atlantic Fleet. The tolerance to positive acceleration of these subjects was measured and mean values were determined prior to water immersion. All subjects were then totally immersed in water for a period of 18 hours. Their tolerance to positive acceleration was measured immediately after the period of water immersion and again after 24 hours recovery. With one exception, there was a decrease in tolerance to positive acceleration immediately following the period of water immersion. However, the magnitude of this decrement was within the range of daily variation in G tolerance of normal subjects.

345

Benton, M. 1958 EARTH SATELLITES, GUIDED MISSILES, ROCKETS, AND SPACE FLIGHT: A BIBLIOGRAPHY OF BOOKS AND PERIODICAL ARTICLES. Wilson Library Bulletin 32:412-419

ABSTRACT: An annotated list of selected publications covering the period 1936 to October 1957, with emphasis given to items of recent date.

346

Benton, Mildred 1958 THE LITERATURE OF SPACE SCIENCE AND EXPLORATION.
(Naval Research Laboratory, Washington, D. C.) NRL Bibliography No. 13.
ASTIA AD-210 057.

ABSTRACT: An annotated bibliography of 2274 references from 1903 to June 1958 on all aspects of space flight, rockets and satellites. Subject indexed.

347

Benzinger, Th. 1941 INJURIES TO HEALTH CAUSED BY FLYING - PART IV OF IV PARTS
(DAS FLIEGEN ALS URSACHE GESUNDHEITLICHER SCHADEN)
ASTIA ATI 62 305 Handbuch der inneren Medizin

ABSTRACT: The physiological and pathological effects of flight upon the health of flying personnel are discussed. It is stated that the so called "aviator's illness," supposedly caused by the effects of flying and hitherto considered a vocational disease, is nonexistent. The physiological effects of high-speed high-altitude flight, effect of centrifugal forces and acceleration, and exhaust gases on the human organism are considered. Pathological conditions occurring in flying personnel are altitude sickness, aeroembolism, kinetoses, and others caused by the effect of acceleration, cold, etc.

348

Benzinger, T., H. Doring, and W. Homberger 1941 PROTECTION OF FLYING
PERSONNEL AGAINST THE EFFECTS OF HIGH ALTITUDE FLYING. (Schutz Der
Flieger Gegen Die Wirkungen Gesteigerter Flughohen). ASTIA ATI-68 251.

349

Benzinger, T. 1943 PHYSIOLOGISCHE GRUNDLAGEN FUR BAU UND EINSATZ VON
STRATOSPHERENFLUGZEUGEN (Physiological Basis for the Construction and Use
of Stratosphere Airplanes) ASTIA ATI 76 122

350

Benzinger, T. 1951 CAUSES OF DEATH FROM BLAST.
Am. J. Physiol. 167:767

ABSTRACT: Arterial air embolism, induced by rupture of boundaries between alveolar spaces and alveolar capillaries, was shown on dogs to be the chief cause of death from blast in air as well as under water. Death from coronary air embolism ensues within 5 minutes. Cerebral air embolism results in a variety of focal symptoms, and may inflict death after 10-20 minutes. Air embolism artificially produced by injection of air into a pulmonary vein produces similar ECG changes, with similar time of survival, and similar post-mortem findings in the heart. The fatal outcome of arterial air embolism from both injection of air or blast effect may be retarded or prevented by instantaneously increasing the ambient pressure. The signs of cardiac anoxia disappear under such treatment, while the size of the emboli is reduced. The finding of arterial air circulation following blast throws light on some hitherto unexplained facts. Previous investigators had observed cardiac as well as cerebral anoxia as a consequence of blast injury. Its origin had remained unknown. Cerebral focal symptoms had been found when the head of an animal had been protected from the blast, while its trunk had been exposed. With the head exposed and the trunk shielded cerebral focal symptoms have not been ob-

served. Post-mortem findings had failed to explain why animals had died, and even more why they had died within a few minutes after a blast of a just fatal intensity. Colored slides from our test animals show air emboli in cardiac and cerebral arteries. The veins have never been affected. (The experiments described were carried out in 1942 and 1943 at the Aeromedical Department, German Air Force Testing Center, Rechlin, Germany, in collaboration with Dr. R. Rossle, Professor of Pathology, University of Berlin, Germany.)

351

Bergeret, P. and L. Gougerot 1939 EFFETS VESTIBULAIRES DES ACCELERATIONS CHEZ L'AVIATEUR (Vestibular Effects of Acceleration with the Pilot)
Travail humain (Paris) 7:1-26

ABSTRACT: A centrifuge of long radius was used for the test. Although the various circulatory disturbances in negative pressure are very marked in acceleration about head, we must not neglect the vestibular effects in particular, as there remain wide gaps in the experimental and practical studies of the latter. Special attention is drawn to the labyrinthine effects of acceleration, including the sensory impression, the muscular reflexes and vegetative reflexes. The authors base their conclusions on the findings of Broca, Ewald, Kleyn, Magnus, Schubert, Quix, Steinhausen, Leiri and Frenzel. Mathematical details of the vestibular stimuli at various inclinations of the head are plotted in curves in looping and rolling. These are purely mathematical deductions. As the physiologic reaction, the author uses not the sense of equilibrium but the motor sensation. Level accelerations are transmitted chiefly through deep sensibility, the labyrinthine activity remaining uncertain. In particular, the transmitting capacity of the vestibular apparatus is subject to dispute. The inferior and superior thresholds are not known.

Angular accelerations are definitely transmitted by the semicircular canals, their threshold limits being exceeded only in very abrupt flight figures.

Coriolis accelerations produce hallucinations which are most disturbing to the aviator and may cause vertigo. Whereas the vegetative reflexes of the smooth muscles have not been thoroughly studied, although of definite significance, the vegetative reflexes of the striate musculature are characterized by classical symptoms. For instance, the nystagmus and counter-movement of the eyes follow definite laws but have not hitherto been adequately studied in aviation. There are, however, also reflexes of the muscles of the neck, body and limbs of static and kinetic types which are well known in animals and which are dependent upon the labyrinth. Delabyrinthine cats no longer fall on their feet but fall like a bundle. In human subjects, the super-imposition of voluntary movements renders testing difficult, especially during flight. This study has been omitted also in parachute jumpers. Further studies on the reflexes of the extremities are of great importance. The author suggests the possibility that just as a black veil forms over the eye in ischemia, severe reactions of like nature may occur in the labyrinth which have probably been the cause of death of many an aviator.

352

Bergeret, P., P.M. Van Wulfften Palthe et al. 1957 AERONAUTICAL PREVENTIVE MEDICINE. PAPAERS PRESENTED AT THE SYMPOSIUM HELD BY THE AGARD AEROMEDICAL PANEL (Advisory Group for Aeronautical Research and Development, Paris) AGARDograph no. 36; Nov 1957, ASTIA AD-233 126

CONTENTS:

Aeronautical preventive medicine in the United States Air Force
Outline of USAF preventive medicine activities
Training in health education
Defense against special types of warfare
Aeronautical preventive medicine in the U.S. Navy
Hazards in air stations
Industrial hygiene program
Organisation de la medecine du travail dans les formations militaires et les etablissements industriel de l'aeronautique Francaise
Les grands principes de la loi sur la medecine du travail
Application de la loi sur la medecine du travail au Department de l'Air
The preservation of health and efficiency
Environmental conditions
Excessive noise
Psychological stresses
Design of equipment
The re-organisation of tasks
Training and selection
Aeromedical problems in operating all-weather aircraft; some Canadian observations
All-weather operations
Aeromedical problems
Preventive measures
Changes in elementary neuron activity produced by some neurotropic drugs

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Bergeret, P., Ed. 1961 AIRCRAFT ACCIDENT INVESTIGATION MANUAL FOR AIR SURGEONS (MANUEL D' ENQUETE SUR LES ACCIDNETS AERIENS A L' USAGE DES MEDECINS DE L' AVIATION).
(New York; Oxford; London; Paris: Pergamon Press, 1961)
ASTIA AD 272 690
NOTE: In English and French. Published for and on behalf of Advisory Group for Aeronautical Research and Development.

ABSTRACT: This manual discusses aircraft accidents in regard to injuries and their causes, investigation of accidents, pathology, and injury prevention. Chapter III considers etiological factors including physical and physiological aspects. (CARI)

354

Bergeret, P. 1961

BIO-ASSAY TECHNIQUES FOR HUMAN CENTRIFUGES AND PHYSIOLOGICAL EFFECTS OF ACCELERATION, (New York, London, Paris: Pergamon Press, 1961) AGARDograph No. 48. Oxford,

The papers discuss various aspects in the study of the human centrifuge and the physiological effects of acceleration.

355

Bergeret, P., ed. 1961 BIO-ASSAY TECHNIQUES FOR HUMAN CENTRIFUGES AND PHYSIOLOGICAL EFFECTS OF ACCELERATION. (London, New York, Paris: Pergamon Press, 1961) AGARDograph 48. ASTIA AD 261 880. Library of Congress Card No. 61 11545.

CONTENTS: The human centrifuge and its application to pilot selection; some recent definitions of the acceleration problem; a review of the physiological effects of angular accelerations; Human tolerance and limits to acceleration; Instrumentation and the human centrifuge; Centrifuge methods and techniques in the U.S. Navy; End points for acceleration tolerances on the centrifuge; A discussion on restraint and protection of the human experiencing the smooth and oscillating accelerations; The physiological effects of acceleration on respiration and protective measures; Effets des accelerations positives repetees de faible intensite et longue duree; Etude anatomique sur le rein de chien; Cardiovascular effects of forward acceleration; Host factors in resistance to acceleration stress; Interet et limites des recherches effectuees sur l'animal et sur l'homme au moyen des centrifugeuses; and Medical machine record cards--their development and use in the astronaut selection program.

356

Bergeret, P., ed. 1961 ESCAPE AND SURVIVAL: CLINICAL AND BIOLOGICAL PROBLEMS IN AERO SPACE MEDICINE. (London, New York, Paris: Pergamon Press, 1961) AGARDograph No. 52. ASTIA AD 261 881. Library of Congress Card No. 61-11 546.

CONTENTS:

Biological problems of escape at high altitudes, by H.L. Roxburg.
Escape from aircraft at high speeds and low altitudes, by F.G. Cumming.
Parachutist's spin problem, by O. Walchner.
Aspect medical des ejections pratiquees en France sur differents types de sieges ejectables, by J. Fabre.
Fundamental concepts in RCAF Arctic survival training, by S.E. Alexander and J.G. Fraser.
Aviation medicine consultation problem cases, by C.A. Berry.
Early diagnosis of hydrops of the labyrinth, by R.N. Kraus.
Therapy of spontaneous pneumothorax in RCAF flying personnel, by

357

C.N. Burgess and D.G.M. Nelson.
A brief survey of the role of elective surgery in a modern air force,
by J.W. Garraway.
The choice of gas mixture for breathing in high performance aircraft, by
J. Ernsting et al.

358

Berghaust, E., & W. Beller 1956 MICE AND MONKEYS, THEN MEN
In Satellite (New York: Hanover, 1956), pp. 155-166

359

Berghaust, E., & W. Beller 1956 SURVIVAL IN SPACE.
In Satellite (New York: Hanover, 1956), pp. 181-195

360

Bergin, K.G. 1949 AVIATION MEDICINE: ITS THEORY AND APPLICATION
(Baltimore: Williams & Wilkins, 1949)

361

Bergin, K.G. 1949 EFFECTS OF ACCELERATION ON MAN.
In his Aviation Medicine (Baltimore: Williams and Wilkins, 1949)
Pp. 109-115

362

Bergstedt, M. 1960 STUDIES OF POSITIONAL NYSTAGMUS IN THE HUMAN CENTRIFUGE
Acta Oto-Laryngologica (Stockholm) Supplementum 163, pp. 1-143
NOTE: Reel 7, Flash 6, Item 28

ABSTRACT: While making experimental studies into alcohol nystagmus the author, like others before him, noticed the strong connection between the phenomenon and the position of the head; the horizontal nystagmus being most pronounced when the head lay on its left or right side and completely absent when the head was supine. Moreover, this phenomenon could be repeated time and again with the greatest regularity, and this clearly suggested the connection between the position of the head and the direction of the gravitational field.

From previous studies of the subject literature the author was aware not only of the divided opinions over the release mechanism of positional nystagmus but also of the difficulties surrounding any attempt to show a relationship between the phenomenon and the receptor organ for gravitational stress.

It then struck the author that if, during the course of positional nystagmus tests, with the head in the side position, one were to vary the stress due to gravity -- and thus varied the stimulus for the appropriate receptor organ -- one could perhaps influence the intensity of the nystagmus. A search of the literature revealed no previous experiments based on this line of thought.

A pilot experiment, carried out with two students who were tested in a large centrifuge both before and after acute alcohol consumption, showed that while prior to the intake of alcohol no nystagmus arose, the nystagmus produced after consumption showed a variation in intensity strongly related to variations in gravitational stress. The hypothesis which led to the experiment was supported.

A closer experimental study of this relationship between positional nystagmus and gravitational stress followed. Alcohol nystagmus can be considered as a pathogenically specific form of nystagmus. In the beginning, these experiments on alcoholically intoxicated subjects were carried out under conditions which varied from case to case; later, these conditions were standardised. The studies were further broadened to include clinical cases of positional nystagmus and here experimental conditions were as standard as possible. These experiments, which were begun on February 19, 1957, are the subject of this thesis. (AUTHOR)

363

Bergstedt, M. 1961 THE EFFECT OF GRAVITATIONAL FORCE ON THE VESTIBULAR CALORIC TEST.

Acta Oto-laryngol. 53(6):551-562

ABSTRACT: Vestibular caloric tests were carried out on four subjects at 1 g, 1.25 g, 1.5 g and 1.8 g in a large centrifuge. The experiments showed that (1) vestibular caloric tests are influenced by the strength of the gravitational field; (2) the maximum intensity of nystagmus increases with higher values of g; (3) this increase is in direct proportion to the increase in the gravitational field strength; (4) the latency period decreases with higher values of g; (5) the results are the same with cold and hot water irrigation. It is also shown that the duration increases with higher g-values but the material relating to this factor is not complete. An extrapolation of the result towards values of g less than 1 tends to show that there is no nystagmus in conditions of weightlessness and that the liminal value for nystagmus is about 0.1 g. An investigation involving the caloric test and preponderance at higher g-loads is planned.

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Bergstedt, M. 1961 STUDIES OF POSITIONAL NYSTAGMUS IN THE HUMAN CENTRIFUGE.
Acta oto-laryngol. Suppl. 165

ABSTRACT: Research was planned to study positional nystagmus in man under the influence of the physical conditions obtained in a large centrifuge, using the technique of electronystagmography.

The central point was the question: does stimulation of the otolith organ, in the form of increased or decreased g-stress in a centrifuge, give rise to variations in either the intensity or direction of positional nystagmus in subjects who already evince positional nystagmus.

365

Bergstrom, O., & H. Koch 1956 THE EFFECT OF CHLORPROMAZINE ON THE VESTIBULAR FUNCTION. Acta oto-laryngologica (Stockholm) 46(6):484-498, Nov.-Dec. 1956

ABSTRACT: Administration of chlorpromazine generally produced a substantial prolongation of postrotatory nystagmus in guinea pigs and cats. In some animals total subsidence of postrotatory nystagmus was observed some time after injection, and this was usually preceded by a considerable prolongation. Both conditions were correlated to the degree of somnolence observed. Continuous chlorpromazine administration for relatively long periods had no effect on the vestibular apparatus. Administration by the intracarotid route and directed to the right half of the brain stem via the vertebral artery produced a typical intracarotid syndrome with torsion and sometimes spontaneous nystagmus. Chlorpromazine is shown to have a central effect on the vestibular function. The probability is discussed of the occurrence of a nystagmus inhibitor in the brain stem (reticular formation) and of the observed prolongations of postrotatory nystagmus being due to inactivation of that inhibitor by the administered chlorpromazine. (AUTHOR)

366

Beritashvili, I. S. 1962 REPORT ON SPACE ORIENTATION
FBIS USSR & East Europe, No. 23, Feb. 1, 1962

ABSTRACT: Physiologists and psychologists have long believed that skin and muscular stimuli play an important role in orientation in space. However, Academician I. S. Beritashvili, an outstanding 78-year old Soviet physiologist and author of more than 400 scientific works, has substantiated a different point of view: "The leading role in orientation in space is played by visual and vestibular stimuli, and in the absence of visual stimuli, by vestibular stimuli alone. The internal ear with its labyrinths and vestibular apparatus is the organ capable of feeling direction, the speed of movement, and even turns and distances. During losses of sight and hearing, the extremely sensitive vestibular apparatus, which is found in the internal ear of man and animals, supplies signals of the outer

world and helps man and animals orient in the surrounding environment.' I. S. Beritashvili generalized the results of his long observations and experiments in this field in another monograph, "On Nervous Mechanism of Spatial Orientation of Higher Vertebrates."

367

Beritov, I. S. 1959 THE MECHANISM OF SPATIAL ORIENTATION IN MAN
Pavlov J. Higher Nervous Activity 9:1-10

ABSTRACT: Man orients himself in space mainly through visual and labyrinthine receptors. Through the medium of these receptors, there is projection into the surroundings of all the objects which are perceived by other receptors—tactile, temperature, taste, and likewise olfactory and auditory.

Not only are images of the path traversed, with its projection in the surroundings, created in man through the agency of the vestibular analyser, but the positions of all the external objects in the surroundings, which the individual perceives during his actual passage along the path are similarly determined: as a result the power to make oriented movements is acquired.

Muscle-joint receptors do not play any essential part in spatial orientation as no images of the paths traversed are created by their stimulation. With repeated passage along the same path, however, the stimulations of these receptors, together with labyrinthine stimulations are converted into conditioned signals for certain movements and so lead to the formation of a chain conditioned reflex. This represents an oriented movement of a special kind, occurring automatically.

The deaf-mute individual with functioning labyrinths orients himself in space with his eyes covered just like the healthy individual. The deaf-mute with non-functioning labyrinths is incapable of orienting himself in space when the eyes are covered—is incapable of projecting objects perceived by him in the surroundings and of executing oriented movements in accordance therewith. With many repetitions, however, he can execute more or less oriented movements with covered eyes because of the conversion of proprioceptive stimulations into conditioned signals for certain movements.

The blind individual orients himself in space mainly through his labyrinthine receptors. This labyrinthine reception determines the location of external objects which the blind person perceives with other sense organs during his passage along a particular path. It in fact plays the essential part in the production of oriented movements.

368

Berkner, L.V., et al., Ramo, Simon ed. 1961 PEACETIME USES OF OUTER SPACE.
(New York; Toronto: McGraw-Hill, 1961)

369

Berman, L.J. 1961 OPTIMUM SOFT LANDING TRAJECTORIES. PART I. ANALYSIS.
(Air Force Office of Scientific Research, Air Research and Development
Command, Washington, D.C.) AFOSR519

ABSTRACT: A variational calculus solution is obtained for the thrust program for minimum propellant consumption to achieve landing of a rocket vehicle from a space orbit with zero relative velocity at touchdown, under the simplifying assumptions of no atmospheric forces and a uniform (i.e., flat-earth) gravitational field. These assumptions are appropriate for lunar landing of a moderately high thrust rocket. The results of the variational solution are interpreted to provide an appreciation of the physical nature of the requirements established by different initial conditions, as specified by initial conditions parametrically by an equivalent energy altitude and the actual altitude, five different regimes are identified and the corresponding thrust programs described.

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Berman, M.L. 1959. A PRELIMINARY REPORT ON QUANTITATIVE ESTIMATION OF A URINARY METABOLITE OF EPINEPHRINE AND NOREPINEPHRINE AS POSSIBLE INDICATOR OF TOLERANCE TO GRAVITATIONAL STRESS.
(Paper, Aero Medical Association Medical Association, Statler Hilton Hotel, Los Angeles, April 27-29, 1959)

ABSTRACT: 3-Methoxy-4-Hydroxy-D-Mandelic acid is a urinary metabolite of epinephrine and norepinephrine. To determine whether estimation of this compound might prove useful as indicator of gravitational stress, six human subjects rode the Air Force centrifuge at 6G forward acceleration for three minutes; periodic sampling of urine was made before and after acceleration. Determination of performed creatinine showed the rate of excretion of this substance to increase in four subjects immediately after acceleration, while in two subjects the creatinine rate dropped. Preliminary results from quantitative measurement of 3-methoxy-4-hydroxy-D mandelic acid by two dimensional paper partition chromatography suggest a rise in the metabolite immediately after acceleration and this rise is independent of the rate of excretion of creatinine. (J. Aviation Med. 30(3):175, March 1959)

371

Berman, M.L. 1959 QUANTITATIVE ESTIMATION OF URINARY METABOLITE OF ADRENALINE AND NORADRENALINE AS POSSIBLE INDICATION OF TOLERANCE TO GRAVITATIONAL STRESS. (Wright Air Development Center, Air Research and Development Command, Wright-Patterson AFB, Ohio)WADC TN 59-376
Nov. 1959. ASTIA AD 229 779

ABSTRACT: Using the method of two dimensional paper partition chromatography, a quantitative estimation of the urinary output of 3-methoxy-4-hydroxy-D-mandelic acid, a major catabolite of both adrenaline and noradrenaline, was determined in six human subjects before, during, and after exposure to a 6 G forward acceleration for three minutes.

The results showed that there was an increased rate output of this catabolite in the period just before acceleration which averaged 274 % over the pre-acceleration control level. In the period encompassing acceleration there was an average increase of 1128% over the control level ($P < .01$). The period following acceleration showed a drop to an excretion rate slightly below the pre-acceleration level and in the next period of sampling, the excretion rate returned to this level. These results indicate a correlation between the output of this metabolite and acceleration.

Preformed urinary creatinine excretion were not significant indicating that the changes in rate of output of 3-methoxy-4-hydroxy-D mandelic acid were independent of glomerular filtration rate.

372

Berrian, 1960 ASSISTANCE IN PRELIMINARY TESTING OF ACCELERATION
SUPPORT SYSTEM FOR PROJECT MERCURY CAPSULE AS REQUESTED BY NASA SPACE TASK
GROUP (SIG) (Naval Medical Research Institute, Bethesda, Md.) April 1960

373

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

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

374

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

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

375

Berry, C.A. 1958 THE ROLE OF PHYSICAL STANDARDS IN JET AND ROCKET
AIRCRAFT FLIGHT. J. Aviation Med. 29(9):631-640, Sept. 1958.

ABSTRACT: Complex modern weapons systems demand that the flight surgeon develop proper aircrew selection and maintenance programs to insure the greatest probability of successful human function. Physical standards attempt to provide personnel who will fly with increased safety, proficiency and longevity. Standards should offer some assurance of acceptable performance under the stresses of flying. Prior to establishing definite standards a good job analysis is needed to determine proper instruments or tests required. These must then be validated. Suggested tests for jet and rocket pilots which involve the cardiovascular, pulmonary, and neuropsychiatric systems, and weight, vision, and mixed stresses in the flying environment, have been discussed. Consideration was given to special requirements for space operations. It is important continually to review and revise the physical standards in the light of new knowledge, validity or the appearance of new tasks and equipments. In any case the role of physical standards in high performance aircraft, or space craft, is to insure that the candidate will not fail at his task "due to discoverable physical defect".

376

Berry, C.A., and A.H. King 1959 AEROMEDICAL PROBLEM CASES: THREE YEARS'
EXPERIENCE IN AVIATION MEDICINE CONSULTATION CENTER.
Aerospace Med. 30(11):806-815

ABSTRACT: To assist in evaluating problem aeromedical cases, three U.S. Air Force Aviation Medicine Consultant Centers were established. During the three-year period 1956 to 1958, these centers evaluated 1,159 cases, and recommended return to flying status in 51 per cent of the cases. The majority of the consultees had both conventional and jet aircraft experience with 68 per cent having between 500 and 4,000 hours. The recorded diagnoses are tabulated and discussed.

377

Berry, C.A. 1961 AVIATION MEDICINE CONSULTATION PROBLEM CASES.
In Bergeret, P., ed., Escape and Survival: Clinical and Biological Problems in Aero Space Medicine.
(London, New York, Paris: Pergamon Press, 1961)

378

Berry, Charles A., Howard A. Minners, Ernest P. McCutcheon, & Richard A. Pollard 1962

AEROMEDICAL ANALYSIS

In: Results of the Third United States Manned Orbital Space Flight, October 3, 1962.

(National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Texas) N63-11990. Pp. 23-36.

ABSTRACT: Astronaut Walter M. Schirra, Jr., incurred no detectable physiologic decrement during his spaceflight which included over 9 hours of weightlessness. His body functions since the flight have remained normal and unchanged from their healthy preflight condition. A variation of the astronaut's instantaneously observed heart-rate response was noted during flight. Immediately following recovery, an orthostatic rise in heart rate, accompanied by a fall in systolic blood pressure, was observed for a brief period. In-flight ionizing-radiation monitoring showed that the astronaut sustained no significant exposure.

379

Berry, F. B. & V. A. Stenbridge 1958 THE HUMAN ELEMENT IN AIRCRAFT ACCIDENTS. Ann. Surg. 147(5):590-595.

ABSTRACT: From the flight safety standpoint there are fewer but more frequently fatal aircraft accidents than in the past. The chief increase in the number of fatal accidents can be correlated with the high performance aircraft--flying higher and faster.

Currently, military medicine evaluates the human element in three major categories: 1) environmental factors 2) traumatic factors, and 3) pre-existing disease.

By taking the man out of his normal habitat he is subjected to a change in his environment. With the increase in altitude he has less oxygen and less pressure. Many times he is placed in a situation which is beyond his capabilities, involving mainly the special senses such as vestibular and visual perception. The vestibular intolerance results in vertigo or spatial disorientation. The traumatic events sustained in an aircraft accident often involve more than one lethal lesion and many observers do not deem it worthwhile to make an investigation. Nevertheless, the death may be the cause of the accident rather than the result. Pre-existing disease will become increasingly important in the jet age. Any condition that might produce death on the ground can also produce death in the air, and the most dramatic among these is the heart attack. The points demonstrate the necessity for closer medical supervision of the aircrew particularly as the newer jet propelled aircrafts are put into service.

Berry, F.B. 1960 "WHICH ERRING MEN CALL CHANCE".
Aerospace Med 31:91-100, February 1960

ABSTRACT: It is evident that "the increasing performances of modern aircraft give to flight safety a more and more important role in the responsibilities of the authorities concerned. In spite of the improvements and aeronautical techniques, the human element is still an essential feature in the operation of an aircraft and the origin of aircraft accidents." The greater the efforts for prevention for humans, appliances and structure, the less there will be "which erring men call chance."

Berry, M. R., Jr., B. T. Horton, & A. R. MacLean 1940 THE IMPORTANCE OF STUDY-
ING THE POSTURAL RESPONSES OF THE BLOOD PRESSURE AND THE HEART RATE, WITH A
NOTE ON THE METHOD OF TAKING THE BLOOD PRESSURE IN THE ERECT POSTURE. The
Medical Clinics of N. America 24(4):1095-1126, July 1940.
NOTE: Reel 7, Flash 7, Item 56

SUMMARY AND CONCLUSIONS: In this review of postural maladaptation, we have tried to present a working picture of the complex chain of mechanisms which allow man to walk instead of to crawl; to point out that postural maladaptations may occur in the presence of a variety of diseases which may affect any link of the postural adaptation chain and account for many symptoms; to stress the diagnostic value of the simple procedure involved in comparing the blood pressure and pulse rate with the patient in the recumbent and erect postures; and finally, we propose a simple method of taking the blood pressure when the patient is erect which obviates some of the errors which occur with vascular engorgement of the arm distal to the cuff. Sewall in 1919 stated the problem of the physician well: "In his examination of a patient the doctor is guided by his conception of the ratio of effort to use; necessity not luxury, determines his technic; the burden of a new method is intolerable unless it yields very practical results and fits easily into the routine of examination." We believe so strongly that comparison of blood pressure and pulse rates when the patient is in the erect and recumbent positions fulfills these requirements that two of us (MacLean & Horton) have advocated this procedure as a routine part of the general physical examination at The Mayo Clinic. We suggest the following procedure for recording the postural changes in blood pressure as a routine part of the physical examination: 1) After the general examination has been completed and while the results are being written, allow the patient to rest quietly for about five mins., lying supine on the examination table. 2) While the patient is supine, record the blood pressure rapidly 3 to 5 times, depending on the amount of fluctuation between the readings, and also record the pulse rate. 3) Ask the patient to stand quietly for one min. and then take the pulse rate. 4) Elevate the patient's arm above shoulder level until the veins collapse and then rapidly inflate the cuff. 5) Lower the patients' cubital fossa to the level of the heart. Clasp the subject's right hand between your right upper arm and thorax so that his forearm is horizontal at the level of the heart. Supporting the patient's elbow with the last 3 fingers of your right hand, clasp the stethoscope in place over the brachial artery with the right thumb and forefinger and take the blood pressure in the usual way. 6) In cases in which the examiner has reason to suspect latent postural maladaptation, the blood pressures and pulse rates with the patient standing should also be taken just after an exercise test. (AUTHOR)

382

Berus, W.J. 1961 DEVELOPMENT OF PERSONNEL PROTECTIVE SYSTEMS FOR SPACE FLIGHT AND EXPLORATION MISSIONS.
(B.F. Goodrich Aviation Products, Akron, Ohio) Contract NOw 61-0554-c
First Monthly Engineering Report, 18 May 1961 through 17 June 1961
ASTIA AD-293 056

ABSTRACT: The initial phase of this program has dealt with establishing a set of requirements or conditions the space suit must withstand. This has included cataloging crew activities and tasks in addition to classifying the hostile environment to be encountered.

383

Besco, R.O. 1961 THE EFFECTS OF COCKPIT VERTICAL ACCELERATIONS ON A SIMPLE PILOTED TRACKING TASK. (North American Aviation, Los Angeles, Calif.) Report No. NA-61-47, 13 April 1961.

384

Besco, R. O. 1961 THE EFFECTS OF COCKPIT VERTICAL ACCELERATIONS ON A SIMPLE PILOTED TRACKING TASK
Hum. Factors 3(4):229-236, Dec. 1961

ABSTRACT: The effects of vibratory, linear, and vertical accelerations on tracking errors during a one-dimensional, pitch tracking task were studied. Four experienced test pilots performed this compensatory tracking task on the "Pilot Operated Dynamic Flight Simulator"; motion (four levels), frequency (three levels), and amplitude (three levels) of the command signal were varied. The measure of performance was the root mean square error in pitch attitude. These data were examined by analysis of variance technique. Suggestions for future research were included. (Tufts)

385

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

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

386

Beyer, J.C. & A.A. Bezreh 1962 REVIEW AND FORECAST OF IMPACT STUDIES,
UNITED STATES ARMY
In Impact Acceleration Stress: Proceedings of a Symposium With a
Comprehensive Chronological Bibliography, (National Academy of Sciences,
National Research Council, Washington, D.C.) Publication No. 977. Pp. 17-20

ABSTRACT: During the past ten years, the Commission on Accidental Trauma of the Armed Forces Epidemiological Board has been sponsoring projects which fall roughly into the following areas: (1) Identification of major problems of accidental trauma within Armed Services. (2) Development of quantitative methods for analyzing causative factors in accidents and their control. (3) Determination of human factors problems relative to frequency of errors and injuries. (4) Application of human engineering principles to the design of equipment to increase operational efficiency and safety. (5) Development of personnel protective measures, and (6) Evaluation of program effectiveness. At the present time, the activities of this Commission have been somewhat curtailed.

Beginning in July 1959, the U.S. Army Medical Research and Development Command has been participating with the Transportation Corps in the support of the medical aspects of the overall Aviation Crash Injury Research program with the Flight Safety Foundation, Incorporated, at Phoenix, Arizona. This research in the field of Army aviation is concerned with the delethazing of the cockpit and aircraft cabin structures in order to prevent injury or death to the occupants of such aircraft when they are involved in survivable-type accidents.

387

Bezreh, A.A. 1961 ARMY EXPERIENCE WITH CRASH INJURIES AND PROTECTIVE EQUIPMENT
Paper: Symposium on Biomechanics of Body Restraint and Head Protection, Naval
Air Material Center, Philadelphia, Pa., June 14-15, 1961

ABSTRACT: Reports data representing some features of Army experience, as a user of light fixed wing aircraft and of helicopters, with respect to crash injuries and protective equipment. Because of the performance characteristics of Army aircraft such as relatively low speed, most accidents, approximately 97%, are theoretically survivable. However, far less accidents are actually survived. The development and incorporation of crashworthiness characteristics and improved personal protective equipment, therefore, is of crucial importance if the discrepancy between survivable and survived accidents is to be eliminated.

Some statistical findings are given which illustrate the effectiveness of items of personal protective equipment. Injury patterns are given with respect to injury severity, type, and location; and a comparison between fixed wing and rotary wing injury patterns reveals no striking differences, except that injuries incurred in helicopter accidents appear to have been somewhat more severe.

The dramatic effect of post-crash fire upon mortality is illustrated statistically. Although only 5.7% of all major accidents, both fixed and rotary wing, were complicated by post-crash fire, this relatively small percent of accidents accounted for 49.6% of all fatalities, pointing out the serious need for crash-resistant fuel systems.

388

Bezreh, Anthony A. 1963 HELICOPTER VERSUS FIXED WING CRASH INJURIES
Aerospace Medicine 34(1): 11-14, Jan 1963

ABSTRACT: The purpose of this presentation is to compare the crash injuries and some of the crash injury problems experienced by Army aviation in its fixed wing and in its rotary wing types of aircraft.

389

Bialecki, A. 1961 ANALIZA MOZLIWOSCI WYKORZYSTANIA EFEKTU GIROSKOPOWEGO ORBITALNEGO RUCHU CZASTEK ELEMENTARNYCH DO POMIARU PRĘDKOSCI KĄTOWEJ
(Analysis of the Possibility of Using the Effect of the Gyroscopic Orbital Movement of Elementary Particles for Measuring Angular Velocity)
Pomiary Automatyka Kontrola 6:386-391, 1960.
Palmer, J.W., Trans. (Royal Aircraft Establishment, Great Britain)
Library Trans. No. 971, Oct. 1961. ASTIA AD 268 268

ABSTRACT: The idea of a new instrument for measuring angular velocity within the limit of application of gyroscopic instruments is put forward. To make certain analogies, the gyrotion is shown as a mechanical system subject to returning oscillations under the action of the Coriolis force. An analysis was made of the motion of elementary particles on the circular orbit of an accelerator, after applying to it angular velocity of transfer as the input quantity. Formulae were obtained on the mean deviation of particles for the variants examined of the electron gyroscope and conclusions are drawn as to the suitability of the most accurate theoretical designs. An introductory scheme of a "gyro-accelerator" and considerations relative to the design should be treated solely as an indication of the trend of the investigations. (Author)

390

Bezreh, A. A. 1962 HELICOPTER VERSUS FIXED WING CRASH INJURIES, ARMY EXPERIENCE.
(Paper presented at the Aerospace Med. Assocn. Conf., Atlantic City, N. J., 11 April 1962).

ABSTRACT: A review of three years of Army aviation major accident data revealed more similarities than differences between crash injuries received in rotary wing and fixed wing types of aircraft. The same preponderance, namely 97% of the accidents in both types of aircraft were considered as survivable, although as many aviators were killed in survivable as in non-survivable accidents. There were twice as many injuries produced per accident in rotary wing crashes as there were in fixed wing crashes. When injury patterns were analyzed for injury location, injury type, and for the types of injuries causing death, it was found that rotary wing and fixed wing data paralleled each other remarkably closely. The same similarity appeared in the breakdown for agents of injury

causation. The head and upper and lower extremities were the most frequent body areas involved. Wounds, fractures, and burns were the prevalent types of pathology produced. The most common causes of death were head injuries, multiple extreme injuries, and burns and complications, while the major agents of injury causation were cockpit agents, fire, and decelerative forces. The important cockpit agents of injury causation were the instrument panel, windshield or bubble, and the control column, cyclic or collective stick. Thus, Army crash injury patterns are typical of those found from other sources of light aircraft accident data, in spite of the fact that over 50% of the Army aircraft inventory is rotary wing in type. Further discussion will be devoted to the astounding implications of post-crash fire and to the differences in the injuries attributable to pure decelerative forces in rotary wing and fixed wing aircraft. (Aerospace Med. 33(3):329, March 1962.)

391

Bidwell, J.B. Jan. 1959 VEHICLES AND DRIVERS --1980.
(Society of Automotive Engineers) Pre-print 125.

392

Bierman, E.O. 1959 TRAUMA FOLLOWING EJECTION FROM JET AIRCRAFT: A CASE REPORT
Am. J. Ophthalmol., 48(3, Part 1): 399, Sept. 1959

ABSTRACT: A 34-year-old man, ejected from a jet aircraft at approximately 18,000 ft. at a speed of over 600 miles per hour (0.9 the speed of sound), sustained a multiplicity of broken bones, subconjunctival hemorrhages, marked extravasation of the eyelids, and marked swelling of the face and lips. Examinations within a few hours after the accident and two months later revealed no damage to the eye itself.

393

Bierman, Howard R. 1945 DESIGN OF AN IMPACT DECELERATOR
(Naval Medical Research Institute, Bethesda, Md.)
Research Project X-630, Report No. 3, 30 Nov. 1945

ABSTRACT: An apparatus for applying an impact force to a human being through aircraft shoulder straps and seat belts has been devised. The impact forces are produced by the arresting of freely falling weights which are dropped through varying distances. The duration of the impact forces can be varied by the interposing of resilient materials between the falling weight and the arresting plate. The design of the seat permits alteration of the position of the subject relative to the direction of the impact force. Wire strain gages are used to indicate the magnitude, duration, and characteristics of the impact forces. The limitations of the apparatus include the following: (a) The position of the subject is normal. (b) The restraining mechanism rather than the individual is accelerated. (c) Visceral movement is restricted by the apparatus.

394

Bierman, H.R., & H.K. Hellems 1945 INCREASED PROTECTION TO IMPACT FORCES
BROUGHT ABOUT BY A LARGER AREA OF DISTRIBUTION.
(Naval Medical Research Institute, Bethesda, Md.) Rept. No. 3,
Project NM001006, 30 Nov. 1945.

395

Bierman, H.R. 1946 DESIGN OF AN IMPACT DECELERATOR
Science, 104:510-513

ABSTRACT: Describes an apparatus to simulate the magnitude and duration of a force experienced by an individual in an aircraft crash. This is accomplished by holding the individual in a seat by shoulder straps and seat belt and, at a given time, jerking these back against the body.

396

Bierman, H. R. 1946 HUMAN REACTIONS TO EXPERIMENTALLY INDUCED IMPACT FORCES.
California Medicine 65(4):149-152, Oct. 1946

ABSTRACT: The possibility exists of surviving high impact forces in crashes in military aircraft. 2) The magnitude and duration of a given force in part determines its effect upon the body. Increasing the area of distribution of a force reduces the untoward effects upon subjects. 3) Forces should be distributed to those areas of the body more capable of withstanding these forces. 4) The rate of loading bears a critical relationship to the tolerance of the subject to impact forces. 5) Small oscillations and irregularities in a force are disagreeable to subjects. 6) Force is the etiological agent of trauma, and as such requires much further investigation of a fundamental nature. (AUTHOR)

397

Bierman, H.R. 1946 A STUDY OF METHODS OF INTENTIONALLY CRASHING AIRCRAFT
WITH PURPOSE TOWARD THE SURVIVAL OF PERSONNEL.
(National Research Council, Washington, D.C.) CAM Rept. No. 496,
21 Feb. 1946.

398

Bierman, H.R., H.K. Hellems, & R.M. Wilder, Jr. 1946 PHYSIOLOGICAL
FINDINGS OF HUMANS UNDERGOING IMPACT FORCES.
(Naval Medical Research Institute, Bethesda, Md.) Research Project X-630

399

Bierman, H.R., H.K. Hellems, & R.M. Wilder, Jr. 1946 THE RATE OF LOADING OF IMPACT FORCES AND ITS RELATIONSHIP TO THE TOLERANCE OF THE HUMAN TO MAXIMAL LOADS. (Naval Medical Research Institute, Bethesda, Md.) Research Project X-630.

400

Bierman, H.R. & V. Larsen 1946 DISTRIBUTION OF IMPACT FORCES ON THE HUMAN THROUGH RESTRAINING DEVICES
Naval Medical Research Inst., Bethesda, Md. Proj. X-630, Rept. No. 4
March 21, 1946
NOTE: CARI P&S 4.24na

ABSTRACT: The distribution of impact pressures transmitted to the human body through the regulation shoulder straps and seat belt of aircraft has been investigated. The seat belt exerts a maximal impact pressure to the body at the umbilicus through the center of the belt. Maximal impact pressures are exerted by the shoulder straps to the body at the clavicular areas. An improved design of the present restraining devices in aircraft allowing a more equal distribution of the impact pressures on the body may permit increased tolerance to such pressures.

401

Bierman, H.R., & V.R. Larsen 1946 REACTIONS OF THE HUMAN TO IMPACT FORCES REVEALED BY HIGH SPEED MOTION PICTURE TECHNIQUE.
J. Aviation Med. 17(5):407-412.
See also (Naval Medical Research Institute, Bethesda, Md.) Project X-630 Report No. 5, 25 April 1946.
NOTE CARI P&S 2.13na

ABSTRACT: (1) The effects of impact upon human subjects on the impact decelerator were studied by high speed cinematography. The motion pictures were taken at a rate of 3000 frames a second, permitting the action to be slowed 125 times when projected at the standard rate of 24 frames per second. (2) Interpretation of these films has shown that the pilot's conventional shoulder straps elongate under impact load simultaneously with the shortening of the long axis of the body. This causes the straps to slide over the skin during the onset of the impact. Abrasions, contusions, and ecchymoses about the clavicular areas similar to those lesions seen in aircraft crash victims have been caused by the sliding action of the straps. (3) The widening of the transverse axis of the body has been observed during impact; injuries such as bone bruises, costochondral or ligamentous detachments, and hemorrhage into an abdominal rectus muscle may occur under maximal impact loads. (4) The compression of the body under a maximal impact load of 3500 pounds is estimated to be 5.5 centimeters. (5) With the seat free to rotate, rapid accelerations of the head and neck have been obtained and a temporary alteration of the facial contour has been observed during impact. (6) Various

forms of wave transmissions in the skin and underlying tissues have been observed during impact. These waves travel at a rate of 4 to 14 feet per second, depending upon the type of tissue in which the wave is located. A rapid fluid wave in the engorged external jugulars has been seen to occur immediately after the onset of the impact. (7) If one shoulder strap breaks during impact, its force is then shifted to the companion strap resulting in a twisting movement of the torso. (8) Alteration of the rate of increase of impact loading bears a critical relationship to the tolerance of the individual to such forces. Subjects usually prefer slower rates of loading rather than rapid applications of force. (DACO)

402

Bierman, H.R., et al. 1946 THE PRINCIPLES OF PROTECTION OF THE HUMAN BODY AS APPLIED IN A RESTRAINING HARNESS FOR AIRCRAFT PILOTS
Naval Medical Research Institute, Bethesda, Md. Proj X-630; Rept. No. 6,
10 May 1946
NOTE: CARI P&S 4.24na

ABSTRACT: A restraining harness for aircraft pilots has been developed which has successfully protected volunteers against 2500 foot-pounds delivered on the impact decelerator by dropping a 500 pound weight five feet. This impact force expended in 0.15 seconds on a dummy enclosed in a semi-rigid harness is featured by 10,000 pound peaks as measured by strain gages.

The factors which contribute to the effectiveness of this harness are:
(a) Distribution of the impact load over a large body area. (b) Distribution of the impact load to regions of the body best able to withstand high impact forces. (c) Gradual rate of application of force due to high initial elasticity of the material. (d) Damping of small irregularities during the period of impact. (e) The property of the material to elongate inelastically when the applied force reaches a predetermined tolerable limit, permitting the absorption of large amounts of energy.

403

Bierman, H.R., R.M. Wilder & H.K. Hellems 1946 THE PHYSIOLOGICAL EFFECT OF COMPRESSIVE FORCES ON THE TORSO. (Naval Medical Research Institute, Bethesda, Md.) Project X-630, Report No. 8, 19 Dec. 1946.

ABSTRACT: Biophysical technics have been utilized to study the effects of impact forces and of static loading on volunteers. These technics include the use of the electrocardiograph, thermocouple respirometer, and a photo-electric cell for determining ear pulse and ear opacity. Electrical wire strain gages were employed for pulse and pressure determinations. A static load of 550 pounds was applied to the anterior chest and abdomen of eight male volunteers by the use of traction on a vest type restraining harness. The results of 18 such loadings are reported.

Bierman, H. R. 1947 THE PROTECTION OF THE HUMAN BODY FROM IMPACT FORCES OF FATAL MAGNITUDE.

Mil. Surgeon, 100(2):125-141., Feb. 1947

ABSTRACT:

1. The protection of aircraft personnel in crashes up to 65 G's is a possibility. Many injuries and deaths in aircraft crashes may be caused by inadequate restraining devices.
2. Investigations on the impact decelerator have uncovered at least six fundamental principles which will diminish the effect of linear accelerative forces (impacts) upon the human. They are:
 - (a) Distribution of the impact force over a large body area.
 - (b) Distribution of the impact force to regions of the body best able to withstand high impact forces.
 - (c) Gradual rate of application of the impact.
 - (d) Damping of small irregularities during the period of impact.
 - (e) Small distances of movement in the same direction of the impact during the period in which the force would exceed the injury threshold.
 - (f) Maintenance of the force below the injury threshold at all times.
3. These principles have been incorporated into the construction of a vest-type harness of undrawn nylon and have effectively protected humans from maximal impact forces equivalent to 10,000 impact pounds on a wooden dummy with the conventional harness.
4. Parachute riser straps of the same material have effectively reduced decelerations of 54 G's to 6 G's on a wooden dummy. Volunteers free falling distances of 15 feet were decelerated in less than 0.2 second yet experienced only 6 G's.
5. The principle of reducing impact forces below the damaging threshold by small distances of controlled movement can be applied to prevent injuries in many types of accidents due to rapid acceleration or deceleration.

Bierman, H.R., R.M. Wilder and H.K. Hellems 1947 PROTECTION OF THE HUMAN BODY. PRINCIPLES AS APPLIED IN A RESTRAINING HARNESS FOR AIRCRAFT PILOTS. J.A.M.A. 133(8):522-526, Feb. 22, 1947.

ABSTRACT:

1. A restraining harness for aircraft pilots has been enclosed in a semi-rigid harness is featured by 10,000 pound peaks as measured by strain gages.
2. The factors which contribute to the effectiveness of this harness are:
 - (a) distribution of the impact load over a large body area; (b) distribution of the impact load to regions of the body best able to withstand high impact forces; (c) gradual rate of application of force due to high initial elasticity of the material; (d) dampening out of small irregularities during the period of impact, and (e) the property of the material to elongate inelastically when the applied force reaches a predetermined tolerable limit, permitting the absorption of large amounts of energy.

The principles outlined in this report may be applied to protection against many other types of large accelerative forces that may be encountered.

406

Bierman, H.R. 1948 A STUDY OF METHODS OF INTENTIONALLY CRASHING
AIRCRAFT WITH PURPOSE TOWARD THE SURVIVAL OF PERSONNEL.
J. Aviation Med., 19(4):238-252, Aug. 1948.

ABSTRACT: Three pilots who are experienced in intentionally crashing aircraft for the motion picture industries were interviewed to gain information concerning the performance of nonfatal aircraft crashes.

407

Bierman, H.R. 1949 TEST AND EVALUATION OF EXPERIMENTAL HARNESS
UNDER CONTROLLED CRASH CONDITIONS.
(Naval Medical Research Institute, Bethesda, Md.) Proj. X-630,
Rept. No. 11, 10 Apr. 1949.

408

Billingham, J. 1958 SPACE MEDICINE
Nature (London) 182(4650):1645-1646, Dec. 13, 1958

ABSTRACT: Reviews the first symposium on space medicine in Great Britain, held in London, October 16 and 17, 1958. Among papers presented were: Consequences of Weightlessness (M. P. Lansberg), Impairment of Human Performance in Control (K. F. Jackson), and Effects of Sensory Impoverishment, Confinement, and Deprivation of Sleep (C. Cunningham).

409

Billings, C.E. and W.F. Ashe 1962 THE MEDICAL ASPECTS OF BUSINESS AVIATION
(Ohio State Univ. Research Foundation, Columbus) OSU-RF-1260-2, Contract
no. FA-2192, June 30, 1962

410

Billington, I.J. E.Eggmann, B.C. Stonehill & J.C. Lafrance 1961 THE
ROTATING ARM FACILITY FOR HIGH SPEED LOW DENSITY AERODYNAMIC STUDIES.
(Institute of Aerophysics, University of Toronto) UTIA Report No. 77.
Oct. 1961. ASTIA AD 275 831.

ABSTRACT: The feasibility and usefulness of a rotating arm facility for aerodynamic studies at low density has been studied. Structure of the arm itself appears to be the most critical aspect of the design of such a facility. A theory for optimum arm design is outlined and a number of design charts based on this theory are presented.

This study suggests that it is mechanically feasible to construct a rotating arm facility with a capability of Mach numbers up to about 8 over a range of pressure levels encompassing most of the low density flow regimes of interest. Although somewhat higher Mach numbers are theoretically possible, justification of the attendant increase in facility size and cost.

Based on the theory and design data of this report, facilities with maximum capabilities of 4000 and 8000 ft/sec respectively are discussed. It is concluded that a facility of the 4000 ft/sec class could be designed by direct application of the present analysis. For the higher speed facility, however, analytical investigation and probably some related engineering development work would appear necessary. (Author)

411

Billington, I. J., E. Eggmann, B. C. Stonehill, & J. C. Lafrance 1962 THE ROTATING ARM FACILITY FOR HIGH SPEED LOW DENSITY AERODYNAMIC STUDIES. (Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio) Contract AF 33(616)-6990; Project 7064; Task 70169; ARL EXHIBIT 62-300; Jan. 1962

ABSTRACT: The feasibility and usefulness of a rotating arm facility for aerodynamic studies at low density has been studied. Structure of the arm itself appears to be the most critical aspect of the design of such a facility. A theory for optimum arm design is outlined and a number of design charts based on this theory are presented.

This study suggests that it is mechanically feasible to construct a rotating arm facility with a capability of Mach numbers up to about 8 over a range of pressure levels encompassing most of the low density flow regimes of interest. Although somewhat higher Mach numbers are theoretically possible, justification of the attendant increase in facility size and cost appears doubtful. Based on the theory and design data of this report, facilities with maximum capabilities of 4000 and 8000 ft/sec respectively are discussed. It is concluded that a facility of the 4000 ft/sec class could be designed by direct application of the present analysis. For the higher speed facility, however, analytical investigation and probably some related engineering development work would appear necessary. (AUTHOR)

412

Bingel, A. 1948 FIAT REVIEW OF GERMAN SCIENCE 1939 - 1946
PSYCHIATRY - XVI - PSYCHIATRY IN AIR FORCE MEDICINE
(Wiesbaden: FIAT, 1948). Pp. 276-288

413

Bingham, W.W. 1962 A RATIONAL METHOD OF DETERMINING AIRPLANE DECELERATION FORCES DURING ABNORMAL LANDING CONDITIONS.
(Boeing Co., Seattle, Washington) July 1962.

414

Biot, M.A. & R.L. Bisplinghoff 1944 DYNAMIC LOADS ON AIRPLANE STRUCTURES. DURING LANDING. (National Advisory Committee for Aeronautics, Wash., D.C.) NACA ARR No. 4H10, October 1944

ABSTRACT: The application of transient theory to the rational determination of dynamic loads on airplane structures during initial landing impact is discussed. Simplified procedures are described by which the distribution of the maximum attainable value of the dynamic stresses in the structure may be obtained. Illustrations of the procedure are given by numerical examples for the case of airplane wings. This indicates approximate orders of magnitude to be expected in a typical problem. The validity of the underlying simplifications and assumptions is discussed. A brief outline of the general mathematical theory of transients in undamped elastic system is presented.

415

Bird, J. W., C. C. Wunder, N. Sandler & C. H. Dodge 1963 ANALYSIS OF MUSCULAR DEVELOPMENT OF MICE AT HIGH GRAVITY.
Amer. J. Physiol. 204:523-526, March 1963.

416

Birren, J. 1945 STATIC EQUILIBRIUM AND VESTIBULAR FUNCTION.
J. Exp. Psychol. 35:127-133.

SUMMARY: Observations of body-sway and rail-walking test were made on a 19 year old male who had lost all VIII nerve functions (vestibular) following an attack of acute meningococcus meningitis. The existence of the vestibular defect was established by complete absence of response to the caloric and Barany Chair tests.

This S manifested marked body sway during the first trial period. He did, however, maintain his balance standing erect with eyes open and with eyes closed. One month later this S displayed improvement in his postural control so that the record would not be categorized as pathological. During neither of the sessions could the S score above zero on the rail-walking test.

Postrotational nystagmus time and body-sway measurements were made on 45 male Ss. None of the correlation coefficients obtained between body-sway measurements, eyes open or closed, and nystagmus time were significantly greater than zero.

The findings of this study are interpreted as indicating that man may maintain stable posture despite loss of vestibular function, and that measurements of body sway cannot be used to detect vestibular defects. Postural defects may occur following the loss of vestibular functions, but the defect is soon compensated for. The lack of correlation between postrotational nystagmus time and body sway is further indication of the lack of complete dependence of posture on vestibular functions, or at least on those functions reflected in nystagmus. Superficially it would seem that body-sway measurements were indicative of the adequacy of integration by the cerebellum of sensory cues arriving from many sources, among which those from the labyrinth are not the most important.

417

Birren, J.E., & M.B. Fisher 1945 FURTHER STUDIES ON THE PREDICTION
OF SUSCEPTIBILITY TO SEASICKNESS BY A MOTION SICKNESS QUESTIONNAIRE.
(Naval Medical Research Institute, Bethesda, Md.)
Research Project X-278, Rept. No. 6, 8 Oct. 1945.

418

Birren, J.E. 1949 MOTION SICKNESS: ITS PSYCHOLOGICAL ASPECTS.
In Committee on Undersea Warfare, National Research Council, Washington,
D.C., Human Factors In Undersea Warfare.

419

Bjurstedt, H. MEASUREMENT OF O₂ SATURATION OF ARTERIAL BLOOD IN
THE HUMAN DURING PROLONGED ACCELERATION. (Karolinska Inst., Sweden)
Project 7220(805A), Contract AF 61(052)-153; MRM, AMRL

ABSTRACT: This work effort involves the measurement of oxygen and carbon dioxide exchange in subjects exposed to prolonged accelerations (positive) and (transverse) and specifically, the measurement of oxygen saturation of the arterial blood, as well as concentrations of oxygen and carbon dioxide in the alveolar air. The techniques and experimental data obtained should be applicable to the establishment of objective physiologic indices of human tolerance of accelerations in various vectors.

420

Bjurstedt, Hilding 1958 EFFECTS OF PROLONGED EXPOSURE TO POSITIVE G LOADINGS ON THE PULMONARY GAS EXCHANGE. (Reports from the Lab of Avn and Naval Med., Karolinska Institutet, Stockholm. British Interplanetary Society, Symposium on Space Medicine, London, 16-17 Oct. 1958)
J. Brit. Interplanet. Soc., 17(9):288-289, May-June 1960

ABSTRACT: The results of subjecting anaesthetized dogs to prolonged g forces in the head-to-tail direction are reported. In spite of the fact that the animals were hyperventilating and breathing 100% oxygen, hyperoxaemia was found; this is attributed to disturbances of ventilation and perfusion in the lungs. It was not clear why marked alkalosis was also present.

421

Bjurstedt, H., L. E. Hansson, & G. Strom 1958 ELECTROCARDIOGRAPHIC, HEART-RATE AND SUBJECTIVE RESPONSES TO PROLONGED GRAVITATIONAL STRESS IN RELATION TO SOME DIMENSIONAL AND FUNCTIONAL PARAMETERS OF THE CIRCULATORY SYSTEM. (Reports from the Lab of Avn and Naval Med., Karolinska Institutet, Stockholm, Dec. 1958) Acta Physiol. Scand. 47:97-108, 1959

ABSTRACT: Heart-rate and ECG (including 5 precordial leads) responses were studied in 16 healthy subjects during up to 6 min exposure to 3-3½ times the force of gravity in a human centrifuge. The subjective g tolerance (resistance to kinning or loss of vision) was determined in relation to various circulatory functional and dimensional parameters. The ECG did not show any remarkable alterations during or after the runs. Subjective g tolerance was correlated to orthostatic heart-rate (produced by normal gravity) but not to heart-rate response under increased gravitational stress, physical working capacity, heart volume in the horizontal or vertical body position, or total hemoglobin.

422

Bjurstedt, H. 1960 MEASUREMENT OF O₂ SATURATION OF ARTERIAL BLOOD IN THE HUMAN DURING PROLONGED ACCELERATION.
(Karolinska Inst., Sweden) Contract AF 61(052)-153; Project 7220(805)

ABSTRACT: This research involves the measurements of the O₂ and CO₂ exchange in human subjects during positive acceleration - specifically measurement of the O₂ in alveolar air.

423

Black, A.N., D.G. Christopherson, and S. Zuckerman 1942 FRACTURES
OF THE HEAD AND FEET. (Ministry of Home Security, Oxford, England)
Rept. RC-334, 12 Aug. 1942.

424

Black-Schaffer, B., & G.T. Hensley 1960 PROTECTION AGAINST ACCELERATION BY
IMMERSION DURING HYPOTHERMIC SUSPENDED ANIMATION.
A.M.A. Archives of Pathology 69(5):499-505, May 1960.

ABSTRACT: When baby mice eight to twelve days old in hypothermic suspended animation are centrifuged, the mechanical effects of acceleration upon the tissues are readily separated from the effects upon function, such as respiration, cardiovascular dynamics, and metabolism. Under these circumstances the highly effective protection against acceleration by immersion, to the limits of the apparatus used (ca. 2,700g), are readily demonstrated. Immersion during acceleration introduces a new mechanical factor, hydrostatic pressure. Temperature changes may under given conditions reinforce or reduce the physiologic effects of pressure. Under the experimental conditions, a pressure up to 10 minutes of approximately 10 kg./sq. cm. at 4 to 8 degrees C. is successfully tolerated. When this is prolonged for 15 or more minutes, it is lethal. It is shown that when immersed, the mice can be protected against an accelerative stress, which, when translated into rectilinear velocity, would, at the end of 15 minutes, impart a constant speed of about 23,500 km. per second (14,500 miles/sec.). At such constant velocity a relativistic time dilation of 1 per cent would occur. (Authors)

425

Black-Schaffer, B., G. T. Hensley, & L. R. Simson 1961 PROTECTION OF
THE ADULT MOUSE AGAINST 1800 G ACCELERATION BY HYPOTHERMIC IMMERSION
Aerospace Medicine 32(12):1119-1126, Dec. 1961.

ABSTRACT: Deep hypothermia combined with immersion was used to protect adult mice against 15 min. of 1,800 g. The method was described in detail. After spinning, the mice, while being warmed, were subjected to positive pressure respiration with pure oxygen. After recovery of spontaneous respiration the mice were necropsied and selected tissues were fixed and sectioned for histopathologic examination. The results were tabulated and discussed in detail. (Tufts)

426

Black-Schaffer, B., 1962 PROTECTION BY DEEP HYPOTHERMIA AND IMMERSION
AGAINST 2300 G ACCELERATION OF A NON-HIBERNATOR (RAT) AND A HIBERNATOR
(HAMSTER). Aerospace Med., 33(3):286-296, March 1962.

ABSTRACT: A true hibernator, the adult hamster, can be protected against a spin of 2300 G of 30 minutes duration while in deep hypothermia and immersed in a fluid of specific gravity equal to its own, at a temperature of 0° to 10°C.

The adult rat, non-hibernator, can also be protected under the same circumstances, but does not permanently survive more than 5 minutes of the largely compensated 2300 G accelerative stress, despite a total period of deep hypothermia of as little as 50 minutes.

The immediate anatomic cause of death in the revived rats is a prominent congestive gastroenteropathy which does not affect the large bowel. It is suggested that this lesion is a consequence of autodigestion of the mucosa by gastric and pancreatic proteolytic enzymes.

In our experience, the same lesion is regularly found in rats revived after 90 or more minutes of deep hypothermia without any other stress, and rarely in rats revived within 70 or fewer minutes.

It is suggested that the circulatory stasis of deep hypothermia impairs the normal protective devices of the enteric mucosa, and the hydrostatic pressure of the spin accelerates the proteolysis sufficiently to overcome, in a shorter time, these impaired defenses.

The recirculation of blood through large areas of severely injured enteric mucosa must result in the absorption of water soluble substances which ordinarily are not absorbed. It is proposed that these, whether gram negative endotoxins, peptones, or other substances, elicit the irreversible shock to which the revived rats succumb. (Author)

427

Blagonravov, A.A. 1960 THE JOURNEY OF 'OTVAZHNAVA'
Pravda p. 4, 5 July 1960.

ABSTRACT: News article quoting academician Blagonravov. Discusses geophysical rockets and biological apparatus and payloads. "The size of the payload lifted by the rocket makes it possible to make careful biological research, a preliminary step in preparing for flight by a man. In recent experiments we have received new data in respect to muscle tone under conditions of weightlessness." (CARI)

428

Blakemore, C. 1940 VISUAL COMPLICATIONS OF HIGH-SPEED FLYING.
Tr. Ophth. Soc., (Australia) 2:28-33

ABSTRACT: The visual complications that may occur fall roughly into two groups: (a) sudden transient blindness, or some modification thereof, with or without a train of cerebral symptoms, such as fainting, coma, etc., (b) retinal and subconjunctival hemorrhages. One of these two groups the former not only is met with more frequently but is the more important. This type of transient blindness is known colloquially as a "black-out". A "black-out" may occur in an individual if, while flying, sufficient corticofugal centrifugal force is created and provided always the exposure to this force is of sufficient duration. The "black-out," however, does not come on immediately; an individual is subjected to the effects of a suitable centrifugal force, but there is a latent period which varies in length in different individuals. This latent period is followed by a period of complete blindness, after which sudden recovery takes place.

The experimental evidence appears to suggest that the "black-out" threshold is reached when a corticofugal centrifugal force of from 4.5 to 5 is applied for from 5 to 15 seconds. Resistance to "black-out" conditions can be increased by constant flying practice, but the tolerance established is very limited and depends on (a) individual idiosyncrasy, and)b) conditioning of the blood-vascular system to the sudden onset of centrifugal force.

429

Blanchard, W. & S. Bondurant et al 1958 SUBJECTIVE EFFECTS OF TRANSVERSE ACCELERATIONS ON SUBJECTS IMMersed IN WATER
(Paper, 1958 Meeting of Aero Medical Association, Statler Hotel, Washington, March 24-26)

ABSTRACT: To explore the acceleration protection offered by complete submersion in water forty-six centrifuge runs were made on four human subjects*lying flat in a water filled container. Compressed air for respiration was supplied through an aqua-lung valve positioned to maintain a balance between endotracheal pressure and extrathoracic pressure. In each run the subjects were held at peak G for 15 to 55 seconds, after which their subjective impressions were recorded. The tolerance to chest to back G (supine) was limited by increasingly severe substernal pain. The onset of this pain occurred at an average level of 4.1 G with the maximum tolerable level being about 7G. In the prone position (back to chest G) the chest pain did not appear at the same levels noted above but the absolute limit of tolerance was not determined due to difficulties with respiration and chest buoyancy. In contrast to the unimmersed situation all subjects noted a feeling of weightlessness with freedom of limb and head movement. These preliminary experiments do not indicate any marked gain in transverse G tolerance due to water immersion.

430

Blanchard, U.J. 1960 LANDING-IMPACT CHARACTERISTICS OF LOAD-ALLEVIATING STRUTS ON A MODEL OF A WINGED SPACE VEHICLE
(National Aeronautics and Space Administration, Washington, D.C.)
NASA TN D-541, Oct. 1960. ASTIA AD 244 504.

ABSTRACT: The landing-impact characteristics of a 1/9-scale dynamic model of a winged space vehicle were investigated. The tests were made by catapulting a free model onto a hard-surface runway and onto water. The model had a conical fuselage and a flat-plate wing with a basic delta platform and 75° sweep-back of the leading edge. The use of yielding metal shock absorbers and various landing-gear arrangements was investigated during landing impact. The basic landing gear consisted of a dual rubber-tired nose wheel and twin main skids aft of the center of gravity near the wing tips. Landing motion and acceleration data were obtained over a range of landing attitudes, gross weights, and initial sinking speeds. Brief tests were made with an alternate nose-wheel location. An all-skid configuration also was briefly evaluated for hard-surface and water landings. The landing gear employing yielding struts for impact-energy absorption during hard-surface landings resulted in accelerations of approximately $5\frac{1}{2}g$ near the nose gear over a range of landing parameters. Replacing the nose wheel and tire with a skid did not significantly change the accelerations. Landings in smooth water with rigid struts and adequate planing area at the nose skid resulted in a maximum landing acceleration of approximately 4g. (Author)

431

Blanchard, W. G. 1961 THE EFFECTS OF FORWARD ACCELERATION ON RESPIRATION.
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. 96-100.

ABSTRACT: Respiratory embarrassment has previously been found to limit human tolerance to prolonged transverse acceleration. Various aspects of the respiratory abnormalities engendered by headward and traverse acceleration have been studied. Quantitative measurements have been made of the degree of respiratory impairment, and roentgenographic study made of the abnormal intrathoracic organ relationships. These experimental results and roentgenograms are reviewed, and their implications discussed.

432

Blasingama, B.P., et al., ed., Brown, K. and L.D. Ely 1962 SPACE LOGISTICS ENGINEERING. (New York, Wiley, 1962)

433

Bledsoe, Margaret D., Otto Bussemaker, and William E. Cummins 1961 SEAKEEPING
TRIALS ON THREE DUTCH DESTROYERS. (David Taylor Model Basin, Washington D.C.)
Rept. no. 1559. ASTIA AD-269 311.

ABSTRACT: The results are presented of destroyer trials conducted under the joint sponsorship of the Royal Netherlands and United States Navies. Three destroyers of different types participated in the trials. The purpose was to obtain sufficient data for evaluating their relative seakeeping ability when operating parallel in the same seaway. Motions, stresses, accelerations, and slamming pressures were measured for a series of speeds and headings in 2 different sea conditions to obtain a representative picture of the behavior of the ships. While the sea was not recorded, photographs were taken and an attempt was made to reconstruct the sea state from hindcasts. With the exception of slamming, a statistical approach was used in the analysis of a parameter E which defines the behavior of the double amplitudes. In the slamming analysis, pressures and the increased vibratory stresses are noted and an attempt was made to derive the impact pressure theoretically for one slamming condition. All results are presented in the form of plots and for completeness many are also recorded in tabular form. (Author)

434

Blocker, T. G., Jr., V. Blocker, J. E. Graham and H. Jacobson 1959 FOLLOW-
UP MEDICAL SURVEY OF THE TEXAS CITY DISASTER.
American J. Surgery 97:604-623, May 1959
NOTE: Reel 7, Flash 7, Item 13

ABSTRACT: The medical follow-up examinations of the Texas City disaster patients demonstrated the same general pattern as in the original survey conducted in 1947 except for an increase in multiple injuries of all kinds, the prominence of functional complaints which contributed greatly to the periods of disability and suggested both real and assumed psychic trauma residua, and the absence of presumptive evidence of internal blast injury. It was noted that minor injuries to soft tissue has healed well with a minimum of cosmetic disfigurement. The majority of eardrum perforations were associated with subjective hearing impairment, and even without gross evidence of deafness there were varying degrees of permanent nerve-type deafness, as determined by audiogram. In reviewing the fractures a large number of deformities were found, often in association with major injury to soft tissue and accounting for delay in recovery of the majority of patients who were disabled beyond an arbitrary three-month period. Patients with severe penetrating injuries to the eye did poorly, as might be expected; those with mild injuries to the eye, on the other hand, showed good recovery. (CARI)

435

Bloom, Aaron 1961 DEVELOPMENT OF SYNTHETIC HUMAN SKULLS FOR TESTING IN CRASH INJURY EXPERIMENTS
(Paper, Symposium on Biomechanics of Body Restraint and Head Protection, Naval Air Material Center, Philadelphia, Pa., June 14-15, 1961)

ABSTRACT: Concurrent with the development of a crash injury protection helmet, it appeared that it would be of considerable aid to the Engineering Department at Sierra Engineering Co. to have certain physiological information related to the effects of impact loading on the human skull.

A moderately concentrated literature search indicated there was little quantitative data which one might use as criteria for selecting materials of construction and energy absorption in helmet development.

Even though it is known that a considerable amount of work has been done by many able investigators using live skulls and human cadavers for impact studies as related to crash injury, it was felt that a synthetic skull would allow repetitive testing under controlled conditions which would afford quantitative statistical analysis of crash injury protective materials.

The subject of this paper is related to the development of material which can readily by conventional techniques, be molded into an intricate shape of the human skull and maintain the same physical characteristics of human bone. Further, this paper will show the results of the subject development.

436

Bloschies, H.H. 1960 LOW SPEED WIND TUNNEL TEST EJECTION OF .042 SIZE FSU-1 DYNAMIC MODELS OF THE NAVY INTEGRATED FLIGHT CAPSULE.
(Chance Vought Aircraft Inc., Dallas, Texas) Rept. No. EOR-12652, Wind Tunnel Rept. No. 84, 11-18 Jan. 1960. ASTIA AD 263 496L

ABSTRACT: The test objective was to pictorially demonstrate the capsule stability of a .042 size capsule at several speeds, angles of attack, and angles of yaw. These models all had the same configuration which was -9 fins with extended chord $St_e + -10^\circ$ and $I + 57.5^\circ$

437

Boaz, C.W. 1961 A BASIC INVESTIGATION OF CONTROLLABLE THRUST DEVICES FOR ESCAPE FROM SPACE VEHICLES. (Frankford Arsenal, Philadelphia, Pa.) Rept. No. R-1547; (Wright Air Development Division, Wright-Patterson AFB, Ohio) WADD TR 60-348, Jan. 1961. ASTIA AD 256-851.

ABSTRACT: The control of thrust form propellant actuated devices (PAD's) used for escape from space vehicles was investigated. Repetitive start-stop operations and control or thrust rate and direction were considered for gaseous, liquid, solid, and mechanical systems, with respect to the problems of operating in the environmental zone bounded by altitudes of 75,000 and 300,000 ft. Of the

various methods studied for controlling thrust rate, hydraulic or pneumatic systems are the least difficult; control in liquid propellant systems, which give a uniform, reliable, fixed-type performance, offer good possibilities for control through design of the solid propellant charges. So far as the operation of escape mechanisms is concerned, the problems introduced by environmental conditions between 75,000 and 300,000 ft were found to differ only slightly from the problems common at lower altitudes. Vacuum effects, ozone concentration, and temperature were the chief factors considered. (Author)

438

Bock, A. V., D. B. Dill, & H. T. Edwards 1930 ON THE RELATION OF CHANGES IN BLOOD VELOCITY AND VOLUME FLOW OF BLOOD TO CHANGE OF POSTURE. J. Clin. Invest. 8:533-544

NOTE: Reel 7, Flash 7, Item 60

SUMMARY: Estimations of the least circulation time as measured by reaction to histamine indicate a retardation of the velocity of blood flow in the standing position in man. The authors believe this fact supports previous experimental evidence showing a reduction of the total output of the heart when the subject stands still. (AUTHOR)

439

Bock, G. 1955 ORGANIZATION AND STATUS OF DEVELOPMENT OF AERONAUTICAL TECHNIQUE IN THE SOVIET UNION.
(Lecture given at Bonn, 1955)
(Royal Aircraft Establishment, Farnborough) R.A.E. Translation No. 557.

440

Bodner, S.R., & P.S. Symonds 1960 PLASTIC DEFORMATIONS IN IMPACT AND IMPULSIVE LOADING OF BEAMS. (Division of Applied Mathematics, Brown University, Providence, R.I.) ONR Contract 562-10 NR 064-406, TR No. 61, March 1960.

441

Bodó, G. 1961 APPROACH TO THE GENERATION CENTRE OF NYSTAGMUS ALTERNANS BY MEANS OF DRUG TESTS. Acta Otolaryngol. 53:328-332

ABSTRACT: Barbiturates and chlorpromazine stop nystagmus alternans temporarily. During the time of action of the barbiturate nystagmus can be elicited in the patient by caloric stimulation, whereas during the action of chlorpromazine there is no caloric reaction. From these observations the conclusion can be drawn that the generation centre of the nystagmus alternans is above the primary vestibular reflex arch.

442

Boeing Company. 1962 DYNA-SOAR EJECTION SEAT AND SURVIVAL SYSTEM
(Boeing Co., Seattle, Washington) Contract AF 33(657)-7132.
ASTIA AD 282 004L

ABSTRACT: Military requirements, specifications, and design are given for the Dyna-Soar ejection seat and survival system.

443

Boes, A. 1957 BIBLIOGRAPHY OF RESEARCH REPORTS AND PUBLICATIONS
ISSUED BY THE BIOACOUSTIC BRANCH (1947-1957) (Wright Air
Development Center, Aero Medical Lab., Wright-Patterson AFB, Ohio)

444

Boies, L.R. 1957 OTOLOGICAL ASPECTS OF CRASH INJURIES
JAMA 163(4): Jan. 26, 1957.

ABSTRACT: Impairments of hearing and disturbances of equilibrium can prevent normal performance of the automobile driver. Applicants for licensure who have an obvious hearing handicap or who give a history of vertigo should be examined by a physician in order to determine the extent of the disorder and to decide whether they are competent to drive.

445

Boland, J.D. and A.D. Grinstead 1951 COMPARISON OF SCOPOLAMINE HYDROBROMIDE
AND DRAMAMINE IN THE TREATMENT AND PREVENTION OF AIRSICKNESS.
J. Aviation Med., 22(2):137-145

ABSTRACT: Previous studies have shown the value of scopolamine hydrobromide in the prevention and treatment of airsickness, and of dramamine in the prevention of seasickness. This study was conducted to determine the effectiveness of dramamine in the case of airsickness, with scopolamine hydrobromide as a criterion group of fifty were given a standard dose of scopolamine and an experimental group of fifty were given identical appearing capsules containing a standard dose of dramamine. The two groups were taken in roughly random order as they reported to the flight surgeon for help, and no subject knew what medication was being used.

If a student eventually discontinued treatment and was able to continue flight training without further airsickness in the primary and basic phase of his training, he was classed as a successful case. Others were recorded as failures. Follow-up contacts were made to obtain an accurate record of success or failure in each case.

Such imbalance of known factors as chanced to occur between the two groups was found, if anything, to foreordain that the criterion group (on scopolamine) would respond the more readily, other things being equal. However, the subjects in the experimental group (on dramamine) responded with equal success.

446

Bonaretti, T. & A. Guida 1959 CONSIDERAZIONI SUL NISTAGMO OTTOCINETICO STUDIATE CON ACCORGIMENTI PARTICOLARI E L'IMPIEGO DI FARMACI (CONSIDERATIONS OF THE OPTOKINETIC NYSTAGMUS STUDIED WITH SPECIFIC STIMULI AND UNDER THE INFLUENCE OF DRUGS)

Archivio di Psicologia Neurologia e Psichiatria (Milano), 20 (2-3): 111-155, March-June 1959 (In Italian, with English summary)

ABSTRACT: The optokinetic nystagmus was investigated in order to determine the extent to which it may be influenced by variations in the level of attention or by pharmaceutical agents. Results indicate that the level of attention has a twofold influence on the nystagmus by exciting the nystagmogenous structures closely associated with vigilance mechanisms and by controlling the nystagmographic phases (slow phase lengthened, short phase inhibited). An evaluation of pharmaceutical compounds tested on basis of their effect on nystagmus was made. The depressants exhibited the strongest influence under the most passive experimental condition. Experimental conditions requiring active participation on the subject's part were more resistant to depressants. Comparison of the two stimuli showed that optokinetic nystagmus evoked by cylinder is less resistant to drug effect, due to lesser stimulative properties and a premature exhaustion of the powers of concentration.

447

Bonas, W. and M.J. Reilly 1955 THAT FIRST, LONG STEP--PROBLEMS OF AIR-CREW ESCAPE. Society of Automotive Engineers Preprint 430, Jan. 1955.

ABSTRACT: Escape by parachute, ejection seat and escape capsules. Influence on man of slipstream, wind blast, and centrifugal and deceleration forces.

448

Bond, A. C. and A. B. Kehlet 1960 REMARKS ON THE STATUS OF PROJECT MERCURY

(North Atlantic Treaty Organisation, Advisory Group for Aeronautical Research and Development, Paris, France)

Rept. 290 October 1960 ASTIA AD 263 709

SUMMARY: A broad overall review of the initial program of the United States for manned orbital flight, Project Mercury, is presented in the light of

experience gained in the two years since its initiation. The basic Mercury guidelines and design concepts are discussed, along with the implementation undertaken for man's introduction to space flight. The space capsule and some of its primary systems are described in conjunction with the mission and its requirements. Status of the flight-test program and some aspects of current operational plans are also covered. The role of the astronaut and his contribution to the achievement of the scientific objectives of Project Mercury are also discussed.

449

Bond, A.C. 1961 MERCURY SPACECRAFT SYSTEMS
In National Aeronautics and Space Administration, Proceedings of a
Conference on Results of the First U.S. Manned Suborbital Space Flight,
June 6, 1961. Pp. 11-18.

450

Bond, D.D. 1943 A STUDY OF THE EMOTIONAL FACTORS INVOLVED IN A GROUP
OF THIRTY NAVIGATION CADETS IN THE PROCESS OF ELIMINATION FOR SEVERE
AIRSICKNESS. (National Research Council, Washington, D.C.)
C.A.M. Repts. No. 147 and 158, April 1943

451

Bond, D.D. 1943 PSYCHIATRIC ANALYSIS OF FORTY SUBJECTS MADE SICK BY
A SWING. (USAF School of Aviation Medicine, Randolph AFB, Texas)
Proj. No. 149(1), July 1943

452

Bondurant, S.D., N.P. Clarke, S.D. Leverett, & P. Yudkofsky 1957 PHYSIOLOGICAL
RESPONSES TO "BACK-TO-CHEST" G-FORCES ON SEATED HUMAN SUBJECTS.
(Second European Congress of Aviation Medicine, Stockholm, Sept. 1957)

453

Bondurant, S. 1958 EFFECT OF ACCELERATION ON PULMONARY COMPLIANCE
Fed. Proc. 17(1 pt. 1):18 March, 1958.

ABSTRACT: Pulmonary compliance was found to decrease significantly in 5
subjects during acceleration on a human centrifuge for 30 seconds at 3 and

3.5 g in the foot-head direction, and at 4 and 5 g in the back-chest direction. The functional residual capacity of the lung increased in both cases but the increase was not great enough to account for the change in compliance.

454

Bondurant, S., W.G. Blanchard, N.P. Clarke, & F. Moore 1958 EFFECT OF WATER IMMERSION ON HUMAN TOLERANCE TO FORWARD AND BACKWARD ACCELERATION. (Wright Air Development Ctr., Wright-Patterson AFB, Ohio) WADC TR 58-290. ASTIA AD 155 808

ABSTRACT: Accepted physical principles suggest that immersion of subjects in water should constitute effective protection against some of the effects of acceleration. This premise has been evaluated in a study of the duration of tolerance of immersed subjects to forward accelerations of 6 through 14 g. Respiration was maintained by the use of skin diver's breathing equipment. With proper positioning, acceleration time tolerances were observed which were in excess of twice any previously reported. (Author)

455

Bondurant, S., W.G. Blanchard, N.P. Clarke, & F. Moore 1958 EFFECT OF WATER IMMERSION ON HUMAN TOLERANCE TO FORWARD AND BACKWARD ACCELERATION. J. Aviation Med. 29(12):872-878
See also (Wright-Patterson AFB, Ohio) WADC TR 58-290, 1958.
ASTIA AD 155 808

ABSTRACT: To determine the magnitude of protection and technical problems associated with acceleration of subjects immersed in water, subjects were studied under the following conditions: 1) five subjects erect position, 25 accelerations in the forward position; 2) same as 1) but accelerations were in a backward position; and 3) six subjects, spine tilted forward at a 35 degree angle. The results are discussed in terms of magnitude and duration of tolerance, limitations such as chest pain, dyspnea, and blackout, the effectiveness of various breathing masks, e.g., full face, and semi-face (eyes uncovered), and respiratory rate.

456

Bondurant, S., N.P. Clarke, W.G. Blanchard, H. Miller, R.R. Hessberg, Jr., & E.P. Hiatt 1958 HUMAN TOLERANCE TO SOME OF THE ACCELERATIONS ANTICIPATED IN SPACE FLIGHT. (Wright Air Development Ctr., Wright-Patterson AFB, Ohio) WADC TR 58-156, ASTIA AD 151 172
See also U.S. Armed Forces Med. J. 9:1093-1105. Aug. 1958.

ABSTRACT: Selected studies of human tolerance to the linear accelerations which are anticipated in space flight have been reviewed. As defined in these studies tolerance limit is determined by the loss of a critical faculty, i.e., ability to see, think, or exercise at least finger control. Tolerance times at g levels between 2 and 12 in various body positions are presented. The capacity of subjects to stand repeated peaks of acceleration similar to those encountered in multistage rocket vehicles has been explored. Tolerance times longer than any previously reported are obtained by immersion of the subject in water in the semi-supine position.

457

Bondurant, S. & W.A. Finney 1958 THE SPATIAL VECTORCARDIOGRAM DURING ACCELERATION. (Wright Air Development Ctr., Wright-Patterson AFB, Ohio) WADC TR 58-263 June 1958.
See also J. Aviation Med. 29(10):758-762 1958.

ABSTRACT: Spatial vectorcardiograms and standard electrocardiograms have been recorded during several patterns of positive, negative and transverse acceleration. Positive acceleration resulted in tachycardia, occasional auricular and ventricular extrasystoles inconsistent and variable increases in the QRS-T angle and open QRS loops. There were no consistent changes in the initial portions of the QRS loops nor in the orientation of these loops. Positive acceleration can be tolerated for considerably longer periods without evidence of cardiac disability than previously recognized. Transverse accelerations in back to chest or chest to back direction result in vectorcardiographic changes in similar to but less marked than those of positive acceleration. Seated back to chest G of large magnitude is associated with tachycardia which may exceed 180-190. Negative accelerations result in brachycardia and occasional sinus pauses but essentially no changes in the spatial vectorcardiogram were recorded

458

Bondurant, S., & W.A. Finney 1958 THE SPATIAL VECTORCARDIOGRAM DURING ACCELERATION. J. Aviation Med. 29(10):758-762, June 1958.
See also Wright Air Development Center, Wright-Patterson AFB, Ohio) WADC TR 58-263. ASTIA AD 155 653

ABSTRACT: Spatial vectorcardiograms and standard electrocardiograms have been recorded during several patterns of positive, negative and transverse acceleration. Positive acceleration resulted in tachycardia, occasional

auricular and ventricular extrasystoles, inconsistent and variable increases in the QRS-T angle and open QRS loops. There were no consistent changes in the initial portions of the QRS loops nor in the orientation of these loops. Positive acceleration can be tolerated for considerably longer periods without evidence of cardiac disability than previously recognized. Transverse accelerations in back to chest or chest to back direction result in vectorcardiographic changes similar to but less marked than those of positive acceleration. Seated back to chest G of large magnitude is associated with tachycardia which may exceed 180-190. Negative accelerations, result in brachycardia and occasional sinus pauses, but essentially no changes in the spatial vectorcardiogram were recorded.

459

Bondurant, S. 1961 TRANSVERSE G. PROLONGED FORWARD, BACKWARD, AND LATERAL ACCELERATION. In Gauer, O.H. & G.D. Zuidema, eds., Gravitational Stress in Aerospace Medicine (Boston: Little, Brown, and Co., 1961) Pp. 150-159

460

Bondurant, S. 1961 STRAINING MANEUVERS WHICH INCREASE TOLERANCE TO HEADWARD ACCELERATION. In Gauer, O.H. & G.D. Zuidema, Gravitational Stress in Aerospace Medicine (Boston: Little, Brown, and Co., 1961) Pp. 221-223

461

Bonner, R. H. 1957 THE EFFECTS OF STRESS ON UROPEPSIN EXCRETION. (Wright Air Development Ctr., Wright-Patterson AFB, Ohio)
WADC TN 57-427. ASTIA AD-142 256

ABSTRACT: The effect was investigated of various forms of stress, as encountered in certain AF operational situations, on uropepsin excretion in urine. Twenty-three subjects were tested under conditions of prolonged positive G, crew confinement, exposure to high temperature-high altitude, and visual and auditory deprivation. Volumes, specific gravities, and collection times were recorded for the urine samples taken from the crew. The assay method of M. L. Anson (J. Gen. Physiol. 22:79, 1938) was used with some modification. The order of adding reagents was shown to be significant in developing color to reflect the degree of uropepsin excretion. An attempt was made to determine which proteolytic enzyme was being measured. The greatest activity was observed at pH 1.5 which is optimum for pepsin, indicating that pepsin was the enzyme being measured. The results showed that uropepsin excretion increased before the application of specific simulated flight stresses and decreased during the application of specific simulated flight stress. Deprivation of visual and auditory stimuli did not produce any significant change in uropepsin excretion from pretest levels.

462

Borgard, W. 1935 UBER DAS VERHALTEN DES KREISLAUFS BEI PLOTZLICHER RUCKKEHR VOM UNTERDRUCK ZUM NORMALDRUCK. BEITRAG ZUR PATHOPHYSIOLOGIE DES STURZFLUGES (Concerning the Behavior of the Blood Circulation During Sudden Return from Sub-Atmospheric Pressure to Normal Pressure. Contribution to the Pathophysiology of the Diving Flight) Klinische Wochenschrift (Berlin) 14: 198-200.

463

Borges, H. F. 1963 ANALYSIS OF ADVANCED TRACK PERFORMANCE CHARACTERISTICS (Office of Research Analyses, Science & Engineering Div., Holloman AFB, N.Mex.) Rept. No. CRA-63-1; NASA N63-13417

ABSTRACT: Velocity and acceleration profiles of rocket sleds on an advanced track were determined, based on existing and advanced rocket-engine, and sled designs. Sled families with a unit thrust of 100,000 pounds, using propellants of different specific impulse, were postulated. Rocket assembly weight and payload weight were expressed in terms of thrust, and tank and structural weight in terms of propellant weight. The upper limit for rocket sleds using liquid oxygen and liquid hydrogen as propellants is about 5400 feet per second in ambient air density at one percent payload-to-thrust ratio. This speed will increase to about 8000 feet per second if the track is enclosed in an evacuated tube at about one-third of the ambient air density. To attain this performance, a track about 40 statute miles long is required. (AUTHOR)

464

Boring, R. O. 1952 THE EFFECTS OF VISUAL STIMULUS VARIABLES UPON THE PERCEPTION OF THE VISUAL VERTICAL. (Naval School of Aviation Medicine, Pensacola, Fla.) Proj. NM 001 110 500.28., 13 August 1952. ASTIA ATI 170974

ABSTRACT: Gibson has suggested that when the main lines of the visual field are parallel to the direction of the gravitational force, even though the head or body be tilted, there will be a consistency between visual and proprioceptive cues which yields an invariant resultant. When, however, the visual field is tilted relative to gravitational vertical, judgments of the latter will be less precise and more variable. Experimental results reported herein do not support this hypothesis. It is suggested that the visual frameworks used in this experiment were not sufficient to test the hypothesis.

465

Bornschein, H. 1962 THEORIE UND PRAKTISCHE BEDEUTUNG DES VESTIBULAREN CORIOLIS-EFFEKTES (THEORY AND PRACTICAL SIGNIFICANCE OF THE VESTIBULAR CORIOLIS EFFECT) Monatsschrift für Ohrenheilkunde und Laryngo-Rhinologie (Wien and Innsbruck) 96(2):45-49, Feb. 1962

ABSTRACT: The vestibular Coriolis effect caused by certain head movements during constant whole-body rotation manifests itself through sensation of subjective rotation, nystagmus, and nausea. The mechanics of the semicircular canals and the resulting misperception are analyzed on the basis of the Mach-Breuer flow theory. The influence of different stimulus factors on the vestibular Coriolis effect is discussed in detail. Attention is called to the fact that the effect is not weakened by slower head movements as long as the duration of the movement is not more than 6 seconds. The direction of the effect is a function of the direction and extent of the head movement and not of the initial head position. The vestibular Coriolis effect is of importance in aviation medicine, clinical vestibular tests, and particularly space medicine in view of the proposed rotation of space ships and space stations. A long-term sojourn in a slowly rotating room results in progressive weakening of the effect. After-reactions indicate that it is not due to fatigue or adaptation directly, but is based on compensation within the central nervous system. (AUTHOR'S SUMMARY, MODIFIED) (Aerospace Medicine 34(3):274, March 1963)

466

Bornschein, H. & G. Schubert 1962 DIE RICHTUNG DES VESTIBULAREN CORIOLIS-EFFEKTES (The Direction of the Vestibular Coriolis Effect) Zeitschrift für Biologie (Munich) 113(2): 145-160. March 1962.

ABSTRACT: Coriolis nystagmus was produced by head movements during rotation. Its direction was measured in man and guinea pig by recording the vector of the electronystagmogram. For comparison theoretical values of these vectors were calculated and demonstrated in a physical model of the semicircular canal system. The values obtained for man were in full agreement with the theoretical model, while those for the guinea pig deviated systematically. Several explanations are offered.

467

Bornstein, M. E. 1946 PRESENCE AND ACTION OF ACETYLCHOLINE IN EXPERIMENTAL BRAIN TRAUMA J. Neurophysiology 9:349-366

SUMMARY AND CONCLUSIONS: 1) As a result of experimental trauma to the head, ACh is consistently present in the CSF in estimable quantities, 2.7 to 9.0 gamma per cent within a few hrs. of injury. The abnormal amounts of ACh may be detected for

as long as 48 hrs. following trauma, after which time the concentration falls below the sensitivity of the test object. The abnormal presence of ACh is presumed to be due to an excess production or release of the substance, an insufficient destruction, and consequent persistence within the intercellular spaces. It has been suggested that such persistent ACh be termed "free ACh." 2) The EEG of a number of cats and dogs have been studied for varying periods of time following trauma. Confirmation for both the previously described intense neuronal discharge and the transient flattening of all recorded electrical activity has been obtained. Following these effects, there occurs a prolonged period of abnormality in one or both hemispheres. The abnormalities are essentially paroxysmal, high amplitude sharp waves with frequencies varying from 6-7 per sec. to 16-20 per sec. 3) Changes in behaviour include tonic-clonic seizures, apnoea, and loss of ocular and corneal reflexes followed by partial or complete loss of hopping and placing reactions, sense of equilibrium, orientation, and a stuporous condition for varying periods of time of from hrs. to days. 4) The EEG patterns and the stuporous condition may be abolished by appropriate doses of atropine sulphate. 5) ACh perfused over an exposed area of cortex produces high amplitude sharp waves in small physiological concentrations, 1 gamma per cent or less, and a flattening of recorded cortical potentials in high physiological concentrations, 2 gamma per cent or more (depending upon the depth of general anaesthesia). 6) The intracisternal injection of ACh in amounts ranging from 0.02 to 10.0 gamma produces similar behavioural and EEG changes as previously noted, i.e., transient flattening with high concentrations and paroxysmal, high amplitude sharp waves of varying frequencies with low concentrations. 7) The EEG and behavioural effects of intracisternal ACh may also be abolished with appropriate doses of atropine sulphate. 8) It is suggested that "free ACh" may be one of the physiological factors underlying the acute paralytic and excitatory phenomena of cerebral concussion and more severe craniocerebral injuries. (AUTHOR)

468

Borries, G.V.T. 1921 EXPERIMENTAL STUDIES ON THE ROTATORY AND THE CALORIC TEST IN PIGEONS. Acta Oto-laryngol. 2(4):398-421

ABSTRACT: Reviews some of the literature on the rotatory and the caloric tests in pigeons. Argues that the use of a head cap for the pigeon is absolutely essential. Continues with a detailed discussion of experiments on the rotatory and caloric tests.

469

Borst, W. 1935 WERT UND BEDEUTUNG VON KREISLAUFBELASTUNGSPROBEN BEI FLIEGERUNTERSUCHUNGEN. (Significance of Circulation tests in examination of Aviation applicants.) Verh. deutsche. Ges. inn. Med., 58-61

ABSTRACT: The author recommends Buerger's test for determining the condition of the heart and circulation with simultaneous electrocardiography. Marked acceleration increases the intra-pulmonary pressure, leading to deficient blood

supply to the heart, the venous afflux to the right heart being diminished. Serial valsalva electro-cardiograms showed that physiologic changes in the electrocardiogram betrayed subjects who would react with functional strain to the pressure test. Of special significance were cases showing marked pathologic changes in the electrocardiogram, especially those showing a more or less marked change in the site of impulse origin. In cases in which neither clinical nor roentgenologic examination nor simple electrocardiography revealed any pathologic change, slight exertion under pressure would cause severe circulatory disturbance. Such subjects should not be admitted as aviators, especially not for altitude flying. Another circulatory test is the righting reaction, which permits of certain conclusions as to the mechanism of circulatory regulation during sudden changes in position. ABSTRACT: Journal of Aviation Medicine, 7(2):103, Ju 1936

470

Bosee, R. A. n.d.* PERSONAL COMMUNICATION TO C. F. GELL: EJECTION ACCELERATION OF A LIVE SUBJECT (20-G Peak, 258 G'sec on-set rate)

471

Bosee, R.A. & W.C. Buhler 1955 ESCAPE FROM VERTICAL TAKE-OFF AIRCRAFT
J. Aviation Med., 26(4):319-322

ABSTRACT: The U.S. Navy Bureau of Aeronautics has exploited a radically new concept in fighter type aircraft. Standing on their tails like rockets, the turbo-prop powered Lockheed XFV-1 and Convair XFY-1 take off vertically.

In an effort to reduce pilot confusion during emergency ejection, the escape procedure for vertical take-off (VTO) aircraft has been simplified. A completely automatic escape sequence has been devised, tested and installed in both the Lockheed XFV-1 and Convair XFY-1 aircraft. The system is outlined and described in this article.

472

Bosee, R. A., & C. T. Koochembere 1961 NAVAL AIRCRAFT ESCAPE SYSTEMS---PAST, PRESENT AND FUTURE. (Paper, 32nd Annual Meeting of the Aerospace Medical Assoc., Palmer House, Chicago, Illinois, April 24-27, 1961)

ABSTRACT: Escape systems as defined in this paper encompass the ejection seat concept as applied to naval operational and training type jet aircraft. It is also applicable to those escape systems that have been considered for vertical takeoff and landing (VTOL) types. The evolution of seat and seat catapult design as well as performance capabilities are described as they relate to post World War II naval aircraft. The need for increased ejection trajectory height to assure ground level escape is documented. Test and development relative to some

early escape capsule designs as well as a description of some energy attenuation systems are presented. The transition from sixty feet per second to eighty feet per second ejections in conventional seat catapult is explained. The effect of acceleration as applied to seat occupant and equipment is described. The design and function of rocket-type ejection seat systems for more advanced type manned military aircraft and tests to assure performance, reliability and personnel compatibility are also set forth. Finally, an experimental integrated flight capsule concept is described in which a shaped charge is used to cut the capsule away from the remainder of the aircraft. (Aerospace Med. 32(3):223, Mar. 1951)

473

Bosee, R. A. and C. F. Payne 1961 THEORY ON THE MECHANISM OF VERTEBRAL INJURIES SUSTAINED ON EJECTIONS FROM AIRCRAFT.
(Paper, Aerospace Med. Panel of AGARD, NATO, April 10-14, 1961)

474

Bostrom Research Lab. 1959 THE EFFECT OF LOW FREQUENCY, HIGH AMPLITUDE WHOLE BODY VERTICAL VIBRATION ON HUMAN PERFORMANCE.
(Bostrom Research Lab., Milwaukee, Wisc.) Progress Report No. 2A
31 Jan. 1958-1959.

475

Bouhuys, A., & H. J. van Lennep 1962 EFFECT OF BODY POSTURE ON GAS DISTRIBUTION IN THE LUNGS. J. Applied Physiol. 17(1):38-42, Jan. 1962

ABSTRACT: Postural changes of functional residual capacity (FRC) and pulmonary nitrogen clearance efficiency were studied in six male subjects placed supine on a tilting table, in head-up, horizontal, and head-down positions. FRC varied linearly with the angle of tilt. The lung clearance index (LCI) increased significantly in the supine and head-down positions, compared to the head-up positions, which indicates less uniform gas distribution in the former postures. This was confirmed by analysis of semilogarithmic graphs of nitrogen washout. Inhalation of epinephrine did not affect the postural changes of FRC and LCI, but caused a small increase of LCI irrespective of posture. The increased uneven distribution in head-down and supine positions is probably a consequence of the lung volume decrease in these postures, and may be explained by mechanical factors such as surface tension, which tend to close lung units when the lungs are deflated. Bronchomotor tone has no appreciable influence on these postural changes in normal subjects. (AUTHOR)

476

Bourne, G. H., ed. 1963 MEDICAL AND BIOLOGICAL PROBLEMS OF SPACE FLIGHT
(New York, London: Academic Press, 1963)

CONTENTS:

Kuettner, J. P., & F. I. Ordway, III, The Development of Manned Space Vehicles,
Smith, T. D., E. B. Konecni, & M. W. Hunter, Advanced Manned Space Systems,
Ibison, R. A., Marsflight II Space Cabin Simulator,
Levine, R. B., A Device for Simulating Weightlessness,
Graveline, D. E., Maintenance of Cardiovascular Adaptability during Prolonged
Weightlessness,
Generales, C. D. J., Jr., Weightlessness: Its Physical, Biological, and
Medical Aspects,
Ibison, R. A., E. N. Dingley, Jr., & T. Tanner, Remote Visual Monitoring
during Extended Space Missions,
More, K., O. L. Tiffany, & K. Wainio, Cosmic Ray Shower Production in Manned
Space Vehicles,
Wallman, H., & S. M. Barnett, Evaluation of Water Recovery Systems for Space
Vehicles,
Adams, C. C., Nutritional Aspects of Space Flight,

477

Bowen, I. G., R. W. Albright, E. R. Fletcher, & C. S. White 1961 A MODEL
DESIGNED TO PREDICT THE MOTION OF OBJECTS TRANSLATED BY CLASSICAL BLAST
WAVES. (Civil Effects Test Operations, U. S. Atomic Energy Commission)
Report CEX-58.9., June 29, 1961

ABSTRACT: A theoretical model was developed for the purpose of predicting the
motion of objects translated by winds associated with "classical" blast waves
produced by explosions. Among the factors omitted from the model for the sake of
simplicity were gravity and the friction that may occur between the displaced
object and the surface upon which it initially rested. Numerical solutions were
obtained (up to the time when maximum missile velocity occurs) in terms of
dimensionless quantities to facilitate application to specific blast situations.
The results were computed within arbitrarily chosen limits for blast waves with
shock strengths from 0.068 to 1.7 atm (1 to 25 psi at sea level) for displaced
objects with aerodynamic characteristics ranging from those of a human being to
those of 10-mg stones and for weapon yields at least as small as 1 kt or as large
as 20 Mt. (AUTHOR)

478

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

479

Boyce, W.C. 1961 A DEVELOPMENTAL 60 "G" PERSONNEL RESTRAINT SYSTEM
(Paper: Symposium on Biomechanics of Body Restraint and Head Protection, Naval
Air Material Center, Philadelphia, Pa. June 14-15, 1961)

ABSTRACT: This paper described a 60 "g" personnel restraint system currently under development for the Air Force for high g impact tests with live test subjects. The primary objective of these tests is to demonstrate that human tolerance to abrupt deceleration can be increased to 60 g's in all transverse directions. These tests will provide data, heretofore lacking, which may permit more efficient design of advanced, manned space vehicles of the future. These data may enable future space vehicles to land at higher rates of impact than are currently deemed possible, with resultant savings in overall weight and volume.

Design criteria for this restraint system have been derived from examination of representative advanced manned systems in order to determine in which regimes the significant accelerations may occur, the probable magnitude and duration, and the degree of predictability. This restraint system was evolved after analysis of the inertial loadings on the human body, conducted to determine unit pressures on the surface of the body exerted by a hypothetical restraint system. A summary of these studies is shown.

Physiological studies to determine areas and degrees of vulnerability also contributed to the requirements of this system. Unique design requirements that have arisen from the anatomical and engineering studies are described. The effects of fit, body sizing, and comfort upon the degree of protection obtained are examined. Problems of body positioning and geometry and their effect on vehicle cockpit geometry are discussed.

Arising from the analytical and design studies is an integrated support-restraint concept employing a segmented, rigid body shell. This system will soon be tested with human subjects in an effort to extend man's tolerance to abrupt deceleration well beyond the currently established limits. The system is described in detail, and the reasons for the choice of a rigid, molded torso shell are discussed, as well as some of the problems inherent therein.

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Boyce, W.C. & H.E. Freeman 1961 CONSIDERATIONS AFFECTING THE DESIGN OF A
60 G PERSONNEL RESTRAINT SYSTEM
Paper: ARS Space Flight Report to the Nation, New York, Oct. 9-15, 1961
American Rocket Society Preprint No. 2105-61
ARS Journal 32(6): 939-942, June 1962

ABSTRACT: The design requirements for a personnel restraint system to protect a crewman against omnidirectional abrupt deceleration forces are examined and a system to meet these requirements is described. Personnel restraint is examined and a system to meet these requirements is described. Personnel restraint is examined from the standpoint of body segment weight and unit surface pressures. Seating geometry and its effect on cockpit envelope is discussed. Several restraint concepts examined during this program are shown, while the system

selected for development and live, manned testing is described in detail. A newly developed, self-contouring comfort padding with improved rebound characteristics is described. Since test results are not yet available, predictions of system performance are made. (Author)

481

Brady, J.S. 1961 THE DILEMMA OF MAN IN SPACE
Planetary and Space Science 7:301-308, July 1961

ABSTRACT: This paper pursues the idea that techniques exist within the state of the art capable of meeting the stringent requirements of manned space systems. (JPL)

482

Bramati, C. 1953 "SULLE ACCELERAZIONI DELL'ORGANISMO UMANO DURANTE ALCUNI MOVIMENTI VOLONTARI E PARTICOLARMENTE SUI LORO RAPPORTI CON L'ETA DEI SOGGETTI." (ON THE ACCELERATIONS OF THE HUMAN ORGANISM DURING SOME VOLUNTARY MOVEMENTS, PARTICULARLY ON THEIR RELATIONSHIP TO THE AGE OF THE SUBJECTS) Rivista di medicina aeronautica (Roma), 16 (1): 41-50 1953 (In Italian, with English, French, Spanish and German summaries)

Summary: Accelerograms and kymograms were recorded simultaneously in subjects (ranging in age from 19 to 47 years) while performing body-bending exercises. The accelerogram (acceleration in g, plotted against time in 1/10 second) revealed a distinct diphasic pattern corresponding to agonistic and antagonistic muscular activities. With progressing age of the test subjects a distinct decrease of the dimensions of these phases was observed.

483

Brand, E. D., S. W. Britton, & C. R. French 1951 GRAVITATIONAL SHOCK IN DIFFERENT ANIMAL SPECIES AND VARIOUS FACTORS AFFECTING RESISTANCE. Amer. J. Physiology 165:539-547, April-June 1951

ABSTRACT: Responses of many different animal types--snakes, opossums, rats, guinea pigs, rabbits, cats, dogs and monkeys--exposed in the head-up position have been studied on the tilt-table. Survival times to general collapse varied from a few mins. to many hrs. Of all animals, monkeys appeared least affected by gravity and showed the best general condition during exposure; rats, cats, and dogs also survived over long periods. Snakes and rabbits were least resistant. Greater tolerance was shown by rabbits after several exposures.

In all animals tested periods of activity alternated with torpidity in which reflexes were depressed or lost. The conscious state was apparently greatly reduced or suppressed between bouts of activity. In monkeys and dogs large swings in venous and arterial pressure were related to body movements, the rises in carotid pressure being especially marked.

It was noted that heart rate reflected postural changes even in the snake, increasing in the head-up and decreasing in the head-down position similarly as in more highly differentiated forms.

Noteworthy in mammals were a) a sharp rise in venous blood pressure together with b) a fall in venous flow in the lower part of the body immediately on tilting; concomitantly, c) arterial pressure in the head end was significantly and usually progressively reduced.

Under the stress of gravity through the length of the body, life itself may be ultimately preserved by certain compensatory vasoconstrictor reactions; notwithstanding this, there occurs a markedly reduced circulation even in the important areas of the trunk and certain basal levels, e.g. respiratory center, of the brain. Consciousness does not thus appear to be a rigidly safeguarded function of the animal's existence. Alterations in E.E.G. patterns and loss of waves in later stages of exposure were in keeping with other expressions indicative of suppression of cerebral function. Animals which survived several hrs. in the head-up position showed increases in blood sugar at first, followed by hypoglycemia in 3 to 5 hrs.

Rhythmic tilting to the head-up position was withstood for long periods even by gravity-sensitive rabbits, and arterial pressure in dogs was not significantly affected by this maneuver.

A pneumatic cuff around the pelvis inflated to 150 mm. Hg greatly increased survival time (rabbits) and maintained carotid arterial pressure (monkeys) in the upright position. Adrenaline and CO₂ were slightly helpful.

Functional inadequacies shown by lower animal forms in the head-up position are discussed; the most serious handicap appears to be loss of consciousness early in exposure because of cerebral anoxia. The significance of orthograde posture and progression achieved by man is emphasized, and the postulate that brain development may be involved is put forward. (AUTHOR)

484

Brandaleone, H. 1957 MEDICAL ASPECTS OF MOTOR-VEHICLE ACCIDENT PREVENTION
IN INDUSTRY. JAMA 163(4): Jan. 26, 1957.

ABSTRACT: The significance of the human factor in automobile accidents is illustrated by the reduction in the annual rate of accidents (from 6,377 in 1946 to 3,130 in 1955) achieved by a metropolitan transit system by developing its medical program for drivers and introducing psychological tests. The data show that the cost of maintaining a medical department for a year is less than the cost of one bad accident. The division of motor vehicle drivers into categories makes it possible to set up fair standards for each. The details of the examination and the frequency of reexaminations depend on the applicant's age, the history of past and more recent illnesses, and the category for which he wishes to qualify. A reference list of hazardous conditions in drivers of motor-vehicles has been prepared on the basis of experience and is available for the guidance of physicians, industry, safety organizations, and licensing agencies. The comprehensive medical program enlists the cooperation of the family physician, and handicapped employees are grateful for safer jobs.

485

Brandt, U. 1961 INFLUENCE OF TRAINING ON THE MAINTENANCE OF EQUILIBRIUM.
COMPARATIVE STUDY BETWEEN PILOTS AND INEXPERIENCED SUBJECTS.
Rev. Med. Aero. (Paris) 2:22-24, Dec. 1961.

486

Brandt, U. 1961 VESTIBULAR REACTIONS DURING PREORBITAL FLIGHT.
Acta oto-laryngologica (Stockholm) 53(1):80-87, Feb. 1961

ABSTRACT: Accelerative forces affecting the astronaut placed in the nose cone of a rocket are considered. The vestibular sensations were studied experimentally in a human centrifuge in a number of dynamic conditions aimed at changing the resultant between linear and radial acceleration and gravity force. By applying Graybiel's "law of the otoliths," it seems permissible to draw some conclusions as to the probable vestibular experiences of the astronaut, at least during the "gravitational" part of the flight. However there is still insufficient knowledge in regard to the period of weightlessness. The nature of the vestibular sensations coupled with lack of external visual references will aggravate the difficulties associated with active participation of the astronaut in correcting the flight path. (Author)

487

Brandt, V. 1962 THE CAUSE AND PRACTICAL IMPORTANCE OF OCULOGRAVIC ILLUSIONS.
Acta Oto-Laryngol. 54(2):127-135.

ABSTRACT: The oculogravic illusion can be interpreted as a specific otolith response to a stimulus consisting of linear acceleration. It has been suggested as a conclusive proof that the phenomenon does not occur in deaf subjects with labyrinthine areflexia. Two fresh cases of acquired labyrinthine areflexia have been examined in the human centrifuge, the illusion being measured by a special technique. Although abnormal illusion curves much unlike those recorded in the congenitally deaf may be obtained at the end of the "destruction stage", complete compensation with illusion curves resembling those of healthy individuals developed in a comparatively short time. The logical conclusion would be that oculogravic illusion cannot be accepted straight off as a selective measure for otolith sensitivity. In connexion with a discussion of analogies, comparing oculogravic and oculogyral illusion, the author suggests that the "lag effect" (i.e., the time necessary for reorientation on rapid changes of the angle of incidence of the resultant vector) may offer a more adequate expression for static sensibility. The recent advances in the methods of observing these labyrinthine illusions should add to our somewhat unverified knowledge of vestibular physiology and pathology.

488

Brandt, U. 1962 REORIENTATION AND VESTIBULAR FUNCTION
Acta Oto-Laryngologica (Stockholm) 54:543-552
NOTE: Reel 7, Flash 7, Item 18

ABSTRACT: Determinations of oculogravic illusion at increasing rotation speeds of the centrifuge, in accordance with a technique previously described. Results of the two test groups are almost identical, in seeming contradiction to what has been shown of the habituation tendencies of the vestibular apparatus. Author suggests a psycho-physiological explanation to account for this. Among the conclusions oculogravic illusion in the normal human is suggested to indicate the effect of linear acceleration on the inner ear provided this stimulus remains within reasonable limits. For stronger linear stimuli the phenomenon is believed to be an expression of a combined otolith-proprio-exteroceptive excitation. (AUTHOR)

489

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

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

490

Braun, F. 1958 INTRODUCING THE ROCKING AIRCRAFT PASSENGER SEAT.
Sabena, Direction Technique, Division Etudes, Brussels, Belgium)
Rapport No. XA-002, 2 May 1958.

491

Braunstein, P.W. 1957 MEDICAL ASPECTS OF AUTOMOTIVE CRASH INJURY RESEARCH.
J.A.M.A. 163(4):249-255, 26 Jan. 1957.

ABSTRACT: To determine the medical findings that might be expected in the one million persons injured by automobile accidents each year, 1,000 injury-producing accidents were carefully studied. Of the 2,253 occupants involved in the thousand accidents, 1,678 (74.5%) were injured to some degree. Of those persons receiving an injury, only half could be diagnosed as of a minor degree.

When considering body distribution, injuries to the head alone were the most frequent, followed by injuries with a combination of head and lower extremity involvement. Almost two-thirds of the injuries involved more than one body area, emphasizing the need for an extremely careful physical examination so as not to overlook concealed wounds. The practicing physician can profit greatly by knowing the representative picture resulting from automobile accidents.

492

Braunstein, P. W., & J. O. Moore 1959 THE FALLACY OF THE TERM "WHIPLASH INJURY". The American J. of Surgery 97(4):522-529, April 1959

SUMMARY: From 5,710 accidents in which injury occurred, 144 cases of cervical injury were recorded in which a whiplash phenomenon was experienced at the time of accident impact. Accident patterns and severity of injury are discussed. CONCLUSION: On the basis of evidence available in this study, serious cervical injuries caused by exposure to the whiplash phenomenon may be sustained; the majority are accompanied by moderate to serious injuries in other body areas. If an alleged cervical injury is not associated with injury to another body area and is not accompanied by clear-cut clinical findings or roentgenographic findings, on the basis of these data the injury must be considered minimal or nonexistent.

The term whiplash injury is not a diagnosis.
(AUTHOR)

493

Braunstein, M.L. & W.J. White 1961 THE EFFECTS OF ACCELERATION ON VISUAL BRIGHTNESS DISCRIMINATION. (Cornell Aeronautical Lab., Inc., Buffalo, N.Y.) Rept. No. OM-1570-G-1, December 1961. ASTIA AD 269 380.

ABSTRACT: Brightness discrimination thresholds were determined at five levels of transverse acceleration and four levels of positive acceleration. Four background luminance levels, ranging from 31 to .03 foot lamberts, were studied. Contrast required to detect an increment in illumination increased with acceleration. This increase was present for both directions of acceleration, and for the dimmest background. A preliminary study was conducted on the effects of breathing 100% oxygen and 100% oxygen under pressure, on brightness discrimination under acceleration. (Author)

494

Braunstein, M. L. and W. J. White 1962 EFFECTS OF ACCELERATION ON BRIGHTNESS DISCRIMINATION.
In J. Opt. Soc. Amer. 52:931-933, Aug. 1962.

495

Bray, J.L. 1957 INTERNAL BALLISTIC DESIGN AND TRAJECTORY ANALYSIS OF A ROCKET-ASSISTED PILOT EJECTION SEAT. (Naval Ordnance Test Station, China Lake, Calif.) NOTS 1701, NAVORD Rept. No. 5433, ASTIA AD 150 906

ABSTRACT: The problem of safe escape of a pilot from a disabled plane is discussed in general, and a rocket-assisted ejection seat is considered as a solution. Two tentative internal ballistic designs are presented. Equations are developed for the motion of an ejection seat after it leaves the plane. Graphs are included showing thrust-time curves, seat trajectories, forces on the pilot, aerodynamic drag, and physiological acceleration limits. (Author)

496

Brehm, H. E. 1961 COMPACT FEEDING CONSOLE, DESIGN, FABRICATION, AND EVALUATION (Aeronautical Systems Division, Air Force Systems Command, Andrews AFB, Washington, D.C.) AFSC Project 6373, TASK 63121; Contract AF 33(616)7503, ASD-TR 61-569, Oct. 1961, ASTIA AD 271475.

ABSTRACT: The purpose of this research project was to design, fabricate, and evaluate a Compact Feeding Console which will meet the sustenance requirements of three men for an extreme altitude mission of 14 days duration. A comprehensive study of the human and environmental conditions revealed that the astronauts would need equipment, devices, and facilities for storage, preparation--cooling or heating-- of canned, frozen, dehydrated, and ready foods; a water storage, heating and cooling system; and feeding tools. The equipment and systems were tested to evaluate expected performance under operating conditions from normal gravity and 1 atmosphere pressure to zero gravity and 1/2 atmosphere pressure, and acceleration forces from 2 to 8 g's, to insure both independent operation of the component sections and integrated operation of the total Console in compliance with pre-determined optimal performance standards.

497

Brent, H.P., T.J. Powell, & J.W. Scott 1957 THE EFFECT OF POSITIVE ACCELERATION WITH HYPERVENTILATION ON THE EEG. (RCAF Institute of Aviation Medicine, Toronto, Canada)

ABSTRACT: Jet fliers in the Royal Canadian Airforce who had shown unexplained periods of brief unconsciousness in flight were examined medically, and observed while subjected to stresses similar to flight stresses; also the circumstances in which the unconscious episode occurred were investigated. Routine electroencephalograms were recorded at rest, during hyperventilation, during positive acceleration and during a combination of hyperventilation and positive acceleration. The studies were made in both the fasting and the postprandial states. EEG was found to be more stable in the postprandial state. In some who showed no slow activity with hyperventilation alone, combination of hyperventilation and positive acceleration induced slow waves.

In others who exhibited slow waves with hyperventilation, positive acceleration hastened their onset. It is concluded that the stresses produced by hyperventilation and positive acceleration are additive, and combined may be sufficient to interfere with cerebral function, where either stress alone is not sufficient. (Electroenceph. Clin. Neurophysiol. 9:378, 1957)

498

Brent, H.P., G.J. Leitch, J.W. Scott & W.R. Franks 1959 CARDIAC
IRREGULARITIES DURING COMBINED HYPERVENTILATION AND G. (Paper, Aero
Medical Association; Statler Hilton Hotel, Los Angeles, April 27-29, 1959)

ABSTRACT: At the RCAF Institute of Aviation Medicine, aircrew officers were investigated under conditions of voluntary hyperventilation and acceleration. Electrocardiograms and electroencephalograms were recorded throughout the course of these experiments. Ectopic beats appeared more frequently during combined hyperventilation and G than during either of these conditions imposed separately; disturbances in consciousness were produced only when the two stimuli were combined. In the course of analysis of the ECG, successive instantaneous heart rates were computed from intervals between R-waves, and plotted against the time sequence of the experiment. Thus, changes in heart rate from beat to beat were depicted. In some subjects, abrupt fluctuations in heart rate occurred during the hyperventilation-plus-G runs, usually in association with either general convulsive seizures or slow activity in the EEG. Comparable graphs prepared from ECG records of patients undergoing clinical grand mal attacks, or showing EEG epileptic discharges without clinical manifestations of seizure, showed no such cardiac irregularities. It therefore appears that the cardiac irregularities during combined hyperventilation and G resulted from these physiological stimuli directly, rather than as sequelae to any cerebral disturbances during hyperventilation-plus-G were in some respects similar to those immediately preceding onset of ventricular fibrillation. The possibility that the latter event is responsible for some of the many "obscure" fatal crashes must be considered. (J. Aviation Med. 30(3):177, March 1959)

499

Brent, H. P., T. M. Carey, T. J. Powell et al 1960 SYNERGISM BETWEEN EFFECTS
OF HYPERVENTILATION, HYPOGLYCEMIA AND POSITIVE ACCELERATION.
Aerospace Medicine 31(2):101-115
(Paper, 28th Annual Meeting, Aero Medical Assoc., Denver, Colo., 6-8
May 1957)
(Paper, 21st Annual Meeting Canadian Physiological Society, Ottawa, Oct.
1957)

ABSTRACT: Eighteen medically fit aircrew officers were exposed to combinations of voluntary hyperventilation, 3.4 G for five seconds on the centrifuge, and

changes in glycemia one hour and three hours after glucose feeding. A large proportion of the subjects was incapacitated by the effect of two or more of these combined stimuli, although these same stimuli, when acting separately, had failed to induce comparable disturbances in cardiac or cerebral function. The experimental findings are listed in the article.

500

Brewer, G. W. 1959 OPERATIONAL REQUIREMENTS AND TRAINING FOR PROJECT MERCURY (Presented to National Security Industrial Association, Los Angeles, California, 17 November 1959).

501

Briggs, F. E. R. THE FRANKS ANTI-BLACKING-OUT SUIT. (Report of plane tests at RCAF station, Rockcliffe, Ontario and at Wright Field.) FPRC no. 301-A. (RAF Institute of Aviation Medicine, Farnborough).

ABSTRACT: Two subjects wearing FFS were completely protected up to 7 "g" in the P 40 and Harvard III for 12 seconds. Fatigue and nausea were relieved. Some respiratory embarrassment was noted during inverted flight, but no other discomfort. An individually fitted suit is necessary.

502

Brimhall, D. R. and R. Franzen 1944 A PRELIMINARY STUDY OF PHYSICAL STANDARDS IN RELATION TO SUCCESS IN FLIGHT TRAINING (Civil Aeronautics Administration, Division of Research, Washington, D.C.) Rept. No. 26, Feb. 1944. ASTIA TIP UR54 258

ABSTRACT: The study presented in this report represents one of the first in a series of investigations aimed at accurately testing the efficiency of American medical standards of acceptance for flight training. This study, although providing only a partial answer to questions concerning physical standards, definitely points the way for further investigations and indicates the trend the results are taking.

503

Brinkley, J. W., R. N. Headley, and K. K. Kaiser 1961 ABRUPT ACCELERATION OF HUMAN SUBJECTS IN THE SEMI-SUPINE POSITION. (Paper, Symposium on Biomechanics of Body Restraint and Head Protection, Naval Air Material Center, Philadelphia, Penn., June 14-15, 1961.)

ABSTRACT: The Protective Equipment Section of the Aerospace Medical Laboratory is currently conducting a research program to determine principles and methods

of protection during deceleration in minimal stopping distances as associated with ground impact of aerospace vehicles. This report is concerned with a series of eighteen human subject experiments with vertical velocities of twenty feet per second at impact.

The tests have been conducted with each subject held in a semi-supine position with a 12° forward inclination of the head and torso. Individually form fitted, rigid urethane couches have been used in an effort to provide optimum body support. Body restraint included a combination forehead and chin harness, shoulder harness, lap belt and leg retention straps. The acceleration magnitudes have been controlled by crushing various configurations of aluminum honeycomb material under the body support system during impact. The resulting acceleration profiles have been characterized by durations less than 100 milliseconds, very short rise times, and magnitudes ranging up to 65 g's. Stopping distances associated with this series of eighteen experiments have ranged from 3-1/4 to 6-7/8 inches.

504

Brinkley, J. W., E. B. Weis, Jr., N. P. Clarke and W. E. Temple 1963
A STUDY OF THE EFFECT OF FIVE ORIENTATIONS OF THE ACCELERATION VECTOR
ON HUMAN RESPONSE
AMRL Memorandum M-28, February 1963

505

Brissenden, R. F. 1957 SOME GROUND MEASUREMENTS OF THE FORCES APPLIED
BY PILOTS TO A SIDE-LOCATED AIRCRAFT CONTROLLER. (Nat. Advisory
Committee for Aeronautics, Langley Field, Va.) NACA TN 4171, Nov. 1957.

506

Brissenden, R. F., D. C. Cheatham, & R. R. Champine 1957 TOLERABLE LIMITS
OF OSCILLATORY ACCELERATIONS DUE TO ROLLING MOTIONS EXPERIENCED BY ONE
PILOT DURING AUTOMATIC-INTERCEPTOR FLIGHT TESTS. (National Advisory Com-
mittee for Aeronautics, Washington, D. C.) Rept. No. RM L56K20, Jan. 1957

ABSTRACT: This paper presents limited data on the level of lateral oscillatory acceleration due to rolling motions found to be tolerable by a pilot during flight tests. The stest were made during the final attack phase of an automatically controlled interceptor.

507

Britton, S.W. & E.L. Corey 1942 CENTRIFUGAL AND GRAVITATIONAL EFFECTS ON
ANIMALS AND THEIR ALLEVIATION
(National Research Council, Washington, D.C.) CAM Rept. No. 40, 2 Feb. 1942

ABSTRACT: Experiments were conducted using a light duty, 6 ft. radius centrifuge capable of producing up to 50 "g". As a result of the experiments, conclusions were drawn on the following subjects: Orientation; Respiration; Tolerance; Sex; Age; Posture; Lethal limits; Blood and tissue chemistry; adhesive straps; forced exercise; alcoholism; anoxia, oxygen, carbon dioxide; pitressin; cortico-adrenal extract and adrenalin; benzedrine sulphate and normal saline.

508

Britton, S.W., E.L. Corey & G.A. Stewart 1942 GRAVITATIONAL EFFECTS ON
ANIMALS AND THEIR ALLEVIATION
(National Research Council, Washington, D.C.) CAM Rept. No. 41
3 March 1942

ABSTRACT: This report contains observations made on cats, rabbits, and rats during acceleration experiments. The experiments were conducted to observe the result of acceleration on the cardiac activity, nervous system, digestive system, and respiratory system of the animals.

509

Britton, S. W., E. L. Corey, & G. A. Stewart 1942 PHYSIOLOGICAL STUDIES ON
HIGH GRAVITATIONAL FORCES. (National Research Council, Washington, D. C.)
CAM Rept. No. 56, 10 April 1942 ASTIA ATI 121 011.

ABSTRACT: In 18 male rats mortality rate at 25 "g" was reduced 50% by suitably spaced and graded previous exposures to "g". Amyl nitrite inhaled during profound shock following centrifugation in dogs and cats restores normal rate and rhythm of heart, improves A-V conduction, alleviates bundle branch block. Shock gradually disappears and animal recovers. When centrifugation is continued until death, findings are extreme cardiac dilatation, subintimal hemorrhages in left heart, congested lungs, and lobal tears in liver.

Desoxycorticosterone greatly increases resistance to "g", as do glucose-saline injections. Exposure of rats for 5 minutes to 5 degrees C (icewater) increases tolerance. Atropine and pilocarpine do no good. Female rats are much more resistant than male rats. Castration of females and injection of testosterone propionate does not reduce resistance. High gravitational forces inhibit oestrus activity markedly. In dogs, blood concentration and blood sugar are increased by exposure to "g", return to normal levels within 3 to 4 hours following exposure. In frogs, dilation of vessels of web and gross hemorrhage occur in centrifugation.

510

Britton, S.W., E.L. Corey & G.A. Stewart 1946 EFFECTS OF HIGH
ACCELERATORY FORCES AND THEIR ALLEVIATION.
American J. Physiol. 146(1): 33-51

ABSTRACT: A centrifuge for subjecting laboratory animals to acceleratory forces up to 50 g is described. It had two 6-foot rotor arms, a range from 30 to 180 r.p.m., and attained maximum speed in about 1 second. Several nomographs for ready determination of g forces are reproduced. Over 3,000 tests were carried out on rats, and several hundred others on monkeys, dogs, cats, rabbits, guinea pigs, mice, chickens, ducks and frogs. Within limits, rat responses were fairly uniform for the same g x t (g-min. or g-sec.) values. Outside these limits, very high g-min. forces were tolerated. Increasing tolerance to g was shown by rats and dogs on giving a series of exposures, especially over a period of days or months. Minute hemorrhages were observed in the lower limbs of surviving animals after severe tests. At autopsy vascular congestion and small hemorrhagic areas were found in various body sites. It was nevertheless striking that the great majority of animals which were examined after moderate or even severe exposures showed no significant pathological lesions.

511

Britton, S. W., & C. R. French 1946 EFFECTS OF ACCELERATORY FORCES AND THEIR
AMELIORATION (Physiological Lab., University of Virginia Medical School,
Charlottesville)

ABSTRACT: Within limits, rat responses to g forces are fairly uniform for the same g x t values. Female animals tolerated g better than males, while young animals showed less resistance. Resistance differences for many animal species were observed. Negative g was tolerated only about half as well as positive g. Increased resistance was shown by animals which had been given several exposures over periods of days or months.

Considerable protection was afforded by a simple belt placed around the abdomen or upper thighs. The effects of pressor and other substances were studied. Respiratory and circulatory changes (including E.C.G.) under various g forces were observed. Marked effects were observed in a few instances on the central nervous system; chronic rigidity (decerebrate type) sometimes appeared. "Delta" brain waves were commonly aroused during centrifugation.

Hyperglycemia occurred after severe acceleratory shock; tissue glycogen levels were usually reduced by prolonged exposures. Other blood-chemical changes were noted. Autopsy findings even after severe tests (prostration, death) were not striking. (Federation Proceedings 5(1):10-11, 1946)

512

Britton, S. W., V. A. Pertzoff, C. R. French, & R. F. Kline 1947 CIRCULATORY AND CEREBRAL CHANGES AND PROTECTIVE AIDS DURING EXPOSURE TO ACCELERATORY FORCES. American J. Physiology 150(1):7-26, Jan. 1947
NOTE: Reel 7, Flash 6, Item 5

ABSTRACT: A 20-ft. diameter heavy steel centrifuge with blood pressure and other devices attached for determining effects of accelerations up to 50 g is described. Results of tests on a large number of monkeys, dogs and cats are given.

513

Britton, S.W. & V.A. Pertzoff 1947 COMPARATIVE EFFECTS OF POSITIVE AND NEGATIVE ACCELERATIONS
Fed. Proc. 6: 82

ABSTRACT: Experiments have been carried out to determine the effects on carotid and femoral arterial pressures, taken simultaneously, of positive and negative acceleratory forces on dogs and monkeys. Blood flow was also investigated. Well over 700 experimental runs were made. Arterial pressure changes occur more quickly in that part of the animal towards the periphery of the centrifuge, whether positive or negative g forces be considered. That is, in the case of positive g the pressure change appears earlier in the femoral artery, while in negative g tests it occurs earlier in the carotid vessel. A reciprocal relationship between heart rate and arterial pressure is apparent only in the case of reduced supply (flow, pressure) to the head. The involved reflexes were studied. A distinct physiological advantage is possessed by the monkey over the dog (or cat) subjected to acceleratory forces. This advantage is shown in both carotid and femoral pressure values, and approximates 1 g in the different tests used. A higher degree of vascular accommodation to gravity appears to have been developed in the case of the anthropoid type. Investigations indicate that the overall effects produced on the organism by acceleratory forces should be considered on the basis of the product $t \times g$.

514

Britton, S. W., V. A. Pertzoff, et al. PHYSIOLOGICAL STUDIES ON HIGH CENTRIFUGAL FORCES. (University of Virginia)

ABSTRACT: Work was carried out on normal young male and female Macacus rhesus monkeys which were not anesthetized. Constant and striking changes in the ECG were observed under high "g" and consisted of a fall of about 50% in the R-S potential and an increase in heart rate of 10 to 30 beats per minute. Voltage decreases are much more marked than the reciprocal frequency changes. Complete protection against cardiac changes is afforded by a low pelvic belt pressurized to 75 mm Hg or higher. Desoxycorticosterone and benzedrine injections give slight or partial protection against "g" effects.

The appearance of delta waves in the EEG is fairly common under "g". The potential of these delta waves is somewhat reduced by applying a cervical cuff inflated up to 75 mm Hg.

515

Britton, S. W., & C. R. French 1949 CONDITIONS MODIFYING RESISTANCE TO ACCELERATORY FORCES AND PROTECTION BY ABDOMINAL PRESSURE. American J. Physiology 156(2):137-144, Feb. 1949

ABSTRACT: In a number of commonly experienced bodily conditions responses to moderate acceleratory forces (2-3 g, 15 sec.) were considerably modified, as shown by carotid arterial pressure changes in the dog. Fatigue and trauma, inanition and adiposity decreased markedly the tolerance to g; usually the arterial pressure reductions in these cases were 50 per cent greater than in the controls. In certain cases of anoxia, following the administration of narcotics and ethyl alcohol, resistance to acceleration was also greatly reduced.

Spontaneous bursts of struggling, muscular tremors after metrazol treatment, and also breathing of CO₂ in small amounts resulted in definite improvement in tolerance; about 1 g advantage was effected in these cases. The application of cold to the body also was slightly less advantageous. Tobacco smoke and alcohol given in small amounts were definitely not deleterious by the carotid arterial pressure criterion; in the tests with light doses of alcohol, indeed, significant benefit appeared to be conferred. Application of a lower abdominal or pelvic belt inflated to 150 mm. Hg pressure gave by far the greatest protection against g stresses. Even after severely depressing conditions of fatigue, trauma, etc., had been imposed upon the animal, protection was well maintained. In these cases an advantage of 2 to 3 g was commonly observed.

Correlation of tests on applied acceleration with the effects of gravitational force on the body is discussed. (Author)

516

Britton, S. W., V. A. Pertzoff, & C. R. French 1949 COMPARATIVE EFFECTS ON THE CIRCULATORY SYSTEM OF POSITIVE AND NEGATIVE ACCELERATIONS. THE "MAREY" LAW. Amer. J. Physiol. 156(1):1-11, Jan. 1949

ABSTRACT: Inquiry has been made into the circulatory changes induced by negative as well as positive accelerations. Arterial pressure levels in both carotid and femoral vessels have been followed simultaneously and correlated venous pressure and cardiac changes have been studied. Result of tests on different animals indicate that under conditions of circulatory stress a distinct functional advantage is possessed by the primate form. (Author)

517

Broca, A., & P. Garsaux 1919 NOTE PRELIMINAIRE SUR L'ETUDE DES EFFETS DE LA FORCE CENTRIFUGE SUR L'ORGANISME. (Preliminary Note for the Study of the Effects of Centrifugal Force on the Organism)
Bull. Acad. Med. (Paris), Sér. 3, 82:75, 22 July 1919.

518

Brock, F.J. 1954 DYNAMIC RESPONSE OF RESTRAINED SUBJECT DURING ABRUPT DECELERATION. (Northrop Corp., Beverly Hills, Calif.) Rept. No. NAI-54-585, Sept. 1954.

519

Brock, F.J. 1960 ACCELERATION SHOCK EXPERIMENTS USING LIVE PIGS
Paper: 31st Annual Meeting of the Aerospace Medical Association, Americana Hotel, Bal Harbour, Miami Beach, Fla., May 9-11, 1960

ABSTRACT: Acceleration shock experiments were performed on live pigs to determine the usefulness of a proposed Mercury Space Capsule pilot support and energy absorption system. The dynamic response of live test subjects is studied through the application of the principles of theoretical mechanics to an analogous mechanical system and some effects of acceleration shock are predicted. The experimental results measured on the live subject are interpreted in terms of equivalent mechanical system behavior and additional live specimen response characteristics are predicted. Several conclusions based on the experimental data are presented and discussed.

520

Brockett, P. 1925 BIBLIOGRAPHY OF AERONAUTICS 1920 - 1921
(National Advisory Committee for Aeronautics, Washington, D. C.)

521

Broderick, M.A. & R.D. Turner 1961 DESIGN CRITERIA AND TECHNIQUES FOR DEPLOYMENT AND INFLATION OF AERODYNAMIC DRAG DEVICES.
(Aeronautical Systems Division, Wright-Patterson AFB, Ohio)
ASD TR 61-188, 1 May 1959-June 1961, ASTIA AD 269 368

ABSTRACT: Effort was made to determine the requirements to successfully deploy or separate supersonic deceleration devices, both trailing and attached, and to investigate techniques which can be used to inflate devices which otherwise might not be satisfactory. Various devices were investigated; an analytical study of deployment dynamics was undertaken to establish deployment criteria;

and an investigation of the characteristics of inflatable devices was conducted to determine inflation pressure requirements. A system was developed to provide the required separation impulses. Various means of producing inflation pressures were evaluated, and an inflatable torus was investigated as a device to provide additional stiffness to a parachute canopy. Vehicle conditions at time of decelerator deployment encompass a speed range of Mach 1 to 4 at sea level, Mach 4 to 10 at 150,000 feet, and Mach 10 to 30 at 350,000 feet. (Author)

522

Brody, A. W., J. J. Connolly, Jr., and H. J. Wander. 1959 INFLUENCE OF ABDOMINAL MUSCLES, MESENTERIC VISCERA AND LIVER ON RESPIRATORY MECHANICS. J. Appl. Physiol. 14: 121-128

ABSTRACT: In a group of 13 supine, anesthetized cats initial measurement was made of respiratory elastance, total resistance by sinusoidal pressure, total resistance, K1 and K2 and their ratio of change from breath to breath, the natural frequency, damping factor and mass factor or inertance, and the functional residual capacity (FRC) and tissue resistance. Comparison was then made with the value obtained by re-measurement in the same cat after a) control operation of mid-line abdominal incision, b) incisions eliminating the effects of the abdominal muscles (mid line vertical plus transverse incision extended to back; c) evisceration of gastrointestinal tract and spleen; and d) evisceration of gastrointestinal tract. The abdominal response was found to be mainly a surface wave response (at a speed of about 150cm/sec) above the natural frequency. The abdominal muscles impose a steady force, more like a weight than a spring, which decreases the FRC. The liver contributes significantly to the mass factor and natural frequency, but the viscera do not. About half the tissue resistance consists of a resistance within the abdomen to respiratory movements; since nearly half the total resistance is tissue resistance, this is nearly one fourth the total resistance to respiration.

523

Bronk, D.W. 1945 HUMAN PROBLEMS IN MILITARY AVIATION. Smithsonian Institute, Ann. Rept. 1945. (Washington, 1946)
Reprint from Proc. Amer. Philosophical Society 88(3):189-195, 1944.

524

Brooks, C.E. & A.P. Webster 1954 DATA DENSING AND RECORDING TECHNIQUES ESTABLISHED FOR THE HUMAN CENTRIFUGE.
(U.S. Naval Air Development Center, Aviation Medical Acceleration Lab., Johnsville, Pa.) Report No. NADC-MA-5306, 29 Jan. 1954.
ASTIA AD 133 235.

ABSTRACT: The Aviation Medical Acceleration Laboratory has instrumented its principle experimental device, the Human Centrifuge with a system that permits

the investigator to record, on the stationary structure, data that are sensed 50-feet away on a subject who may be undergoing accelerative forces up to 40G, and traveling at a tangential speed of 180 mph. Thorough shielding, carefully designed sliprings, adequate wiring, and patching arrangements as well as the latest type sensing and recording equipment, comprise a data recording system commensurate with the facility provided by the costly and elaborate centrifuge device.

The principle components in the over-all recording system are described and detailed descriptions of the applications of the more commonly used sensing devices are presented.

525

Brooks, G.W. & H.D. Carden 1961 A VERSATILE DROP TEST PROCEDURE
FOR THE SIMULATION OF IMPACT ENVIRONMENTS.
Noise Control 7(5):4-8

526

Brooks, P. M. 1951 THE EFFECT OF PROLONGED POSITIVE ACCELERATION ON
RESPIRATION IN HUMAN SUBJECTS.
(Office of Naval Research, Washington, D. C.)
March 1951 Contract N6ori77

SUMMARY: Eleven subjects in good physical condition and of the age range 21 to 33 years were exposed to accelerations of two and three G units for a period of three minutes. Each subject had five exposures for each acceleration intensity. Respiration was measured by means of the Benedict-Roth respirometer. The findings are:

- (a) Tidal volume was increased.
- (b) Respiratory rate was increased.
- (c) Consequently respiratory minute volume was increased.
- (d) Oxygen consumption was markedly decreased.
- (e) There is evidence that considerable pulmonary pooling of blood occurs.
- (f) The changes in tidal volume, respiratory rate, and respiratory minute volume are greater at three G units than at two, while the decrease in oxygen consumption tends to be less at three G units than at two.

527

Brooks, P. M. 1951 THE EFFECT OF POSITIVE ACCELERATION ON URINE FORMATION
IN HUMAN SUBJECTS.
(Office of Naval Research, Washington, D. C.)
March 1951 Contract N6ori77

SUMMARY: Eleven subjects of an age group of 21 to 33 years of age were exposed to two and three positive G units. Each subject had a total of at least five

exposures for each G unit intensity. Each subject was given two exposures of three minutes each during one session with a fifteen-minute rest between each exposure, thus giving a total of six minutes of acceleration exposure for each urine sample. Urine samples were voided just prior to the accelerations session and immediately at the end. The findings were:

- (a) The specific gravity was decreased with a greater decrease during the three G unit exposure than during the two G unit one.
- (b) The acidity was increased with a greater increase during the two G unit exposure than the three G unit exposure.
- (c) Chloride excretion was variable but was greater during the three G unit exposure than during the two G unit exposure.
- (d) Inorganic phosphorus excretion was decreased with a greater decrease during the three G unit exposure than during the two G unit exposure.
- (e) Ammonia excretion was decreased a greater decrease during the two G unit exposure than the three G unit exposure.
- (f) No reducing substances (glucose), albumin or occult blood were found in the urine of the subjects excreted during the acceleration exposures.

528

Brooks, P. M. 1951 THE EFFECT OF TILT TABLE POSITION ON RESPIRATION IN HUMAN SUBJECTS.
(Office of Naval Research, Washington, D. C.)
March 1951 Contract N6ori77

SUMMARY: Eleven male subjects of the age range of 21 to 33 years in good health were used. The respiration was determined by the Benedict-Roth respirometer. The Tilt table positions were related to the hydrostatic height of the blood column. These heights were . . . no hydrostatic height, one third, two thirds, and full height. Three determinations were made on each subject in each position.

As the tilt was increased, the respiratory rate, tidal volume, and respiratory minute volume was increased, but the oxygen consumption was decreased. The apparent pulmonary pooling of blood increased as the tilt was increased.

529

Brooks, P.M. 1951 THE INFLUENCE OF EXTRA-ABDOMINAL PNEUMATIC PRESSURES OF ANTI-BLACKOUT GEAR ON RESPIRATORY CHANGES CAUSED BY EXPOSURES OF HUMAN SUBJECTS TO PROLONGED POSITIVE ACCELERATIONS. (Department of Aviation Medicine, Los Angeles, California) Contract N6ori77, Task 1, 31 March 1951

ABSTRACT: Anti-blackout suit pressures of 2.2 and 2.8 psi were used during a three-minute exposure to two G units, while 3.3 and 4.2 psi were used during exposure to the 3 G units. The findings as compared to the changes caused by acceleration exposures without anti-blackout gear are:

- (a) Tidal volume was decreased, but was still greater than normal.
- (b) The respiratory rate was increased.

- (c) The respiratory minute volume was increased.
- (d) Oxygen consumption was little changed, but the tendency appeared to be a decrease. At the higher suit pressure it definitely was decreased below that without the anti-blackout gear.
- (e) As the anti-blackout suit pressures were increased the changes noted above were increased.
- (f) The apparent pulmonary pooling of blood occurring during acceleration exposures appeared to be unchanged by the anti-blackout gear.

530

Brooks, P. M. 1951 THE INFLUENCE OF EXTRA-ABDOMINAL PNEUMATIC PRESSURE OF ANTI-BLACKOUT GEAR ON THE EFFECTS OF TILT TABLE POSITION ON RESPIRATION IN HUMAN SUBJECTS.
(Office of Naval Research, Washington, D. C.)
March 1951 Contract N6ori77

SUMMARY: The same subjects used in the previous study were used in this one. The suit pressures used were those of 50, 100, and 150 mm of Hg. The tilt table positions were those outlined previously.

As the suit pressures were increased, the tidal volume was decreased, but the respiratory rate and respiratory minute volume was increased. Oxygen was decreased as the suit pressures were increased.

531

Brouwer, J.E. 1931 LE MAL DE L'AIR. (AIR SICKNESS) 5 Congr. internat. Nav. aer
La Haye, 1930. Tome 2, pp. 1327-1338

532

Brouwer, J. E. 1935 DES LIMITES AEROPHYSIOLOGIQUES IMPOSEES AU PILOTE DE L'AVION DE CHASSE. (Aerophysiological Limits Imposed on Pursuit Pilot)
Arch. med. belges, (Liège) 88:307-316.

ABSTRACT: Progress in aeronautic technic has rendered unlimited the possibilities as far as construction of planes, motors, and instruments is concerned, but the human body has its physical limitations. Two of the main problems of the aviator are altitude and speed. When atmospheric pressure falls below the minimum partial oxygen pressure required for diffusion of oxygen in the blood, the pilot experiences oxygen deficiency with its physical and psychological sequel even in spite of adequate oxygen supply. The speed question encompasses level speeding, angular accelerations and centrifugal accelerations. Acceleration may give rise to severe circulatory and physiological disturbances.

533

Brown, B.P., & H.I. Johnson 1959 MOVING COCKPIT SIMULATOR INVESTIGATION
OF THE MINIMUM TOLERABLE LONGITUDINAL MANUEVERING STABILITY.
(National Aeronautics and Space Administration, Langley Field, Va.)
NASA TN D-26

534

Brown, B.P., H.I. Johnson & R.G. Mungall 1960 SIMULATOR MOTION EFFECTS
ON A PILOT'S ABILITY TO PERFORM A PRECISE LONGITUDINAL FLYING TASK.
(National Aeronautics and Space Administration, Washington)
NASA TN D-367. May 1960. ASTIA AD 236265

SUMMARY: A program was conducted on the NASA normal acceleration and pitch (NAP) Simulator to determine the effect that body-motion cues have on the pilot's ability to perform a precision close-coupled tracking task. These tests were conducted with heavy stick-force gradient and with zero-stick-force gradient over a range of longitudinal stability conditions. Pilots controlled the simulator from both a fixed and a moving cockpit.

The results indicate that there was improvement in pilot performance due to motion cues over the stability range tested. The motion cues appreciably improved the performance of both pilots when the feel forces were absent. The pilots always preferred to be supplied with motion cues. In the absence of feel forces, confusion was exhibited by one pilot as to the proper direction to execute control when bodily-motion cues were not provided.

535

Brown, B.P., & G. Merritt Preston 1962 LAUNCH-COMPLEX CHECKOUT AND
LAUNCH-VEHICLE SYSTEMS. In NASA, Results of the First U.S. Manned
Orbital Space Flight, Feb. 20, 1962. Pp. 45-52.

536

Brown, B. R., and J. G. Howlett 1943 SOME ACCELEROMETER RECORDINGS IN
AN AIRCRAFT (ANSON) (National Research Council, Toronto, Canada)
Report from No. 1 Air Observers School & No. 6 Medical Selection Board,
April 1943 Report No. C2505, June 1943.

537

Brown, C. W. 1948 SPEED AND ACCURACY OF REACHING FOR CONTROLS IN DIFFERENT AREAS FROM THE PRONE POSITION. (Air Materiel Command, Wright-Patterson AFB, Ohio) Report No. MCREXD-694-4H, 28 Jan. 1948

ABSTRACT: It is concluded from this study that the preferred locations for control levers, switches and knobs for operation from the prone position are directly below and forward of the pilot's shoulders. Control locations become progressively less desirable as they are moved upward and to the rear. Areas to the right and to the left are approximately equal in desirability.

It is further concluded that the Aero Medical Laboratory should apply the findings and conclusions of this study to the location of accessory controls in the current B-17 prone position modification project. (DACO)

538

Brown, C. W., E. E. Ghiselli, R. F. Jarrett, E. W. Minium and R. M. U'Ren 1949 MAGNITUDE OF FORCES WHICH MAY BE APPLIED BY THE PRONE PILOT TO AIRCRAFT CONTROL DEVICES. (Aero Medical Lab., Wright-Patterson AFB, Ohio) Memorandum Report No. MCREXD-694-4J, 4 March 1949 ASTIA ATI-72377

ABSTRACT: A study was made of the forces which pilots could be expected to apply to aircraft controls operated from the prone position. These dimensions of hand movement suitable for operation of elevator, rudder, and aileron controls were tested on subjects in each of 9 prone positions and in the seated position. From the standpoint of forces which can be applied to hand operated controls, the prone position compares favorably with the seated position for application of pull forces on elevator controls, but is inferior to the seated position for the rotation movement normally used for aileron control. The push right-push left movement dimension, suitable for operation of the rudder controls, is unfavorable for application of high control forces in the prone position.

539

Brown, C. W., E. E. Ghiselli, R. F. Jarrett, E. W. Minium & R. M. U'Ren 1950 COMPARISON OF AIRCRAFT CONTROLS FOR PRONE AND SEATED POSITION IN THREE-DIMENSIONAL PURSUIT TASK. (USAF Air Materiel Command, Wright-Patterson Air Force Base, Ohio) AF-TR-5956, March 1950. ASTIA ATI 73 414

ABSTRACT: One hundred and eleven university students were divided into four groups. Each group was tested on the same psychomotor pursuit task but utilized different controls. Two of the groups operated their controls from the seated position, and two from the prone position. One of the seated groups used the conventional stick and rudder controls, and the second seated group together with one of the prone-position groups employed a three-dimensional hand control. The second prone-position group used the Amptmann three-dimensional control.

The results indicated that for either of the positions, seated or prone, the type of control utilized made little or no difference as far as performance on the pursuit task was concerned. However, performance in the prone position was found to be significantly inferior to that in the seated position. The indications are, therefore, that for this kind of task the type of control is relatively unimportant but the position of the pilot's body may be a prime consideration. (ASTIA)

540

Brown, C. W., E. E. Ghiselli, R. F. Jarrett, et al. 1950 MAGNITUDE OF FORCES WHICH MAY BE APPLIED BY THE PRONE PILOT TO AIRCRAFT CONTROL DEVICES. III. FOOT CONTROLS. (Air Materiel Command, Wright-Patterson AFB, Dayton, Ohio) AF TR 5955, Feb. 1950, ATI-70 936

ABSTRACT: Forces which may be applied by extension of the foot from each of five initial angular positions were determined for twenty-seven male subjects, twenty-five of whom were former pilots. The limits of practical usefulness of control by dorsi-extension of the foot seem to be about 85 degrees -105 degrees. Beyond these limits performance is erratic. The forces exerted through dorsi-extension increase steadily with increased flexion of the foot. Response is equally effective in the right and left feet. (AUTHOR)

541

Brown, C. W., E. E. Ghiselli, R. F. Jarrett, E. W. Minimum and R. M. U'Ren. 1950 MAGNITUDE OF FORCES WHICH MAY BE APPLIED BY THE PRONE PILOT TO AIRCRAFT CONTROL DEVICES. II. Two-Dimensional Hand Controls. (Air Materiel Command, Wright-Patterson AFB, Ohio) AF TR 5954, Feb. 1950.

ABSTRACT: The maximum forces which could be applied in the vertical direction (up and down) and in a horizontal arc were measured for the thirty-seven men in several prone position situations. Much greater forces could be applied to horizontal rotation than to the lifting or depressing movements. Averaging all bed positions the means were 114 pounds for the "up" movement, 138 pounds for "down", and 269 and 260 pounds, respectively, for right and left rotation.

When instructed to apply to a given dimension of control movement "as much pressure as you can and still keep enough reserve so that you felt you could retain control over the other movements, and be prepared to make emergency adjustments as would be necessary in the flying situation," these pilots applied about 59% of their maximum forces to the controls.

Altering the elevation of the bed and its horizontal distance from the control handles influenced the forces which could be applied.

542

Brown, C. 1960 BIBLIOGRAPHIC STUDIES OF AFOSR INFORMATION STORES
(Library of Congress, Washington, D.C.) Project 9769(803), Contract
CSO 680-60-4; AFOSR, DMS.

ABSTRACT: Novel techniques of indexing coding, and machine storage, search, and retrieval to be carried out elsewhere under this task (e.g., Western Reserve University, Documentation, Inc., Zator Co.) require a collection of abstracts for experimentation. This contract will provide AFOSR abstracts for this purpose by making a chronological compilation of abstracts of all AFOSR Technical Notes and Technical Reports issued between 1 January 1954 and 31 December 1958. These abstracts are to be suitably indexed by good standard methods to provide a valid basis for comparison with new techniques.

543

Brown, D. 1961 THE DIESEL-POWERED BALLISTIC CENTRIFUGE
(U.S. Navy Bureau of Naval Weapons) Contract NOrd 16640, ABL/X-69,
Oct. 1961. ASTIA AD 266 363

ABSTRACT: Allegany Ballistics Laboratory has designed and constructed a centrifuge for use in ballistic and physical testing of rockets and rocket either ignited or unignited. Depending upon the size of a rocket or a component, forces up to 55 g can be applied. Upon approved request, this centrifuge can be made available to outside agencies.

544

Brown, D. 1961 THE DIESEL-POWERED BALLISTIC CENTRIFUGE.
(Allegany Ballistics Lab., Hercules Powder Co., Cumberland, Md.)
Report no. ABL/X-69, ASTIA AD 266 363

ABSTRACT: A description is given of the Allegany Ballistics Laboratory ballistic centrifuge which is used in ballistic and physical testing of rockets and rocket components. Certain flight conditions are simulated by centrifuging a rocket either ignited or unignited. Depending upon the size of the rocket or component being tested, forces up to 55 g can be applied. (Author)

545

Brown, D. W. 1961 A RECORDING TECHNIQUE FOR KITE BALLOON YAW BEHAVIOUR AND ACCELERATIONS, AND SOME EXPERIMENTAL RESULTS. (Royal Aircraft Establishment, Farnborough, England) Tech. Note Mech. Eng. 343. ASTIA AD-275 073

SUMMARY: The continued demand for kite balloons as carriers for experimental equipment, and for other purposes, stimulated a study of balloon flight behaviour to improve stability.

This note describes methods developed for recording balloon yaw behaviour, and gives results obtained from some experimental balloons.

Photography was used to record balloon lateral displacements and sideslip angles, and balloon lateral accelerations were derived therefrom.

A second method of obtaining balloon accelerations employed an accelerometer, the attitude of which was measured by a gyroscope. This method is suitable for longer duration records where peak accelerations are required rather than a detailed history of balloon yaw behaviour. Both methods are promising and could be combined and simplified to obtain more accurate results for less effort.

546

Brown, E.L. 1960 HUMAN AND SYSTEM PERFORMANCE DURING ZERO "G"
In Vistas In Astronautics (2nd symposium) (New York: Pergamon, 1960)
Pp 85-90.

ABSTRACT: Research areas covered by this article include: (1) Human performance on motor and mental tasks; (2) Locomotion of Individual humans inside large space vehicles; (3) Locomotion of Individual humans outside space vehicles; (4) Human perceptive orientation during zero g; (5) Behavior of liquids during zero-g; (6) Fluid transfer problems during zero g; and (7) Heat transfer problems during zero g.

547

Brown, F.W., III & R.N. Lee 1953 A BIOPHYSICAL ANALOG FOR EXPLOSIVE DECOMPRESSION STUDIES IN ANIMALS. (U.S. Navy Mine Defense Lab., Panama City, Fla.) Medical Research Report No. 3, April 1953.
ASTIA AD 226 301

548

Brown, G.E., Jr., E.H. Wood & E.H. Lambert 1949 EFFECTS OF TERA-ETHYL-AMMONIUM CHLORIDE ON THE CARDIOVASCULAR REACTIONS IN MAN TO CHANGES IN POSTURE AND EXPOSURE TO CENTRIFUGAL FORCE.
J. Appl. Physiol. 2:117-132, Sept. 1949.

ABSTRACT: Studies of man's reactions to the effects of gravity produced by tilting erect to 70° from the supine position or by exposure to positive acceleration (centrifugal force) reveal that a fall in arterial blood pressure and an increase in heart rate result. These physiologic effects are quickly compensated for by reflex mechanisms mediated by the autonomic nervous system which produce an increase in arterial pressure at heart level and a subsequent slowing in heart rate.

The intravenous injection of 5.5 to 7.7 mg. of tetra-ethyl-ammonium chloride per kilogram of body weight has been found to block these reactions for periods of 5 to 15 minutes so that arterial pressure continues to fall often to levels that produce symptoms of cerebral anoxemia. The marked decreases in arterial pressure fail under these circumstances to produce compensatory alterations in heart rate. The compensatory cardiovascular reactions induced by tilting to an upright position of 70° or exposure to centrifugal force are gradually recovered in a period of from 10 to 45 minutes after injection of the drug.

Simultaneous studies of arterial pressure, heart rate, venous pressure and volume of the leg indicate that these compensatory reactions which determine man's tolerance to the upright position or positive acceleration are chiefly concerned with the arterial rather than the venous side of the circulation. The failure of reflex vasoconstriction to compensate for the increased hydrostatic pressure in the dependent parts of the body and thus to prevent an increase in blood flow through these parts, rather than reduced venous return to the heart, is the primary factor accounting for the reduction of man's tolerance to positive acceleration after the administration of tetra-ethyl-ammonium chloride.

549

Brown, G.L., B. McArdle, & J.W. Magladery 1942 CLINICAL INVESTIGATIONS INTO AIRSICKNESS. (RAF, Institute of Aviation Medicine, Farnborough)
FPRC 410(a), Jan. 1942.

550

Brown, G.W., M.W. Brown & H.M. Hines 1951 CARDIOVASCULAR AND RESPIRATORY CHANGES ASSOCIATED WITH EXPERIMENTAL CONCUSSIONS IN DOGS.
(Wright Air Development Ctr., Wright-Patterson AFB, Ohio) WADC TR 6737
Oct. 1951.

551

Brown, G.W., M.L. Brown and H. M. Hines 1952 EFFECTS OF EXPERIMENTAL
CONCUSSION ON BLOOD FLOW, ARTERIAL PRESSURE AND CARDIAC RATE.
Am. J. Physiol., 170(2):294-300, Aug. 1952

ABSTRACT: These experiments sought direct and continuous measurement of blood flow, blood pressure and cardiac rate in the common carotid artery of dogs before, during and after experimental concussion.

552

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

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

553

Brown, J. L., H. Kuehnelt, F. Nicholson, & A. Futterweit n.d. VALIDITY OF THE
CENTRIFUGE AS A FLIGHT SIMULATOR (Bureau of Medicine and Surgery)
Task MR005-15-1003-1, Rept. No. 4

554

Brown, J.L. 1955 ACCELERATION AND HUMAN PERFORMANCE: A SURVEY OF RESEARCH
(Aviation Medical Acceleration Lab., Naval Air Development Center,
Johnsville, Pa.) Report No. NADC-MA-5503, 22 March 1955,
ASTIA AD-59257

ABSTRACT: This report summarizes the important research which has been conducted to date on the problem of human performance under acceleration. The material has been grouped according to five major headings; the senses, simple motor behavior, complex tasks, cognitive processes, and psychological effects. Research relevant to each of these classifications is reviewed, important questions which appear to remain unanswered are raised, and suggestions are made regarding desirable lines for future research. It appears that only a very limited amount of research has been conducted relating to actual performance sequences which may be required of pilots exposed to acceleration.

555

Brown, J.L., & M. Lechner 1955 ACCELERATION AND HUMAN PERFORMANCE:
A SURVEY OF RESEARCH J. Aviation Med. 27(1):32-49, Feb. 1956
See also (Naval School of Aviation Medicine, Pensacola, Fla.)
NADC-MA-5503, 22 March 1955. ASTIA AD 59 257

ABSTRACT: There is growing interest in such problems as the optimum flight path to be used in establishing manmade satellites. These developments have created a need for information concerning the effects of acceleration on man's ability to perform various control functions and on his performance capabilities in general under a variety of acceleration conditions. It is, therefore, of interest to review research in this general area. There are many ways in which exposure to acceleration may interfere with a pilot's performance. For example, performance decrements may be a direct result of the effects of acceleration on the senses because it is through the medium of the senses that the pilot receives all information upon which are based his actions in controlling the aircraft. Of primary importance are the visual, vestibular, kinesthetic, and auditory senses. It is essential to consider the mechanical effects of acceleration on movement of various parts of the body. Speed of movement and the distance through which motion is possible in a given direction will vary with acceleration. Forces which the pilot is capable of exerting will also be affected by acceleration.

556

Brown, J. L., R. F. Gray, & H. N. Hunter 1955 THE EFFECTS OF MAGNITUDE AND DURATION OF ACCELERATIVE FORCES ON HUMAN PERFORMANCE. PHASE I AND II.
(Naval Air Development Ctr., Johnsville, Pa.) Project NM 001 111 301;
31 Dec. 1955

ABSTRACT: Problems of pilot performance requirements which may exist during, or immediately after, exposure to acceleration have been surveyed in several areas, and a literature search has been completed. It has been concluded that one of the most critical situations requiring investigation is the air-to-air combat situation. In this situation, the interceptor pilot may be required to perform a complex missile control function while, at the same time, he is exposed to relatively high acceleration in maintaining pursuit of the target. An experimental design has been formulated to investigate this problem on the AMAL centrifuge. Programming of the experimental conditions will be accomplished with analog computing equipment. A survey is being made to determine what available computer equipment is best suited to this particular experiment and to other similar ones which may be conducted on the centrifuge.

557

Brown, J.L., R.F. Gray, B. Lewis, B.F. Burgess, & M. Chianta 1955 ROD -
CONE INTERACTION IN THE DARK ADAPTED EYE. (Paper, American Psychological
Association Convention, Aviation Medical Acceleration Laboratory, Naval
Air Development Ctr., Johnsville, Pa., Sept. 1955)

ABSTRACT: Spectral sensitivity of the dark-adapted eye is usually expressed in terms of the scotopic cuminesity curve. Although this curve affords a good description of sensitivity for light detection, it is unlikely to represent sensitivity for such visual functions as recognition of complex forms when these are presented in short flashes to the dark-adapted eye. It was the purpose of this experiment to determine possible changes in the relative contributions of rods and cones to "seeing" by the dark-adapted eye with changes in the criterion of threshold. (American Psychologist 10(8):443-444. Sept. 1955)

558

Brown, J. L., R. F. Gray, B. Lewis, B. F. Burgess, & M. Chianta 1955 VISUAL
FUNCTION UNDER STRESS (Naval Air Development Ctr., Johnsville, Pa.)
Project NM 001 110 300; 31 Dec. 1955

ABSTRACT: A preliminary experiment has been performed on the centrifuge. It was determined that acceleration tolerance, when based on a subject's ability to respond to a visual signal, may be influenced by the luminance of the signal and the portion of the retina which is stimulated. Time required for a subject to react to a signal increases as the signal is made dimmer. For a fixed signal luminance, reaction time remains constant and shows no gradual increase with increased acceleration. Experiments are in progress in a low pressure chamber and with oxygen-poor gas mixtures, the results of which will afford quantitative data on the impairment of vision at altitude for a variety of visual tasks, from the gross detection of light to the discrimination of fine detail. A validating experiment has been completed to check the experimental procedure at normal atmospheric pressure.

559

Brown, J.L. 1956 THE STUDY OF HUMAN PERFORMANCE LIMITATIONS UNDER
CONDITIONS OF ACCELERATION. In Proceedings of the Twentieth International
Physiological Congress, Brussels, Belgium, 1956 Pp. 1020-1021

560

Brown, J.L. 1957 SUBJECTIVE PREFERENCE AMONG DIFFERENT MODES OF CLOSED-
LOOP OPERATION OF THE CENTRIFUGE FOR FLIGHT SIMULATION.
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA 9535,
9 Dec. 1957.

ABSTRACT: Four simulations, using the three degrees of freedom capability of the human centrifuge at AMAL, were investigated. They were defined as follows: (1) counterclockwise centrifuge rotation with the subject facing in the direction of rotation and the inner gimbal position compensated for the angular acceleration of the main arm, (2) counterclockwise centrifuge rotation with the subject facing in the direction of rotation and the inner gimbal position not compensated for angular acceleration of the arm, (3) clockwise centrifuge rotation with the subject facing in the direction opposite that of rotation and the inner gimbal position not compensated for angular acceleration of the main arm, and (4) clockwise centrifuge rotation with the subject facing the direction opposite that of rotation and with the inner gimbal position compensated for angular acceleration of the arm. Four subjects were run while performing 8 maneuvers under each of the 4 conditions of centrifuge operation in a given run. Three of the subjects remarked that conditions 2 and 3 were less provocative of nausea than other conditions. All four subjects remarked that the operation of the centrifuge felt smoother under conditions 2 and 3 than under the other conditions. It is concluded that with the computer system employed in this investigation, differences in realism introduced by changing the direction of rotation of the centrifuge or altering the nature of inner gimbal motions were not clearly perceived by the subjects.

561

Brown, J.L., W.H.B. Ellis, M.G. Webb, & R.F. Gray 1957 THE EFFECT OF
SIMULATED CATAPULT LAUNCHING ON PILOT PERFORMANCE.
(U.S. Naval Air Development Center, Aviation Medical Acceleration Lab.,
Johnsville, Pa.) NADC-MA-5719, 31 Dec. 1957. ASTIA AD 156 851.

ABSTRACT: Four subjects were exposed to acceleration patterns which simulated the accelerations of catapult launchings up to 11.3G. Subjects were trained in a task which required stabilization, by manipulation of a control stick, of disturbances of a standard pitch and roll indicator. Scores for performance were obtained during a control period prior to acceleration exposure and immediately following exposure. Performance immediately following exposure showed no decrement at any level of acceleration when compared with performance prior to exposure. Some discomfort at the higher levels of acceleration was attributed to a negative component of acceleration on the subject which was proportional to the sine of the angle formed by the seat-back with the vertical.

Brown, J.L., & R.E. Burke 1957 THE EFFECT OF POSITIVE ACCELERATION ON VISUAL REACTION TIME. (U.S. Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-5712. ASTIA AD 143 551
See also J. Aviation Med. 29(1):48-58, 1958

ABSTRACT: Reaction time to visual test signals was measured for two subjects during exposure to positive acceleration. Two test light luminances, 4560 millilamberts and 0.025 millilambert, and two regions of the retina, one close to the foveal center of the eye and the other far removed from the fovea, were investigated. When measured in terms of a visual effect, acceleration tolerance was higher for the brighter light. It was also higher when the more central region of the retina was stimulated. Reaction time is increased significantly with increases in positive acceleration below the tolerance level. Increase in reaction time does not occur until after a minimum of about 5 seconds exposure to acceleration between 3 and 6 G. (Author)

563

Brown, J.L., W.H.B. Ellis, M.G. Webb & R.F. Gray 1957 THE EFFECT OF SIMULATED CATAPULT LAUNCHING ON PILOT PERFORMANCE. (U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-5719. 31 December 1957. ASTIA AD 156 851.

ABSTRACT: Four subjects were exposed to acceleration patterns which simulated the accelerations of catapult launchings up to 11.3G. Subjects were trained in a task which required stabilization, by manipulation of a control stick, of disturbances of a standard pitch and roll indicator. Scores for performance were obtained during a control period prior to acceleration exposure and immediately following exposure. Performance immediately following exposure showed no decrement at any level of acceleration when compared with performance prior to exposure. Some discomfort at the higher levels of acceleration was attributed to a negative component of acceleration on the subject which was proportional to the sine of the angle formed by the seat-back with the vertical

564

Brown, J.L. & J.H. Hill 1957 HUMAN PERFORMANCE LIMITATIONS IN AIRCRAFT CATAPULT-ING AND ARRESTING (U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR22 April 8, 1957

ABSTRACT: In order to study the effects of accelerations encountered in catapult launching on pilot performance immediately following launching, it is necessary to determine the nature of this performance and to select critical aspects of performance for investigation. To ascertain performance requirements, five jet pilots with considerable catapulting experience (100 launchings), eight jet pilots and four AD-5N pilots were interviewed. A summary of the findings of

these interviews is given. On the basis of information obtained, it was decided that the most important aspect of pilot performance immediately after catapult launching is that which relates to the maintenance of correct aircraft attitude. Accordingly, instrumentation for a task which required the stabilization of a pitch and roll indicator by manipulation of an aircraft control stick has been designed and constructed for tests on the AMAL centrifuge.

565

Brown, J. L. 1958 PLANS FOR DYNA SOAR I CENTRIFUGE EXPERIMENT
(Naval Air Development Ctr., Johnsville, Pa.) Letter Rept. TED ADC RS-7019,
Serial 01017, 10 Nov. 1958

566

Brown, J.L. 1958 AIR-TO-AIR TRACKING DURING CLOSED-LOOP CENTRIFUGE
OPERATION. (U.S. Naval Air Development Center, Johnsville, Pa.)
NADC-MA-5803, 10 March 1958. ASTIA AD 159 716

ABSTRACT: Performance was studied on the centrifuge in a simulated, air-to-air tracking situation. Centrifuge motion was controlled by manipulations of aircraft controls located in the centrifuge gondola in such a way that subjects were exposed to acceleration patterns which were appropriate to their performance in the tracking situation. It was found that performance of the tracking task showed a statistically significant decrement under experimental conditions as compared with control conditions with the centrifuge stationary. A score which represented flight coordination showed a statistically significant improvement under experimental conditions as compared with control conditions.

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Brown, J.L., & C.C. Collins 1958 AIR TO AIR TRACKING DURING CLOSED
LOOP CENTRIFUGE OPERATION. (Naval Air Development Ctr., Johnsville, Pa.)
NADC-MA-5803, 10 March 1958. ASTIA AD 159 716.
See also J. Aviation Med. 29(11):794-804

ABSTRACT: Performance was studied on the centrifuge in a simulated air-to-air tracking situation. Centrifuge motion was controlled by manipulations of aircraft controls located in the centrifuge gondola in such a way that subjects were exposed to acceleration patterns which are appropriate to their performance in the tracking situation. It was found that performance of the tracking task showed a statistically significant decrement under experimental conditions as compared with control conditions with the centrifuge stationary. A score which represented flight coordination showed a statistically significant improvement under experimental conditions as compared with control conditions.

568

Brown, J.L. & C.C. Collins 1958 AIR -TO-AIR TRACKING DURING CLOSED LOOP
CENTRIFUGE OPERATION. J. Aviation Med. 29(11):794-804

ABSTRACT: The Navy centrifuge was converted to a flight simulator to provide a method for a study of the interaction between pilot performance and acceleration. Flight instruments and controls were installed in the gondola of the centrifuge which effected control of centrifuge motions (rotation of the gondola and rotation of the arm) by an analog computer. Five subjects were required to fly the simulator in a coordinated fashion (minimal lateral acceleration) while centering a moving target on a simulated radar scope. All subjects were observed to perform better in vertical tracking when the centrifuge was at rest than during acceleration up to 2.5 g, but no significant difference was observed in horizontal tracking. Direction of rotation of the centrifuge had no effect on tracking performance. Flight coordination was considerably improved when the centrifuge was in motion. It is concluded that acceleration patterns appropriate to a given flight simulation problem result in a decrement in tracking performance.

569

Brown, J.L., & R.E. Burke 1958 THE EFFECT OF POSITIVE ACCELERATION ON
VISUAL REACTION TIME. J. Aviation Med. 29:48-58
See also (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-5712,
12 Aug. 1957. ASTIA AD 143 551.

ABSTRACT: Reaction time to visual test signals was measured for two subjects during exposure to positive acceleration. Two test light luminances, 4560 millilamberts and 0.025 millilambert, and two regions of the retina, one close to the foveal center of the eye and the other far removed from the fovea, were investigated. When measured in terms of a visual effect, acceleration tolerance was higher for the brighter light. It was also higher when the more central region of the retina was stimulated. Reaction time is increased significantly with increases in positive acceleration below the tolerance level. Increase in reaction time does not occur until after a minimum of about 5 seconds exposure to acceleration between 3 and 6 G. (Author)

570

Brown, J.L. 1958 THE STUDY OF HUMAN PERFORMANCE LIMITATIONS IN AIRCRAFT
CATAPULTING WITH A LINEAR TRACK; LETTER REPORT ON PROPOSED EXPERIMENTAL
PROGRAM
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR61, August 13, 1958

ABSTRACT: It is necessary to gain more information on how high a level of acceleration a pilot can tolerate without physiological effects or injury and how high a level he can withstand and still perform those functions necessary for maintaining aircraft stability. There are several areas in which additional information

is required: (1) the effect of acceleration on more complex tests, (2) the rate of onset of acceleration must also be investigated in terms of its effect on the performance of a complex task, and (3) the possibility of vestibular effect following exposure to high linear accelerations. Apparatus requirements to perform the experiments necessary are stated along with the physiological data required. An experimental program is outlined.

571

Brown, J.L. 1958 DYNA-SOAR I CENTRIFUGE EXPERIMENT; LETTER REPORT CONCERNING PLANS FOR.
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR71 Nov. 10, 1958
Confidential

572

Brown, J.L. 1958 TRACKING PERFORMANCE DURING SIMULATED EXIT AND REENTRY FLIGHTS OF THE X-15 RESEARCH AIRCRAFT. (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA 5801, 15 Jan. 1958. ASTIA AD 157 843.

573

Brown, J.L. 1959 THE BIO-DYNAMICS OF LAUNCH AND RE-ENTRY.
Military Med., 124(11):775-781.
Also in Med. Affairs, 1(2):8-10; 26-27, Autumn 1959.
See also Naval Res. Rev., May, 1959, pp. 8-15

ABSTRACT: Acceleration tolerance, effects of acceleration upon man's performance, and human adaptability to space flight are discussed briefly.

574

Brown, J.L. 1959 THE BIODYNAMICS OF LAUNCH AND REENTRY.
Naval Res. Rev., May 1959, pp. 8-15
See also Medical Affairs 1(2):8-10, 26-27, Autumn, 1959.
See also Military Medicine 124(11):775-781, 1959.

ABSTRACT: It has been demonstrated that, as a passenger, man can tolerate the acceleration and vibration stresses which may be encountered in flight to and from space if he is provided with adequate mechanical support and restraining equipment, and if adequate design and damping are employed in constructing the vehicle. Little is known about man's motor performance capabilities under the above-mentioned conditions, however. Fluctuations of acceleration will vary

the effective weight of the pilot's arms and hands and may result in inadvertent movements of the controls. With each change, the range of frequencies over which his muscles can be expected to exert control will undoubtedly change and so will the optimum characteristics of the controls he is operating. It is recommended that efforts should be increased in the systematic study of the dynamic relations between a pilot and his controls in order to determine the frequency response characteristics of his limbs in various positions under different conditions of acceleration.

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- Brown, J.L. 1959 CENTRIFUGE SIMULATOR STUDIES OF THE EFFECTS OF FLIGHT ACCELERATION ON PILOT PERFORMANCE. (Franklin Institute Symposium on Med. Instrumentation, May 18, 1959.) p. 52.

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- Brown, J.L. 1959 CHANCE VOUGHT PROJECT FOR THE STUDY OF PILOT PERFORMANCE DURING CENTRIFUGE SIMULATION OF THE BOOST ACCELERATION OF THE DYNA-SOAR ORBITAL VEHICLE EXIT FLIGHT (Aviation Medical Acceleration Laboratory, U.S. Naval Air Development Center, Johnsville, Pa.) Report No. NADC-MA-LR 84, 22 April 1959, ASTIA (Confidential)

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Brown, J.L. 1959 CHANCE VUGHT PROJECT FOR THE STUDY OF PILOT PERFORMANCE DURING CENTRIFUGE SIMULATION OF THE BOOST ACCELERATIONS OF THE DYNA SOAR ORBITAL VEHICLE EXIT FLIGHT. (US Naval Air Dev. Ctr., Johnsville, Pa.) Letter Rept. No. TED-ADC-RS-7019, Serial 0365, 22 April 1959.

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Brown, J.L., H. Juehnel et al. 1960 COMPARISON OF TRACKING PERFORMANCE IN THE TV-2 AIRCRAFT AND THE ACL COMPUTER/AMAL HUMAN CENTRIFUGE SIMULATION OF AIRCRAFT. (Naval Air Development Center, Johnsville, Pa.) NADC-MA-6016, Nov. 1960. ASTIA AD 250 129.

ABSTRACT: A tracking task was performed by each of six subjects in a TV-2 aircraft, in a static simulation of the aircraft and in each of two centrifuge modes of simulation which provided acceleration forces similar to those encountered in the aircraft. Centrifuge accelerations were controlled by pilot performance in the simulation. A preliminary analysis of tracking performance was conducted based on absolute error. In order to perform this analysis it was necessary to filter out low frequency biases which affected data in the aircraft but not in the centrifuge. Conclusions from the analysis must be qualified accordingly. Tracking performance on the centrifuge was inferior to performance under static conditions. In the case of four subjects who are qualified pilots, performance in the aircraft was consistently superior to performance on the centrifuge and frequently superior to performance under static conditions. The subject, a nonpilot, who had the best performance on the centrifuge, had the poorest performance in the aircraft. A spectral density analysis of results of the experiment will be presented in a subsequent report.

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Brown, J.L., H. Kuehnel, F.T. Nicholson & A. Futterweit 1960 COMPARISON OF TRACKING PERFORMANCE IN THE TV-2 AIRCRAFT AND THE ACL COMPUTER/AMAL HUMAN CENTRIFUGE SIMULATION OF THIS AIRCRAFT. (U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-6016/NADC-AC-6008, 7 Nov. 1960. ASTIA AD 250 129.

ABSTRACT: The analysis of this experiment does not indicate any advantage in the use of the centrifuge for the study of pilot tracking performance in a maneuvering aircraft when the maximum linear accelerations are on the order of 5 G. Anomalous angular motions of the centrifuge, which in this experiment caused disorientation and nausea of the subject pilots, probably served to offset any advantage gained by the inclusion of the acceleration forces in the simulation. For the tracking tasks employed in the present experiment, the results of work with a static, or fixed-base, simulator provided just as good a basis for prediction of the way in which pilots would perform a specific task in the aircraft as did work performed on the centrifuge.

It is probable that the primary advantage of a centrifuge simulation lies

in situations in which linear acceleration forces are sufficiently high to have an appreciable mechanical effect on a pilot, are sustained for relatively long durations, and are introduced primarily as a result of action of longitudinal thrust or longitudinal drag and not by angular motions. These are the conditions which will prevail in space flight. Although the validity of centrifuge simulations of space vehicles cannot be assessed until space missions are flown, the centrifuge provides the only way in which effects of acceleration encountered in rocket vehicles such as the X-15 and the Mercury capsules can be studied at all in advance of actual missions into space.

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Brown, J. L. 1961 ACCELERATION AND MOTOR PERFORMANCE.
Human Factors, 2(4):175-185, Jan. 1961

ABSTRACT: Experiments concerning the effects of acceleration on motor performance are discussed in a sequence which illustrates the evolution of research techniques in recent years. In the simplest of these techniques, performance is evaluated during or immediately following exposure to pre-programmed acceleration time histories. A more complex technique involves the study of interaction of subject performance with the pattern of acceleration experienced. Accelerations are actually controlled by subject performance by means of an analog computer control system. Certain limitations of centrifuge simulations are discussed.

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Brown, J.L., & H. Tremblay 1961 COMPARISON OF TRACKING PERFORMANCE IN THE TV-2 AIRCRAFT AND THE ACL COMPUTER/AML HUMAN CENTRIFUGE SIMULATION OF THIS AIRCRAFT. (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.)
See also (Naval Air Development Ctr., Johnsville, Pa.) NADC MA 6016/AC-6008, 7 Nov. 1960.

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Brown, J. L. 1961 ORIENTATION TO THE VERTICAL DURING WATER IMMERSION
Aerospace Medicine 32(3):209-217, March 1961.

ABSTRACT: To determine the extent of possible disorientation in a liquid environment when visual, tactual, kinesthetic, and buoyancy cues are largely eliminated, Ss were immersed in water at 18 or 25 ft. and then rotated in a tucked position on a rod through 3, 4, or 5, revolutions. Rotation was

terminated with the head in one of four positions: upright, forward, down, or back. Ss then attempted to point in the up direction, then to nod the head and correct the direction of pointing if necessary, and, finally, to swim slowly toward the surface. The results (errors in pointing, correction after head movement, etc.) were interpreted with respect to the function of the utricles as g sensors. Suggestions were made about procedures for simulation of zero-g. (Tufts)

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Brown, J. L., ed. 1961 SENSORY AND PERCEPTUAL PROBLEMS RELATED TO SPACE FLIGHT. REPORT OF A WORKING GROUP OF THE PANEL ON PSYCHOLOGY ARMED FORCES--NRC COMMITTEE ON BIO-ASTRONAUTICS. (National Research Council, Wash., D.C.) Publication No. 872. ASTIA AD-257 215

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Space Flight missions

Launching, orbital flight; lunar flight; interplanetary flight; landing

Unique aspects of space flight

Vision outside the space vehicle

Classification of tasks; relation of tasks to phases of space flight:

- (1) Launch;
- (2) Orbit;
- (3) Lunar and interplanetary flights; and
- (4) Landing

Additional problems relating to vision outside of the space vehicle:

- (1) High illumination levels;
- (2) High contrast;
- (3) Empty field myopia; and
- (4) the limits of visual acuity

Suggested areas of research:

- (1) Attitude control;
- (2) Reconnaissance;
- (3) Detection;
- (4) Rendezvous;
- (5) Navigation; and
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- (1) Display design;
- (2) Astronomical Navigation;
- (3) Vehicle illumination; and
- (4) Visual orientations in environments having unique geometry

Non-Visual sensory and perceptual problems

The relevance of theories of sensation and perception to problems in space flight
(ASTIA)

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Brown, J. L., H. Tremblay, G. H. Byford, et al 1961 ABSTRACTS OF PAPERS TO BE PRESENTED AT THE MEETING OF THE PANEL ON ACCELERATION STRESS OF THE ARMED FORCES-NRC COMMITTEE ON BIO-ASTRONAUTICS, 6-11 MARCH 1961, NASA AMES RESEARCH CENTER, MOFFETT FIELD, CALIFORNIA.

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Brown, R.B., J.R. Brett, & J.G. Howlett 1943 SWING SICKNESS AND A HISTORY OF MOTION SICKNESS IN RELATION TO AIRSICKNESS. (NRC, Canada, Com. Avn. Med.) May, 1943

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Brown, Robert H. et al. 1949 THE RELATIONSHIP BETWEEN APPARENT DISPLACEMENT AND MOTION IN THE OCULOGYRAL ILLUSION (Joint project Rept. No. 1, (Tulane University in cooperation with Naval School of Aviation Medicine and Research, Pensacola, Proj. NM 001 002) May 1949. ASTIA TIP U7477.

ABSTRACT: Under the proper conditions, angular acceleration gives rise to a well defined apparent movement which has been termed the oculogyral illusion. This illusion comprises apparent displacement of a visual target as well as apparent motion. In the case of an object in actual motion, real displacement, that is, change in position, has a very definite relationship in duration and magnitude to the causal motion. On the other hand, the illusory displacement reported here, as observed during apparent motion, does not obey such precise or meaningful laws. The relationship between these two characteristics was studied by rotating 12 subjects in a Link Trainer at 26 rpm for one minute. They were then decelerated to 0 rpm rapidly. During and after rotation the subject's head was maintained at a fixed 15 degree forward inclination. The target was observed only during the last 15 seconds of rotation and until the illusory effects subsided; the eyes were closed during the initial 45 seconds of rotation. Each subject was given 5 trials at 7 minute intervals per day and 10 daily sessions. One half of the subjects reported on motion phenomena in the first 5 sessions and displacement phenomena in the second five sessions.

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Brown, R. H., H. Imus, J. I. Niven, & A. Graybiel 1950 APPARENT DISPLACEMENT AND MOTION IN THE OCULOGYRAL ILLUSION. ONR Monthly Research Report, Sept. 1950, 14-16.