

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

690

Titov, G.S. 1962 REPORT OF MAJOR GHERMAN S. TITOV AT FIFTH PLENARY MEETING OF COSPAR ON MAY 3, 1962  
(Committee of Space Research (COSPAR), The Hague (Netherlands))

ABSTRACT: Major Gherman S. Titov's speech, given at the Fifth Plenary Meeting of COSPAR, includes details of his flight on August 6-7, 1961, in the spacecraft Vostok II. Major Titov reviews the purpose and accomplishments of his flight. He indicates that reentry into the earth's atmosphere was accomplished by means of a parachute mechanism. The physical sensations he encountered during the flights are discussed.

691

Tobias, C. A., & J. V. Slater 1961 CERTAIN ASPECTS OF SPACE BIOLOGY  
(Space Sciences Laboratory & Donner Laboratory of Biophysics & Medical Physics, Univ. of Calif., Berkeley, Calif.) USAEC & NASA Series No. 2; Issue No. 7, Aug. 1, 1961

#### CONCLUSIONS:

- 1) Space flight for man involves a great many physiological and psychological stresses. It is imperative that we carry out further research to understand man's homeostatic responses to these stresses and their limits.
- 2) Acceleration forces greater than 1 "g" cause profound chronic alterations in animal longevity, development, and physiology.
- 3) The condition of weightlessness presents a challenge to the biophysicist, for it presents a new environment, previously untested. It will probably cause chronic alterations in:
  - a) growth, differentiation and development.
  - b) longevity and metabolic physiology, with perhaps beneficial effects.
- 4) Underlying physical causes for the effects of weightlessness probably involve alterations in convection patterns. These appear to change the mode of mixing and of phase changes and might also result in reduced cell division.
- 5) Radiation hazards, particularly from flares and from heavy primaries, present a serious problem. For long voyages shielding must be applied. For the most

space radiations accelerators are available or could be built to evaluate biological effects. Two types of studies are of great interest:

- a) neurological effects of radiation.
  - b) developmental effects in embryonic forms.
- 6) Knowledge in biology is gained slowly and many experiments need to be done. It would be useful if each satellite in the physical programs, particularly those that are to be recovered, would leave some space for a biological experiment.
  - 7) Complete knowledge of planetary life will be gained only when man himself can go to the planets, hence the approaches described above are of some immediate significance.

(AUTHOR)

692

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

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

693

Toong, Tau-Yi 1962 SIMILITUDE CONSIDERATIONS IN SPACE ENVIRONMENTAL SIMULATION  
(Directorate of Research Analysis, Holloman AFB, N. Mexico)  
AFOSR/DRA-62-16, Aug. 1962 ASTIA AD 283 353.

ABSTRACT: Simulation of space environment has been examined on the basis of similitude considerations. Examples are given to indicate how subgravitational effects can be studied in an earth-bound laboratory. Conjectures are also made as to possible effects of subgravity on human locomotion and heartbeat. It appears that much understanding of the subgravity effects on man also can be achieved by the use of similitude rules. The similitude considerations presented in this note can also be applied to the simulation of other more exotic space environmental conditions. (Author)

694

Trusela, R.A. and R.C. Clodfelter 1960 ZERO G SPACE BOILERS.  
Society of Automotive Engineers Journal. 68:56-57, September 1960

ABSTRACT: Visual observations during zero-g flight tests show that bubbles do not combine. Film boiling will probably predominate in zero-g environments

WEIGHTLESSNESS

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695

Unterberg, W., & J. Congelliere 1962 ZERO GRAVITY PROBLEMS IN SPACE POWER-PLANTS: A STATUS SURVEY. (Paper, ARS Space Flight Report to the Nation, New York, Oct. 9-15, 1951, revision received 4/23/62)  
ARS Journal 32(6):862-871, June 1962

ABSTRACT: One of the fascinating facets of space flight is the existence of a state of apparent weightlessness called zero gravity, experienced by matter situated within space vehicles when these move solely under the action of gravitation, e.g., in freefall or in orbit around Earth. Strictly speaking, the term "zero gravity," hereafter called zero g, is a misnomer, since the effect is caused by the vehicle and its contents both experiencing the same gravitational acceleration, which varies with the locale (Earth, moon, etc.) but which is never zero. It is the acceleration of the contained matter relative to the vehicle which is zero.

The principal effect of zero g is the absence of body forces. The vehicle and its contents are both "falling" at the same rate, so that there is no direction with respect to inertia, no "up" or "down". Every body, of course, retains its mass but does not exert any weight forces on its environment. In the case of liquids with free surfaces, there is no hydrostatic force since no directional "head" exists. Therefore, buoyancy and natural convection cannot exist under zero g.

This paper deals with the effect of zero g on the operation and design of space powerplants with emphasis on the physical phenomena involved. The principal aim is to survey the present status of zero-g technology and hence to indicate the zero-g efforts required for the future. (AUTHOR)

696

Usachev, B. 1958 MAN IN FLIGHT AND CHANGE IN GRAVITY  
Trans. from Sovetskaya Aviatsiya (USSR), Aug. 22, 1958, p.3  
(Office of Technical Services, Washington, D.C.)  
1960 60-23534

697

Usachev, B. 1958 MAN IN FLIGHT AND CHANGE IN GRAVITY  
Trans. from Sovetskaya Aviatsiya (USSR), Aug. 22, 1958, p.3  
(Office of Technical Services, Washington, D.C.)  
1960 60-23534

698

U.S. Adjutant General's Office 1958 MILITARY ASPECTS OF SPACE EXPLORATION  
Adjutant General's Office, Washington, D.C.) Spec. Bibliography No. 16;  
June 1958

ABSTRACT: This bibliographic survey was made to throw light on available unclassified literature that points up the military implications of space exploration. The materials are arranged in alphabetical order by title within major and subordinate subject groups. The major groups are miscellaneous; United States space effort; Soviet Russia space effort; satellites, trends and developments (electronics, navigation, orbits, propulsion, guidance control, and telemetry); environmental factors and problems (acceleration, survival, weightlessness); exploration of the moon and Mars; space ships and stations; international and legal aspects; and conferences, conventions, and symposia.

699

U. S. Air Force 1952 THE BEGINNINGS OF RESEARCH IN SPACE BIOLOGY AT THE AIR  
FORCE MISSILE DEVELOPMENT CENTER, HOLLOMAN AIR FORCE BASE, NEW MEXICO,  
1946-1952 (Air Force Missile Development Ctr., Holloman AFB, N. Mex.)  
ASTIA AD-208 018

ABSTRACT: The first installment toward fulfilling the need for examining the history of Air Force participation in space-biology research. A serious study of the origins of biological projects, their gradual evolution, and their scientific and technical contributions is of considerable value in avoiding old mistakes or duplicating previous effort, and for suggesting new paths of endeavor in the planning and pursuit of the more complex programs required in the immediate future. The V-2 and Aerobee rocket experiments and balloon flights are reviewed, with emphasis upon the biomedical information obtained therefrom. Experiments included fungus spores, fruit flies, mice, hamsters, cats, dogs, and monkeys as subjects. The effect at high speed and altitude of G forces, subgravity, and cosmic radiation were major factors explored. Experience gained in rocket and balloon launching, instrumentation and recovery techniques, and the growing collection of scientific data particularly related to cosmic radiation and subgravity problems marked the practical beginning of Air Force research in space biology.

700

U.S. Air Force Missile Development Center 1957 MAJOR ACHIEVEMENTS IN SPACE  
BIOLOGY AT THE AIR FORCE MISSILE DEVELOPMENT CENTER, 1953-1957  
(Air Force Missile Development Ctr., Holloman AFB, N. Mex.) ASTIA AD 208 016

ABSTRACT: This historiographical effort was prepared as part of a larger history of aeromedical research at Holloman AFB. Important technological advances, discussed in the initial portion of this study, contributed to outstanding accomplishments in two broad fields of space biology research - cosmic radiation and controlled artificial environments. Scientific and engineering progress in these latter fields is the main theme of this publication, which culminates with a review of the record-making Manhigh II flight.

701

U S. Air Force 1958 HISTORY OF RESEARCH IN SUBGRAVITY AND ZERO-G AT THE  
AIR FORCE MISSILE DEVELOPMENT CENTER, 1948-1958.  
(Holloman AFB, N. Mexico) ASTIA AD 208 017

ABSTRACT: Weightlessness, the weird condition of subgravity which man has never before experienced and survived--except for the initial split-second of short-distance free fall-- has recently become a major field of serious scientific research. Man now approaches this condition as his fast-climbing fighter flattens out to intercept at enemy bomber, and he may soon experience it for long duration on multimonth interplanetary excursions. In recent years man has gone to considerable expense and personal risk to fly Keplerian trajectories in high-performance aircraft in order to experience a force of less than normal gravity for fractions of a minute.

702

U. S. Air Force 1958 REPORTS ON SPACE MEDICINE - 1958  
(Air University, School of Aviation Medicine, Randolph AFB, Texas) Feb.1958

CONTENTS:

Hauty, G. T., Human Performance in the Space Travel Environment,  
Ward, J. E., S. J. Gerathewohl, & G. R. Steinkamp, Supersonic and Hypersonic Human Flight,  
Steinkamp, G. R., Human Engineering of the Sealed Space Cabin,  
Hauty, G. T., & R. B. Payne, Fatigue, Confinement, and Proficiency Decrement  
Hawkins, W. R., The Feasibility of Recycling Human Urine for Utilization in a Closed Ecological System,  
Hawkins, W. R., & G. T. Hauty, Space Cabin Requirements as seen by Subjects in the Space Cabin Simulator,  
Gerathewohl, S. J., Weightlessness - The Problem and the Air Force Research Program.

703

USAF School of Aviation Medicine 1958 EPITOME OF SPACE MEDICINE  
(USAF, School of Aviation Medicine, Randolph AFB, Texas) ASTIA AD-159 052

CONTENTS:

On the physical process of explosive decompression, by Fritz Haber  
Possible methods of producing the gravity-free state for medical research,  
by Fritz Haber and Heinz Haber  
Life on Mars in view of physiological principals, by H. Strughold  
Study on subgravity states, by Fritz Haber  
The Physiological day-night cycle in global flights, by H. Strughold  
Physics and engineering of rapid decompression: A general theory of rapid  
decompression, by Fritz Haber, and H. C. Clamann  
Escape and Survival at high altitude, by Fritz Haber  
Comparative ecological study of the chemistry of the planetary atmospheres,  
by H. Strughold  
Medical problems of space flight, by H. Strughold, E. J. Kendricks, H. Haber  
and S. J. Gerathewohl  
Producing the weightless state in jet aircraft, by S. J. Gerathewohl, Oskar  
Ritter, and H. D. Stallings

704

U. S. Air Force 1960 PROCEEDINGS OF WADC SPACE TECHNOLOGY LECTURE SERIES,  
VOLUME 1 TECHNICAL AREAS. (Wright Air Development Ctr., Wright-Patterson  
AFB, Ohio) WADC TR 59-732; ASTIA AD-235 424

ABSTRACT: This report is a consolidation of the papers presented by members of the  
WADC laboratories at its Space Technology Lecture Series between 7 Oct. 1958 and  
11 Dec. 1958. The papers were prepared for the purpose of cross-education and  
therefore are directed toward an audience representing many disciplines of science  
and engineering. The presentations contained basic technical as well as state-  
of-the-art information in at least sixteen unique technical areas and subsystems  
directly related to space technology. The topics covered in this report are as  
follows: Propulsion; Flight Mechanics and Structures; Flight Control; Guidance;  
Communications; Secondary Power; Supporting Subsystems; Reconnaissance; and  
Vehicle Defense, technical areas: International Geophysical Year - The Ground  
Work for Space Flight; Environment of Space; Mechanics of Space Flight; Electro-  
magnetics; Space Medicine; and Materials

705

U.S. 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.

706

USAF Air Information Division 1961 ITEMS OF INTEREST: NEW INDICATIONS IN SOVIET SPACE TECHNOLOGY. (Air Information Division, Science and Technology Section, Washington, D.C.) AID Report 61-40, 28 Mar. 1961.  
ASTIA AD 254 409

ABSTRACT: Academician N.M. Sisakyan discusses certain biological data obtained in experiments with animals during vertical and orbital flights.

707

U.S.A.F., Air Information Div. 1961 SOVIET LITERATURE ON LIFE SUPPORT SYSTEMS (Science & Technology Section, Air Information Division) AID Work Assignment No. 22, Rept. 4; AID Rept. 61-109; July 1961 ASTIA AD 261 452

ABSTRACT: This is the fourth in a monthly report series reviewing Soviet developments in life support systems as reflected in Soviet publications. This report is based on materials made available at the Air Information Division during June 1961. Items are selected from Soviet open literature and include scientific publications and literature of a popular type.

The materials in this report deal with the following topics:

- I Space Medicine and biology
- II. Space physiology
- III. Space psychology
- IV. Space vehicle ecology

708

U.S.A.F., Aerospace Information Div. 1961 SOVIET LITERATURE ON LIFE SUPPORT SYSTEMS

(Science and Technology Branch, Aerospace Information Division) AID Work  
Assignment No. 22, Report 6 AID Rept. 61-143 October 27, 1961  
ASTIA AD 267 926

ABSTRACT: This is the sixth in a monthly report series reviewing Soviet developments in life support systems as reflected in Soviet publications. It reviews Soviet developments in space biology, medicine, vehicle ecology, and life support instrumentation. This report is based on materials made available at the Aerospace Information Division during September 1961. Items are selected from Soviet open literature and include scientific publications and literature of a popular type.

709

U.S.A.F., Aerospace Information Division 1961 SOVIET LITERATURE ON LIFE SUPPORT SYSTEMS

(Science and Technology Branch, Aerospace Information Division) AID Work  
Assignment No. 22, Report 7 AID Report 61-168 December 20, 1961  
ASTIA AD 271 154

ABSTRACT: This is the seventh in a monthly report series reviewing Soviet developments in life support systems as reflected in Soviet publications. This report is based on materials made available at the Aerospace Information Division during October-November 1961. Items are selected from Soviet open literature and include scientific publications and literature of a popular type.

The materials in this report deal with the following topic: Space medicine and biology.

710

U.S.A.F., Air Information Division 1961 FURTHER DETAILS ON GAGARIN FLIGHT  
(Science and Technology Branch, Air Information Division) AID Rept. 61-113  
July 27, 1961 ASTIA AD 261 454

ABSTRACT: The present brief report recounts certain details found in three articles published by USSR scientists and discusses the implications of this information. 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. The third was written by Inna Yavorskaya, scientific secretary of the Interplanetary Travel Commission of the Academy of Sciences USSR

711

U.S. Air Force 1961 PERIODICAL REPORT ON AEROMEDICINE: BIOPHYSICAL ASPECTS OF GAGARIN'S FLIGHT. (1126th USAF FAG, Arlington Hall Station, Arlington, Va.) Rept. 1452517

ABSTRACT: The authors point out that the design of the spacecraft "Vostok I" incorporated many years of work by numerous groups of scientists and engineers. It takes into consideration the data yielded by probes on geophysical, ballistic and space rockets, satellites, and space ships as well as the data on properties of space surrounding the earth.

The problems discussed by the authors are varied. The problem of meteorite danger was investigated in particular detail. Radiation danger was examined with equal zeal. The problem of temperature conditions arose because of the problem of acceleration is reviewed. Although the authors avoid stating Gagarin's reaction to weightlessness, they do include it as a very real problem in space flight. The authors then give a brief description of the interior of the space cabin and the function of television cameras throughout the flight. (CARI)

712

USAF 1961 PERIODIC REPORT ON AEROMEDICINE: THE COMMUNIST PROGRAM ON BIOLOGY (1126th USAF FAG, Arlington Hall Station, Arlington 12, Va.) Rept. 1452516.

ABSTRACT: The author tells of the intention of the Soviet Union to determine the laws governing the extreme conditions of stresses on the animal and human organisms, this being a theoretical prerequisite for the substantiation of the most advantageous conditions needed to insure safe flight. The author then discusses the three following problems: hypoxia, astronaut selection, and danger in weightlessness. (CARI)

713

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

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

714

U.S. Air Force 1963 NEW GERMANY (SELECTED ARTICLES)  
(Translation Services Branch, Foreign Technology Division, WP-AFB, Ohio)  
FTD-TT-62-1584/1+4 Jan. 17, 1963 ASTIA AD 295 769  
Original Source: German Newspaper, Neues Deutschland, August 14, 1962,  
Pp. 1 & 2

ABSTRACT: This publication contains a group of articles praising the flights of spaceships Vostok III and Vostok IV

715

USAF 1960 HERALD OF THE ACADEMY OF SCIENCES OF THE USSR (SELECTED ARTICLES)  
(Foreign Tech. Div. Air Force Systems Command, Wright-Patterson AFB, Ohio)  
Trans. no. MCL-1188/1+2 of Vestnik Akademii Nauk SSSR, ASTIA AD-268 871

ABSTRACT: A NEW STAGE OF LUNAR STUDY: A review is presented of the structural and physical characteristics of the moon. The composition and formation of the surface, possible existence of atmosphere, and temperature of the moon are discussed in relation to studies conducted in the USA, France, Russia and Ireland.  
FLIGHT OF THE SECOND COSMIC SHIP: A report is given of the press conference held on August 24, 1960, by the Presidium of the USSR Academy of Sciences. The purposes and the preliminary results of the Soviet flight of August 19, 1960 which carried experimental animals and other living organisms around the earth are discussed.

716

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

717

USAF School of Aviation Medicine 1959 BIOASTRONAUTICS. ADVANCES IN RESEARCH  
(School of Aviation Medicine, Randolph AFB, Texas) ASTIA AD 226 473.

CONTENTS:

Definitions and subdivisions of space (bioastronautical aspect) by H. Strughold  
Bio-paks: Instrumentation and biomedical research  
Primates in space  
Center of gravity and moments of inertia measurements for seat plus a rhesus  
monkey, by H.G. Clamann  
Summary of immunochemical analyses on sera from humans exposed in a simulated  
altitude chamber, by W.G. Glenn  
Survival of terrestrial micro-organisms under simulated Martian conditions, by  
J.D. Fulton  
Photosynthetic gas exchangers and recyclers used in closed ecological system  
studies, by W.A. Kratz  
Man in space, by B. Balke  
Physiological instrumentation of man during flight, by C.H. Kratochvil  
Carbon monoxide phenomena in green plants systems, by S.S. Wilks, R.M. Adams,  
J.A. Green and E.G. Shaw.

718

U.S. Joint Publications Research Service 1962 THE EFFECTS OF CHANGES IN  
THE GRAVITATIONAL FIELD ON THE COORDINATION OF MAN'S VOLUNTARY MOVEMENTS  
(Joint Publications Research Service, Washington, D.C.)  
JPRS-15539, 2 Oct. 1962.

ABSTRACT: A study is made of the effect of changes in the gravitational field on the coordination of man's voluntary movements. The coordination of man's voluntary movements is disturbed by heightening of the gravitational field. Limits of the disturbances depend upon the condition and training of the person appearing in the field and are proportional to the logarithm of acceleration of force of weight. Systematic execution of the disturbed movement habit in a heightened gravitational field will lead to the restoration of coordination of movements. The indicated restoration will depend on the condition and training of the person appearing in this field, on the magnitude of gravitation and, in separate periods, is proportional to the logarithm of the time of the fulfillment of the movement. These deductions may be applied to the case of zero gravitation.

719

U.S. Air Force        1959        DISCOVERER III BIOMEDICAL DATA REPORT.  
(Directorate of Bioastronautics Projects, Air Force Ballistic Missile  
Division, Headquarters ARDC, Los Angeles, Calif.) WZPB Report No. 2,  
ASTIA AD 241 853

**ABSTRACT:** Four C-57 black mice lived through the stresses of launch and accelerative forces produced by the two stage Discoverer vehicle and through more than 500 seconds of weightlessness. Speciment activity correlated with ignition and burn-out of each stage and marked activity occurred during weightlessness. Speciment activity correlated with ignition and burn-out of each stage and marked activity occurred during weightlessness. The life support system of the Mark I biomedical recovery capsule functioned satisfactorily from lift-off to 790 seconds. The atmosphere, continuously moved through a ducted gas control system, varied between 330 mm Hg oxygen partial pressure, maintained a low pCO<sub>2</sub> and low relative humidity (below 60%) with a constant but relatively low temperature of 56° F. During flight, no leaks occurred in the capsule or oxygen system and the latter functioned normally to maintain a satisfactory cell pressure between 6.3 to 7.0 psia from an oxygen cylinder maintaining approximately 1200 psig.

The primary biomedical mission objective was not achieved because of failure of the Discoverer III vehicle to gain sufficient velocity, resulting in a prolonged ballistic trajectory, rather than the programmed orbit. However, part or all of secondary mission objectives were achieved

720

U.S. Air Force        1960        AEROMEDICAL FIELD LABORATORY MEETS THE CHALLENGE  
OF BIOASTRONAUTICS. Holloman Monthly News Bulletin 5(1):6,8, 11-12,  
Nov. 1960.

**ABSTRACT:** The research problems in this field presently under consideration and development by Holloman's Aeromedical Field Laboratory are discussed in this article.

721

U.S. Air Force        1960        AEROMEDICAL FIELD LABORATORY MEETS THE CHALLENGE  
OF BIOASTRONAUTICS. Holloman Monthly News Bulletin 5(1):6,8, 11-12,  
Nov. 1960.

**ABSTRACT:** The research problems in this field presently under consideration and development by Holloman's Aeromedical Field Laboratory are discussed in this article.

722

U.S. Dept. of Health, Education & Welfare 1958 BIBLIOGRAPHY OF SPACE MEDICINE  
(U.S. Dept. of Health, Education & Welfare, Public Health Service, National  
Library of Medicine, Reference Division, Washington, D.C.) Public Health  
Service Publication No. 617; Public Health Service Bibliography Series No.

ABSTRACT: This bibliography contains information on the following topics:  
sealed cabin problems; acceleration/deceleration; fractional and zero gravity;  
cosmic radiation; survival problems; psychological and social problems; ground  
crew problems; and extra-terrestrial aspects.

723

U. S. Armed Services 1961 FUTURE SPACE SHIPS MAY HAVE TO BE PROVIDED WITH  
ARTIFICIAL GRAVITY IF SUBSEQUENT INVESTIGATIONS SHOW A REPETITION OF GHERMAN  
TITOV'S EXPERIENCE THAT PROLONGED WEIGHTLESSNESS CAUSES VESTIBULAR DISTURBANCES  
ASTAR No. 2089, Sept. 27, 1961

ABSTRACT: Pravda recalled that would-be cosmonauts were subjected to brief periods  
of weightlessness in training. Some felt excellent in such state -- others had  
unpleasant sensations such as sickness, dizziness, loss of balance, sensation of  
rotating and so on. It was found however that people were so bothered could adapt  
themselves to weightlessness with training. Space shots with animals indicated  
that man could endure zero gravity up to twenty four hours without danger to life  
or health. Yuri Gagarin's one orbit flight brought no unpleasant sensations.  
Titov's sustained flight in zero gravity did not bring any pathological disturbances.  
Some changes however were observed in function of vestibular apparatus but they  
did not have any effect on the ability of the astronaut to work. During accelera-  
tion Titov suffered no unpleasant consequences but in spite of his good subjective  
condition, the astronaut had somewhat quickened heartbeat which reached one  
hundred eighteen to one hundred thirty-four beats per minute. These changes in  
heartbeat and respiration rate were caused by flight factors taken together.  
(CARE)

724

U.S. Directorate of Research and Development FUNDAMENTALS OF ASTRONAUTICS  
(Directorate of Research and Development, Headquarters U.S.A.F., Washington, D.C.)  
ASTIA AD 252 825

ABSTRACT: This paper is intended to serve as a brief refresher for some of the  
physics and physiology of space flight. It will also define some of the more

important astronomical terms and concepts. The author defines the separate layers of the Earth's atmosphere including the troposphere, stratosphere, ionosphere, and exosphere. He then discusses the solar system including the planets, satellites, asteroids, and sun. The physics of space flight is discussed with particular emphasis on rocket propulsion, thrust, specific impulse, mass ratios, thermal efficiency, and propulsion efficiency. The subject of human factors in space flight concentrates largely on the aspects of cabin environment requirements, waste disposal, weightlessness, isolation and sensory deprivation, cosmic radiation, and limited G forces.

725

U.S. Naval Air Development Ctr. 1958 STATUS REPORT ON ANIMAL SATELLITE  
(Naval Air Development Center, Johnsville, Pa.) NADC Letter Report AE-1412

ABSTRACT: Progress which has been made in the biosatellite program since its initiation on February 2/, 1958, is listed. The preparations for this animal satellite which has not been put in orbit were made with cooperation of the Franklin Institute.

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WEIGHTLESSNESS

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726

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

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

727

van der Wal, L. 1961 LIQUID-GAS INTERFACE IN ZERO-G.  
(Space Technology Labs., Inc., Los Angeles, Calif.) Rept. No. 7230-0001-RU-000; Contract AF 04(647)619; BSD TR-61-15; ASTIA AD-269 757; 30 June 1961

ABSTRACT: In the investigation of the behavior of a liquid-gas mixture in a zero-g field, an experiment unit was installed in an Atlas re-entry nosecone test vehicle. The experiment unit houses a movie camera, placed so as to observe and record the interaction of gas and water contained in a plastic cube during the 25-minute near-zero-g conditions present on an ICBM flight. Temperature and pressure changes are also recorded. (AUTHOR)

728

Velasco de Pando, M. 1958 ARTIFICIAL SATELLITES AND INTERPLANETARY TRAVEL: PHYSIOLOGICAL EFFECTS OF CHANGE IN GRAVITY.  
Revista de la Real Academia de Ciencias de Madrid 52(2):141-145, 1958  
Abstract: J. Aviation Med. 30(4):294. April 1959

729

Velasco do Pando, M. 1959 ARTIFICIAL SATELLITES AND INTERPLANETARY TRAVEL: PHYSIOLOGICAL EFFECTS OF CHANGE IN GRAVITY.  
A.M.A. Proceedings, April 1959.

ABSTRACT: This is the corrected and extended version of part of an analytical study (Sec. 13) on the launching of space rockets, which was published in a previous issue of the same journal (52(1):11-61, 1958). An attempt is made of correlating mathematically basic physiological and physical parameters. If  $j$  represents the effects of gravity experienced by a traveler within the space vehicle ("Sensible Gravity"), the following formula applies:

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

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

The validity of the formula is tested for the following conditions: (1) the vehicle rests on the terrestrial surface; (2) the vehicle travels unaccelerated at a given altitude (this being the case when the upward acceleration equals the weight of the vehicle); (3) the vehicle travels at a given altitude and at a given acceleration and (4) the vehicle travels through outer space with the rocket motor shut off (the occupants are in a state of weightlessness). In conclusion, the author derives optimal values for escape velocity and trajectory of the hypothetical space ship.

730

Vloynkin, Yu. M., V.I. Yazdovskiy et al. 1962 THE FIRST MANNED SPACE FLIGHTS (Pervyye Kosmicheskiye Polety Cheloveka)  
Foreign Tech. Div., Air Force Systems Command, Wright-Patterson AFB, Ohio)  
Transl. No. FTD-TT-62-1619 Dec. 7, 1962 ASTIA AD 294 537  
Original Source: Mediko-Biologicheskkiye Issledovaniya (Moskva)

ABSTRACT: Contents include material on the following subjects:  
Training cosmonauts in controlling the ship  
Life Support in space flight  
Microclimatic conditions in a spaceship cabin  
Food and water supply

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**Life support and recovery systems**

Radiation protection

The biological effect of cosmic radiation in spaceships

Measures providing radiation safety on the flights of Gagarin and Titov

The protective properties of space suits

Emergency supply pack of the cosmonaut

Systems for landing the cosmonaut

Familiarization-training flights on aircraft under weightlessness conditions

Psychological investigations

Organization and method of carrying out physical training exercises

Results of the medical examination of the astronauts

Methods of physiological investigations and medical monitoring during spaceflight

The physiological reactions of the astronauts in flight

732

Voas, R. B. 1961 PROJECT MERCURY ASTRONAUT TRAINING PROGRAM.

In The Training of Astronauts. (National Academy of Sciences, National Research Council) Publication No. 873, pp. 22-40

ABSTRACT: A general over-all outline of the training program is given. A brief discussion is presented of the astronaut selection program and basic considerations for the training program. Training in vehicle operation includes lectures, field trips, and study programs of the various capsule systems. Simulators for training in attitude control during orbit and retrofire, navigation, control of tumbling, environmental control of the cabin, and management of procedures are discussed. Training in various scientific disciplines is described along with the various lecture courses that each astronaut takes. Space flight conditions such as disorientation, weightlessness, reduced pressure, etc., are described and simulated for the astronauts. A physical fitness program for the trainees is discussed pertaining to weight control, breathing control, and general physical conditioning. Countdown procedures and ground communications and recovery-survival methods are part of ground activity training. Maintenance of flight skills as a method to maintain vigilant decision making is accomplished by regular flights in high-performance jet aircraft. The significance of this program on future space flight is discussed. (J. Aerospace Medicine 33(11):1403, Nov. 1962)

733

Voas, R. B. 1963 TRAINING MAN FOR SPACE

(Paper, Lectures in Aerospace Medicine, School of Aviation Medicine, Brooks AFB, Texas, 4-8 February 1963)

734

- von Beckh, H. J. A. 1953 UNTERSUCHUNGEN UBER SCHWERLOSIGKEIT AN VERSUCHSPERSONEN UND TIEREN WAHREND DES LOTRECHTEN STURZFLUGES (INVESTIGATION OF WEIGHTLESSNESS OF HUMANS AND ANIMALS DURING VERTICAL DIVES) In Space-Flight Problems; being a Complete Collection of all Lectures Held at the Fourth Astronautical Congress, Zurich, 1953 (Biel: Laubscher, 1953) pp. 196-202

735

- Von Beckh, H.J.A. 1954 EXPERIMENTS WITH ANIMALS AND HUMAN SUBJECTS UNDER SUBGRAVITY AND ZERO GRAVITY CONDITIONS DURING THE DIVE AND PARABOLIC FLIGHT. J. Aviation Med. 25(3):235-241, June 1954.

ABSTRACT: Certain species of chelonia (turtles) are found on parts of the South American continent. Tests were conducted on the turtles under sub-and zero-gravity conditions. This article is a report on the observations made during the tests and studies of the data recorded.

736

- von Beckh, H. J. A. 1955 LA GRAVITACION CERO (ZERO G) In Fisiologia del vuelo (Physiology of Flight) (Buenos Aires: Alfa, 1955) pp. 99-110

737

- von Beckh, H. J. A. 1955 ASPECTOS FISIOLÓGICOS DEL VUELO ESPACIAL (PHYSIOLOGICAL ASPECTS OF SPACE FLIGHT) In Fisiologia del vuelo (Physiology of Flight) (Buenos Aires: Alfa, 1955) pp. 111-123

738

- von Beckh, H.J.A. 1955 VELOCIDAD, ACCERACION, GRAVITACION. Riv. nac aeronaut. Sept. 1955

739

von Beckh, H. J. A. 1956 GRAVITY CHANGES IN AIRCRAFT AND SHIPS.  
J. Brit. Interplanetary Soc. 15(2):73-81. March - April 1956

740

von Beckh, H.J. 1958 FLIGHT EXPERIMENTS ABOUT HUMAN REACTIONS TO ACCELERATIONS  
WHICH ARE FOLLOWED OR PRECEDED BY THE WEIGHTLESS STATE  
(Air Force Missile Development Ctr., Holloman AFB, N. Mex.) AFMDC-TN-58-15  
Dec. 1958 ASTIA AD 154 108

ABSTRACT: Flight experiments which simulated Pre-weightlessness and Post-weightlessness acceleration were conducted in jet aircraft. It was shown that alternations of acceleration and the weightless state decrease the acceleration tolerance of the subject and the efficiency of the physiological recovery mechanisms. The implications for planning of manned space flight are (1) thrust values and re-entry profiles must take the lower acceleration-tolerance into consideration; and (2) adequate G-protection must be designed for the pilot, to prevent dangerous effects of unavoidable high accelerations. (Author)

741

Von Beckh, H.J. 1959 FLIGHT EXPERIMENTS ABOUT HUMAN REACTIONS TO ACCELERATIONS  
WHICH ARE FOLLOWED OR PRECEDED BY THE WEIGHTLESS STATE  
Aerospace Medicine 30 (6): 391-409, June 1959

ABSTRACT: Alternation of weightlessness and acceleration results in a decrease of acceleration tolerance and of the efficiency of physiologic recovery mechanisms. This indicates that acceleration thresholds of reversible and irreversible injury will be lower in space flight conditions than in the one G field of man's earthly environment. Defects of circulation, muscular effectiveness, vision, and of conscious judgment will occur at lower acceleration values and will probably continue for longer times than they do under present normal flight conditions. In an astronautical venture depending upon the skill of a human pilot, a blackout, lapse of judgment or even the slightest reduction in efficiency at a crucial time, could undoubtedly cause the failure of the mission.

The implications for planning of manned space flight are, first, that thrust values and reentry profiles must take the lower acceleration tolerance into consideration and second, that adequate G protection must be designed for the pilot to prevent dangerous effects of high acceleration.

742

von Beckh, H.J. 1959 FLIGHT EXPERIMENTS ABOUT HUMAN REACTIONS TO ACCELERATIONS WHICH ARE FOLLOWED OR PRECEDED BY WEIGHTLESSNESS  
In: International Astronautical Congress, Proceedings of the IXth, 1958  
(Wien: Springer - Verlag, 1958, Pp. 507-525)

ABSTRACT: Alteration of weightlessness and accelerations results in a decrease of acceleration tolerance and of the efficiency of physiologic recovery mechanism. The implications for planning manned space flight are, first, that thrust values and re-entry profiles must take the lower acceleration tolerance into consideration, and second, that adequate G protection must be designed for the pilot, to prevent dangerous effects of unavoidable high accelerations

743

von Beckh, H.J. 1959 WEIGHTLESSNESS AND SPACE FLIGHT  
Astronautics 4(2):26-27, 84-86, Feb. 1959.

ABSTRACT: Deterioration of neuromuscular coordination and disorientation are considered to be originated by the weightless state per se. However, more complex problems arise during extended space flights, as well as during alternate acceleration and weightlessness, such as occurs during the ascent and re-entry of space vehicles. Results of experiments in jet aircraft are cited to show that the weightless state aggravates other physiological conditions, which, in combination, pose serious problems to man in space flight. Subjects reported experiences of increased susceptibility to or severity of acceleration effects when they entered positive G states immediately after experiencing weightlessness. Subjects who normally blacked out at 5 G could tolerate only 3.5 to 4 G in the experiments. In the opposite case, when acceleration preceded weightlessness, physiological recovery mechanisms seemed disturbed. Blackout lasted longer, and more severe discomfort and chest pains were reported. Cinematographic observations, registrations of heart rate, electrocardiograms, and galvanic skin responses corroborated the subjective reports. It is suggested that extended weightlessness may lead to lessened muscle tone and strength, as well as to inconveniences to the cardiovascular system. The heart, having transported the blood without the force of gravity during the weightless state, would need a certain time for adaptation after re-entry into the gravity field of the earth or of another planet.  
(Aerospace Med. 30(6):456, July 1959)

744

von Beckh, H.J. 1959 SPACE FLIGHT HAZARDS CAUSED BY WEIGHTLESSNESS  
(Paper, Meeting of Aero Medical Association, Statler Hilton Hotel,  
Los Angeles, 27-29 April 1959)

ABSTRACT: The lack of neuromuscular coordination and optical illusions, as they might possibly affect the efficiency of the human operator of a space vehicle, are discussed. However, it should be expected that more difficulties would arise from the alternation of high G loads and weightlessness which increases discomfort and the lowers human tolerance to G loads. (J. Aviation Med. 30(3):208, March 1959)

745

von Beckh, H. J. 1959 INVESTIGATIONS ON THE EFFECT OF WEIGHTLESSNESS ON THE  
HUMAN BODY. Weltraumfahrt (Germany) 10(1):21-28, March 1959

746

von Beckh, H.J. 1960 A SUMMARY OF MOTION SICKNESS EXPERIENCES IN  
WEIGHTLESS FLIGHTS CONDUCTED BY THE AEROMEDICAL FIELD LABORATORY.  
(Paper, Symposium on Motion Sickness in Weightlessness Research, March 1960,  
Wright-Patterson AFB, Ohio)

747

von Beckh, H.J. 1961 THE INCIDENCE OF MOTION SICKNESS DURING EXPOSURES TO THE  
WEIGHTLESS STATE  
(In: "Space Medical Symposium", Astronautik (Stockholm), v. 2, no. 4, 1961,  
pp. 217-224)

ABSTRACT: Although motion sickness is approximately 30 per cent in weightlessness experiments using fighter aircraft with the subject restrained, it is much higher in a cargo aircraft with the subject unrestrained. Because the subjects were exposed to acceleration before and after weightlessness, it was difficult to distinguish between those effects due to acceleration and those due to weightlessness. During burnout and re-entry, the vagal symptoms decrease an operator's ability to perform. However, if weightlessness is able to produce motion sickness, then the operator might suffer long-term vagal symptoms which would incapacitate him to a high degree. Also included is the applicability of the Weber-Fechner in this respect

748

von Diringshofen, H. 1943 AENDERUNG DER LAGE DES MENSCHEN IM SCHWEREFELD DER ERDE (Change of the Human Position in the Field of Gravity of the Earth)  
Deutsche Medizinische Wochenschrift (Stuttgart) 69: 498

749

von Diringshofen, H. 1943 DER MENSCH IM VERANDERTEN SCHWEREFELD (Man in the Changed Field of Gravity)  
Klinische Wochenschrift (Berlin) 22: 450

750

von Diringshofen, H. 1944 DER BLUTKREISLAUF IM VERAENDERTEN SCHWEREFELD (Blood Circulation in Changing Field of Gravity)  
Deutsche Medizinische Wochenschrift (Stuttgart) 70:150, 17 March 1944.

751

von Diringshofen, H. 1948 DAS GESUNDHEITLICHE PROBLEM DES WELTRAUMFLUGES: DAS FEHLEN DER SCHWERKRAFT (HEALTH PROBLEMS OF SPACE FLIGHT: ABSENCE OF GRAVITY) Grenzgeb. Med. 1:144-145, 1948

752

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

753

von Diringshofen, H. 1952 MEDIZINISCHE PROBLEME DER RAUMFAHRT (MEDICAL PROBLEMS OF SPACE FLIGHT) In Gartmann, H., ed., Raumfahrtforschung (Space Flight Research) (Munich: Oldenburg, 1952) pp. 167-182

754

von Diringshofen, H. 1956 PROBLEMS OF WEIGHTLESSNESS  
Medizinische 1956(52):1846-1847, 29 Dec. 1956

755

Von Diringshofen, H. 1958 RAPIDITA DELLA DIMINUZIONE DELLA GRAVITA COME  
IMPORTANTE FATTORE DELLA SENSAZIONE DI ASSONIA DI PESA (STEEPNESS OF G-FALL  
AS AN IMPORTANT FACTOR FOR THE SENSATION OF WEIGHTLESSNESS) Rev. Med.  
Aeronaut. (Paper, International Congress of Aviation Medicine, Louvain,  
Belgium, Sep. 1958)

756

von Diringshofen, H. 1959 FLUGMEDIZINISCHE PROBLEME DER GEWICHTSLOSIGKEIT  
(Aeromedical Problems of Weightlessness)  
Munch. Med. Wchnschr. 101(32):1326-1328, 1345-1349, 1959, (in German).

ABSTRACT: The transition from air flight to space flight makes weightlessness one of the most important problems of aerospace medicine. The condition of weightlessness has been already experienced up to a duration of 50 seconds in parabolic flight. The sensations observed therein of stall, fall, and vertigo emanate from the organ of equilibrium. The confusion of the equilibrium center in the brain may also affect the vegetative nervous system and provoke nausea. The type and strength of these disturbances is determined by the following factors: (1) individual sensitivity, which can be reduced by training, (2) abruptness of transition, from gravity to weightlessness, and (3) irregularities in this transition. In a state of free weightless suspense, body rotations with additional tilting of the head may cause Coriolis accelerations in the labyrinth, thus bringing about strong nausea. In the course of protracted weightlessness, one must expect increasing psychical and physical enervation with subsequent reduced resistance to acceleration. Such conditions can be prevented by previous rigorous aero-gymnastics as well as by aerodynamical parabolic flights. It seems reasonable that carefully selected fliers may sustain not only short periods of weightlessness but also a prolonged weightless condition in space flight without serious disturbances, provided they are well trained, remain strapped in their seats, and have become adjusted to the extraordinary sensory perceptions of a weightless environment. To what extent weightlessness may affect blood circulation cannot yet be predicted since disturbances experienced by fliers in from 20- to 30- second parabolic flights may as well be due to the transition or irregularities in the transition to weightlessness. A partial reduction of gravity, say to  $1/3 G$ , may even produce pleasant sensations, such as we experience when we completely relax in a warm bath tub.

757

von Diringshofen, H. 1959 CERTAIN OBSERVATIONS ON PHYSIOLOGY OF THE SENSES DURING THE PASSAGE FROM THE STATE OF ACCELERATION TO ZERO GRAVITY Riv. Med. Aero. (Roma) 22:15-25, July-Sept. 1959

758

von Diringshofen, H., 1959 SINNESPHYSIOLOGISCHE BEOBACHTUNGEN BEIM UBER-GANG VON BESCHLENNIGUNGEN ZUR GEWICHTSLOSIGKEIT (Sensory-Physiological Observations During the Transition from Acceleration to Weightlessness. Raketentechnik und Raumfahrtforschung (Stuttgart) 3(2):33-35, April 1959.

ABSTRACT: This is a review of three experiments concerning the immediate physiologic effects to short exposure to gravity. The test results indicate that acclimitization takes place when weightlessness extends over long periods. Nausea and other disagreeable sensations are experienced less frequently by those individuals engaged in a mind-absorbing task. The author suggests that the changes in G force during the various accelerative launching stages may be particularly inducive to "space sickness"

759

von Diringshofen, H. 1959 SENSORY-PHYSIOLOGICAL OBSERVATIONS DURING THE TRANSITION FROM ACCELERATION TO WEIGHTLESSNESS

Raketentechnik und Raumfahrtforschung (Stuttgart) 3(2): 33-35 (In German)

See also: J. Aerospace Medicine 30(8): 621-622

See also: U.S. Joint Publications Research Service, Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N.J., Picatinny Arsenal Translation No. 61, Pp. 1-8, Nov. 1959 ASTIA AD 228 967

ABSTRACT: A review of three experiments is presented concerning the immediate physiologic and psychologic effects of short exposures to subgravity. (1) About 20 years ago, the author induced weightlessness by vertical dives in a Ju-87 aircraft for durations of 7-8 seconds (radial acceleration 8 G). The psychologic reaction was a pleasant one, and the sensation of "slumping", which usually introduces weightlessness episodes, was not perceived. (2) In 1954, while in Argentina, the author achieved weightlessness in parabolic flight for durations of 12-14 seconds, preceded by an acceleration of 5 G lasting 5 seconds. Transitional accelerations of 2 G preceding weightlessness lasted 2 seconds. Disagreeable sensations of "slumping" and of falling through empty space were distinctly perceived for about 5 seconds after the onset of weightlessness, leading over eventually to a sensation of floating in space. (3) In a "subgravity

tower" designed by Dr. T. Lomonaco at the Aeromedical Research Institute in Rome, weightlessness was produced in a seat suspended from and catapulted upward by rubber straps fastened to the top of a 15-m.-high tower. Initial acceleration was 3 G and lasted .5 second. Three launchings were carried out consecutively, inducing weightlessness for 2, 1.3, and .8 seconds, respectively. At the point of transition from acceleration to weightlessness a very disagreeable sensation of falling was perceived. The findings of these three experiments, in conjunction with results of more extensive experiments carried out in the United States by Gerathewohl and others, can only be considered preliminary to weightlessness conditions in space travel. There is evidence to the effect that acclimatization takes place when weightlessness extends over longer periods. It appears that nausea and other disagreeable sensations are experienced less frequently by individuals actively engaged in navigation or in other mind-absorbing tasks than by "passive" riders. In conclusion, the author speculates on the possibility that changes in G force during the various accelerative launching stages may be particularly inducive to "space sickness".

760

von Diringshofen, H. 1961 INTERNATIONALES SYMPOSIUM UBER LUFT-UND RAUMMEDIZIN  
(International Symposium on Aerospace Medicine)  
Weltraumfahrt (Frankfurt), 12(1):11-12, (in German), Feb. 1961.

ABSTRACT: The symposium, sponsored by the Aviation Medicine Institute of the Argentine Air Force, was held 6-13 Oct. 1960, at the School of Medicine, University of Buenos Aires. Discussions centered on the psychological aspects of space flight, acceleration forces, and acceleration tolerance. Films of rocket-sled studies and of weightlessness during aircraft maneuvers and during free fall in a pressure suit from a balloon gondola were shown. Discussions made clear the differences in European and American outlooks on the relative importance of psychological tests in the evaluation of space flight candidates. Attention was also given to the physiology of respiration and the effects of oxygen lack on the endocrine system, tissue damage caused by decompression, and the human engineering problems of space flight.

761

von Diringshofen, H. 1962 HYDROTHERAPY AS A PARTIAL SIMULATOR OF WEIGHTLESSNESS IN SPACE MEDICINE.  
Arch. Phys. Ther. (Leipzig) 14:307-311, July-August 1962 (Ger)

762

von Gierke, H.E. & E.P. Hiatt 1962 BIODYNAMICS OF SPACE FLIGHT  
In: Singer, S.F., ed., Progress in the Astronautical Sciences, 1: 343-401

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763

Wade, J. E. 1962 PSYCHOMOTOR PERFORMANCE UNDER CONDITIONS OF WEIGHTLESSNESS.  
(6570th Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio)  
MRL-TDR-62-73; ASTIA AD-285 549; June 1962

ABSTRACT: Subjects operated three different sets of switches as they were flown through 0-g trajectories in a C-131B aircraft. Pushbutton, toggle, and rotary switches were each paired with a master push-button switch to form the three sets used to turn an indicator light on and off. The subjects were instructed to perform the task as fast as possible by alternate actuation of the two switches of each set. Each subject also performed in straight and level flight with each set of switches for control data. Performance data, along with aircraft accelerative forces in three dimensions, were recorded on a high-speed oscillograph. Small but statistically significant decrements were found in speed of operation of all three sets of switches in the 0-g environment in comparison with performance at 1 g. The toggle switch set showed the greatest decrement, the rotary switch set the least decrement. The push-button switch set was operated most rapidly in both 1-g and 0-g conditions. (AUTHOR)

764

Waggoner, C.E. & C.W. Nixon 1962 SELECTED SPEECH DURING WEIGHTLESSNESS.  
(Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio)  
Final Report. MRL-TDR-62-45, May 1962. ASTIA AD 284 688

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

765

Walton, H. Jr. 1957 A DEVICE FOR ARTIFICIAL PRODUCTION OF ALTERNATING GRAVITATIONAL FORCES  
Journal of Aviation Medicine 28 (3): 291-294, June 1957

ABSTRACT: As far as the author is aware, the devices described above represent

novel ways of producing gravity free state for intermittent periods. Among the few proposals that have been made for a device to test gravity free state at ground level was one by Haber and Haber who proposed to use express elevators for gravity free experiments. The use of the gravitron is expected to furnish some new knowledge in several experimental fields. In medicine, new information may be gained concerning the physiology of gravity free state; in psychology, coordination in conditions of changing gravity. It may be useful as a physical testing device to find out the physical behavior of systems in the gravity free state (e.g. convection, diffusion, dilution, and heat transfer of gases and liquids) and as a testing device for equipment designed to function in the gravity free state -- for example, the function of clocks, and electrical instruments, etc. An objection can be made against the use of such a device on grounds that rapid changes in acceleration appear to cause excessive nausea. However, a device such as the gravitron might be useful just for the study of such a syndrome

766

Ward, J.E. 1957 REQUIREMENTS FOR PRESENT-DAY EXPERIMENTAL ZERO GRAVITY PARABOLAS. (USAF, School of Aviation Medicine, Randolph AFB, Texas) Rept. No. 57-121. See also J. Aviat. Med. 29(6):428-432  
ASTIA AD-143 896

ABSTRACT: In simplified form, graphs are presented which allow rapid determination, without calculation, of parabolic entry velocity, angle of climb at entry, and vertical altitude traveled during the trajectory as a function of the total duration of zero gravity and minimum speed attained during the parabola (determined by stalling speed) by the experimental aircraft.

767

Ward, J.E. & D.G. Simons 1958 PROSPECTS AND LIMITATIONS OF HUMAN FLIGHT BEYOND THE ATMOSPHERE. THE ELUSIVE SPHERE OF INTEREST  
(Paper, International Council of the Aeronautic Sciences, Sept. 12, 1958, Madrid, Spain)

768

Ward, J.E. 1958 REQUIREMENTS FOR EXPERIMENTAL ZERO GRAVITY PARABOLAS. J. Aviation Med. 29(6):428-432, June 1958.  
See also (School of Aviation Med., USAF Aerospace Medical Ctr., (ATC) Brooks AFB, Texas) Research Rept. No. 57-121.

ABSTRACT: In simplified form, graphs are presented which allow rapid determination, without calculation, of parabolic entry velocity, angle of climb at entry, and vertical altitude traveled during the trajectory as a function of the total duration of zero gravity and minimum speed attained during the parabola (determined by stalling speed) by the experimental aircraft.

769

Ward, J.E., S.J. Gerathewohl & G.R. Steinkamp 1958 SUPERSONIC AND HYPERSONIC HUMAN FLIGHT. (School of Aviation Medicine, USAF, Randolph AFB, Texas)  
USAF Reports On Space Medicine - 1958 (Reprinted with permission from the Institute of Aeronautical Sciences, Jan. 1958) Reprint no. 797.

ABSTRACT: Man's sense organs are not designed to function at hypersonic speed. Traveling at supersonic speeds creates problems in the delay of visual perception and changes of direction bringing about accelerative effects. Man in space must have artificial sensing and monitoring devices to sense environment changes and to make split-second decisions. Escape and survival from vehicles traveling at supersonic and hypersonic speeds offers a great many complex physiological and engineering problems.

770

Ward, J. E. 1958 BIOMEDICAL CONSIDERATION OF WEIGHTLESSNESS.  
(Paper presented at the Amer. Astronaut. Soc. Meeting, Palo Alto, Calif.  
18 Aug. 1958)

771

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

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

772

Ward, J.E., W.R. Hawkins, and H.D. Stallings Jr. 1959 PHYSIOLOGIC RESPONSE TO SUBGRAVITY. MECHANICS OF NOURISHMENT AND DEGLUTITION OF SOLIDS AND LIQUIDS (Air University, School of Aviation Medicine, USAF, Randolph AFB, Tex.) Report 59-2, Jan. 1959.

ABSTRACT: In order to study the mechanics of nourishment during weightlessness, 165 subgravity parabolas were flown in an F-94C aircraft. 25 experimental subjects attempted to drink from an open container, a container fitted with pierced lid and plastic straw, and a plastic squeeze bottle. Drinking from open containers proved to be more difficult than had been anticipated. Only a small quantity of liquids should be taken at one time.

773

Ward, J.E. & W.R. Hawkins 1959 PHYSIOLOGIC RESPONSE TO SUBGRAVITY  
I. MECHANICS OF NOURISHMENT AND DEGLUTITION OF SOLIDS AND LIQUIDS  
J. Aviation Med. 30(3):151-154

ABSTRACT: To study the mechanics of nourishment during weightlessness, 165 subgravity parabolas were flown in an F-94C aircraft. Twenty-five experimental subjects attempted to drink from an open container, a container fitted with pierced lid and plastic straw, and a plastic squeeze bottle. Observations were made regarding deglutition of solids, including swallowing of both well and poorly masticated boli. Drinking from open containers proved to be more difficult than had been anticipated. For reasons of safety closed containers such as squeeze bottles, must be used to transfer liquids to the mouth under conditions of zero-gravity; the use of straws is not practical. Deglutition of liquids or well masticated solids can be accomplished with little or no difficulty in the weightless state. However, a large solid bolus of food is a potential aspiration problem. Regurgitation of stomach contents may become a serious annoyance during orbital flight. Only a small quantity of liquids should be taken at one time. Movements or abdominal pressures, which may initiate vomiting, must be avoided

774

Ward, J. E., W. R. Hawkins, & H. D. Stallings 1959 PHYSIOLOGIC RESPONSE TO  
WEIGHTLESSNESS: Initiation of Micturition. (School of Avia. Med., USAF  
Aerospace Medical Center, (ATC) Brooks AFB Texas) Research Rept. No.  
59-35, Aug. 1959.

See Also Aerospace Medicine 30:572-575, August 1959.

SUMMARY: Twenty-six subjects were exposed to a total of thirty-seven separate jet aircraft flights during which zero gravity parabolic flight maneuvers were performed. The capability of subjects to initiate micturition during weightlessness following a period of hydration was studied. Only one subject was unable to void in the zero gravity state but was able to micturate in straight and level flight. Four subjects were unsuccessful in either situation. With one exception, all five of these subjects had two hours or less jet flying experience. A majority (58 per cent) of the subjects noted a slight to marked decrease in urinary urgency when exposed to weightlessness. The consideration is offered that the floor of the urinary bladder may be the primary sensory zone for the sensation of bladder fullness. Scheduling of body waste elimination should be incorporated into the crewman's standard operating procedures and check list. Special consideration must be given to the design and development of a satisfactory urine receptacle.

775

Warren, B.H. 1962 WEIGHTLESSNESS - A PHYSIOLOGICAL PROBLEM IN SPACE  
In: Lectures in Aerospace Medicine, Air Force,  
School of Aerospace Medicine, Aerospace Medical Div., Brooks AFB, Texas.  
Armed Forces Press Service, 1962, 447 pp.)

ABSTRACT: Prolonged weightlessness could easily cause serious physiological

problems. For example, the disuse of reflexes of the autonomic nervous system might cause them not to respond. In that case, an abrupt acceleration might cause blood to pool in the extremities reducing the vital organ blood supply. Disorientation is another physiological problem of weightlessness. The answer to physiological problems of weightlessness depend upon the attainment of prolonged periods of true weightlessness

776

Warren, Bruce H. 1963 A COMPARISON OF PHYSIOLOGICAL CHANGES OCCURRING DURING WATER IMMERSION AND BED REST  
Paper: 34th Annual Meeting of the Aerospace Medical Association, Statler-Hilton Hotel, Los Angeles, Calif., April 28 - May 2, 1963

ABSTRACT: Human water immersion experiments have been performed by several investigators under the assumption that the resulting "hypodynamic" environment simulates certain conditions of weightlessness. Bed rest has also been used as a method for studying the hypodynamic state. In the present investigation a controlled comparison of these techniques was made. Twelve healthy male volunteers took part in these experiments. Each subject was studied during two 6-hour water immersion periods and one 6-hour bed rest period. Physical and psychological variables were kept as constant as possible. Electrocardiograms were traced continuously and blood pressures were recorded automatically. Blood and urine samples were collected for physical and chemical determinations. A tilt table was used to produce gravitational stress for measuring cardiovascular responses before and after each hypodynamic period. An analysis of the data revealed that the direction of change of a physiological parameter during water immersion coincided with the direction of change of the same parameter during bed rest. The biological relationship of the above hypodynamic factors to weightlessness can only be hypothesized. Further evaluation of physiological changes occurring during water immersion and bed rest appear warranted, however, before either is accepted as a better tool than the other for studying the hypodynamic state in man. In over thirty hypodynamic periods above, no significant differences were noted in the physiological parameters measured during water immersion and bed rest which could not be attributed to factors other than an increased hypodynamic state during water immersion

777

Warren, J.K. 1962 ASTRONAUTICA E MEDICINA (ASTRONAUTICS AND MEDICINE)  
Rassenga medica e culturale (Milano) 39(9): 15-18, 51. Sept. 1962.

ABSTRACT: Results of recent American and Russian research projects and space missions are reviewed concerned with man in space as affected by magnetic fields, solar radiations, gravitational forces, weightlessness, accelerations, decelerations, and psychological factors. Pictures of a space environment simulator and gondola to study disorientation and the effects of accelerative forces are included. (Aerospace Medicine 34(3): 271, March 1963)

778

Watson, J.T. 1961 GRAVITATIONAL CONTROL RESEARCH  
(Report, Faculty of the Graduate School of Southern Methodist University  
as Partial Fulfillment of the Requirements for the Degree of Master of  
Science in Electrical Engineering) Feb. 1961. ASTIA AD 253 588.

ABSTRACT: Success in attaining control over gravitation seems unquestionably tied to a better understanding of gravitation. At the present time, most of the work being done towards gaining gravitational control is centered around the quest for better knowledge concerning the nature of gravitation. This report will be concerned with some of the more applicable theories and research. The information will be discussed in four sections: Introduction, Characteristics of Gravitation, Theories of Gravitation, and Current Research Effort. Some of the material will, of necessity, fall into more than one category.

779

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

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

780

Weiss, R. 1962 ZERO-GRAVITY PARABOLA TECHNIQUES  
(Lear, Inc., Grand Rapids, Michigan) Contract AF 33(657)7199; ASTIA AD-278  
680  
(Paper, 6th National Convention of Military Electronics, June 26, 1962,  
Washington, D. C.)

ABSTRACT: Among the environmental effects encountered by a space voyager is a state of weightlessness. The effects of this weightless state on both the pilot and the equipment on board are actively being investigated. The simplest method of producing a weightless state is by dropping a body and allowing it to fall without the influence of any outside forces. A second method is to fly a ballistic trajectory in either a manned aircraft or a manned or unmanned missile. Payload, space, and economic considerations favor the manned aircraft scheme, and this method is discussed. (AUTHOR)

781

Weiss, R. & L. Siegler 1963 DISPLAY SYSTEMS FOR SUB- AND ZERO-GRAVITY FLIGHT (Behavioral Sciences Laboratory, 6570th Aerospace Medical Research Laboratories Aerospace Medical Division, AF Systems Command, Wright-Patterson Air Force Base, Ohio) Technical Documentary Report No. AMRL-TDR-63-11, proj. no. 7184, task no. 718405. ASTIA AD 402 382.

ABSTRACT: A study was performed of the controls and pilot displays used to fly a C-131B and KC-135 aircraft in a Keplerian trajectory to create zero-gravity conditons. Evaluation criteria for this maneuver were proposed and applied to two basic instrumentation systems which were developed. An analog simulation was formulated and these results will be used to further improve the systems. Recommendations are made for improved instrumentation which should enable consistent flights of 10 seconds at zero-gravity plus or minus 0.0005g.

782

Welch, B.E. 1962 PHYSIOLOGIC NECESSITIES IN SIMULATED LUNAR FLIGHTS  
In USAF School of Aerospace Medicine Lectures in Aerospace Medicine,  
1962. Pp. 77-96

ABSTRACT: The primary purpose of including man in a space mission is to utilize man's full and unique capabilities toward successful mission completion. This means, therefore, that the man portion of the space mission must be at maximum effective performance consistent with the mission profile. To insure that man will be at maximum effectiveness, it is necessary to satisfy the various physiologic requirements that man places on the space vehicle system. These physiologic requirements are not necessarily unique to space operations and, for this discussion, will be classified somewhat arbitrarily into atmospheric and metabolic requirements. This paper will be divided into two parts; the first consisting of data collected during space cabin simulator experiments.

783

Welle, B. 1962 COSMONAUT TRAINING PROGRAM  
FBIS, USSR & East Europe, No. 70, April 10, 1962.

ABSTRACT: Special efforts are surely being made to improve the training program of future cosmonauts. German Titov experienced several disturbances--slight vertigo and sickness. This was probably because of the influence of weightlessness on the middle ear, the organ of equilibrium. This effect disappeared almost completely when Titov assumed his normal resting position and made no strong movements with his head. Experts are now investigating whether this is a biological effect, or an individual peculiarity of Titov's. A scientist stated that better methods will strengthen the organ of equilibrium. In other words, cosmonauts must spend even more time than previously on rotating disks

and swings, on apparatuses which move in three directions simultaneously. If, despite all training, the troublesome effects show up during future flights, if they interfere with the ability to work of the cosmonauts, then-- the principle possibilities are already known--artificial gravity will be created in the space crafts which will amount to about one-fourth or even only one-tenth of the Earth's gravity. Currently, stress is laid on cosmonauts exercising under considerable weight. (CARI)

784

Weybrew, B. B. & J. W. Parker, 1960 BIBLIOGRAPHY OF SENSORY DEPRIVATION, ISOLATION AND CONFINEMENT.  
(USN Medical Research Lab., New London Submarine Base, Conn.)  
Task MR005.14 2100.04.04, Memo. Rep. 60 1, Jan. 1960.

ABSTRACT: This bibliography contains 146 publications in the area of sensory deprivation, isolation, and confinement. The entries are categorized as follows: review articles, anecdotal literature, and experimental literature--reduction of level or variability of stimulation, confinement peculiar to space flight, confinement peculiar to submarine environment, sociological and prison confinement, animal studies, theoretical articles, and miscellaneous. (Tufts)

785

Whistsett, C.E., Jr. 1963 SOME DYNAMIC RESPONSE CHARACTERISTICS OF WEIGHTLESS MAN. (6570th Aerospace Medical Research Laboratories, Wright-Patterson AFB, Ohio) Report No. AMRL-TDR 63-18. April 1963.

ABSTRACT: By segmenting the body into 14 idealized masses, a mathematical model is developed to approximate the mass distribution, center of mass, moments of inertia, and degrees of freedom of a human being. An analysis of the model reveals that the segment moments of inertia about the mass centers of the hands, feet, and forearms are negligible, when compared to the total body moments of inertia, although the torso moment of inertia is not negligible. Some selected problems in thrust misalignment, free-body dynamics, stability of rotation, and torque application are solved analytically to predict man's dynamic response characteristics in space. Preliminary experiments indicate that the torque which weightless man can exert by applying a sudden twist to a fixed handle varies as a half-sine wave, and is approximately 67% of his maximum torque under normal gravity conditions.

786

Whiteside, T.C.D. 1960 HAND-EYE CO-ORDINATION IN WEIGHTLESSNESS.  
(Flying Personnel Research Committee, Gt. Britain) F/PRC/1175  
ASTIA AD 279666, May 1960

ABSTRACT: Test were conducted to repeat previous experiments but without

visual information on performance yet with a visual fixation point so that eye movement might be controlled. The intention was to plot results on a time scale by taking the Cartesian co-ordinates of each point made by the subject and plotting "X" against time and "Y" against time. In this way it was thought to demonstrate the presence of any adaption times or recovery trends. None were shown in this investigation but other interesting observations were made.

The most immediate practical conclusion to be drawn from this small investigation is that if a pilot is in the cabin of an aircraft which has "ditched" and filled with water, he will be unable to locate without difficulty such a familiar emergency control as a hood jettison handle if he cannot see it.

787

Whiteside, T.C.D. 1960 THE EFFECTS OF WEIGHTLESSNESS ON SOME POSTURAL MECHANISMS  
(Paper, 1960 Meeting of the Aerospace Medical Assoc. May 9-11, 1960, Miami Beach, Fla.)

ABSTRACT: The performance of an aiming task in which a subject has to point to the center of a target before him, depends on the coordination of visual information with intact proprioceptive and efferent mechanisms. When the task is carried out with the eyes closed, some verification of performance is still possible -- especially if the hand is brought back to touch the nose as in the well-known clinical test. Such an aiming test with eyes closed has been carried out while the subject was exposed to different G forces including zero-G. In addition, subgravity was simulated by water immersion. The results of these tests are reported in this paper.

788

Whiteside, T. C. D. 1961 HAND-EYE COORDINATION IN WEIGHTLESSNESS  
Aerospace Medicine 32(8):719-725, Aug. 1961

ABSTRACT: To study hand-eye coordination under conditons that would eliminate the variable of visual monitoring of performance yet with eye movement controlled, Ss were required to point at graph paper situated some 20 to 25 inches from his chest at chest level.. A thimble with a point was worn on the index finger so that accurate measurements could be made. A mirror was located in such a manner that the S saw a target situated to one side but could not see his hand and arm.. The aiming task was performed under normal conditions, under simulation of subgravity (immersion in water up to neck), under zero g in an aircraft flying the well-known parabola, and under acceleration (2g) on the centrifuge. Practical implications of the findings were indicated. (Tufts)

789

Whitsett, C. E. 1963 A MATHEMATICAL MODEL TO REPRESENT WEIGHTLESS MAN  
(Paper, 34th Annual Meeting of the Aerospace Medical Association, Statler-Hilton Hotel, April 29-May 2, 1963)

ABSTRACT: To maneuver and work in space, the astronaut of the future must be equipped with a system to provide propulsion, stabilization, and life support. The most desirable characteristics of this self-maneuvering and life support system are maximum freedom of motion for the man, and minimum mass for the system. These criteria make the system dynamics heavily dependent upon the dynamic response characteristics of the human body. A gap exists, however, between anthropometric data and dynamic parameters needed to design a self-maneuvering unit for the astronaut. A mathematical model which will represent the biomechanical properties of the human body is needed to bridge this gap. The purpose of this paper is to describe such a model. It is concerned with only those major dynamic effects which result when the human body is subjected to unbalanced forces, and not the physiological and psychological problems of manned space flight. The development and analysis of the model is followed by the description of an effort to validate the model experimentally. (CARI)

790

Winter, K. 1961 DER ERSTE SCHRITT INS WETTALL (The First Step into the Universe) Weltrumfahrt (Frankfurt), 12(4):101-103, July-August 1961, in German

ABSTRACT: This is a description of Yu. Gagarin's orbital flight as compiled from open Soviet literature and newspapers. Education, training and background of Soviet astronauts are similar to those in the United States. According to Gagarin's own notes, he ate and drank, wrote, and was not adversely affected by weightlessness. Gagarin wore a space suit throughout the flight. Preparation for the flight included parabolic flight, centrifuge rides, and parachute jumps.

791

Wolazek, O. 1959 ON THE TECHNICAL REALIZATION OF SUBGRAVITY AND WEIGHTLESSNESS  
Proceedings of the Xth International Astronautical Congress, 1959  
(Wien: Springer-Verlag, 1960)

ABSTRACT: Considers the problem of a technical realization of sub-gravity and weightlessness on earth and under the full effects of the force of gravity. Practical methods are presented with the aim of conducting research work in space technics and medicine.

WEIGHTLESSNESS

X

Yaslovskiy, Y.J. 1958 BIOLOGICAL EXPERIMENTS ON ROCKETS AND ARTIFICIAL EARTH SATELLITES. (Paper, presented at the Rocket and Satellite Symposium during the Fifth Reunion of the Committee Special Annee Geophysique Internationale, Moscow, July 30 - August 9, 1958)

ABSTRACT: The safety of living organisms during rocket flights can be guaranteed only under conditions which protect the organism from the action of a whole complex of unfavorable external factors: high degrees of rarefaction of the air, the absence of molecular oxygen, cosmic rays, ultraviolet radiation, meteors, weightlessness, etc. This paper discusses the programs conducted by the Russians to (1) select the most suitable biological specimen for conducting the experiments (2) develop methods of investigating the physiological functions of an animal suitable for use under the conditions of flight on a rocket, (3) determine the possibility of guaranteeing the conditions necessary for the animal to live with the aid of a small, regenerating, hermetically sealed cabin during rocket flights to an altitude of 100 km, and (4) determine the possibility of utilizing an ejectible cabin to recover animals and apparatus from high altitudes. A good description is given of the Laika experiment.

WEIGHTLESSNESS

Y

793

Yazdovshii, V.I., E.M. Yuganov & I.I. Kas'ian 1960 USTANOVOCHNYI REFLECKS INTAKTNYKH ZHIVOTNYKH V USLOVIYAKH VESESOMOSTI (Postural Reflexes of Intact Animals Under Conditions of Weightlessness)  
Akademiya Nauk SSSR. Izvestiya. Seriya Biologicheskaya (Moscow) 25: 762-767.

ABSTRACT: During a rocket flight, two white rats and two white mice were enclosed in a sealed cabin of the regenerative type with normal atmospheric conditions. The postural reflexes were studied during a sevenfold increase in gravity and a nine-minute period of weightlessness. Food and drink were accessible throughout the entire flight. The studies resulted in data concerning individual and species differences for motor activity during weightlessness. The animals were more coordinated within 40-45 seconds of weightlessness. The first signs of adaptation to weightlessness were made after 40-45 seconds.

794

Yazdovskiy, V. I., Yuganov, Ye. M., and I. I. Kas'yan. 1960 THE ADJUSTING REFLEX OF INTACT ANIMALS IN ZERO-GRAVITY CONDITIONS. Letopis'Zhurnal'nykh Statey. 46. (from periodical: Izvestiya Akad. Nauk USSR, Seriya Biol. Nr. 5.

795

Yazdovskiy, V.I., & R.M. Baevskii 1962 MEDICO-BIOLOGICAL CONTROL IN COSMIC FLIGHT. (Joint Publications Research Service, Washington, D.C.) JPRS 16205, 15 Nov. 1962. ASTIA AD 299 170.  
Translation from Akademiya Nauk SSR. Vestnik 32(9):9-15, 1962.

ABSTRACT: The task of this article is to give a general idea of the character of radiotelemetric systems of medicobiological control in their current state i.e. the state in which they were utilized partim in the vehicles "Vostok-3" and "Vostok-4" and to indicate the ways of their improvement in view, of the guarantee of bio-medical control in subsequent cosmic flights covering greater distances and having longer duration. (Author)

796

Yazdovskiy, V.I., E.M. Yuganov, & I.I. Kasyan 1963 POSTURAL REFLEXES IN INTACT ANIMALS UNDER CONDITIONS OF WEIGHTLESSNESS (National Aeronautics and Space Administration) NASA TT F-130, March 1963

ABSTRACT: Experiments were conducted on two albino rats and two albino mice to study their postural reflexes under conditions of alternately increased and decreased gravity and to determine the time required for development of adaptive reactions in the weightless state.

797

Young, R.S. 1961 BASIC RESEARCH IN ASTROBIOLOGY  
(In: Advances in the Astronautical Sciences, Volume 6, Ed. by H. Jacobs and E. Burgess, The Macmillan Company, New York, 1961) pp. 317-327

ABSTRACT: The sea urchin eggs and sperm were used in tests to determine the effect of zero gravity on two basic cellular phenomena: fertilization and cell division. The sperm and eggs were mixed at the end of the acceleration phase of the flight and fertilization occurred during weightlessness. The techniques and results are discussed in detail

798

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

ABSTRACT: This article describes training tests for astronauts and provides full page photos (including cover in color) of weightlessness tests. Author, Life science editor, participated in 90 zero-gravity experiments in a modified Convair 131-B Aircraft...."power-dived from about 12,000 ft. until it reaches an airspeed of 285 mph. Then it is sharply pulled up into a 30° climb. For the next 15 seconds the plane arcs through the air....weightlessly." Very clear article describing gravity and zero-gravity research work being done at various U. S. Laboratories. (CARI)

799

Yuganov, Ye. M., I. I. Kas'yan, & V.I. Yazdovskiy 1960 MUSCULAR  
TONUS UNDER CONDITIONS OF WEIGHTLESSNESS. Izvestiya Akademii Nauk,  
Seriya Biologicheskaya, 25(4):601-606. July-Aug. (Academy of Medical  
Sciences USSR). (Translation). NASA TT F-131, March 1963

ABSTRACT: The authors of this article report experiments which were performed on a rabbit to determine the nature and extent of change in the muscular tonus of a living organism when it is subjected to the alternating action of gravity and weightlessness. On the basis of the data collected, it was concluded that vertical shifting of the eye of a rabbit in space indicates a decrease in the tonic tolerance of the ocular musculature during weightlessness. It is suggested that oculogravitational and agravitational illusions are connected with vertical shifts of the eye. These shifts are caused by reflex action of the otolith apparatus. The nature and extent of counterrotation of the eye of a rabbit in space was recorded by direct filming. The muscular tonus was estimated from the condition of the tonic labyrinthine reflex of counterrotation of the eye. No experimental data on the subject has been found either in Soviet or in foreign literature. The only information available seems to consist of theoretical assumptions concerning the possibility of changes in muscular tonus during weightlessness. It has now been recognized that weightlessness is not dangerous to life and that it does not cause any substantial change in the cardiovascular and respiratory systems.

800

Yuganov, Y. M., N. N. Gurovskiy, I. I. Kas'yan, A. M. Konovalov, V. A. Yasubov, & V. I. Yasdovskiy 1961 SENSORY REACTIONS AND THE STATE OF VOLUNTARY MOVEMENTS OF MAN UNDER CONDITIONS OF WEIGHTLESSNESS. Izvestiya Akademii Nauk SSR (Seriya Biologicheskaya) (Proceedings of Academy of Sciences USSR, Biological Series) (Moscow) (6):897-903, Nov-Dec. 1961

ABSTRACT: A study was carried out of the pattern of sensory reactions and of the changes in some indices of voluntary movements of man under the conditions of a short exposure to imponderability reproduced in an aeroplane flight. It was shown that under these conditions in healthy persons no adverse sensory reactions do arise in most cases. During the initial period of imponderability the exactness of the motor function is reduced and the time of voluntary movements somewhat increases. This change however is of a transient character and becomes less pronounced in reiterated flights or disappears altogether. When a man is fixed in an arm-chair simple motor acts can be performed under the conditions of imponderability fairly rapidly and precisely. (CARI)

801

Yuganov, Ye. M., I.I. Kas'yan, N.N. Gurovskiy, B.I. Yakubov, & V.I. Yazdovskiy  
1961 SENSORY REACTIONS AND VOLUNTARY MOVEMENTS IN MAN DURING WEIGHTLESSNESS  
In: Akademiya nauk SSSR. Izvestiya. Seriya biologicheskaya, no. 6, 1961,  
897-904

ABSTRACT: A study was conducted with 39 men, 22 to 28 years old, in 40 flights in an airplane in which weightlessness occurred for periods of 35 to 40 sec. Weightlessness was created by movement of the aircraft along a parabolic curve. The amount of overload at the start and the end of flight along the parabola, and the condition of weightlessness were controlled visually. The data obtained indicated that 38 men experienced a "very pleasant feeling of unusual lightness," and only one in the first flight noted an unpleasant sensation in the epigastric region. The data obtained indicated that there was no change in the analytical and synthetic cortical function during brief periods of weightlessness. All the subjects adjusted quite rapidly to weightlessness. The precision of muscular efforts was determined by experiments conducted with 14 men trained to exert muscular efforts on a special dosimeter from which the visual reading of its indicator movement was impossible. The table indicates that the performance precision remained practically unchanged only in 4 men out of 14. Ten subjects committed errors of 150-1250 g. The errors in the performance precision during weightlessness were apparently due to the fact that the subjects did not have to make any effort in holding the hand in a given position. Twelve subjects participated in a study of movements preparatory to taking food and movements of swallowing liquid, semiliquid, and solid foods under conditions of weightlessness. Five men out of 12 noted slight difficulty in swallowing liquid and semiliquid foods. During weightlessness, a number of individuals showed changes in the indexes characterizing voluntary movements. These disturbances are probably connected with changes in the character and degree of the stimulation of the neuroreceptor apparatus of the statokinetic and vestibular sensors. Thus it seems that man is able to adapt himself to the conditions of space flight and weightlessness.

802

Yuganov, Ye. M., P.C. Isakov, I.I. Kaciyan, D.V. Afanasiev & G.I. Pavlov 1962  
MOTOR ACTIVITY OF INTACT ANIMALS UNDER CONDITIONS OF ARTIFICIAL GRAVITY  
(Akademiya nauk SSSR. Izvestiya. Seriya Biologicheskaya, no. 3, 1962, 455-460)

ABSTRACT: The minimal effective value of artificial gravity necessary to maintain the body posture and coordination of movements of mice and rats under conditions of weightlessness as in the parabolic flight of an aeroplane was determined. Artificial gravity was created in a small size centrifuge which produced radial accelerations varying from 0.05 to 1.0 g. Accelerations of 0.28 to 0.3 g were sufficient for prophylaxis of the unfavourable effect of weightlessness upon the motor reactions of the animals. There are 2 figures and 1 table. English-language references are: Beckh H.J. 1959. Flight experiments about human reactions to accelerations which are followed or preceded by weightlessness. Aerospace medicine, 30, 6, 391-409; Graveline D.E., Balke B., McKensie R., Hartmann, B. 1961. Psychobiologic effects of water immersion induced hypodynamics. Aerospace medicine, 32, 5.

803

Yuganov, E. M. P. K. Isakov et al 1963 MOTOR ACTIVITY OF INTACT ANIMALS  
UNDER CONDITIONS OF ARTIFICIAL GRAVITY.  
Fed. Proc. 22:589-592, May-June 1963.

804

Yugov, Y., A. Serov 1958 BEFORE MAN'S FLIGHT INTO SPACE.  
Soviet Press (Embassy of the USSR, Washington., D.C.)  
Translation No. 553, 5 Nov. 1958.

ABSTRACT: Outlines both biological problems solved and yet to be resolved for manned rocket space flights and summarizes briefly some accomplishments of Soviet space biology, which include some Sputnik II findings and some results of preceding investigations on animal - carrying rocket flights.

WEIGHTLESSNESS

Z

805

Zylstro, D. 1960 ASTRONAUTS WILL REQUIRE LESS SLEEP  
Missiles and Rockets. 6:33-34, 29 February 1960

WEIGHTLESSNESS

ANONYMOUS

806

Anon. 1950 ELEVATORS TO HELP DETERMINE EFFECTS OF REDUCED GRAVITY ON  
SUPERSONIC PILOTS, Tech. Data Digest, 9(19):11-12

ABSTRACT: Discussion, in nontechnical terms, of the problems involved in space travel, with particular attention to problems of weightlessness, orbital phenomena, travel time to planets and stars, and surface conditions on the planets. The importance of space exploration for scientific studies is discussed.

807

Anon. 1952 MAN WITHOUT GRAVITY: THE PHYSIOLOGICAL AND PSYCHOLOGICAL PROBLEMS  
OF SPACE FLIGHT. Flight 61:298-300, March 14, 1952

ABSTRACT: The principal physiological functions of the human body, such as respiration, circulation, and digestion, are primarily muscular in action and therefore independent of gravitational pull. The action of the labyrinthine fluid in the inner ear is determined by mass inertia rather than by weight. The otolith organs on the other hand require a gravitational field for their normal operation.

However, it is not known what nervous impulses would be transmitted by the otolith organs under true zero g conditions; experimental evidence allows the assumption that vision and somatic sense organs would partly compensate for disturbances in the balancing mechanisms of the inner ear. The author summarizes other problems that will arise in actual space flight, such as the need for atmospheric circulation because of lack of convection currents; prevention of blackouts during high take-off accelerations, protection from radiation, the possibility of infection by alien viruses and germs encountered on other planets, and the need of proper preparation against psychological crises on extended flights. (Literatuuroverzicht (Over Ruimtevaartgeneeskunde) (Space Medicine Bibliography) (Technisch Documentatie en Informatie centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

808

Anon. 1952 THEY'RE OFF. THE MONKEYS AND THE MICE: PHYSIOLOGICAL  
RESEARCH ON ANIMALS LEADING TO HUMAN SPACE FLIGHT.  
Western Aviation 32(11):12

ABSTRACT: Two monkeys and two mice have survived a ride to an altitude of 200,000 feet in Aerobee and V-2 type rockets fired from Holloman Air Force Base at Alamogordo, New Mexico. The experiment was carried out by the U.S. Air Force Air Research and Development Command. The monkeys had been anesthetized to prevent them from interfering with the recording instruments. The mice were placed in two separate drums, one smooth on the inside, the other provided with a small shelf. An initial acceleration of 15 g for less than one second was followed by 3 to 4 g for about 45 seconds. At the peak of the trajectory the animals were weightless. Films taken during the flight showed the "floating" mouse in a state of complete disorientation and unable to coordinate its movements. The mouse in the drum provided with a shelf was able to hold on to it and command its body at will. A statement by major Charles Yaeger on his reactions during near-zero conditions (while following a ballistic trajectory) confirmed the fact that proper performance of the pilot is not impaired under such conditions. (Literatuuroverzicht (Over Ruimtevaartgeneeskunde) (Space Medicine Bibliography) (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-160903, Feb. 1959. ASTIA AD 227 817.

809

Anon. 1957 SOVIET EXPERIMENTS ON EFFECT OF WEIGHTLESSNESS ON HUMANS  
Esti Hirlep (Budapest), 8 Nov. 1957

ABSTRACT: An article in a Budapest daily revealed that "A correspondent of the Daily Worker (presumably London) reports from the Soviet capital that 16 Soviet fliers have performed experiments on themselves to determine what effects the absence of the gravitational force of the Earth has on the human organism. This is a sign that the Soviet scientists are preparing to send men into space. They have established by means of repeated experiments on weightlessness that the human organism can adapt itself to such circumstances. One of them on whom such experiments have been done a number of times, was able to correctly orient himself and perform coordinated movements during levitation (lebeges)." The article then reported that Professor Romadin placed the speed of the second Soviet artificial satellite at only 2.5 kilometers per second less than would be needed to completely overcome the Earth's gravitation. The professor also said that the power developed during the few seconds of the rocket's ascent is more than the capacity of the Kuybyshev hydroelectric works.

810

Anon. 1957 MAN IN SPACE  
Brit. Med. J. (London), 2(5052):1041-1042, 2 Nov. 1957.

ABSTRACT: The possibility of human space travel is discussed in general. The hazards and problems of space travel (confinement, acceleration, barometric pressure, radiations, meteorites, food, re-entry problems) and possible means of overcoming them are briefly considered.

811

Anon. 1957 SPACE MEDICINE  
MD 1(3):27-33, Dec. 1957

ABSTRACT: In commenting on space travel, the author first gives a history of man's attempts to find out more about their environment. Psychologists explain man's stubborn desire for space travel through the "escapist" urge. Another urge might be man's desire to conquer physical obstacles. Also, curiosity plays an important role. The amount of time required to travel from Earth to Mars or Venus has been computed and is reported in this paper. The author also comments on certain problems to be encountered in a space flight such as weightlessness and lack of oxygen.

812

Anon. 1958 HOMO SPACIENS  
Physician's Bulletin 23:67-69

ABSTRACT: The question of man's traversing the upper atmosphere and the vacuum of outer space poses medical problems which are both challenging and formidable. In the main, it will be necessary to devise measures for his protection and his physiologic maintenance. This presumably, will require man's enclosure in a hermetically sealed shell encompassing an environment to which he is accustomed.

Physiologically, man in a space vehicle presents a variety of major problems. Most conspicuous, of course, is his vital need for oxygen. Then, too, exhaled carbon dioxide will need to be eliminated. The problem of the disposal of human waste material is, as yet, unsolved.

Beyond the sphere of earth's gravitational pull, man will have to cope with "weightlessness" just as soon as the rocket's propulsive motor is cut off. Space man's environment will be one of absolute monotony. Heron has demonstrated experimentally that monotonous situations may produce striking mental abnormalities in normal human subjects.

The aim of space medicine is essentially to aid engineers in creating approximately the same environmental conditions for man in space that prevail near the earth's surface.

813

Anon. 1958 SPUTNIKS AND SPACE SHIPS BREAKING THROUGH THE BIOLOGICAL BARRIER. USSR no. 4:17-19, 1958

ABSTRACT: A general article which covers the physiology of cosmic flight; overcoming hazards of space; how much speed can the body endure; weightlessness and acceleration; altitude and survival; and the space age.

814

Anon. 1958 SATELLITES PAVE WAY FOR SPACE TRAVEL.  
FBIS USSR/East Europe No. 186, Sept. 24, 1958.

ABSTRACT: The problems during the third stage of rocket investigations included the checking of all the results obtained during the flight of animals up to a height of 212 kilometers. During the so-called "active" stage of the flight, with the intense noise and G-force, the rate of pulse and breathing and the blood pressure of nonanesthetized animals increased as a rule. When the state of weightlessness set in, these physiological indices remained at a high level for the first two to three minutes, but by the fifth or sixth minute they returned to the initial level. Animals which were anesthetized showed no changes in the rate of pulse and breathing and in blood pressure during the state of weightlessness. Telemetric data obtained during the ascent of the rocket showed that the heartbeat was almost trebled. But subsequently, while acceleration rose, the rate of the heartbeat fell. The rate of breathing also rose three to four times under the influence of maximal acceleration; this is apparently due to the considerable increase in the weight of the dog. (CARI)

815

Anon. 1958  
The New York Times, Feb. 10, 1958. p. 14

ABSTRACT: Description of a manned sphere, 10 ft in diameter which could be lifted to 100,000 feet altitude by balloon, then released and a rocket motor boost it to 3400 mph, raising the sphere to 600,000 feet altitude. It would then begin a free-fall that would produce 2.5 minutes of weightlessness. It is primarily designed to give training in weightlessness but could give some experience in acceleration, deceleration and isolation as in space flight. (CARI)

816

Anon. 1958 MOUSE IN LIQUID SUIT SHOWS HOW MAN MAY SURVIVE STRESS OF GRAVITY  
IN SPACE TRIPS  
Wall Street J. 8 Feb. 1958

817

Anon. 1958 CORNELL PROBES WEIGHTLESSNESS  
Science News Letter 73:39  
See also Aviation Week 68(2):26-28, Jan. 13, 1958

818

Anon. 1958 AIR GROUND TELEMETRY SYSTEM FOR THE ACQUISITION OF PHYSIOLOGICAL  
DATA DURING SUB-GRAVITY CONDITIONS (Aeromedical Lab., Holloman AFB)  
8 May 1958.

ABSTRACT: Airborne system, teltneter, tape facility, mounting and installation of all equipment, galvanic skin resistance, skin temperature measurement, heart rate, blood pressure, respiration rate and depth, amplifiers, transducers, physiological console, etc.

819

Anon. 1958 FEW PHYSIOLOGICAL CHANGES NOTED IN MONKEY'S WEIGHTLESS  
FLIGHT Aviation Week, 69(25):23. 22 Dec. 1958.

ABSTRACT: The longest weightless period achieved thus far with a primate (13.3 min.) produced no significant physiological changes in a 1-pound squirrel monkey fired 300 miles into space in an Army Jupiter intermediate range ballistic missile nose cone as part of a joint Navy-Army medical experiment. Enclosed in a small metal cylinder placed inside a larger capsule, "Gordo" was placed supine with his knees drawn over his chest and equipped with gear to measure his heart action, blood pressure respiration, pulse rate, and voice response. Special instruments were installed to measure the temperature and pressure inside the smaller cylinder. A physiological telemetric system developed by Captain Norman L. Barr, chief of the Navy's aviation and space medicine program, and a telemetric system developed by the Army provided information.

820

Anon. 1958 ZERO GRAVITY TESTS SHOW MAN CAN ADJUST TO SPACE  
Aviation Week (December 22, 1958) pp. 52-55

ABSTRACT: Weightlessness in space may not cause the serious crew problems many biomedical scientists have envisioned. No serious decrement in man's performance should occur as a result of zero gravity. (Literatuuroverzicht (Over Ruimtevaartgeneeskunke) (Space Medicine Bibliography) (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. No. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

821

Anon. 1958 THE HUMAN FACTOR IN SPACE TRAVEL  
Air University Quarterly Review 10 (2):1-151; Summer 1958

ABSTRACT: This issue deals with the human factor in space travel and discusses the following subjects: Air Force human factors, basic factors, biodynamics, the engineered environment, observations in high altitude sealed-cabin balloon flight, human performance, human requirements, weightlessness of manned space operations. This issue deals over these subjects by 12 chapters. (Literatuuroverzicht (Over Ruimtevaartgeneeskunke) (Space Medicine Bibliography) (Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, den Haag, Netherlands) Rept. TDCK-16903; ASTIA AD-227 817; Feb. 1959)

822

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

ABSTRACT: Izvestia reports two dogs, Belyanka and Pestraya, were recovered from 280 miles altitude in a single-stage research rocket launches from the "middle latitudes of Soviet European territory" on Aug. 27, 1958, with a 3,726-lb. payload. This is reported as being the second launching of such a rocket. The felt-lined cabin, which landed "in a selected area," contained "a generation system, a self-contained system for recording the biological functions of the animals, and a special motion picture camera." The rocket was stabilized "during the entire flight, including the inertial part of its flight," to ensure the necessary conditions for the experiment. The rocket also carried instruments for measuring concentration of free electrons, ion composition of the atmosphere, concentration of positive ions, electron temperature, air pressure, micro-meteorite impingement, ultraviolet region of the solar spectrum, infrared radiation of the earth, and the earth's atmosphere.

823

Anon. 1958 CORNELL PROBES WEIGHTLESSNESS  
Aviation Week 68(2):26-28, Jan. 13, 1958  
See also Science News Letter 73:39, 1958

824

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

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

825

Anon. 1959 ROCKET TECHNOLOGY AND SPACE RESEARCH  
(Picatinny Arsenal, Feltman Research and Engineering Labs., Dover, N.J.)  
Translation No. PA-61, Nov. 1959. ASTIA AD 228 967  
See also Raketentech. u Raumfahrtforsch., V. 3, No. 2, Apr. - June 1959

ABSTRACT: Included in this report are observations on the physiology of the senses during the transition from acceleration to weightlessness.

826

Anon. 1959 RABBIT AND TWO DOGS RECOVERED FROM SPACE  
Science 130:258

ABSTRACT: From Soviet announcements, two dogs and a rabbit on a 4000-lb payload were launched into space on July 2, 1959, and successfully recovered. According to the Soviet press, instruments aboard the missile sent back information on the animal's reaction to weightlessness, and information on the ultra-violet part of the solar spectrum, the structure of the ionosphere, and the direction and speed of air streams at various altitudes. Among commentator's reports: "This has proved we can bring animals back alive," and "It means much in the preparation for space flights by human beings."

827

Anon. 1959 NINE MINUTES OF WEIGHTLESSNESS IN SPACE  
Weltraumfahrt (Germany) 10(3):62, Sept. 1959

828

Anon. 1959 WEIGHTLESS EXPERIMENTS DETAILED Aviat. Week 70:34, April 6, 1959

829

Anon. 1959 THEY FLOAT THROUGH THE AIR  
Astronautics 4:42-43, Feb. 1959

830

Anon. 1959 ARTIFICIAL EARTH SATELLITES NO. 3, 1959.  
Iskusstvennyye Sputniki Zemli, no. 3 (National Aeronautics and Space Administration, NASA Techn. Transl. F-8, April 1960)

CONTENTS: Presented are abstracts of 13 articles on artificial earth satellites and related subjects, which comprise the third of a series of publications by the Academy of Sciences USSR.

831

Anon. 1960 NONTITLED

Discovery 21: 482-486, 1960

ABSTRACT: A concise summary with illustrations of the experiments carried out in Sputnik V, launched Aug. 19, 1960, based on information from official Russian sources. The bio-medical experiments carried out in the 10,000 lb. satellite were designed to provide data on specific features of the vital activity of different animal and plant organisms during a space flight, the biological action of space-flight conditions on living organisms (overstrain, prolonged weightlessness, the transition to and from weightlessness), the action of cosmic rays on the vital activity and heredity of animal and plant organisms, systems for maintaining life and well-being during space flight (air regeneration, temperature, regulations, food and water supply, sanitation, etc.). In addition to dogs, Belka and Strelka, the biological payload included 21 black and 19 white mice, the seeds of different varieties of onions, peas, wheat, and maize, Nigella, actinomycete fungi, Chlorella in liquid and solid nutritive media, sealed ampules of cultures of intestinal bacteria (type KK-12, B, "aerogenes") butyric fermentation bacteria, a culture of staphylococci, two varieties of phages (T-2 and 13-21), DNA, HeLa cells, and pieces of preserved human and rabbit skin. Also the container carried four automatic bioelements with a culture of butyric

832

Anon. 1960 DOGS ADJUST QUICKLY TO FLIGHT.

TASS, Radioteletype in Russian to Europe (Moscow), August 22, 1960.

0110 GMT. (translation. Excerpts)

ABSTRACT: P. Fedorov reports that television observations were conducted from the moment the spaceship was launched and practically to the beginning of its descent. The dogs were reported to have pricked up their ears and looked with perplexity into the inside of the cabin. During the first seconds the dogs felt uneasy and agitated. As the speed of the ship increased they were gradually pressed to the floor by the increasing force of gravity. Strelka pressed down with her paws, tried to resist, and looked from side to side with alarm. Then the animal stood stock still. The ship was in orbit. After great changes in the load the condition of weightlessness was reached. The dogs "hung" in the cabin. Their paws and heads hung down weakly and at first sight the animals appeared lifeless. Having accustomed themselves to weightlessness, the animals began to eat. During the day they got worried from time to time, but they gradually settled down.

fermentation bacteria, two enclosed in a spherical thermostat and two in an unheated container. The various microbiological and cytological specimens were intended to provide data on the effect of space-flight conditions on growth and genetic change. The oxygen concentration was to be maintained at 20 to 25 percent, with a carbon dioxide concentration no higher than 1 percent; the temperature was to be between 15° and 25° C, the relative humidity at 39 to 70 percent, and the pressure at one atmosphere. The feeding method was similar to that used with Laika. The physiological information recorded during the flight included arterial blood pressure, electrocardiograms, frequency of respiration, body temperature, and movements. Data transmitted to earth stations by radio-telemetry included cabin temperature, pressure, humidity, and control data on the functioning of the life-support system. Television was employed to study the motor activity of the dogs, and transducers mounted on each cradle provided additional data on their movements. Ionizing radiation dosimeters placed near the dogs and on their suits measured radiation dose from cosmic rays. Pre- and post-flight studies included metabolism, blood and urine, cardiovascular, immunological, and (for the rats only) nervous activity and their typological peculiarities. The post-flight examination showed that the rats, like the dogs, took the trip well. The Arknik also investigated cosmic radiation and short-wave solar radiation. Measurement techniques and some experimental results are given.

833

Anon. 1960 MAN IN SPINNING TANK OF WATER WILL TEST EFFECTS OF WEIGHTLESSNESS IN SPACE. Army Navy Air Force Journal. 97:21, 23 April 1960.

834

Anon. 1960 DOGS ADJUST QUICKLY TO FLIGHT.  
TASS, Radioteletype in Russian to Europe (Moscow), August 22, 1960.  
0110 GMT. (translation. Excerpts)

ABSTRACT: P. Fedorov reports that television observations were conducted from the moment the spaceship was launched and practically to the beginning of its descent. The dogs were reported to have pricked up their ears and looked with perplexity into the inside of the cabin. During the first seconds the dogs felt uneasy and agitated. As the speed of the ship increased they were gradually pressed to the floor by the increasing force of gravity. Strelka pressed down with her paws, tried to resist, and looked from side to side with alarm. Then the animal stood stock still. The ship was in orbit. After great changes in the load the condition of weightlessness was reached. The dogs "hung" in the cabin. Their paws and heads hung down weakly and at first sight the animals appeared lifeless. Having accustomed themselves to weightlessness, the animals began to eat. During the day they got worried from time to time, but they gradually settled down.

835

Anon. 1960 SATELLITE RETURNS SAFELY  
FBIS USSR & East Europe, No. 163, 22 Aug. 1960.

ABSTRACT: After 18 revolutions the second Soviet spaceship landed safely.  
The animals returned safely and hungry. (CARI)

836

Anon. 1960 DESCRIPTION OF THE EXPERIMENTS PERFORMED DURING  
THE FLIGHT OF THE SECOND RUSSIAN SPACE-SHIP SATELLITE  
Pravda, 4-6 Sept. 1960. R.A.E. Translation No. 921

837

Anon. 1960 EFFECTS OF WEIGHTLESSNESS ARE REDUCED WHEN SPECIMEN IS STRAPPED  
INTO SEAT  
Business Week, no. 1601, p. 94, May 7, 1960

838

Anon. 1960 MAN IN SPINNING TANK OF WATER WILL TEST EFFECTS OF WEIGHTLESSNESS  
IN SPACE. Army, Navy, Air Force J. 97:21, 23 April 1960

839

Anon. 1960 ZERO GRAVITY TROUBLES: AIR FORCE FINDS BUBBLES MISBEHAVE, TUBES  
WON'T FEED IN WEIGHTLESS STATE. Machine Design 32:30, 9 June 1960

840

Anon. 1960 SECOND SOVIET SPACESHIP (Official Report)  
Pravda 4: 3-4; Sept. 1960

841

Anon. 1960 LOCKHEED WEIGHTLESSNESS SIMULATOR BEING BUILT.  
Missiles and Rockets 6(18):32, 2 May 1960.

ABSTRACT: The first insight into how a man will behave under the conditions of long periods of weightlessness in outer space will be gained through experiments with Lockheed's null gravity simulator.

842

Anon. 1960 LUNAR JOURNEY  
Lancet (London) 1(7134): 117-118, 21 May 1960

ABSTRACT: The physiological problems of orbital and space flight are briefly reviewed, including: (1) the typical aviation stresses of acceleration, low barometric pressure, and temperature and humidity extremes, for which adequate measures of protection are available; (2) prolonged weightlessness, the "breakoff phenomenon," and primary cosmic radiation, about which little is known; and (3) problems of lunar flight which will require further development of existing techniques, such as increased acceleration stress, the mental strain of extended flight, the additional radiation hazard of the Van Allen belts, and the necessity for the provision of large quantities of food and oxygen.

843

Anon. 1960 NUTRITION IN SPACE  
Nutrition Revs. 18(11):325-329, Nov. 1960

ABSTRACT: The present state of research on the nutritional problems of space travel is reviewed. Consideration is given to such subjects as the development of regenerative systems; the digestibility, toxicity, and general acceptability of algae as food; eating patterns and food preferences during extended periods of isolation, feeding programs during balloon trials (which provide short-term situations comparable to manned space flight); and the development of concentrated, synthetic diets for space travelers. The effects of such stresses as acceleration, deceleration, weightlessness, noise and vibration, and space radiation upon food supplies and food intake are also discussed.

844

Anon. 1960 DESIGN FOR ZERO-G DINING  
Machine Design, 32(26):12 22 Dec. 1960

ABSTRACT: A space kitchen has been designed for feeding one astronaut at a time in a weightless state.

845

Anon. 1961 OT MECHTY K DRISTVITEL'NOSTI (MEDIKO-BIOLOGICHESKIE PROBLEMY KOSMICHESKOGO POLETA (From Thought to Reality (Bio-Medical Problems of Cosmic Flight) Voenno-Med. Zhur. (Moscow) (In Russian) 5:3-9, 1961. See Also Military Med. J. (USSR), 5:3-12, 1961 See Also U. S. Joint Publ. Research Serv., Washington, D. C., Trans. no. 10052 (1374-N/42), 31 Aug. 1961.

ABSTRACT: Scientific preparations leading to the man-in-orbit satellite flight on 12 Apr. 1961, are discussed in detail. Rocket and satellite flights carrying biological materials were used to work out problems associated with flight dynamics (g-forces, noise, vibration, weightlessness), problems stemming from the physical characteristics of outer space (cosmic radiation), meteors, temperature changes, lack of atmosphere), and problems associated with the internal cabin environment (microclimate, isolation, diurnal rhythm disturbances). Results were satisfactory and information on optimum conditions for space flight. In regard to cosmic radiation, acceleration growth and germination were shown for onion and Nigella seeds after flight, as well as an increase in the frequency of chromosomal aberrations in root cells, bone marrow cells of mice, and growth points of plants. Also the frequency of dominant and recessive lethal factors in Drosophila was increased after a 24-hour satellite

846

Anon. 1961 WEIGHTLESSNESS: MAN IN SPACE. A LITERATURE SURVEY.  
(North American Aviation, Inc., Downey, Calif.) Rept. No. SID 61-447;  
12 Dec. 1961. ASTIA AD 282 469.

ABSTRACT: A review of literature from 1957 to August 1961 on the state of weightlessness, with primary emphasis on the physiological aspects, is given. Some engineering documentation is included. The 131 references are listed alphabetically by periodical title and corporate author in one alphabet. Both an author and subject index follow the bibliography. (Author)

847

Anon. 1961 FROM SPUTNIK TO ASTRONAUT  
Wojskowy przeglad lotniczy 1961(5):1-8

ABSTRACT: This feature article commemorates Major Y. Gagarin's successful orbital flight of April 12, 1961 and briefly describes all Soviet space vehicles launched during the last 3½ years preceding the manned orbital flight. Gagarin's flight was preceded by Vostok-type space ships launched for a test of the capsule's landing equipment. Gagarin's task during the flight was to observe the earth, the sky, and the lower layers of the atmosphere, as well as his own physical reactions to acceleration, weightlessness, etc. Sensors attached to his body recorded cardiac currents, respiration and pulse rate. The data showed that acceleration and deceleration caused little changes in his pulse rate and respiration. During weightlessness, his pulse and respiration rates returned to nearly normal. It can be assumed that manned space flights to the moon and other planets will come true in the near future. (CARI)

848

Anon. 1961 THE SCHOOL OF WEIGHTLESSNESS  
Komsomol'skaya Pravda (Moscow), 11 Aug. 1961, p.3

ABSTRACT: In answer to the questions concerning weightlessness, scientists replied that only Yu. Gagarin and G. Titov know the true meaning of the word weightlessness, since it is difficult to reproduce long periods of weightlessness on earth. Yuriy Gagarin stated that during the period of weightlessness, he felt at ease and experienced no disagreeable sensations. Preliminary data obtained as a result of Titov's flight showed that weightlessness did not hinder normal circulation of the blood. Food intake also proceeded in a satisfactory manner; Titov was successful in handling food both in liquid and solid forms. Weightlessness in no way interfered with his sleep. Both spacemen stated that weightlessness produced no ill effect on their vision, hearing, and sense of touch. During a long flight, some organs, particularly the muscles, may change to conform to the weightless condition. While arriving on another planet or returning to earth, spacemen might discover that they had difficulty in moving around. Two suggestions have been made for creating an artificial gravitational pull within a manned vehicle during long flights. One involves rotating the space vehicle around its axis. The second method consists of placing a magnetic floor in the space vehicles and providing iron shoe soles for its occupants. Training of spacemen to endure weightlessness will always be necessary. (CARI)

849

Anon. 1961 LA RELAZIONE UFFICIALE SUL VOLO SPAZIALE DI TITOV  
(Official Account of Titov's Space Flight).  
Oltre il cielo (Rome), 5(90):292-296, Oct. 1961. (In Italian)

ABSTRACT: The spaceship-sputnik "Vostok 2" was successfully launched into space for a 25 hour and 18 minute flight on August 6, 1961. The astronaut was Gherman Stefanovid Titov. This report of the flight includes a description of the communications system, the effects of flight stress on the astronaut and the astronaut's impression of the flight.

850

Anon. 1961 ACADEMY OF SCIENCES USSR, ARTIFICIAL EARTH SATELLITES (SELECTED ARTICLES) AKADEMIYA NAUK SSR, ISKUSSTVENNYE SPUTNIKI ZEMLI (8):64-71, 90-93  
(Foreign Tech. Div., Air Force Systems Command, Wright-Patterson AFB, Ohio)  
Trans. No. FTD-TT-62-694, 18 Oct. 1962; ASTIA AD-288 521)

ABSTRACT: General solution of the problem of the motion of an artificial satellite in the normal field of the earth's attraction.  
Detection of radiation anomalies over the South Atlantic at heights of 310-340 Km.

851

Anon. 1961 THE TRIUMPH OF SOVIET SCIENCE AND TECHNOLOGY--THE  
LAUNCHING AND RETURN TO EARTH OF THE SECOND SPACESHIP.  
(Technical Documents Liaison Office, Wright-Patterson AFB, Ohio)  
MCL-1255/1+2, 17 Aug. 1961. ASTIA AD 269 642.  
Translation from Priroda, No. 9, Pp. 3, 5

ABSTRACT: For the first time in the history of mankind a spaceship weighing 4600 kg (not counting the last stage of the carrier-rocket) has been launched and safely returned to earth with living beings on board. To conduct scientific investigations aboard the ship there were apparatus directly related to biological research, devices to investigate light and heavy nuclei in primary cosmic radiation, to study solar x-ray and UV radiation, and to record the levels (doses) of cosmic radiation in the animal container. The scientific information was stored and, on command from the ground, was transmitted after each revolution of the ship and before landing.

852

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

853

Anon. 1961 WEIGHTLESSNESS SMALL PROBLEM TO SOVIETS?  
Missiles and Rockets, February 6, 1961

ABSTRACT: Soviet biomedics apparently feel that weightlessness is a minor problem, if a problem at all, in space flight. Their published comments on the subject reflect concern only with the psychological adjustment for the astronaut, rather than any difficulties in carrying out missions, consuming foods, or moving about in space vehicles. To help defeat radiation hazards, Russian chemists are working on a protective agent containing sulfur, albumens, vitamins, and hormones, which--when introduced into the body--is expected to increase resistance against radiation.

854

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

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

855

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

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

856

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

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

857

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

ABSTRACT: Moscow -- The dogs which have taken part in space flights are still in excellent health and their journey into space has had no harmful aftereffects on the, said Soviet medical scientist Vasil Parin today, appearing on Moscow television program devoted to the conquest of space. Parin stressed that Soviet technology had created vehicles capable of placing living creatures into orbital flight and that both the stages of acceleration and deceleration had caused no harmful aftereffects. Academician Parin said that apparently for some time to come cosmonauts would be selected from among pilots. Outlining the requirements to be met by a cosmonaut, the scientists said that he must possess the same qualities as those possessed by Yuriy Gagarin. Speaking about Yuriy Gagarin's preparation for the flight, Academician Parin said that it had been carried out according to a big program, and all the tests were carried out with "large endurance margins" exceeding in severity those conditions which Gagarin was likely to encounter during the flight. Parin said that Gagarin's space suit incorporated special transmitters with the help of which all the data on the condition of his body during the flight were transmitted to earth. Academician Parin said that in future flights into unexplored cosmic regions the first explorers would apparently again be man's four-legged friends - dogs.

858

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

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

859

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

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

860

Anon. 1962 BLAGONRAVOV SPEAKS ON COSMONAUTICS DAY  
FBIS USSR & East Europe, Nr. 73, April 13, 1962

ABSTRACT: Work on conquering outer space was started in the Soviet Union over 10 yrs. ago. Scientists attempted to investigate the physical phenomena in the atmosphere. Rockets were used as auxiliary transport. In 1950, the rockets were designed for the upper atmosphere. In 1961, the first rocket designed for cosmic flight was flown into space carrying various animals. Three main problems caused concern: weightlessness, danger of meeting meteorites, and radiation. Many satellite ships were launched that investigated the space environment that would be encountered by man during his first space flight. (CARI)

861

Anon. 1962 ADAPTATION AND GENETICS  
Trans. of Akademiya Meditsinskikh Nauk SSSR. Vestnik, 17(4):27-37,  
44-57, and 76-81, 1962.  
(Joint Publications Research Service, San Francisco, Calif.)  
Sept. 10, 1962 JPRS: 15187

862

Anon. 1962 WEIGHTLESSNESS IS SOVIET PROBLEM  
Columbus Dispatch, April 4, 1962

863

Anon. 1962 SOVIETS DISCUSS SPACE WEIGHTLESSNESS EFFECT  
Aviation Week and Space Technology, February 26, 1962

ABSTRACT: Although the human nervous system is highly adaptable and has considerable compensating ability to restore normal contact with the outside world, it is not known how much it can compensate for deleterious effects of weightlessness. Soviet scientists contend that the following factors dictate effects on the nervous system in any space venture: low barometric pressure, rocket flight noise and environmental system. Scientists were said to have established that weightlessness induced functional changes of the heart, but cardiac disturbances disappeared after the first two hours of space flight. The absence of gravity excludes the activity of the otolith receptor of the inner ear. This apparently resulted in a distinct feeling of nausea reportedly experienced by Titov.  
(CARI)

864

Anon. 1962 SOVIET STUDIES ON THE EFFECTS OF WEIGHTLESSNESS AND PHYSICAL EXERTION.  
Trans. of Zhurnal Vysshei Nervnoi Deyatel'nosti (USSR) 12(2):202-207 and 332-337, 1962.  
(Joint Publications Research Service, Washington, D.C.)  
Aug. 10, 1962 JPRS: 14796

CONTENTS:

Changes in the Biopotentials of the Human Brain in Connection with Physical Work, by M. P. Ivanova  
The After-Effect of Singly and Repeatedly Acting Centripetal Accelerations on the Higher Nervous Activity of Animals, by A. S. Barer.

865

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

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

RESTRAINT, PROTECTION, AND  
EMERGENCY ESCAPE SYSTEMS

A

1

Abelson, Albert N. 1960 SUMMARY REPORT OF INVESTIGATION TO IMPROVE TROOP  
RESERVE PARACHUTE  
(Wright Air Development Division, Wright-Patterson AFB, Ohio) WADD TR 59-17  
ASTIA AD 249 384

ABSTRACT: Experimental and modified standard canopies, a sleeve attached pilot chute, and various types of experimental as well as standard pilot chutes were tested to investigate means of improving the reliability of the troop reserve parachute used with the standard Type T-10 personnel troop parachute assembly. It was concluded that the tested configurations did not exhibit improved performance when compared to the standard troop chest reserve parachute, P/N 48C7155.

2

Achiary, A., L. Servanty, A. Cabanon, & V. André 1956 LA DYNAMIQUE DU SIEGE  
EJECTABLE (DYNAMICS OF THE EJECTION SEAT) Médecine aeronautique (Paris)  
11(1):55-58

ABSTRACT: Characteristics of the accelerative forces imposed by ejection and the dynamic relation between accelerations of the seat and its occupant are discussed. It is shown that the discrepancies between accelerations of the seat and the body parts, as well as the physiological dangers of ejection, are dependent on the elasticity of the body and on seat cushion hardness.

3

Adams, C.C. 1958 HUMAN FACTORS IN SPACE FLYING  
In: Space Flight (New York: McGraw-Hill, 1958) Pp. 239-277

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

4

Adams, Oscar S., R.B. Levine & W.D. Chiles 1959 RESEARCH TO INVESTIGATE FACTORS AFFECTING MULTIPLE-TASK PSYCHOMOTOR PERFORMANCE  
(Wright Air Development Center, Wright-Patterson AFB, Ohio) WADC TR 59-120  
ASTIA AD 213 592

ABSTRACT: Fifteen male subjects participated in an experiment designed to study: (a) the 24-hour test-retest reliability and intercorrelation of a battery of seven performance tasks; (b) the effects of performing simultaneously various combinations of physically comparable tasks; (c) the 24-hour test-retest reliability and intercorrelation of a battery of four psychophysiological variables; and (d) the relation of psychophysiological criterion measures to performance criteria and to conditions of task presentation.

The results indicate moderately high reliability and sensitivity for five of the performance task criteria, but a negligible amount of intercorrelation. While no significant correlation was obtained between performance scores and measures of psychophysiological activity, several of the psychophysiological measures showed significant reliability, intercorrelation, and sensitivity to conditions of rest and performance activity.

5

Adamson, R.L. 1949 RADAR OPERATOR'S SEAT STATIC TEST - MODEL F-94A (Fighter)  
(Lockheed Aircraft Corp., Burbank, Calif.) June 1949, ATI-69863

ABSTRACT: Static tests were conducted on the radar operator seat for the F-94A fighter. For all tests, the seat was installed in a built-up steel frame with the seat-back horizontal and facing upwards. Hydraulic jacks acting through wood and steel jigs were used to apply loads to the safety harness, seat bottom and the front edge. Load was distributed over the seat bottom by a wood block faced with a one-inch layer of sponge rubber. Distributed load was applied to the seat back by lead pigs and shot bags. The seat withstood without failure 100% scheduled load for all test conditions. Failure in both front corners of the seat bucket occurred at 160% when a load of 4000 lb was uniformly distributed over an area of the seat bottom.

6

Adams, R. M. & J. R. Dickey 1961 STUDIES OF ESCAPE FROM BALLISTIC SPACE VEHICLES. II. INSTRUMENTATION.  
(USAF School of Aviation Medicine, Brooks, AFB, Tex.) Rep. 61 29,  
April 1961.

ABSTRACT: Specific details of a biopack instrumentation system were discussed as well as the design philosophy underlying the approaches used. Bio-

medical information on primates successfully flown through programmed escape profiles was obtained by the instrumentation in conjunction with a National Aeronautics and Space Administration project. The instrumentation consisted of devices for 1) sensing the life cell temperature, humidity, atmospheric pressure, and oxygen partial pressure; 2) detecting and measuring the S's respiratory rate, pulse, eye movements, vectoralectrocardiogram, and psychomotor performance; and 3) photographing the facial area of the animal during flight. (Tufts)

7

Ahrens, D.J. 1950 STATIC TEST PROPOSAL - MISCELLANEOUS  
(Cessna Aircraft Company, Wichita, Kansas) Report No. 920-1, August 1950.  
ASTIA ATI-91823.

ABSTRACT: The object of the front and rear seat tests is to substantiate the Model 305A seats for utility category in accordance with CAR 3.390. Load determination comprises most of this report with an emphasis on seat bottom, seat back, safety belt attachments, and shoulder harness.

8

The Aerotherm Corporation 1960 CONDUCT STUDY, DESIGN, DEVELOP AND FURNISH  
PROTOTYPES OF ENERGY ABSORPTION SYSTEMS FOR AIRCRAFT SEATS  
(Navy Bureau of Aeronautics, Contract NOa(s)57-367-C Progress Reports No.  
1-No. 30, Jan 2, 1957 to Feb. 29, 1960), ASTIA AD 269 485

ABSTRACT: Work is in progress on the general problem "regions where it appears that the deliberate incorporation of energy absorbing features in the design of aircraft seats could be beneficial and those regions where it would be futile and possibly actually dangerous".

Preliminary calculations on this phase are approximately 80% complete.

9

Agate, J.N. 1961 SOME EFFECTS OF VIBRATION UPON THE EXTREMITIES OF THE HUMAN  
(Paper, Symposium on Vibration, 20 January 1961, Imperial College, London)

ABSTRACT: This paper discusses the evidence that certain vibrations transmitted to the hands can induce a circulatory disturbance known as Raynaud's disease, resulting in an abnormal sensitivity of the fingers to exposure to cold.

10

Ahrens, D.J. 1950 STATIC TEST RESULTS - MISCELLANEOUS - AND REVISION A.  
(Cessna Aircraft Co., Wichita, Kansas) Report No. 920-2, September, 1950.  
ASTIA ATI- 91822

ABSTRACT: This is a report of miscellaneous static test results of the Model 305A front seat, rear seat, safety belts, and shoulder harness.

11

Aho, A., & E. Tahti 1957 SIGNIFICANCE OF FUNCTIONAL RADIOGRAPHY OF THE LUMBAR SPINE IN FORWARD AND BACKWARD FLEXION. Annales Chirurgiae et gynaecologiae Fenniae (Helsinki) 46(3):336-350

SUMMARY: Functional radiography of the lumbar spine was found to supplement conventional radiography. The diagnosis from functional radiography was based on exceptionally restricted mobility or exceptional mode of movement of the intervertebral space.

Exceptional mobility was almost always associated with symptoms from the lumbar spine. Exceptional segmental mobility disclosed intervertebral degeneration. Exceptional mode of movement can often be considered an indication of incipient degeneration of the nucleus pulposus. A considerable and exceptional restriction of movement is a radiological symptom of more advanced intervertebral degeneration. In the event of radiating pain, functional radiography helped to localize the prolapsed segment in acute cases of recent origin.  
(Author)

13

Aviation Crash Injury Research 1956 HV HARNESS AND REEL QUESTIONNAIRE  
(Aviation Crash Injury Research, A Division of Flight Safety Foundation, Inc., Phoenix, Arizona) Report AvCIR-6-F-70, Oct. 1956

14

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.

15

Alexander, M. 1957 HEIGHT-WEIGHT SIZING AND FIT-TEST OF A CUTAWAY G-SUIT,  
TYPE CSV-3/P WADC Technical Report 57-432, July 1957

16

Alexander, S. E. & J. G. Fraser 1961 FUNDAMENTAL CONCEPTS IN RCAF ARCTIC  
SURVIVAL TRAINING. In Bergeret, P., ed., Escape and Survival: Clinical  
and Biological Problems in Aero Space Medicine. (Advisory Group for  
Aeronautical Research and Development, Paris) AGARDograph No. 52.  
ASTIA Doc. No. AD-261 881.

(See also Paper, Aerospace Med. Panel, AGARD, NATO meeting, 1960)

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Ali, A., & H. Matlock 1957 CUSHIONING FOR AIR DROP, PART VI, PRELIMINARY  
INVESTIGATION OF THE ABSORPTION OF SHOCK ENERGY BY WOOD IN LATERAL COM-  
PRESSION. (Structural Mechanics Research Lab., Texas University, Austin,  
Texas) Contract No. DA 19-129-qm-150, ASTIA AD-132 863.

ABSTRACT: In addition to tests to determine the feasibility of using wood in lateral compression, a few exploratory tests were made using wood in combination with steel wire in tension. Devices designed especially for repeated use in testing were utilized, and a limited number of tests were made to give an indication of the quantity of energy absorbed under these conditions. The force-displacement curves obtained from free-fall tests are shown. The cost of absorbing impact energy is based on the cost of devices used to apply the loads. The tests indicate that it is feasible to use wood in lateral compression to absorb shock energy of impact efficiently and economically; the cost for energy absorption for wood is \$0.00003/ft-lb as compared to \$0.000015/ft-lb for paper honeycomb. The type of surface, wedge-shaped or cylindrical, which is used for compressing the wood has an influence on the energy absorption. The force level at which the energy is absorbed appears to be affected by the amount of lateral compression, though not in direct ratio as friction seems to play a significant part in the absorption of shock energy.

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Ali, A. 1957 CUSHIONING FOR AIR DROP, PART VIII, DYNAMIC STRESS STRAIN CHARACTERISTICS OF VARIOUS MATERIALS. (Structural Mechanics Research Lab., Texas University, Austin, Texas) Contract No. DA 19-129-qm-150. ASTIA AD-141 943.

ABSTRACT: In the delivery of supplies from aircraft in flight, cushioning materials are needed for absorbing the shock energy on impact with the ground. The capability of a material for absorbing impact energy can best be evaluated from the dynamic stress-strain curve for that material. Under the title contract, a survey has been made of the cushioning materials available, and materials exhibiting a wide range of physical properties were tested. Dynamic stress-strain curves, along with some static stress-strain curves, are presented for these cushioning materials. Some of the data presented were taken from other sources. The evaluation of dynamic stress-strain curves is discussed briefly to indicate the type of material necessary for efficient and economical absorption of impact energy.

19

Ali, A., & L. R. Benson 1957 CUSHIONING FOR AIR DROP, PART IX, BIBLIOGRAPHY OF LITERATURE PERTAINING TO THE ABSORPTION OF IMPACT ENERGY. (Structural Mechanics Research Lab., Texas University, Austin, Texas) Contract Nos. DA 19-129-qm-150 and DA 11-009-qm-19309; ASTIA AD-141 944

ABSTRACT: This report consists of an annotated bibliography of literature dealing with all phases of the problem of the absorption of impact energy in the air drop of supplies and equipment. Included in this survey are pertinent articles in the following phases: (1) theory and design of cushioning, (2) economics of energy-absorbing systems, (3) materials, devices, and systems which may be available, (4) dynamic test facilities and procedures for investigation of energy absorbers, and (5) results obtained from actual dynamic laboratory and field tests.

20

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

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.

21

Amiragov, I. L., V. V. Ruzakov, L. F. Rastegayev, & A. V. Govorov 1962 A DEVICE FOR AUTOMATIC ACTUATION OF A PARACHUTE RESCUE SYSTEM FOR USE DURING EJECTION. Soviet Patent No. 132957, (655682/40), 22 Feb. 1960  
(Translation Services Branch, Foreign Technology Div., Wright-Patterson AFB, Ohio) Trans. No. FTD-TT-62-350/1+2+4; ASTIA AD-288 988.

ABSTRACT:

Has the following special feature: in order to automatically release the stabilizer chutes and the main chute, and also the harness lines, depending on the altitude and speed at the time of ejection, it contains aneroids and diaphragm boxes attached to the static and dynamic air-pressure lines; and, by means of a potentiometric bridge and an electric motor, using shaped (profiled) cams and contact discs of the chronometer, it sets the contacts of the capacitors of the electromagnetic relays of the power-mechanism retainers in a specific angular position relative to the contact hand of the chronometer, as a function of flight speed and altitude. (CARI)

22

Amos, S.W. 1951 PERSONAL PROTECTIVE EQUIPMENT OF AIRCRAFT ACCIDENTS. (Directorate of Flight Safety Research, Norton AFB, California)  
Publication M-36, 16-19 October, 1951. ASTIA ATI 197 463.

ABSTRACT: This report is an evaluation of a study on ejection seats made by the author. Information of the suitability of ejection seats was obtained through questionnaires sent to all pilots who have intentionally used the ejection seat as a means of emergency escape from aircraft. It was found that ejection of the seat at too low an altitude is the greatest difficulty encountered and this will much improve when automatic means of release from

23

Andrews, N.L. 1955 THEORETICAL APPROACH TO THE DESIGN OF EJECTION  
SEAT CUSHION. (Flying Personnel Research Committee, Air Ministry)  
F.P.R.C. Memo No. 64, September 1955

24

Arizona Highway Department 1961 SMART DRIVERS USE SEAT BELTS.  
(Arizona Highway Department, August 1961)

ABSTRACT: The booklet contains information on how seat belts work and why they are necessary. Questions are answered concerning the safety of seat belts and specifications are given to help in choosing a seat belt. Tables are included on motor vehicle traffic fatalities and cause of accidents.

25

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.

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Armored Force Medical Research Laboratory 1943 SEAT DESIGN FOR M4  
TANKS. (Armored Force Medical Research Laboratory, Fort Knox, Ky.)  
Project No. 5-12. 5 March 1943.

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Armored Force Medical Research Laboratory 1945 SEATS FOR TRUCK  
(4 x 4)  $\frac{1}{2}$  TON (JEEP). (Armored Force Medical Research Laboratory,  
Fort Knox, Kentucky). Project No. 5-12. 17 Feb. 1945.

28

Aron, W.K. 1959 STUDY AND DEVELOPMENT OF PARACHUTES AND SYSTEMS FOR IN-FLIGHT  
AND LANDING DECELERATION OF AIRCRAFT, PART III. DESIGN OF ASSISTING  
AND CONTROL DEVICES  
(Wright Air Development Center, Air Research and Development Command, United  
States Air Force, Wright-Patterson Air Force Base, Ohio) Contract No.  
AF 33(038)-22112, Project No. 6069-61517; WADC Technical Report 57-566,  
Part III. ASTIA AD 155708

ABSTRACT: Certain devices were designed for the purpose of controlling  
parachutes deployed as air brakes on aircraft. Development has progressed  
through the prototype stage, and performance tests were conducted in conjunction  
with the high speed taxi tests of Ring Slot parachutes in a B-25 airplane. To  
provide for jettisoning the parachute, a mechanically operated disconnect was  
built, and to provide for parachute reefing control, a combination disreefer  
and swivel unit was devised.

Typical flight operations utilizing these units and the accompanying design  
criteria evolved from their uses are presented in this report along with  
descriptions of their construction. Illustrations, test results, performance  
specifications including environmental test recommendations, and engineering  
drawings are included in the appendices. The enclosed engineering drawings  
were used in the manufacture of the prototype items and are not intended to  
be finalized to the extent of standardization.

29

Aviation Crash Injury Research 1960 AO-1BF U. S. ARMY "MOHAWK" MOCKUP  
EVALUATION: BETHPAGE, LONG ISLAND, NEW YORK, 31 MARCH 1960 (Report of  
Crash Injury Evaluation AvCIR-12-PV-117, Aug. 1960, for U. S. Army Transporta-  
tion Research Command) Contract DA-44-177-TC-624, TREC TR 60-45

30

Arrowhead Products 1961 COCKPIT RETENTION AND PARACHUTE SUSPENSION GARMENT  
(Dept of Navy, Bureau of Naval Weapons, Airborne Equipment Div.) Contract  
NOW 60-0053, Final Engr. Rept., Oct. 27, 1961. ASTIA AD 269 824  
(See Huettl, George)

ABSTRACT: Cockpit retention and parachute suspension flight clothing which can distribute high acceleration forces over large areas of the body was studied to reduce injuries occurring in present day high performance aircraft. It was found that a flexible, inelastic nylon-netting garment could be utilized in distributing acceleration loads over the body torso. By crossing the fibers of a material over each other and biasing them at 45 degrees to the external load, a Chinese finger grip containment action can be developed. This containment action (axial compression load) is applied when acceleration forces are applied to the cockpit seat or the risers. Several restraint garments were constructed for evaluation. Hip and shoulder restraint straps were integrated into the netting pattern for attachment to the risers and cockpit seat. The final garment had a cover and liner for additional comfort and ease of donning and doffing. (Author)

31

Arsen'eva, M. A., V. V. Antipov, V. G. Petrukhin, T. S. L'vova, N. N. Orlova, & S. S. Il'ina 1961 IZMENENIYA V KROVETVORNYKH ORGANAKH MYSHEI POD VLIYANIE POLETA NA KORABLE-SPUTNIKE. (CHANGES IN THE HEMATOPOIETIC ORGANS OF MICE UNDER THE INFLUENCE OF FLIGHT IN A SPACESHIP) Iskusstvennye sputniki zemli (Moskva) 1961(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 significantly 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. (Aerospace Medicine 33(11):1395-1396, Nov. 1962)

33

Askren, W.B. 1959 MAN FUNCTIONS IN SPACE FLIGHT.  
(Wright Air Development Div., Wright-Patterson AFB, Ohio)  
June 1959. ASTIA AD 238 480.

Presented to the Panel on Psychology, of the Armed Forces-NRC Committee  
on Bio-Astronautics, in Washington, D.C. December 2, 1959.

ABSTRACT: The hypothetical activities of a 3-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, communication, escape, reconnaissance, offense and defence. The following selection criteria were suggested: (1) sensory 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.

34

Astakhov, M.F, A.V. Karavayev et al. 1956 HANDBOOK OF STRENGTH SPECIFICATION  
OF AIRCRAFT. PART VI. THE AIRCRAFT LANDING GEAR SHOCK ABSORBER AND ITS  
CALCULATION (Air Technical Intelligence Center, Wright-Patterson Air Force  
Base, Ohio) Rept. No. ATIC-202004, ASTIA AD-136 091

ABSTRACT: This publication contains chapters on each of the following subjects:  
Landing Gear Shock Absorbers; The Oleo-Pneumatic Shock Absorbing System; and  
Rubber Shock Absorbers.

35

Atlantic Research Corp. 1958 DEVELOPMENT OF FOAMED-IN-PLACE PLASTIC ENERGY  
ABSORBING MATERIALS. (Atlantic Research Corp., Alexandria, Va.)  
Final Rept. 31 Dec. 1956 - 31 March 1958; Contract No. DA 19-129-qm-838.  
ASTIA AD-206 052

ABSTRACT: Investigations were made of materials, methods and equipment, which  
would be suitable for the production of foamed-in-place, plastic, energy-dissipa-  
ting structures in the field for later assembly with aerial drop containers.  
Polyurethane systems were selected for initial studies. The thermal balance was

also studied of highly exothermic foamed-in-place plastic systems as possible energy absorbers and flexible and rigid insulating materials. A process was developed for the production of highly exothermic one-shot resin systems which could be foamed in place under their own heat of reaction to cured, rigid foams with equivalent or better energy dissipating properties than foamed glass at comparable densities; the systems were modified castor oil polyurethanes. The heat of condensation of mixtures of castor oil and other simple polyols with di-isocyanates or isocyanate adducts when properly catalyzed induced the formation of thermal radical from added vinyl and related monomers, with subsequent copolymerization with castor oil to give rigid foams of high strength and good energy-dissipating properties. A simple laboratory drop tester was used to screen out unsuitable experimental and commercial products and to select formulations for further improvement. Thermal properties of resin systems and foams pertaining to processing were studied; foam formulations were adjusted to permit preparation of the product under field conditions. The feasibility of producing foamed-in-place flexible and rigid structures at arctic temperatures (-40 degrees to -65 degrees F) was demonstrated.

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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.

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, Colo., 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.

RESTRAINT, PROTECTION, AND  
EMERGENCY ESCAPE SYSTEMS

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37

Babione, R. W. 1956 ACCIDENTAL DEATHS IN MILITARY VEHICLES. IN RELATION TO  
THE USE OF SEAT BELTS.  
U. S. Armed Forces Med. J. 8(10):1500-1505, October 1956.

SUMMARY: Deaths of Navy and Marine Corps personnel in government-owned ground vehicles are analyzed for a three-year period. More than half of these (41 out of 72) occurred in open-top military type vehicles, a higher proportion than would be expected during peacetime. Provision of seat belts in open-top vehicles would probably not have reduced but would more likely have increased these fatalities. In only five deaths did this type of vehicle remain upright when involved in an accident, whereas in 33 it rolled over. By comparison, 10 persons who escaped death in rollover accidents by being thrown out would probably have been killed if they had been kept in by seat belts.

In hard-top vehicles involved in accidents, 15 of 20 deaths would probably have been prevented if the victim had been wearing a seat belt, although in two cases he was too drunk to have used one. In 12 of the deaths, the victim was thrown from the cab, with or without rollover. Front seat passengers in ambulances appear to be especially at risk when not provided with seat belts.

Seven deaths, or one out of 10, occurred in falls from fire and crash trucks when the vehicle was merely making a turn. In two of these, the man slid off a seat. In these two cases, seat belts would certainly have prevented the accidents had they been worn. Quick-release belts for standees should also be considered for this type of vehicle.

If seat belts are used in hard-top vehicles, potential monetary savings on deaths alone amount to \$470,000 in three years. In addition, many serious and costly injuries would be prevented.

Weighing the cost of preventive measures against their savings, both in deaths and in the far more frequent nonfatal but costly injuries, requires more detailed reporting of the causes of trauma in serious and fatal vehicular accidents.

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Bacas, G. A. 1960 A4D ESCAPE SYSTEM, EVALUATION OF MODIFIED HEAD-REST  
INSTALLED BY A4D AIRCRAFT SERVICE CHANGE NO. 157C FOR ACCEPTABLE HEAD  
POSITIONING. (Naval Air Test Center, Patuxent River, Md.) Proj.  
TED no. PTR RAAE-23004, Serial No. AT311-276, Rept. No. 1, 5 August 1960.  
ASTIA AD-267 383.

ABSTRACT: The Service Test Division conducted an evaluation of a modified  
headrest configuration (A4D ASC 157C) for the RAPEC low level ejection system  
to determine if the headrest configuration afforded acceptable pilot head  
positioning during catapult launches. The modified headrest configuration  
was considered satisfactory for service use; however, incorporation of firmer  
headrest material is considered desirable for improved service use. (Author)

39

Baier, W. H. 1961 ESCAPE IN SPACE  
Frontier, Summer 1961 pp. 28-31

ABSTRACT: This article discusses briefly the precautions taken to insure  
safety for U. S. astronauts. (JPL)

40

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

ABSTRACT: The pamphlet presents the problems of meteoric danger, weightlessness,  
hypoxia, space suits, acceleration and water and food. There is also information  
concerning Sputnik 2 and the dog, Layka.

41

Bair, F.H. & L.J. Petti 1953 DETERMINATION OF THE MOST DESIRABLE RIDGE PATTERN FOR PILOTS' PROTECTIVE HELMETS  
(Aeronautical Materials Laboratory, Naval Air Material Center, Philadelphia, Pa.)  
AML NAM AE 4407 , Part I Dec. 9, 1953 ASTIA AD 30 501

ABSTRACT: Helmet shells having 6 designs were prepared and tested under static and dynamic (impact) loads. The plain shell appeared to be the most resistant to impact loading, but was the least resistant to static loading; sandwich or semi-sandwich construction may improve the properties. A dynamic (impact) test is considered a better method of evaluating helmet shells than a static-load test. Rounded ridges are preferred over sharp ridges. Intersecting ridges tend to deleteriously localize the stresses. The pendulum-impact-high-speed-camera procedure, developed during this investigation, is a satisfactory method of conducting impact tests.

42

Barkla, D. 1961 THE ESTIMATION OF BODY MEASUREMENTS OF BRITISH POPULATION IN RELATION TO SEAT DESIGN  
Ergonomics 4(2):123-132, April 1961.

ABSTRACT: The principal published information on human dimensions relevant to seat design is brought together. The populations surveyed comprise British, Swedish, and American individuals. Estimates of the measurements of young British adults are derived from the data and applications made to seat design. (Tufts)

43

Barnaby, R. S. Feb. 1942 REPORT ON PRONE PILOT INSTALLATION IN THE MODEL XSD2U-3 AIRPLANE. (Naval Aircraft Factory, Philadelphia, Pa.) Rept. no. M-H 268, 24 Feb. 1942.

44

Barnes, Richard W. 1946 PILOT EJECTION SEAT ACCESSORIES  
(Personal Equipment Laboratory, Army Air Forces) Serial No. TSEAP-7-9-482  
ASTIA ATI 179 496

ABSTRACT: Experiments were conducted using various parachutes for the following

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purposes: To determine a method to prevent tumbling of the ejection seat; to determine a method for insuring positive separation of occupant and ejection seat at a certain point on the seat trajectory; to determine a method for decreasing the minimum safe bailout altitude in aircraft equipped with an ejection seat; and to determine a method for the interim use of standard parachute with an ejection seat, at all altitudes, and at speeds up to 600 miles per hour. A description of the guide surface parachute to be installed on the ejection seat is given in this report.

45

Barnes, R. W. 1951 UNITED STATES AIRFORCE PARACHUTE HANDBOOK (Air Material Command, Engineering Div. Equipment Lab. Parachute Branch, Wright-Patterson AFB, Ohio) April 27, 1947; Revised, March 1, 1951. ATI 35532.

46

Bartlett, R. G., Jr., V. C. Bohn, & R. H. Helmendach 1954 ABILITY OF RAT TO ADAPT TO STRESS OF LIGHT RESTRAINT. Proc. Soc. Exp. Biol. Med. 86: 395-396

ABSTRACT: Ability of the albino rat to adapt to stress of light restraint was investigated. Rats were able to adapt to the stress of restraint (for one week) in a cylinder of wire mesh so that they did not become hypothermic when exposed to the stress in the cold. The possible roles of emotional adaptation and adrenal cortical activity in producing the increased resistance to these stresses are discussed. (Author)

47

Bartlett, R. G. 1956 STRESS ADAPTATION AND INHIBITION OF RESTRAINT-INDUCED (EMOTIONAL) HYPOTHERMIA. J. Appl. Physiol. 8(6):661-663. May 1956.

ABSTRACT: From the data presented, three general conclusions may be drawn on the rat's ability to adapt to the dual stresses of cold and restraint; (a) the rapidity of this adaptation suggests that a familiarity or emotional component may be involved in the process; (b) there is a fairly rapid loss of the adaptation if it is not 'reinforced' by the application of the stress; (c) adaptation to stress may protect against the body temperature drop in this restraint-induced (emotional) hypothermia. This is suggested by the observation that repeated exposures of the rat to the stress of forced muscular activity as well as adaptation to cold and/or restraint inhibit this hypothermia.

48

Bartlett, R. G. & P. D. Atland 1959 EFFECT OF RESTRAINT ON ALTITUDE TOLERANCE  
IN THE RAT.  
J. Appl. Physiol. 14(3):395-396, May 1959.

ABSTRACT: Young adult male and female Sprague-Dawley rats were exposed to a simulated altitude of 33,500 ft. both with and without restraint. The exposure was begun immediately upon the restraint of the experimental animals. The restrained animals died significantly sooner than did the nonrestrained controls. The possible relation of colonic temperature, oxygen consumption and emotional stress to the decreased altitude tolerance is discussed. It is suggested that the data serve as a warning for caution in the use of restraint for convenience in altitude tolerance experiments.

49

Bartlett, R. G. 1962 DESIGN CONCEPTS FOR DOME TYPE HELMET IMPROVEMENTS  
(Naval School of Aviation Medicine, Pensacola, Fla.) Project no.  
MR005.13-3100, Subtask 6, Report no. 4, June 13, 1962

ABSTRACT: The design concepts for a modification of the dome-type (neck-seal) helmet are presented. The modified helmet is designed to: (1) prevent fogging, (2) conserve breathing oxygen stores, (3) provide crash protection, (4) control the added anatomical dead space for CO<sub>2</sub> accumulation, (5) ameliorate or prevent hyperventilation, and (6) humidify the dry inspired oxygen. The use of the device is optional and it may or may not be used on any time schedule during the flight.

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Bartlett, R.G. 1962 A STUDY OF CO<sub>2</sub> BUILD-UP WITH A NECK SEAL SUBSTITUTED FOR  
THE FACE SEAL IN THE FULL PRESSURE SUIT HELMET  
(Naval School of Aviation Medicine, Pensacola, Fla.) Project no. MR005.13-3100,  
Subtask 8, Report no. 11, June 8, 1962

ABSTRACT: Breath-by-breath CO<sub>2</sub> levels were compared for two seal configurations: the face seal now used in both the Air Force and Navy pressure suits (advantages, smallness of dead space and of rebreathing, facilitating delivery of dry oxygen in a number of fine streams over the face plate eliminating fogging of the aviator's vision, but requiring personal fitting for reasonable comfort and restriction of head movement) and the neck seal (which would eliminate the undesirable aspects of the face seal provided no dead space or CO<sub>2</sub> problem is created). The pCO<sub>2</sub> measurements revealed zero to 1.5% difference in CO<sub>2</sub> levels with the face seal and the neck seal. Such differences should not disqualify the neck seal for further consideration.

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Bartlett, R. G., Jr. 1963 DESIGN CONCEPTS FOR DOME TYPE HELMET IMPROVEMENTS.  
Aerospace Medicine 34(3):213-217, March 1963

**ABSTRACT:** The dome type (neck seal) helmet offers several advantages over the face seal (Mark IV) helmet in terms of allowing free head movement, providing potentially better head cooling, and permitting the removal of the uncomfortable face seal. The dome type helmet, however, brings its own problems. The increased dead space, the lessened crash protection, and the rapid fogging in the cold with the much enlarged visor area are the more acute problems.

The design concepts for a modification of the dome type helmet are presented. The modified helmet is designed to: 1) prevent fogging, 2) conserve breathing oxygen stores, 3) provide crash protection, 4) control the added anatomical dead space for CO<sub>2</sub> accumulation, 5) ameliorate or prevent hyperventilation, and 6) humidify the dry inspired oxygen. The use of the device is optional and it may or may not be used on any time schedule during the flight. (Author)

52

Barwood, A. J. 1953 EMERGENCY ESCAPE AND SURVIVAL  
In "Discussion on Survival and Rescue", Proceedings Royal Society of Medicine 46(7):523-526

**ABSTRACT:** This paper is one of a series devoted to the problems of survival in aviation, particularly at altitudes over 40,000 feet. The author discusses the conditions which must be satisfied in order to ensure the maximum chance of survival during and after escape from aircraft. Considerations of survival must influence the design of aircraft, of clothing, of protective devices used by crew members, of escape mechanisms, and of auxiliary equipment, e.g., automatically opening parachutes and survival packs designed for any kind of global surface. Survival in isolated areas or under conditions of extreme cold presents particular problems as far as accessory equipment is concerned. The author elaborates on the type of gear which should be packed for flights over each of these specific areas. Training of aircrew personnel in the use of survival equipment under each of the various conditions is considered an important factor in survival.

53

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

54

Bary, J.L. 1957 INTERNAL BALLISTIC DESIGN AND TRAJECTORY ANALYSIS OF A  
ROCKET-ASSISTED PILOT EJECTION SEAT. (Naval Ordnance Test Station,  
China Lake, Calif.) 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.

55

Baumunk, D.B. and H.L. Walpole 1945 AN INVESTIGATION OF SEAT DESIGN FOR  
COMBAT AIRCRAFT. (Douglas Aircraft Co., Inc., Santa Monica, Calif.)  
Rept. No. ES 6950. Nov. 1945

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Bayley, C. H. & M. Mitton 1958 EXAMINATION OF NYLON SEAT HARNESS WEBBING.  
(National Academy of Sciences -- National Research Council, Washington,  
D. C.) NRC Rept. No. C.81-58S

57

Bebout, R. W. 1961 DESIGN, DEVELOPMENT, AND FABRICATION OF SIX (6) PROTOTYPE  
MODEL MISSION COMPLETION FULL PRESSURE SUIT ASSEMBLIES. (B. F. Goodrich  
Aviation Products, Akron, Ohio) Monthly Engineering Rept. No. 20, 1 Jan. -  
31 Jan. 1961; Contract NOas 59-6199C, 1 Feb. 1961. ASTIA AD-252 658L.

ABSTRACT: The sixth and final suit to be delivered on this contract will be  
used for Project "Strato-Lab High #5". This suit, designated XN-14, will be  
delivered to A.C.E.L. the first week of February and the mating helmet, XNH=14,  
one week later. (AUTHOR)

58

Beck, A.I., and G. Hildebrand 1958 NEW OPEN EJECTION SEATS.  
SAE Journal, 66(10):67-69.

ABSTRACT: A veritable crash program has been conducted by the aircraft industry  
and the military to fill the immediate need for extending the usefulness of the  
open ejection seat escape system. A group of Air Force contractors joined  
together to form the Industry Crew Escape Systems Committee, known as ICESC,  
in an effort to accelerate this endeavor. Accomplishments in fulfilling the  
essential design requirements have been made in the following fields: ejection  
acceleration and separation; dynamic stability; deceleration and windblast;  
high altitude; high temperature; low altitude; and landing and post landing  
conditions.

59

Beck, A.I. 1958 ESCAPE SYSTEMS: A METHODOLOGY TO MEET THE NEEDS.  
(Paper, SAE Meeting 29 Sept - 4 Oct. 1958.) S.A.E. Preprint No. 91C.

ABSTRACT: Relative advantages and disadvantages of open ejection seats and  
escape capsules are discussed. Optimum design criteria for the open ejection  
seat type are presented. Essential requirements of an escape capsule are  
given.

60

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

ABSTRACT: The problem areas concerned in providing adequate protection for aircrewmembers prior to and during escape sequences from 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 the 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. ( J. Aviation Med. 30(3):174, March 1959)

61

Beckett, L.C. 1959 PASSENGER SEAT DESIGN AS APPLIED TO THE CONVAIR 880. (Paper, The American Society of Mechanical Engineers, Aviation Conference, Los Angeles, Calif., 9-12 Mar. 1959)

62

Beckman, E.L., O.L. Slaughter & E.H. Wood 1955 MEASUREMENTS TO EVALUATE THE EFFECTIVENESS OF THE FULL PRESSURE HALF SUIT IN APPLYING EXTERNAL PRESSURE TO THE BODY  
(U.S. Naval Air Development Center, Aviation Acceleration Lab., Johnsville, Pa.)  
NADC-MA-5502 21 March 1955 ASTIA AD 62 492

ABSTRACT: A series of experiments was performed on 5 human subjects in order to evaluate the effects of applying, by means of an anti-blackout suit, known increments of external pressure to the body below the xiphisternum. In each subject, during a short inflation period at 1 G, the pressure measured within the G-suits was compared to (1) the pressure measured between the suit and the body surface, (2) the intrarectal pressure and, (3) the intra-esophageal pressure. It was found that the pressure increment at the body surface, was approximately 90 per cent of the suit pressure increment; the pressure increase within the rectum was 40-65 per cent of the suit pressure increase; and the rise in intra-esophageal pressure was approximately 3 per cent of the rise in suit pressure. These pressure changes within the body are interpreted as aiding the venous return to the heart.

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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 1049, May 1958. ASTIA AD 201 166

ABSTRACT: A programme of research into the problems of escape from ditched aircraft has been undertaken at this Institute. The programme has included an assessment of the feasibility and advisability of using the standard Martin\_Baker ejection seat system as a means of escape from submerged aircraft.

Although the problems relating to underwater ejection have not been completely evaluated, we think that sufficient pertinent information has been accumulated to justify a preliminary report so that the results of the trials to date can be made available to aircrew.

64

Beckman, E. L., J. Rawlins, and D. McNutt 1958 AN INVESTIGATION INTO THE FEASIBILITY OF USING THE STANDARD EJECTION SEAT SYSTEM FOR UNDERWATER ESCAPE FROM DITCHED AIRCRAFT. (Paper, Meeting of Aero Medical Assoc., Statler Hotel, Washington, March 24-26, 1958)

ABSTRACT: An investigation into the feasibility of using the ejection seat system as a means of escape from ditched aircraft has been carried out at water depths down to 34 feet. An evaluation was made of the blast pressure, accelerations, drag and decompression loads which would act upon the pilot in using the ejection seat under water. The physiologic acceptability of these loads when acting singly and combined were then evaluated clinically be experienced subjects. The function of the automatic release mechanisms were also observed. Simulated escapes from submerged aircraft utilizing standard pilot survival equipment and ejection seat equipment were then carried out. J. Aviation Med., 29(3):229, March 1958.

65

Beckman, E.L., D.C. McNutt, & J.S.P. Rawlins 1959 AN INVESTIGATION INTO THE FEASIBILITY OF USING THE MARTIN BAKER EJECTION SEAT SYSTEMS FOR UNDERWATER ESCAPE FROM DITCHED AIRCRAFT. (RAF, Institute of Aviation Medicine, Farnborough) FPRC Rept. 1076, Aug. 1959. See also Aerospace Medicine 31(9):715-732

66

Beckman, E. L., D. C. McNutt and J. S. P. Rawlins 1959 ESCAPE FROM  
DITCHED AIRCRAFT. III. AN INVESTIGATION INTO THE FEASIBILITY OF USING  
THE STANDARD MARTIN-BAKER EJECTION SEAT SYSTEMS FOR UNDER WATER  
ESCAPE FROM DITCHED AIRCRAFT  
(Flying Personnel Research Committee (Gt. Brit.).  
Rept. no. FPRC 1093 July 1959 ASTIA AD 243 787

ABSTRACT: Investigation of the problems of escape from ditched aircraft has been in progress at the RAF Institute of Aviation Medicine, Farnborough, for several years. It was early established that the standard Martin-Baker Ejection Seat System might be used for escape from a submerged aircraft with reasonable safety. Because of the importance of this information to naval aviators, a preliminary report was issued presenting the possible advantages and hazards of using the ejection seat system for escape from a ditched aircraft. Further investigations and evaluation of the original data have permitted a more accurate assessment of the problem. The results of these studies together with the conclusions which are indicated on the basis of this further knowledge are presented. The conclusions are in general agreement with previous ones, i.e. that the use of the ejection seat system is to be recommended as a means of escape from a submerged aircraft. Ejection through the canopy is recommended for aircraft with frangible canopies. The inherent dangers of injury when using the ejection seat under water are accepted as a reasonable risk for a life-saving procedure. Recommendations are made for modifying the present ejection seat systems so as to improve their performance under water and to decrease the danger to the aircrew in the use of the equipment. (Author)

67

Beckman, E. L. 1959 ESCAPE FROM DITCHED AIRCRAFT. IV. EVALUATION  
OF THE FACTORS WHICH AFFECT SURVIVAL IN A DITCHING ACCIDENT IN CURRENT  
OPERATIONAL AIRCRAFT WITH RECOMMENDATIONS FOR INCREASING THE RATE OF  
SURVIVAL  
(Flying Personnel Research Committee, Great Brit.)  
Rept. no. FPRC 1094 March 1959 ASTIA AD 243 788

ABSTRACT: Despite the high order of efficiency which has been evolved in naval carrier operations, a fraction of one per cent of the launches and landings still end in a ditching accident. In the past, approximately half the aircrew involved in these accidents lost their lives. The Royal Air Force Institute of Aviation Medicine has carried out an extensive series of investigations into the factors which affect survival from a ditching accident. The methods by which these factors limit survival are reviewed and their significance is discussed. 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

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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. (Author)

68

Beckman, E. 1960 AN INVESTIGATION INTO THE FEASIBILITY OF USING THE STANDARD MARTIN-BAKER EJECTION SEAT SYSTEMS FOR UNDERWATER ESCAPE FROM DITCHED AIRCRAFT. Aerospace Medicine, 31 (9): 715-732.

ABSTRACT: The increase in the density of jet aircraft and the introduction of the pressurized cabins in military aircraft have increased the mortality rate from ditching accidents at sea and have therefore increased the significance of ditching to Naval aviators.

The advantage to be gained by using the ejection seat system for escaping from a ditched aircraft was established by a Royal Naval pilot who escaped from his submerged, ditched aircraft by use of the ejection seat. Investigations were therefore undertaken to evaluate the use of the ejection seat as a method of escape from submerged aircraft. It has been determined that the acceleration and drag loads, the blast pressure, and the rapid pressure changes due to the trajectory of the seat to which a pilot would be subjected in using the Martin-Baker Mark 1, 2, 3, 4 or A.5 ejection seat-gun systems are within the human tolerance limits for an emergency escape procedure. Ejection through the canopy is also recommended for escape from submerged, ditched aircraft with frangible canopies. The inherent dangers of injury from striking the canopy when ejecting through the canopy during escape from a ditched aircraft are considered to be within the acceptable limits for a life-saving procedure.

69

Beckman, E.L. 1960 CHANCE VOUGHT AIRCRAFT COMPANY, INC. F8U PILOT CAPSULE: FEASIBILITY STUDY OF  
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-L6036 Oct. 18, 1960

ABSTRACT: The evaluation of the feasibility of utilizing an explosive shaped charge for separating the cockpit section of an F8U aircraft from the remaining fuselage section was carried out by the Chance Vought Aircraft Co. and the Jet

Research Center between 25 June 1958 through 11 January 1959. This report relates to the medical aspects of a test conducted for the Naval Weapons Laboratory to determine the effectiveness of the linear shaped charge in separating the cockpit section from the remainder of the fuselage when the fuselage was immersed in water. It is concluded that the over-pressures measured within the cockpit and on the water above the canopy during severance of an F8U fuselage by use of linear shaped charges were within the limits of human tolerance under conditions of this experiment. The magnitude, rate of application of acceleration, and displacement of the ejection seat guide rail were of such magnitude that if they were transmitted through a seat to a pilot, the load would be expected to cause severe damage to the pilot's back with incapacitation and permanent injury. The damage to the cockpit canopy and to the capsule structure as a result of the over-pressure of the explosion and distortion of the airframe were such as to render the cockpit uninhabitable to a pilot who was not supplied with accessory breathing

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Beer, M., R. M. Jayson, V. E. Carter & F. H. Kresse      1961    SURVEY OF ESCAPE  
TRAINING IN THE AIR FORCE  
(USAF Behavioral Science Lab. & USAF Aerospace Medical Lab., Wright-  
Patterson AFB, Ohio) (Proj. 7222, Task 71748) WADD TR 60 792, March 1961

ABSTRACT: To study the effectiveness of the present U. S. Air Force ejection training program, the following sources were canvassed for relevant information: literature on ejection training, training films, aircrew personnel, training instructors, and accident statistics. Questionnaire data were obtained from all personnel who had ejected successfully during a stated period and standardized direct interviews, based on the questionnaire, were administered to all personnel in a Fighter Interceptor Squadron. On the basis of an analysis of the information, specific deficiencies in training procedures, training media, and content of the program were indentified. Recommendations were included. (Tufts)

71

Benditt, A.      1959      DEVELOPMENT OF A PROPELLANT ACTUATED DEVICE CATAPULT,  
AIRCRAFT PERSONNEL, T18. (Frankford Arsenal, Research and Development  
Group, Philadelphia, Pa.) Memorandum Report No. M59-38-1, WADC TR 59-305.  
Jan. 1959. ASTIA AD 233 485.

ABSTRACT: This report details the design, development, and fabrication of the T18 personnel catapult. The T18 catapult differs from the conventional catapult in that it is the first to use the high-low ballistic principle

in conjunction with a temperature-sensitive nozzled cartridge. In this system the propellant burns at a high pressure in a small chamber from which the gases are metered at optimum pressure to the catapult tubes. Used in conjunction with the temperature-sensitive nozzle on the cartridge, it is capable of producing optimum performance characteristics throughout the temperature range of  $-65^{\circ}$  to  $160^{\circ}$  F. The T18 catapult project was terminated after partial final evaluation test firings.

It was concluded that the separation velocity, acceleration, and ejection height exceeded corresponding performance characteristics of the M3 catapult at  $-65^{\circ}$ F; at  $70^{\circ}$ F, performance of the T18 is comparable to that of the M3; however, at  $160^{\circ}$ F, the rate of change of acceleration is too high. It is felt that further development could bring the rate of change of acceleration within the allowable limits.

72

Benneche, R.A. 1948 WIND TUNNEL INVESTIGATION OF THE STABILITY CHARACTERISTICS OF A 1/12 SCALE MODEL OF THE PILOT EJECTION CAPSULE OF THE MODEL XP-92 AIRPLANE IN THE CVAC 4 FT WIND TUNNEL (Consolidated Vultee Aircraft Corporation, San Diego Division, San Diego, Calif.) CVAC Test #27, 3 May 1948. ASTIA ATI 54 176.

ABSTRACT: The 13.124 inch capsule consisting of the entire portion of the fuselage ahead of the break station is statically unstable at angles of zero pitch and yaw. The capsule can be made marginally stable by shortening the inner body length to 6.54 inches. The stability of the capsule with aft stations of inner body and outer shell corresponding will be improved by removing a portion of the forward part of the outer shell. The stability of the capsule in pitch will be improved by incorporating a portion of the airplane wing into the capsule design. The stability of the capsule in yaw will be improved by opening the nose wheel doors. The optimum combination of the effects of 3, 4, and 5, will result in a capsule which is stable in pitch but unstable in yaw. To obtain stability in yaw it will probably be necessary to redesign the nose wheel doors, preferably combining them to make a single large door; or to use a stabilizing device such as a small vertical fin or a trailing parachute. It is planned to investigate the effect of capsule stabilization by means of a parachute.

73

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 related to nausea and vomiting. Twenty-eight subjects (11 aircrewmembers, 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. Aircrewmembers using this ejection seat system should be instructed to move their heads as little as possible during the angular motion. (Aerospace Medicine 33(11): 1404, Nov. 1962)

74

Benson, V.G. 1961 AEROSPACE MEDICAL ASPECTS OF U.S. NAVY MANNED  
BALLOON FLIGHT OF 4 MAY 1961 "STRATO-LAB HIGH NO. 5"  
(U.S. Naval Air Development Center, Aviation Medical Acceleration Lab.,  
Johnsville, Pa.) NADC-MA 6208, 20 Aug. 1962. ASTIA AD 285575.

ABSTRACT: This paper presents medical considerations and results pertinent to the Strato-Lab High No. 5 balloon flight during which two naval officers reached a record altitude of 113,733 feet in an open gondola while wearing the Navy-Mercury full pressure suits. The flight provided means for testing (1) the complete capabilities of the full pressure suit for a prolonged period of time in an actual space equivalent environment and (2) biotelemetry methods for measuring the physiological reactions of the subjects. The operation and functioning of the full pressure suit and the performance of the pilots during the flight is discussed. The temperature control capability provided by the venetian blinds system in the gondola is examined and the physical status of the pilots, as indicated by bio-instrumentation data, is summarized.

75

Benton, R. 1943 PILOTS' HEAD SUPPORT.  
Memo Rept. No. ENG-49-695-38 (USAF, AMC, Wright-Patterson AFB, Ohio)  
4 Nov. 1943 ASTIA AD 39 862.

ABSTRACT: The purpose of this publication is to report examination of a pilot's head support sent to the Aero Medical Laboratory by Avion, Incorporated. The following undesirable features of the head support which

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was sent may be pointed out: The metal ring inserted in the ear phone socket would: (1) Prevent secure seating of the earphones in their proper places. (2) Completely destroy the acoustical qualities of the earphones assembly by replacing a sound absorbing material with a sound conducting material. (3) Be the least desirable location for a stress-bearing structure from the standpoint of intercommunication. (4) Perhaps pull out of a seating as insecure as relatively soft rubber. As a result of the tests, it was concluded that the head support, as constructed, is not satisfactory for its purpose.

76

Benzinger, T. 1946 PHYSIOLOGISCHE GRUNDLAGEN FUR BAU UND EINSATZ VON STRATOSPHERENFLUGZEUGEN. (Physiological Basis for the Construction and Use of Stratosphere Airplanes. (Hdq. Air Materiel Command, Wright Field Dayton, Ohio) Translation Report No. F-TS-467-RE, Oct. 1946. ASTIA ATI 25545

77

Berg, C. R., et al. 1958 SEATS  
(Hardman Tool & Engineering Co., Los Angeles, Calif.) July 21, 1958

78

The Berger Bros. Co. 1946 THE STORY OF THE G-SUIT  
(New Haven: The Berger Brothers Company, 1946)

ABSTRACT: A pamphlet including a reprint of an article by D.N.W. Grant published in Flying, Sept. 1945, with additional text and illustrations by the Berger Brothers Co. Discusses effects of acceleration, particularly blackout. Traces the development of anti-blackout apparel from World War I through the end of World War II, emphasizing U.S., Canadian, and British developments.

79

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

ABSTRACT: This collection of monographs is published for and on behalf of AGARD NATO (Advisory Group for Aeronautical Research and Development, North Atlantic Treaty Organization). Contributed by experts in the field, the papers discuss various aspects in the study of clinical and biological problems in aero space medicine on the subject of escape and survival.

80

Beresford, T. 1959 RECOVERY FROM SPACE.  
Prod. Eng., 30(12):17-19 , 23 Mar. 1959

ABSTRACT: Discusses problems of recovering manned satellites and their occupants from space and some of the tests and devices being designed to aid in their recovery. Discusses the heat problem, the altitude at which recovery apparatus should be employed, the control of vehicle orientation upon landing to facilitate the work of rescue teams, and the reduction of landing impact. The heat of re-entry may be studied with high-altitude windtunnel tests; an automatic triple-control recovery system such as that designed by Northrop Aircraft Corp. seems most feasible; the vehicle can be positioned with ground-actuated retro-rockets; final impacts can be softened by use of airbags or honeycomb decelerators also designed by Northrop. Recovery might also be effected by a variation of Northrop's Skysail parachute.

81

Bernardini, A.T. 1959 THE NEED FOR RADICAL DEVELOPMENT OF RESTRAINING DEVICES FOR MANNED FLIGHT. (Paper, Aero Medical Association, Statler Hilton Hotel, Los Angeles, April 27-29, 1959)

ABSTRACT: Today's "weapon system" has moved rapidly from the "aeroplane," through the "aircraft" phase, and is heading for the "manned missile" development. Each connotation depicts the evolution of manned flight. We have arrived at a stage which demands a reappraisal of restraint concepts so that resultant products of new thinking may rise, analogous to beneficial mutants in nature, in order to provide proper restraint for present and future manned flight. (J. Aviation Med. 30(3):175-176, March 1959)

82

Berus, W. J. 1961 DEVELOPMENT OF PERSONNEL PROTECTIVE SYSTEMS FOR SPACE FLIGHT AND EXPLORATION MISSIONS (B. F. Goodrich Aviation Products, Akron, Ohio) Monthly Engineering Report No. 3, 18 July 1961 - 17 August 1961; Contract NOW 61-0554-c. ASTIA AD-265 163L

ABSTRACT: The list of general movements or motions that may be required of the space craft crewman has not been substantially enlarged. However, work is continuing to make this list as complete as possible. Potential environmental hazards inside the vehicle were investigated. The magnitude of these conditions is difficult to determine. The materials investigation phase of this program has been outlined. Three (3) areas of endeavor constitute this phase: a) Inner layer, b) Shielding layer, and c) Outer layer. (AUTHOR)

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Berus, W.J. 1962 DEVELOPMENT OF PERSONNEL PROTECTIVE SYSTEMS FOR SPACE FLIGHT AND EXPLORATION MISSIONS (B.F. Goodrich Aerospace and Defense Products, Akron, Ohio) Contract NOW 61-0554-c Covering Period April 18, 1962, through May 17, 1962. Twelfth Monthly Engineering Report, ASTIA AD 283 613

ABSTRACT: AT-1 yarn is currently being coated with Teflon-Mgo in an attempt to improve its reflectance properties. Glass-rayon blend yarn is being woven in an attempt to obtain a high-strength low-creep fabric for pressure suit application.

Emissivity studies are continuing in an effort to obtain a complete thermal analysis of the present full pressure suit as well as potential space suit constructions.

Fabrication of the XGD-37 full pressure suit is 80% complete. This suit will be delivered to ACEL during the week of May 21, 1962.

84

Beson, E.E. 1958 DESIGN CONSIDERATIONS OF A BALLOON-BORNE PRESSURIZED CAPSULE FOR HIGH ALTITUDE BAILOUT STUDY. J. Aviation Med. 29(7):516-525, July 1958.

ABSTRACT: The purpose of Project High-Dive was to determine how a man can survive a parachute jump from 90,000 feet at fall velocities as high as 400 miles per hour, how stable his descent would be and if he could survive the low temperatures and opening shock of the parachute.

85

Beupre, F.J. 1947 PILOT EJECTION SEAT ACCESSORIES, UPWARD EJECTION  
TESTS OF 3 NOVEMBER 1947. (Army Air Forces Materiel Command)  
Memorandum Report No. TSEPE-672-22B, ASTIA ATI-171669.

ABSTRACT: The purpose of these tests was to determine the operational characteristics of automatic safety belt and release assemblies, and seat and dummy salvage parachutes, when used on upward ejection tests from a P-82B fighter type aircraft.

As a result of the tests, it was found that the Cook Electric Aneroid-Timer Actuator, in its present form, is not satisfactory from an engineering viewpoint. The BA-15, 1-1/2 volt dry cell battery, when used singly, does not have sufficient output to fire the present explosive bellows consistently. The standard B-10 parachute, 24-ft. diameter, is not satisfactory when used as a dummy salvage parachute if opened at speeds above 200 miles per hour. However, the dummy which was used in these tests was not of a construction which would allow efficient operation of the safety belt and shoulder harness assembly. An ejection seat salvage parachute does not operate efficiently

86

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 when used in the position of a seat type parachute.

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.

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Bierman, H.R. 1945 STATIC LOADING TESTS OF LAP SAFETY BELTS AND SHOULDER HARNESSSES (NAF 1201-1) (Naval Medical Research Institute, Bethesda, Md.) Research Project X-630, Rept. No. 2, 27 Oct. 1945.

ABSTRACT: Three lap safety belts and shoulder harness assemblies made by a different company than the con concerned in Report No. 1 of this project were stretched longitudinally by static loading to the point of failure. Failure of the lap safety belts occurred when static loads of from 2430 to 3350 pounds were applied. In two belts the metal connectors failed, while in the third the webbing tore at the point of attachment to the female buckle fitting. The failure of the lap safety belts under static loads occurred about the center connecting buckle but at a different point than in previous tests. Six shoulder harness straps were tested by stretching longitudinally under static loading to the point of failure. The webbing of five harness straps failed at loads of 820 to 1180 pounds. The sixth strap slipped at the adjustment buckle and was not tested to the point of destruction. No metal part failure occurred during these tests.

88

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

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.

89

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.

91

Bierman, H.R. 1947 TEST AND EVALUATION OF EXPERIMENTAL HARNESS  
UNDER CONTROLLED CRASH CONDITIONS.  
(Naval Medical Research Institute, Bethesda, Md.) Proj. X-630,  
Rept. No. 11, 10 Apr. 1947.

92

Billingham, J. and P.J.R. Phizackerley 1956 A COMPARISON BETWEEN THE  
MK 2 AND MK 3 AIR VENTILATED SUITS.  
(RAF Inst. Av. Med., Farnborough). FPRC Memo 79. Dec. 1956.

93

Billingham, J. and P.J.R. Phizackerley 1957 THE PHYSIOLOGICAL  
ASSESSMENT OF TWO AIR VENTILATED SUIT SYSTEMS FOR CANBERRA AIRCRAFT.  
(RAF Inst. Av. Med., Farnborough). FPRC Memo 81. Mar. 1957.

94

Billingham, J. and P.J.R. Phizackerley 1957 RAF AIR VENTILATED SUIT  
MK 2. (RAF Inst. Av. Med., Farnborough) FPRC Memo 90. Dec. 1957.

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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.

96

Billingham, J. and T.L. Hughes 1960 PROTECTION OF AIRCREW AGAINST  
THE HIGH CABIN TEMPERATURES WHICH MAY OCCUR IN PROLONGED SUPERSONIC  
FLIGHT AFTER FAILURE OF THE CABIN COOLING SYSTEM  
(RAF Inst. Av. Med., Farnborough). FPRC Rept. 1109, Feb. 1960.

97

Bjorksten Research Laboratories, Inc., 1959 DEVELOPMENT OF IMPROVED  
FLIGHT HELMET LINER. (Wright-Air Development Center, Wright-Patterson  
AFB, Ohio) WADC TR 59-435, Oct. 1959.

ABSTRACT: Various low-density plastic foam systems were evaluated for suitability for a padding helmet liner providing maximum comfort with greatest protection against shock and impact. Means of fabricating uniform and reproducible liners by injection of fluid foam into molds were studied. A liner was developed which appears to meet specification requirements for comfort, protection, ease of application, and durability. It consists of a complete inner layer of a maximum comfort, open-celled, hydrophobic, polyurethane foam, integrally bonded to an outer layer of high-energy, absorbent, polyurethane foam which is thickest over the parietal, upper occipital, and temporal areas and also provides chin area protection. Density of the composite material is approximately 4 pounds per cubic foot. Polyurethane foam systems are shown to be capable of providing the desired combination of properties for the application, utilizing techniques adaptable to production processing.

98

Black, H.W. 1944 CHARACTERISTICS OF A PRONE POSITION CONTROL  
INSTALLATION IN A TG-6 GLIDER. (USAAF, Air Materiel Command, Wright-  
Patterson AFB, Ohio) Memo Rept. No. ENG-51-4561-1-9, 3 Aug. 1944.

99

Bloetscher, F. & G. W. Quaint 1954 GENERAL ANALYSIS OF THE PROBLEM  
OF ESCAPE FROM AIRCRAFT  
(Goodyear Aircraft Corp., Akron, Ohio) Rept. no. GER 5974  
(US Navy Dept., Bur. of Aeronautics) (Contr. NOas 53-1014-C) 15 Mar. 1954

100

Bloetscher, F. 1956 DESIGN AND DEVELOPMENT OF A GENERAL PURPOSE  
EJECTABLE SEAT-CAPSULE FOR SUPERSONIC AIRCRAFT. PHASE II - FINAL REPORT  
(Goodyear Aircraft Corporation, Akron, Ohio) GER 7669, R-1173,  
BuAer Contract No. Noas 53-820-c, 23 May 1956. ASTIA AD 131966

SUMMARY: An ejectable seat-capsule was designed by the Goodyear Aircraft Corporation in accordance with the Department of the Navy, Bureau of Aeronautics, Contract No. NOas 53-820-c. This contract was established by the Bureau of Aeronautics as part of their program to develop safe means of escape from aircraft traveling at supersonic speeds.

The program for this design phase included the detail design of a capsule which provides a safe means of escape from an aircraft traveling at  $M = 1$  at sea level and  $M = 1.5$  at 30,000 feet, ejection tests of full-scale dynamic models, flotation tests, various structural tests, and a complete stress-weight analysis. The construction of the full-scale dynamic test models necessitated the fabrication of many prototype components and the design and fabrication of a high-speed test sled for use on the Supersonic Naval Ordnance Research Track (SNORT) at the US Naval Ordnance Test Station (NOTS), China Lake, California.

101

Blohn, W.J. 1959 EVALUATION OF CREW SEAT FOR COMFORT.  
(Airship Test & Development Dept., U.S. Naval Air Station, Lakehurst, N.J.) Navy, Bureau of Aeronautics Proj. Directive TED LAK AC 7075.1, Final Report, NAS Lakehurst 13-59, 30 July 1959. ASTIA AD 229 005.

ABSTRACT: A new crew seat for a comparative comfort evaluation was given. The seat was placed at the radar scope operator's position aboard a squadron ZPG-2W airship and the evaluation was made against an existing crew seat in the airship. The new seat under evaluation was installed in the airship and data collection periods were made during flights of the airship while participating in the assigned squadron missions for a period of four months. Processed data indicate the contoured seat to be more comfortable than the standard seat. It is recommended that in any future seat study a variety of seats be selected for evaluation and compared under controlled laboratory conditions.

102

Bloschies, H.H. 1960 LOW SPEED WIND TUNNEL TEST EJECTIONS OF .042 SIZE F8U-1  
DYNAMIC MODELS OF THE NAVY INTEGRATED FLIGHT CAPSULE  
(Chance Vought Aircraft Inc., Dallas, Texas) Rept. No. EOR-12652  
ASTIA AD 263 496

ABSTRACT: A series of dynamic model test ejections, of an established configuration, were performed January 11 to January 15, 1960 at the Low Speed Wind Tunnel of Chance Vought Aircraft. The objective of the tests was to pictorially demonstrate the capsule stability of a .042 size capsule at several speeds, angles of attack, and angles of yaw. The ejection tests were made with a .042 Dynamically Scaled F8U-1 nose section. Photographic records of the dynamic test trajectories obtained during this test are shown on pages 11 to 39 of this report. Static test ejections of a model of the same weight as the dynamic capsule model were also accomplished.

103

Blum, E. 1944 SEAT STATIC TESTS XR-9 HELICOPTER.  
(G & A Aircraft, Inc., Pitcairn Field, Willow Grove, Pa.)  
ASTIA ATI 45447, November 1944

ABSTRACT: Tests were conducted on the pilot and passenger seats of the XR-9 helicopter to determine its strength. Static tests were made to design loads for each loading condition. Deflection of seat pans were obtained during vertical seat loadings and deflections of supporting structure were obtained during belt loadings. Upon conclusion of the tests, loads were applied to seat bottoms until failure occurred as indicated. It was concluded that the seat successfully complied with the strength with reference to vertical loads, in that failure occurred at loadings considerably above the design criteria.

104

Boaz, W. 1958 DEVELOPMENT OF CARTRIDGE ACTUATED DEVICE, EJECTOR, T7.  
(Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia)  
Project No. TS1-15, Memo Rept. No. 692, ASTIA AD 204 520

ABSTRACT: The T7 drag parachute ejector is a cartridge actuated device designed to eject a drag parachute for main parachute deployment from the F103 aircraft emergency escape capsule. The T15 delay element was used to delay operation of the ejector for approximately two seconds after the ejection.

tion of the escape capsule from the F103 aircraft. This delay enables the capsule to clear the aircraft and decelerate sufficiently to deploy the drag parachute safely. The ejector is externally mounted to the escape capsule behind the pilot compartment, and its yoke, connected to the drag parachute, is in the aft direction. The drag parachute is then used to extract the main parachute from its case when the capsule falls to a safe altitude. The normal and alternate method of parachute deployment for the F103 aircraft emergency escape capsule is described. This report documents the design and development of the T7 drag chute ejector and includes a summary of the T15 delay element development. (Author)

105

Boaz, C.W. 1961 A BASIC INVESTIGATION OF CONTROLLABLE THRUST DEVICES FOR ESCAPE FROM SPACE VEHICLES. PHASE I, PART I, VOLUME I - SUMMARY REPORT. (Wright Air Development Division, Air Research and Development Command, Wright-Patterson AFB, Ohio) WADD Technical Report 60-348, FA Report R-1547, Jan. 1961. ASTIA AD 256 851.

ABSTRACT: The control of thrust from propellant actuated devices (PAD's) used for escape from space vehicles was investigated. Repetitive start-stop operations and control of 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 feet.

The problems of repetitive start-stop operations probably are not of importance at the altitudes considered, since there the flight time of vehicles is relatively short and complicated maneuvers would not be required. This, however, would not be true at higher altitudes. Present solid propellant-operated devices are believed to be satisfactory for operation from 75,000 to 300,000 feet, but some changes in performance characteristics may be required. Of the various methods studied for controlling thrust rate, hydraulic or pneumatic systems are the least difficult; control in liquid propellant systems is rather flexible; solid propellant systems, which give a uniform, reliable, fixed-type performance, offer good possibilities for control through design of the solid propellant charges. Of the methods for controlling thrust direction examined, it was found that selection of a particular method will depend on a number of factors; the problem is believed to be more important at the higher altitudes, for the reasons stated above.

So far as the operation of escape mechanisms is concerned, the problems introduced by environmental conditions between 75,000 and 300,000 feet were found to differ only slightly from the problems common at lower altitudes. Vacuum effects, ozone concentration, and temperature were the chief factors considered. The need for an examination of the problem of thrust control at altitudes of 200 miles or more was evident from the results of this program.

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Boaz, C.W. 1961 A BASIC INVESTIGATION OF CONTROLLABLE THRUST DEVICES FOR ESCAPE FROM SPACE VEHICLES, PHASE I, PART I, VOLUME II - SUPPORTING DATA. (Frankford Arsenal, Philadelphia, Pa.) Rept. No. R-1548; (Wright Air Development Division, Wright-Patterson AFB, Ohio) WADD TR 60-349, Feb. 1961. ASTIA AD 258546

ABSTRACT: A basic investigation for controlling thrust from propellant actuated devices used for escape from space vehicles was completed. Various devices used to measure and control temperature, pressure, fluid flow, and liquid level were examined for the start-stop and rate control areas, the principles of operation outlined, and a performance evaluation made in a space environment zone from 75,000 to 300,000 feet. The closed-chamber, load discharge, vented-vessel, and mechanical energy systems for controlling thrust direction were received and evaluated for the proposed space environment. Constant-volume closed chamber, constant-volume vented chamber, and variable-volume closed chamber systems (Gas-operated devices) were analyzed generally to provide simple ballistic models which can be used in establishing basic design criteria for propellant operated devices. Charge design studies were made with emphasis on developing analytical means for solving the charge design problem. An analytical method for designing charges was developed for several ballistic systems and dimensionless ratios simplified the final design. A detailed analytical model of the seat-ejection catapult was developed and a specific computation made for the M3 catapult. Stress is laid upon heat-transfer in the discussion of the catapult. The solution procedure suggests the need for programming the procedure for digital computer operation.

Boaz, C.W. 1961 A BASIC INVESTIGATION OF CONTROLLABLE THRUST DEVICES FOR ESCAPE FROM SPACE VEHICLES. PHASE I, PART II. PROPELLANT AND IGNITION SYSTEM (Frankford Arsenal, Philadelphia, Pa.) Rept. No. R-1609 Proj. 1362, Oct. 1961. ASTIA AD 277 700

ABSTRACT: Controllable thrust devices for escape from space vehicles are being investigated. Emphasis was on the use of suitable liquid propellants and ignition methods in propellant actuated devices (PAD) to achieve start-stop, rate, and directional control. Bipropellant, monopropellant, and hybrid systems were evaluated for use in PAD. The pressurization and liquid transfer methods for these systems were kept very simple to insure greater reliability to the device. Thrust versus volume flow rate of propellant combination, based on a number of impulse densities, was charted to determine approximate PAD sizes using liquid propellants. A number of ignition methods were studied in the light of anticipated effects of a space environment. In addition, loading, assembly, and design techniques were discussed to point out safety precautions in addition to those required with solid propellants. Well-known and unclassified propellant properties and combinations were tabulated. (Author)

108

Boeing Airplane Co. 1958 ECP 420 DOWNWARD EJECTION SEAT FLIGHT TEST EVALUATION  
11 NOV. 1958. (Boeing Airplane Co., Wichita, Kansas) Doc. No. D2-3357, Sec.  
4.45.01

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MOTION PICTURE

Boeing Airplane Co. 1958 IN-FLIGHT EJECTION OF DOWNWARD EJECTION SEATS  
(ECP 420) TESTS 3-8, 18 AUGUST 1958. (Boeing Airplane Co., Wichita,  
Kansas) Wichita Flight Test Film, Wichita No. BWM 147

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MOTION PICTURE

Boeing Airplane Co. 1958 IN-FLIGHT EJECTION OF DOWNWARD EJECTION SEATS  
(ECP 420) TESTS 9-2 AND 9-8, 28 AND 29 APRIL 1958, 1 MAY 1958.  
(Boeing Airplane Co., Wichita, Kansas) Seattle Flight Test Film, Seattle  
No. J3.8.0.6, Wichita No. BWM 148

111

Boeing Company 1962 AERIAL AIRCRAFT RECOVERY AND EVACUATION SYSTEM  
(U.S. Army Transportation Research Command, Fort Eustis, Va.)  
Vol. I, R-260A, Project 9R38-01-017-39, Contract DA44-177-TC-662,  
March 1962. ASTIA AD 275 027

ABSTRACT: Results are presented of a program of historical record surveys, analytic studies, and preliminary design pertaining to development of an aerial aircraft recovery and evacuation system for the United States Army. The stability and control problems of transporting a damaged aircraft suspended beneath a helicopter have been determined by these analytic studies. Moreover, the effectiveness of various types of equipment in dealing with these problems has been rigorously studied in terms of their mathematical analogies on the electronic computer. It is shown analytically that pitch and roll stability of an inherently unstable external load can be provided by a multiple cable suspension system deployed from the apex of the prime mover helicopter cargo sling. A method for restraining yaw rotation of the load in hover or transition flight, as well as for counteracting load-yawing in forward flight, has been devised and analytically substantiated. It is concluded that further development of this aircraft recovery system should

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be pursued by detail design and fabrication of test components, followed by qualification testing in accordance with the proposed flight test program outlined in this report.

Volume II is available upon request from U.S. Army Transportation Research Command, Fort Eustis, Va. (Author)

112

Bogart, B.K. 1958 GUIDE TO AIRCREW PERSONAL AND AIRCRAFT INSTALLED EQUIPMENT. (Wright Air Development Division, Wright-Patterson AFB, Ohio)  
WADD TN 58-259. ASTIA AD 155 895

ABSTRACT: Note: This report supersedes Technical Note 57-331, dated October 1957.

113

Bond, G.F. 1961 ESCAPES FROM SINKING JET AIRCRAFT COCKPITS  
(Panel Discussion -- Symposium on Impact Acceleration Stress, Brooks AFB, Texas  
Nov. 27-29, 1961)

ABSTRACT: This report presents the findings derived from a large series of underwater escapes, performed both at New London and Key West. The purpose of these tests was to determine, as a part of a NavDevGen Project, whether it would be possible for a pilot to make an unassisted escape from various jet cockpit assemblies, in simulated nose-sink and tail-sink attitudes, with canopy on and off, and increasing sink-rates up to maximum of seven knots. The necessary simulated conditions were achieved by securing the cockpit assembly to be tested on the afterdeck of a submarine, which then submerged, with the test subject in the cockpit, and reached the designated underwater speeds, at which time the test subject attempted to make an egress. In all, about forty egresses were completed without serious casualty. As a result of this escape series, it would appear that the pilot, if trained in buoyant ascent, and not severely disabled, should be able to escape from these types of jet aircraft at maximum sink-rates.

114

Bondurant, Stuart      1958      OPTIMAL ELASTIC CHARACTERISTICS OF EJECTION  
SEAT CUSHIONS FOR SAFETY AND COMFORT.  
(Aero Medical Lab., Wright Air Development Center, Wright-Patterson  
AFB, Ohio) Rept. on Aircrew Fatigue on Extended Missions.  
WADC Tech Note No. 58-260.    ASTIA AD 203 384

ABSTRACT: Ejection seat cushions of low compression resistance and/or great thickness may significantly magnify the force acting on the occupant of the seat, thus increasing the likelihood of vertebral injury. Cushions of the compression resistance used in this study which exceed 3.5 in. in thickness were found to amplify the g force acting on the seat occupant while the use of a 1 to 3-in. cushion decreased this force. RAF studies in this field have led to replacement in RAF aircraft of all foam rubber ejection seat cushions with plastic cushions. Studies at the Aero Medical Laboratory have shown the danger of the A-5 cushion because of low compression resistance and considerable thickness and the improvement in safety and comfort afforded by the MC-1 and MC-2 cushions of medium density foam rubber. Moreover, these studies are in agreement with those of the RAF in suggesting that further improvement could be effected by use of a suitable plastic cushion. The Aero Medical Laboratory studies show that a standardization procedure for evaluating seat cushions should be established. In addition, it was determined that safety testing of all seat cushion designs should be conducted through a series of test ejections with human subjects until further studies provide a suitable mechanical test. (Author)

115

Borgeson, G.      1959      CRASH HELMET PROGRESS.  
Hot Rod Magazine, Pp. 38-42

ABSTRACT: This publication reviews the history of the crash helmet in the United States. It describes recent experiments on protective headgear for both pilots and racing drivers. It explains the powerful forces that a helmet must absorb. The elements that constitute a good crash helmet are also reviewed. (CARI)

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Borisov, V. 1958 HERMETICALLY SEALED CABIN OF A SPACE SHIP  
Trans. from Sovetskaya Aviatsiya (USSR) No. 141(3005)p.3, 1958.  
(Office of Technical Services, Washington, D.C.)  
1960 60-23526

ABSTRACT: Current information and hypotheses on the requirements of hermetically sealed cabins are surveyed in nontechnical language.

117

Boritz, R. & S. Narisi 1961 ANALOG COMPUTER STUDY OF THE INTERIOR  
BALLISTICS OF PROPELLANT ACTUATED PERSONNEL CATAPULTS.  
(Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.)  
FA Report No. M61-17-1, ASD TR 61-455. ASTIA AD 270 815

ABSTRACT: The interior ballistics performance of personnel ejection catapults depends strongly on energy distribution. It was proposed that the major portion of the energy lost is lost by heat transfer to the metal parts of the device, and that the transfer occurs mainly by conduction. A study was conducted to determine whether or not such an assumption is valid. A mathematical expression for heat loss by conduction was used in the standard energy equation used in interior ballistics. An analog computer was programmed to solve the interior ballistics equations for personnel ejection catapults. The theoretical performance data thus obtained for a typical 3 tube catapult were compared with the actual performance data. The proposed heat transfer model was partially confirmed. An improved model is proposed. A technique which allows a proper blending of experimental and theoretical procedures is outlined. (Author)

118

Bosee, R. A. and P. W. Gard 1951 AVIATION MEDICINE IN THE EVALUATION OF NEW  
NAVAL AIRCRAFT.  
J. Aviation Med. 22(5):518-523.

ABSTRACT: The collective goal, in aviation medicine, is to maintain the balance on the "normal" side, using as the standard the ability of the individual to perform first, all those bodily functions which are basic to life; second, the series of synchronized activities that constitute his special job. The efficacy of man's performance in both those categories is the product of (a) his own physical condition, and (b) the nature of his environment.

The peculiar nature of the environment which the aviator encounters in modern military flying, that is, the combination of acceleration, reduced atmospheric pressure, diminished oxygen supply et cetera, itself requires that aviation medical personnel have a special type of training and experience.

It is evident that, both in original intent and in present practice, aviation medicine is a functioning integral part of new aircraft development and evaluation. There are many important factors that affect flight personnel in the evaluation of new aircraft, designed for high performance and high altitude, such as oxygen equipment, cabin temperature and pressurization, and protective clothing.

119

Bosee, R.A., 1957 ACCESSORY EQUIPMENT AND TESTING PROBLEMS. PROBLEMS OF ESCAPE FROM HIGH PERFORMANCE AIRCRAFT: A SYMPOSIUM.  
J. Aviation Med. 28(1):82-90

ABSTRACT: The parachutes and ejection seats are the most common devices for escape from aircraft. One outstanding advantage of the rapid seat and pilot separation sequence in the ejection seat is the provision of maximum available altitude for velocity reduction that is most desirable prior to parachute deployment. A major disadvantage attributable to the accelerated separation of seat and occupant is the complete exposure of the parachute pack and other accessory equipment to the adverse effects of the impact of high wind velocity

The escape capsule is a new source of escape and is not yet a popular source of escape. The prime purpose of the long-heralded escape capsule is to provide positive physical shielding from windblast and other adverse environmental conditions during escape from aircraft. If escape by capsule could be confined to high altitudes only, the problems associated with its development would be materially reduced. However, the system should also be suitable for physiologic problems.

120

Bosee, R.A. & C.F. Payne, Jr. 1961 THEORY ON THE MECHANISM OF VERTEBRAL INJURIES SUSTAINED ON EJECTIONS FROM AIRCRAFT  
(Paper, Aerospace Medical Panel of the Advisory Group for Aeronautical Research and Development, N.A.T.O., April 10-14, 1961) ASTIA AD 256 378

ABSTRACT: if the body must be supported by the spinal column during ejection, it is important to maintain: (1) The normal vertebral alignment; (2) The normal spinal axis; (3) Parallel ejection and vertebral axes. This will result in good body posture and therefore good force distribution on the weight-bearing portions of the vertebrae.

121

Bosee, R. A. and C. T. Koochembere 1961 NAVAL AIRCRAFT ESCAPE SYSTEMS—  
PAST, PRESENT AND FUTURE.  
Aerospace Medicine 32(3):223, March 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.

122

Bostrom, K. 1952 MILITARY TRANSPORT SEATING  
(Bostrom Research Laboratories Publications, Milwaukee, Wisc.) No. 105.

ABSTRACT: The complex limiting factors of human physiology, neuro-physiology and psychology have been either casually appreciated, or not at all in the design of military and commercial vehicles. In 1945, a report was issued stating that 90% of low back injuries seen from one service were from the services' truck transport organizations. At that time, the Bostrom Manufacturing Co. had already developed a suspension seating system to absorb shock and vibration to a degree that was not possible by any type of padding material or cushion spring system.

In Bostrom Manufacturing Co., a set of intra-company objectives brought about a keen interest in the man-machine relationship as applicable to commercial trucks and farm tractors. Being manufacturers of seating for trucks, crawler tractor and farm tractors, emphasis on the man-machine relationship was carried over into design and development work on various products.

There is a trend in the machinery building and machinery operating fields.

The trend is based on a knowledge of how of people see, feel, move and fatigue when they use mechanical devices. The aim is to design machines to fit human controllers.

Millions of men have been operating these vehicles and it is understandable that they accept these vehicles as standard. Another wrong assumption was that if millions of commercial drivers apparently had not suffered from vibration and shock, there should be no complaint because slightly worse conditions prevailed on similar military vehicles painted olive drab. Complaints as by-products of rough riding have carried little weight because the medical by-products of overstrain from lifting, stooping and jumping are the same as rough riding and they are synergistic. Accomodation through vehicle design should be within human limitations if maximum machine and individual combat efficiency is to be realized.

123

Bottem, J. M., B. S. Mill, et al. 1962 DYNA-SOAR EJECTION SEAT AND SURVIVAL SYSTEM. (The Boeing Co., Seattle, Wash.) Ident. No. 81205, Rept. No. 10-81000, ASTIA AD-282 004

124

Bowman, J.S., Jr. 1961 DYNAMIC MODEL TESTS AT LOW SUBSONIC SPEEDS OF PROJECT MERCURY CAPSULE CONFIGURATIONS WITH AND WITHOUT DROGUE PARACHUTES. (National Aeronautics and Space Administration, Washington, D.C.) NASA TM X-459.

125

Bowring, John I.R. April 1960 CREW STATIONS OF THE FUTURE  
1960 Proceedings of the Institute of Environmental Sciences, 261-281

ABSTRACT: An attempt has been made to outline a few of the problem areas in the crew station field, and to give an idea of the efforts being made "in house" to solve these problems and produce feasible answers.

The problems include those of isolation, physiological stresses which stem from the deceleration forces, and emergencies necessitating either the abandonment of the mission or of the flight vehicle. A description of the flight suit, crew seats, recreation facilities, and feeding devices is also included.

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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, Penn. 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.

127

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)

128

Bradley, R. 1945 JETTISON SEAT-MODEL XP-80A  
(Lockheed Aircraft Corp., Burbank Calif.) Report 5399, June 1945.  
ASTIA ATI 47039.

ABSTRACT: Design considerations are presented for a jettisonable pilot seat and a method is discussed for ejecting the pilot from the F-80A jet fighter. The proposed design incorporates an actuating cylinder attached to the floor slightly aft of the seat. This cylinder incorporates two sets of tracks; one set to guide the cylinder during its extension, and the other set to guide the cylinder after the power stroke. The use of an engine starter type cartridge is contemplated and a pressure of 3000 psi and a burning rate sufficient to operate the mechanism has been assumed. Several other methods were also considered. It is recommended that the oxygen system of the aircraft be revised to include a bail-out bottle and attendant equipment, also that the G-suit valve be attached to the seat with break-away connections, and that some means of protection for the pilot's face and other exposed parts of the body be developed.

129

Braunstein, P. W., J. O. Moore, & P. A. Wade 1957 PRELIMINARY FINDINGS OF THE EFFECT OF AUTOMOTIVE SAFETY DESIGN ON INJURY PATTERNS Surgery, Gynecology & Obstetrics 105(3):257-263, Sept. 1957

SUMMARY: Several thousand cases of injury-producing automobile accidents have been studied. The incidence of multiple injuries as well as multiple body areas injured is striking. Specific objects that cause injuries following crash impact are discussed and their relative importance is listed. Recent safety design engineering in its relative infancy apparently has decreased frequency and severity of injury as determined by the preliminary comparison with representative control

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Seat belts, as studied in 162 cases of automobile accidents, seem to lessen dramatically the severity and frequency of injuries. It is believed that these forward steps in safety design have been concrete in their accomplishments. This type of engineering solution is based on medical findings and when linked with public acceptance of the inherent value of such protection may well lessen the toll on the lives and well-being of more than 150,000,000 people who use the automobile as the common denominator of transportation. (AUTHOR)

.130

Bray, J.L. 1957 INTERNAL BALLISTIC DESIGN AND TRAJECTORY ANALYSIS OF A ROCKET-ASSISTED PILOT EJECTION SEAT. (U.S. Naval Ordnance Test Station, China Lake, Calif.) NOTS 1701, NAVORD Report 5433, 17 Oct. 1957. ASTIA AD 150906.

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.

.131

Brazier, J.C. and J.L. Fuller PILOT ESCAPE STUDY - MODELS D-558 & D558-2 PART IV. OPERATIONAL LIMITS FOR USE OF THE JETTISONABLE NOSE SECTION. (Douglas Aircraft Co., Inc., El Segundo, Calif.) Contract no. NOa(s) 6850, Report 15379

ABSTRACT: During the early design stages of the D-558 and D-558-2 Airplanes a jettisonable nose was chosen as a high speed emergency escape means instead of a jettisonable seat. Tests conducted by the NACA indicated that a jettisonable nose of this type was subject to autorotation and that accelerations encountered might be beyond human endurance limits even at relatively low speeds.

It can be said that the noses of the D-558 and D-558-2 do not autorotate after several initial tumbling revolutions caused by the disengaging action. This high initial acceleration is usually of the order of a fraction of a second duration, damping to a mild oscillating motion in five to ten seconds.

An analysis of physiological limitations based upon experiments indicate that a pilot with shoulder and seat belts properly secured can probably withstand the maximum accelerations experienced at release speeds approaching the design speed of the airplane without fatality, although some local injuries may result.

132

Brehaut, W.H. 1962 DESIGN AND TESTING OF PASSENGER SEATS FOR CRASH SURVIVAL (Paper, SAE Aeronautic Meeting, New York, New York, April 3-6, 1962)

133

Brennan, J. N. 1956 DEVELOPMENT OF A METHOD FOR RATIONAL DESIGN OF AIR-DROP PACKAGING (Pennsylvania State University, University Park) Progress Rept. No. 8, 1 Sept. - 31 Oct. 1956; Project No. 7-87-03-004B; Contract No. DA 19-129-qm-386; ASTIA AD-235 525

ABSTRACT: Mathematical analysis of shock spectra for various pulses has been made. An apparatus for testing columns has been designed and construction is underway. Preliminary tests on transmission of pulses through joints have been made. A report on dynamic behavior of plastics has been prepared. The first phases of study of repeated impacts of 61S-T6 aluminum alloy has been completed and the second phase started. Available stress wave pulses from a drop weight machine have been measured. A large size ballistic pendulum has been designed for testing simple structures. Comprehensive tests of our Calidyne shaker have revealed that the motion is markedly nonlinear at some frequencies. Calibrations by steady state and impulse methods have been completed for the Riehle Impact Machine instrumentation. Calibration of all our accelerometers using small amplitude sinusoidal vibration technique has been completed. Work on analog methods has continued. A series of tests has been carried out to determine the shock resistance of an electrical meter. Preliminary work has been started on study of creep recovery after impact. Construction of a 60 foot drop facility for light weight articles has been started.

134

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.

135

Brewster, O. C. 1955 PRELIMINARY INVESTIGATION ON THE USE OF ENERGY ABSORPTION  
IN AIRCRAFT SEATS. (Aerotherm Corp., Bantam, Conn.) March 1955

136

Brewster, O. W. 1954 PROPOSED PROGRAM FOR THE DYNAMIC TESTING OF AIRCRAFT  
SEATS. (Aerotherm Corp., Bantam, Conn.) 1 Sept. 1954

137

Briggs, F.E.R. 1941 FRANKS'ANTI BLACKING-OUT SUIT.  
(Flying Personnel Research Committee, Air Ministry) F.P.R.C. Rept. 301a  
May 1941

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.

138

Brissenden, R. F., D. C. Cheatham, & R. A. Champine 1961 TOLERABLE LIMITS OF OSCILLATORY ACCELERATIONS DUE TO ROLLING MOTIONS EXPERIENCED BY ONE PILOT DURING AUTOMATIC-INTERCEPTOR FLIGHT TESTS (National Aeronautics & Space Administration, Washington, D. C.) NASA TN D-810; April 1961 (Supersedes NACA RM L56K20)

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 tests were made during the final attack phase of an automatically controlled interceptor. (Author)

139

British Standards Institution 1960 SPECIFICATION FOR PROTECTIVE HELMETS FOR RACING CAR DRIVERS: BRITISH STANDARD. (British Standards Institution, London W. 1, England) British Standard 2495.

140

British Standards Institution 1960 SPECIFICATION FOR SEAT BELT ASSEMBLIES FOR MOTOR VEHICLES. (British Standards Institution) British Standard 3254: 1960 (UDC 614.85:629.113.042:656.13.08)

141

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.

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Brown, C. W., E. E. Ghiselli, R. F. Jarrett, E. W. Minium and R. M. U'Ren  
1950 COMPARISON OF AIRCRAFT CONTROLS FOR PRONE AND SEATED POSITION  
IN THREE DIMENSIONAL PURSUIT TASK. (Air Material Command, Wright-  
Patterson AFB, Ohio) AF TR 5956. March 1950.

.143

Brown, Emma E. & Ruth T. Walton 1961 ABSTRACTS OF HERB RESEARCH PUBLICATIONS--  
FY 1961  
(Human Factors Research Branch, TAG Research and Development Command, U.S. Army)  
Technical Research Note 116, Army Project No. 2L95-60-001, August 1961.  
ASTIA AD 265 468

ABSTRACT: Research Note 116 identifies both by publication serial number and by  
Research and Development Research Task all research publications prepared and  
released by the Human Factors Research Branch of The Adjutant General's R and D  
Command in FY 1961. The listing includes 2 Technical Research Reports, 8  
Technical Research Notes, 3 Research Studies, and 16 Research Memorandums.

Abstracts have been prepared for the majority of FY 1961 publications. Where  
a publication has been abstracted, the principal research findings have been  
described as much as possible in non-technical language. Technical language  
has generally been used as the most expeditious method of communicating details  
of research and analysis.

144

Brown, G. W. et al. April 1948 COMPARATIVE EFFECTIVENESS OF SPEED OF  
DETECTION OF VISUAL STIMULI IN THE PRONE AND SEATED POSITIONS.  
(USAF, AMC, Engng. Div., Wright-Patterson AFB, Ohio) Memo Rept.  
MCREXD 694-41. 3 May 1948.

.145

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

CONTENTS:

Bourne, G. H., Neuromuscular Aspects of Space Travel,  
Lindberg, E. F., & E. H. Wood, Acceleration,  
Hall, C. E., Stress,  
Balke, B., Human Tolerances,  
Chambers, R. M. & R. Fried, Psychological Aspects of Space Flight,  
Green, C. D., Biomedical Capsules,  
Hawkins, W. R., Space Flight Dynamics --- Weightlessness,  
Welch, B. E., Ecological Systems

146

Brown, J.L., W.H.B. Ellis et al 1957 THE EFFECT OF SIMULATED CATAPULT  
LAUNCHING ON PILOT PERFORMANCE  
(Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-5719, 31 Dec. 1957  
ASTIA AD 156 851

ABSTRACT: To determine the effect of exposure to transverse accelerations (similar to those encountered in catapulting) on motor performance, four subjects were exposed to acceleration patterns ranging from four to twelve G. Subjects were trained in a task that 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 and immediately following acceleration exposure. Heart rate was recorded during the experimental period and subjective comments obtained. The data were analyzed in terms of performance decrements, effect on heart rate, and subjective effects due to acceleration patterns.

147

Brown, J.L. 1957 HUMAN PERFORMANCE LIMITATIONS IN AIRCRAFT CATAPULTING AND  
ARRESTING  
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR31, Sept. 26, 1957

ABSTRACT: An experiment was carried out to determine whether or not pilots can tolerate higher levels of acceleration during catapulting than those now employed and, if they can, whether or not they are capable of adequately controlling their aircraft immediately following such exposure to acceleration. A method was devised which afforded an approximate simulation on the AMAL 50-foot centrifuge of catapult launching accelerations. The maximum level of acceleration was sustained for approximately 1.5 sec and five levels of acceleration were employed: 3.8, 6.0, 7.2, 9.6 and 11.3 G. Subjects performed a tracking task under acceleration simulating the kind of task performed by the pilot in attitude control after catapulting. Tracking scores were subjected to statistical analysis. There was no tendency for tracking error to increase with an increase in the level of acceleration from 3.8 to 11.3 G. It may be concluded that performance of a tracking task such as that which was employed in this experiment, when measured in terms of cumulative error scores, is not adversely affected by exposure to accelerations up to 11.3 G.

148

Brown, J.L. 1957 PROJECTED RESEARCH AIRCRAFT  
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR26, August 20, 1957.  
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Brown, J.L. & M. Hudson 1958 INSTRUMENTS AND CONTROLS TO BE USED IN THE X-15  
RESEARCH AIRCRAFT  
(U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR36 March 5, 1958.  
Confidential

150

Browne, M.K. & J T. Fitzsimmons 1956 PHYSIOLOGICAL ASPECTS OF A  
MULTI-GRADIENT ANTI- 'g' VALVE. (RAF Institute of Aviation Medicine,  
Farnborough) FPRC 991

ABSTRACT: Many workers, British and American, have shown that man's tolerance to positive g is subject to wide individual variations. These are still present when anti-g equipment is used. It seemed possible, therefore, that in some subjects increased g tolerance might be obtained with new equipment.

151

Bruggink, G. M., and Daniel J. Schneider 1961  
LIMITS OF SEAT-BELT PROTECTION DURING CRASH DECELERATIONS  
(Aviation Crash Injury Research, Phoenix, Arizona)  
Rept. no. AVCIR 61-8. TREC TR 61-115 September  
ASTIA AD 265 868L

ABSTRACT: The protective limits of aircraft seat-belt protection, as discussed in the available literature, are compared with recent crash injury experience. To insure maximum survivability under the most adverse conditions, the strength of a seat-belt restraint system should be based on the threshold between the injurious and fatal limits of seat-belt restraint. The study indicates that an aircraft seat-belt restraint with an energy absorbing capability of 25 G's (occupant weight, 200 pounds) for a duration of at least .2 second may form a realistic compromise between the ideal and the practicable strength of such a system. (AUTHOR)

152

Bruggink, G. M. & D. J. Schneider 1961 LIMITS OF SEAT-BELT PROTECTION DURING  
CRASH DECELERATIONS.  
Rev. Med. Aero (Paris) 2:204-209, Dec. 1961

153

Bruggink, G. M. Feb. 1961 RESTRAIN YOURSELF. (Flight Safety Foundation, Inc., New York. Pilot's Safety Exchange Bull. 61-101, 28 Feb. 1961.)

154

Bruggink, G. M. & D. J. Schneider 1963 LIMITS OF SEAT-BELT PROTECTION DURING CRASH DECELERATIONS.  
Industr. Med. Surg. 32:33-37, Jan. 1963

155

Bryant, Royal C. & W.D. Stewart 1958 DEVELOPMENT OF FOAMED-IN-PLACE PLASTIC ENERGY ABSORBING MATERIALS  
(Atlantic Research Corporation, Alexandria, Va.) Contract No. DA-19-129-QM-838  
Final Report Dec. 31, 1956 to March, 31, 1958 ASTIA AD 206 052

ABSTRACT: This program of research dealt with investigations of materials, method and equipment which would be suitable for the production of foamed-in-place, plastic, energy-dissipating structures in the field ofr later assembly with aerial drop containers. Some of the requirements for suitability were stringent, e.g. the resin system should foam, cure, and develop the necessary energy-dissipating characteristics within twelve hours, under its own heat of reaction without an accessory source of heat, under field conditions at ambient temperatures of +42 F to +125 F. The energy-dissipating properties desired for the foams would be similar to those of foamed glass at comparable densities. Another phase of the program was concerned with investigations on the thermal balance of highly exothermic foamed-in-place plastic systems, which might have application as energy absorbers and as flexible and rigid insulating materials. It was also necessary to devise, construct, and install an inexpensive but reliable instrument for measuring and comparing the energy-dissipating properties of the experimental foams.

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Byrne, W.A. 1943 FINAL REPORT ON TEST OF ANTI-"G" DEVICES UNDER SIMULATED COMBAT CONDITIONS  
(Proof Dept., AAF Proving Ground Command, Eglin Field) Serial No. 4-43-40.  
AAF Board Project No. (M-4)205. 3 Nov. 1943

ABSTRACT: (a) Pilots wearing an anti-"g" suit have a definite tactical advantage over those not protected in combat. They are also less fatigued. (b) Guns can be fired without difficulty under as much as 8.8 "g". (c) The Berger Bros. GPS is definitely superior to the Clark-Wood AOS. (d) The instrument vacuum pump installation is more satisfactory than the Cornelius Air Compressor installation from the standpoint of reliability, ease of installation and maintenance, and adequacy at altitude. (e) Photographs of GPS and AOS are included.

157

Buckhout, R. 1962 A WORKING BIBLIOGRAPHY ON THE EFFECTS OF MOTION ON HUMAN PERFORMANCE  
(Aerospace Medical Division, 6570th Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio) Rept. No. MRL-TDR-62-77, July 1962. ASTIA AD 287 530

ABSTRACT: In this bibliography a list of reports is compiled from a number of disciplines which bear on the problem of motion and its effects on human performance. Psychophysiological reports in the area of spatial orientation, perception, and receptor mechanisms provide background on the human organism in relation to motion stimuli. The effects of aerospace vehicle motion are represented by a compilation of studies of performance under acceleration, vibration and buffeting, tumbling, and weightlessness. Finally reports on training and motion simulation, equipment and methodology, and general analyses of the whole problem area are presented.

158

Buhrlen, L. 1937 VERSUCHE UBER DIE BEDEUTUNG DER RICHTUNG BEI EINWIRKEN VON FLIEHKRAFTEN AUF DEN MENSCHLICHEN KORPER (Studies on the Importance of Direction in the Action of Force on the Body During Flying)  
Luftfahrtmed., 1: 307-325

ABSTRACT: Large increases in speed cause visual disturbances. In the flat position (flying direction chest-back) visual disturbances occurred, but the brain and consciousness were not affected. Experiments were made in the sitting and lying positions.

159

Burgess, B.F. & H.N. Hunter 1955 TEST AND DEVELOPMENT OF ANTI-BLACKOUT  
EQUIPMENT  
(Naval Air Development Ctr., Johnsville, Pa.) Project NM 001 100 310;  
TED ADC AE-5201, 31 Dec. 1955

ABSTRACT: A study of G tolerances has been made on trained centrifuge subjects wearing various types of anti-G suits. (1) An experimental full-pressure half suit, due to severe discomfort, was found to limit the protection to no more than that provided by the standard Z-2 suit plus straining. (2) An integrated anti-blackout suit (basically a Z-2 suit with built-in parachute and restraint harness) was evaluated and found to be very comfortable and to provide the same protection as the standard Z-2 suit.

160

Burgess, B.F. & H.N. Hunter 1955 THE G-PROTECTION PROVIDED BY THE FULL PRESSURE  
HALF SUIT  
(Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-5511, 23 Sept. 1955

161

Burgess, B.F. 1956 INTEGRATED ANTI-BLACKOUT SUIT  
U.S. Naval Air Development Center, Johnsville, Pa. NADC-MA-LR15, 6 Feb. 1956

ABSTRACT: In a total of 75 runs on the centrifuge, 4 subjects were used to evaluate the characteristics of the integrated anti-blackout suit. G protection with the suit ranged from 0.7 to 1.8 G with a mean protection of 1.1 G. The MA-1 parachute/safety harness integration did not interfere with, or reduce, the efficiency of these features. All subjects wearing this suit during the test found it more comfortable than the standard Z-2 suit with the parachute harness worn over the suit.

162

Burgess, B.F., Jr. 1957 THE EVALUATION OF A PULSATING ANTI-G SUIT.  
(U.S. Naval Air Development Center, Aviation Medical Acceleration Lab.,  
Johnsville, Pa.) NADC-MA-5702, 27 Jan. 1957. ASTIA AD 132 753.

ABSTRACT: An evaluation was made of the G protection provided by a pulsating type of anti-blackout suit. It was compared to the standard Navy Z-2 suit. Results indicate that this suit does not provide any more protection than the Z-2 suit and, in addition, is less comfortable.

Skin temperature measurements on the hands and feet suggest that the massaging type of action of the pulsating suit has no effect on peripheral circulation.

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Burgess, B.F. 1957 ESTABLISHMENT OF A QUALIFIED PRODUCTS LIST FOR TYPE Z-3 (CUTAWAY) ANTI-BLACKOUT SUIT, CONFORMING TO SPECIFICATION MIL-S-5085 (Aer)-3 (U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR29, August 30, 1957

ABSTRACT: The following suppliers submitted sample Z-3 suits for testing in accordance with MIL-S-5085 (Aer)-3: David Clark Company, Berger Brothers, Switlik Company, and Seymour Wallas and Company. The suits submitted by these suppliers were found to conform to specifications either by test or by certification, and it is recommended that these companies be entered on the Qualified Products List.

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Burgess, B.F. 1958 TEST AND EVALUATION OF ANTI-BLACKOUT EQUIPMENT (U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR42 Feb. 28, 1958

ABSTRACT: This report describes the test and evaluation of Z-2 anti-G suits that were modified to afford comfort to pilots operating under high temperatures. The Z-2 modification from COMNAVAIRPAC was altered by the removal of the upper torso at the level of the inflation tube, the seat and the crotch sections. These suits were tested on the centrifuge and were found to give 0.4 G less protection than the standard Z-2. This lack of G protection precludes their use. Suits were modified at Johnsville by removing the upper torso at a level 2 inches above the entrance of the pressure hose and the cloth was sewn to give additional strength and a snug fit was essential. This modification showed no decrease in G protection when compared to a standard Z-2 suit.

165

Burgess, B.F. 1958 TEST AND EVALUATION OF U.S. AIR FORCE EXPERIMENTAL CUTAWAY TYPE ANTI-BLACKOUT SUITS, DESIGNATED MA-1 (U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR51 30 April 1958

ABSTRACT: The Air Force MA-1 suit and the standard Navy Z-3 suit were compared through tests conducted on the human centrifuge. Six experienced centrifuge subjects were exposed to acceleration stress while seated in a mocked-up cockpit seat with lap belt and shoulder harness. Each series of runs began at the 2.5 G level and subsequent runs were increased by 0.25 G increments until the end point was reached. The runs were 40 seconds in duration with peak G maintained for 15 seconds or until the subject noted peripheral light loss and stopped the run

himself. It was concluded that there is no significant difference between the G protection provided by the Air Force MA-1 suit and the Z-3 suit. In general, the subjects found the Z-3 suit more comfortable while under acceleration. The major complaint against the MA-1 suit was that the larger abdominal bladder tended to produce slight nausea due to pressure in the "pit of the stomach." Because of this factor and the fact that both suits provided equal G protection it was concluded that the Z-3 suit was the more desirable of the two suits.

166

Burgess, B.F. 1958 INVESTIGATION OF DEFECTIVE TYPE Z-2 ANTI-G SUITS FURNISHED BY SEYMOUR WALLAS & CO., ST. LOUIS, MISSOURI UNDER CONTRACT N383-40133A (U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR48, April 29, 1958

ABSTRACT: Four type Z-2 anti-G suits, manufactured by Seymour Wallas & Co., were submitted to AMAL in order to determine the causative factors producing excessive pressure points when worn by pilots. The suits were tested in accordance with MIL-S-5085 (Aer). Four subjects wore the suits for a total of 36 centrifuge runs and, although the suits showed a normal inflation time and normal G protection, pilot acceptability would be low due to the discomfort produced by the excessive pressure points. The suits were then examined by the Naval Air Material Center and it was found that the seam sealant of the bladders of the four defective suits was very stiff and brittle. According to the manufacturer, the suits having the unsatisfactory bladders cannot be repaired. It is therefore recommended that the defective suits be withdrawn from the supply system.

167

Burgess, B.F. 1959 TEST AND EVALUATION OF INTEGRATED COTTON-FORTISAN ANTI-BLACKOUT SUMMER FLYING COVERALL (U.S. Naval Air Development Center, Johnsville, Pa.) NADC-MA-LR88, July 9, 1959

ABSTRACT: Two cotton-fortisan anti-G suits were evaluated for anti-G protection on the AMAL centrifuge. An average of 1.5 G protection was found to be provided by the suits which is equivalent with the standard Navy Z-2 anti-G suit. Subjects found the suits comfortable. It is recommended that this suit not be adopted as standard equipment and that investigations continue in an attempt to find a lighter weight material that has a fire-resistant characteristic.

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Burke, J. E. 1960 PHYSIOLOGICAL REQUIREMENTS INTEGRATED FLIGHT CAPSULE  
(Chance Vought Aircraft, Inc., Dallas, Texas) Contract NOa(s) 59-6150-C,  
Rept. No. AER-EOR-12841, 1 June 1959 - 1 March 1960; ASTIA AD-263 491L

ABSTRACT: The improvement of the pilot environment in the Integrated Flight Capsule required definition of the physiological capabilities and limitations of the man. This was accomplished for cabin pressure; atmospheric composition, temperature; ventilation rate; environmental toxicity; accelerations; noise; vibration; body restraint; oscillation and tumbling; pilot incapacitation sensing; vision; thermal radiation effects and body waste removal. The physiological requirements presented assumed that no personal protective equipment is worn. (AUTHOR)

169

Burkhardt, W. 1939 STURZ AUS DER HÖHE (Dives from High Altitude)  
Deutsch. z. Ges. Gerichtl. Med. (Berlin) 30: 334-341

170

Burns, H.I., & R.E. Stockman 1958 DESIGN AND DEVELOPMENT OF A PRESSURE  
AND CYCLE CONTROL FOR DYNAMIC SEAT CUSHIONS. (Wright Air Development  
Center, Air Research and Development Command, Wright-Patterson AFB, Ohio)  
WADC TR 58-616, Dec. 1958. ASTIA AD 209 386

ABSTRACT: The advent of long range aircraft has created a requirement for maximum long term seating comfort. Research and development have evolved in efficient Dynamic Seat Cushion. Successful operation of a Dynamic Seat Cushion depends on close control of air pressure and inflation cycles.

Engineering problems in design and development of this close control involve air pressure regulation, manual control, inflation and deflation valving, and cycle timing. The application of this control to aircraft use imposed additional requirements of light weight, small size, and reliability over wide ranges of environment and long term continuous use.

171

Burns, N.M., & E.C. Gifford 1959 PRESSURE SUIT MOBILITY: A PRELIMINARY STUDY. (Naval Air Material Center, Air Crew Equipment Lab., Philadelphia, Pa.) NAMC-ACEL-412, 15 Oct. 1959. ASTIA AD 227 656

ABSTRACT: Four subjects were used in this study, with each subject wearing each of the basic suit configurations on at least one occasion. The time taken to activate the appropriate switch, once the signal was given, and the time taken to complete a sequence of movements was recorded. The data was plotted graphically in order to demonstrate the restricting effects of the various suits and the effects of inflating the suit to 5 psi. This data is shown. The results indicate two primary findings. First, the three suits tested appear to be roughly equivalent with regard to their respective mobility. Secondly, in the event of a loss of cabin pressure, inflation of the suit to 5 psi can be expected to lengthen RT. The differences in RT among the three suits at 0 and 5 psi were statistically significant in every case.

172

Burns, N. M. and R. B. Ziegler 1960 ENVIRONMENTAL REQUIREMENTS OF SEALED CABINS FOR SPACE AND ORBITAL FLIGHTS. A BIBLIOGRAPHY OF PSYCHO-PHYSIOLOGICAL STUDIES RELEVANT TO SPACE AND ORBITAL FLIGHT (Naval Air Material Center, Air Crew Equipment Lab., Philadelphia, Pa.) NAMC-ACEL-441, 26 Oct. 1960  
ASTIA AD 246 414

ABSTRACT: A bibliography is presented of psychological, physiological and environmental reports pertinent to man's role in space and orbital flight. Five hundred and eight-two entries are provided on 3 x 5 inch file card forms with the content of the report indicated by the category into which it is placed. The literature review for this bibliography was completed in April 1960.

173

Burns, Neal M. & R.L. Burdick 1961 COCKPIT DESIGN STUDIES; STANDARD COCKPIT MOCKUP (PRESSURE SUIT MOBILITY. II. THE PROJECT MERCURY SUIT) (Air Crew Equipment Laboratory, Naval Air Material Center, Philadelphia, Pa.) NAMC-ACEL-443 Feb. 21, 1961 ASTIA AD 254 517

ABSTRACT: The present report is a continuation of the laboratory's efforts on the human factors problems involved in pressure suit design. The purpose here was to investigate the effects of suit pressurization on motor performance and

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a modified reaction time experimental paradigm was used. The task console consisted of a modified Mercury control panel, with the subjects required to perform specific responses when the appropriate signal was displayed. Six of the Project Mercury astronauts served as subjects, and were first tested with the suit at 0 psi or, more accurately, ventilation air pressure. After a series of measurements of performance were obtained, the suit was inflated to a pressure of 5 psi. The same series of measurements were taken under both conditions. Inflation of the suit to 5 psi significantly increased the time required to activate the controls on the Mercury panel. In addition, the number of inadvertent actuations (i.e., errors) also increased under the 5 psi condition.

174

Bushnell, D. 1958 MAJOR ACHIEVEMENTS IN BIODYNAMICS: ESCAPE PHYSIOLOGY 1955 - 1958. (Historical Div., Office of Information Services, Holloman AFB, New Mexico) June 1958 ASTIA AD 201 282

ABSTRACT: In the study here presented, the author has carefully documented that portion of the work done in the Biodynamics and Space Biology Branches of the Air Force Missile Development Center's Aeromedical Field Laboratory towards the exploration of the punishing effects of wind blast and the tremendous forces of abrupt deceleration encountered during emergency escape from high-mach aircraft. The author has also mentioned the application of this experimentation to the effects of the magnitude and relatively long duration of g-loading experienced during sustained acceleration of multistage space vehicles.

This monograph is the fourth of a projected series of six related to the contributions of Holloman's Aeromedical Field Laboratory.

RESTRAINT, PROTECTION, AND  
EMERGENCY ESCAPE SYSTEMS

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Caldara, J. D. 1956 FLIGHT SAFETY TESTIMONY GIVEN BEFORE THE SUB-COMMITTEE OF THE COMMITTEE ON APPROPRIATIONS. (House of Rep., Eighty-fourth Congress, Washington, D.C.) Special Report No. 31-56, March 20, 1956.

176

Campbell, A. J., & J. T. Greenslade 1960 CREW EJECTION INVESTIGATION DURING LANDING APPROACHES FOR T33 AIRCRAFT. (Royal Canadian Air Force, Air Materiel Command, Central Experimental & Proving Establishment) CEPE Rept. No. 1527; ASTIA AD-248 347; Oct. 1960

SUMMARY: An investigation was made of the T33 ejection escape system during shallow dives (as encountered during approach-to-landing) and shallow climbs. A program of airborne tests indicated that tail clearance is not significantly affected by small changes in flight path angle at a given aircraft speed. The flight path angle was found to have a major effect on the height lost before the points at which full chute deployment and the start of stable descent are reached. These trajectory points give a measure of the safe minimum altitudes from which ejections should be attempted.

The problem has been evaluated theoretically as well as practically. Although in certain analytic "areas" there are quite wide numerical variations between theory and the practical results, the trends and general behaviour patterns found in both approaches agree favourably.

No practical tests were conducted on the Sabre system. It was felt however, after a theoretical comparison, that the Sabre and T33 ejection systems would behave almost identically during shallow dives and climbs. For either aircraft, the minimum altitudes for a possibility of a successful ejection are:

Type of Approach	Lanyard	No Lanyard
GCA (800 ft/min descent rate)	60 ft	350 ft
"Off the break" (4,000 ft/min)	160 ft	550 ft

177

Campbell, P. A. 1958-59 ESCAPE AND SURVIVAL DURING SPACE OPERATIONS  
AUQR 10(4) Winter 1958-59.

178

Cannon, C.W. and E.F. Cox 1947 A PRACTICAL APPROACH TO OPERATOR'S COMFORT  
(A technical paper presented at the SAE Nat. Tractor Meeting, 1947)  
Farm Implement News 80, 9 Oct. 1947.

179

Car, H. A. 1954 PROCUREMENT SPECIFICATION DC-7C DAY-PLANE PASSENGER SEAT.  
(Douglas Aircraft, Santa Monica, Calif.) Drawing No. A-7535260, 26 Nov. 1954

180

Carayon, A., & V. Andre 1956 NOTE SUR LES ACCIDENTS CRANIOCERVICAUX  
DU PARACHUTAGE. (NOTE ON CRANIO-CERVICAL INJURIES CAUSED BY PARACHUTING)  
Societe de medecine militaire francaise, Bulletin mensuel (Paris)  
50(4):124-126  
April 1956

ABSTRACT: Cases are recorded of cranio-cervical injuries (fractures, dislocations, closed injuries, contusions) occurring during parachute jumps. Lesions are attributed to either a faulty jump due to bad terrain, violent winds, or bad body position, and to the shock produced by the opening parachute

181

Carriston, L.E. 1941 EMERGENCY EXIT FROM AIRPLANES WITH PUSHER  
PROPELLERS. (War Department, Air Corps, Materiel Division)  
2 Jan. 1941. ASTIA ATI 186670.

ABSTRACT: The purpose of this report is to present the results of a study to determine the practicability of methods for emergency exit from airplanes with pusher propellers. Data from this study is to be used to influence design and operation of pusher propelled airplanes.

It has been found practical to release the propeller before attempting egress from the airplane when such is necessary or desired. A pilot can be ejected from an airplane with pusher propeller by providing suitable means. Emergency exit can be incorporated with a minimum compromise in the basic design of an airplane.

182

Carter, R. L. & G.A. Holcomb 1959 HUMAN TOLERANCE TO FORCES IMPOSED UPON AN AIRMAN DURING SIMULTANEOUS SEAT BOTTOMING, KNEE ELEVATING AND LEG POSITIONING AND RESTRAINING IN THE A3J-1 ESCAPE SYSTEM. (Paper, Meeting of Aero Medical Association, Statler Hilton Hotel, Los Angeles, April 27-29, 1959)

ABSTRACT: The seat bucket on the A3J-1 escape system adjusts to accommodate various height airmen while the rest of the seat and the seat catapult remain stationary. The seat bucket must be bottomed prior to firing the seat catapult in order to have proper center of gravity-rocket thrust relations when the seat leaves the rails. At the same time, the seat is being bottomed, the knees are being elevated and the legs positioned and restrained. This prevents flailing of the lower extremities, insures symmetry of the ejected mass, and reduces the decelerative forces imposed by the dynamic wind pressure. All these operations are accomplished on 0.2 seconds by ballistically powered units. This paper presents data that show that all forces imposed upon the airman during these operations are within human tolerance limits. Production units were tested using anthropomorphic dummies and a human subject. No deleterious effect whatsoever was experienced, not even mild, transient pain. The knee raising bar impacted the legs with a maximum velocity of 7.6 feet per second. The leg restraining hooks impacted the legs with a maximum force of 110 pounds. Raising the knees did not produce spinal flexure. Movies of the human test are presented. (J. Aviation Med. 30(3): 179, March 1959.)

183

Cartwright, E. O., et al. 1957 SHOCK ABSORBING SAFETY SEAT. (Chance Vought, Dallas, Texas) U. S. Patent 2, 981, 317, Nov. 1957

184

Casey, D.F. 1945 FINAL REPORT ON SUITABILITY TEST OF THE HAMMOCK TYPE SEAT FOR FIGHTER AIRCRAFT (Air Proving Ground, Eglin AFB, Fla.) 26 July 1945. ASTIA ATI 84893

ABSTRACT: The purpose of the tests was to determine the suitability of the hammock-type seat for use in fighter aircraft. The tests were also conducted to help evaluate the various types of canvas hammocks and frames submitted. It was determined that when properly adjusted, the hammock-type seat greatly reduces pilot fatigue and discomfort during long missions in P-510 type aircraft. The hammock seat as tested is unsuitable for operational use for the following reasons: (1) Adjustments provided for the fitting of various-sized pilots are completely inadequate. (2) The seat frame cannot be used in P-47 type airplanes. (3) Design and adjustment of the back support strap are unsatisfactory. Furthermore, the parachute sling is too long to permit proper positioning of the parachute and dinghy throughout the range of required hammock adjustment. Thorough indoctrination of all personnel who are to use the seat is essential.

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Castor, J.G.B. 1946 ACCELERATION (G-FORCE) RESEARCH EQUIPMENT, STUDIES, RESULT AND TRAINING. (Hq., AMC, Wright-Patterson AFB, Ohio) Air Tech. Intelligence Review Rept. F-IR-127-RE, Dec. 1946. ASTIA ATI 12710.

**ABSTRACT:** In order to observe the changes of the intermediary carbohydrate metabolism produced by centrifugal effects in the direction of feet toward head or head toward feet, rabbits were subjected to centrifugal forces of 10 g for 10 seconds in various directions, and the changes in blood sugar and lactic acid were determined. Furthermore, the influence on the above changes by anesthetics (urethane and luminal), as well as by vegetative nerve stimulants (pilocarpine, atropine, adrenalin, and ergotamine) and by vagotomy, was analyzed.

From the experimental results it may be concluded that hyperglycemia and hyperlactacidemia which are gradually produced by centrifugal effects in the directional of feet toward head or head toward feet, and persist for 1-1-1/2 hours after stopping the centrifugal action, are probably due to the fact that the vegetative nerve center or the control center of the carbohydrate metabolism in the midbrain are irritated by the centrifugal forces. This stimulus, in turn, is transmitted to the liver via the sympatheticus, where it results in the splitting of glycogen. It was furthermore pointed out that hyperlactacidemia which occurs immediately after stopping the centrifugal action in direction of head toward feet, and which is intensive but transitory, must be of peripheral and not of central origin.

186

Celent, C. 1960 HUMAN FACTORS: NEWEST ENGINEERING DISCIPLINE  
Electronic Ind., 19(2):85-100. Feb. 1960.

**ABSTRACT:** Rapid technologic advances have generated problems concerning man-machine compatibility that call for an exhaustive knowledge of human behavior. These problems are especially critical in preparing for space travel, in that the man and the machine must be assigned the function each performs best. The space traveler must be protected against high or complex acceleration forces and weightlessness, and the effects of extremes of pressure, temperature, humidity, radiation, noise and vibration. Descriptions are given of various programs from industry, government, non-profit organizations, and private consulting firms which are attempting to solve these problems. Included are studies on the effect of motion and vibration on the ability of the pilot to control his craft; the development of telemetric devices for monitoring physiologic responses during space travel, and for lunar suit communications systems; the development of a satellite simulator to facilitate the design of living and working conditions in future extended-trip space vehicles; and the development of analog computers to simulate control situations in manned space vehicle re-entry.

187

Chaffee, J. W. 1960 ANTHROPOMETRIC CONSIDERATIONS FOR ESCAPE CAPSULE  
DESIGN  
(Convair, Fort Worth, Tex.) (Internal Furnishings rept. no. 302)  
(Cont. AF 33(600)36200) 18 Jan. 1960 ASTIA AD 240 484

ABSTRACT: The problem of determining the amount and configuration of the packaging space required within an escape capsule for the human operator of a high performance aircraft is discussed. A method, based upon photogrammetric techniques, of locating human body components and sensors in three-dimensional space is introduced. Means, standard deviations and 5th and 95th percentile statistics are presented for each of the Cartesians coordinates of a large number of body dimensions collected on twenty-four subjects while in body attitudes representative of the emergency abandonment sequence. Three-dimensional graphical summaries of design ranges are included along with suggestions and limitations regarding application of findings to specific problems. (Author)

188

Chaffee, J. W. 1961 ANTHROPOMETRIC CONSIDERATIONS FOR ESCAPE CAPSULE  
DESIGN  
Hum. Factors 3(1):36-52, March 1961.

ABSTRACT: An experimental investigation was made of the location and spatial requirements of salient anatomical features of the human operator of high performance aircraft when simulating the use of an escape capsule. Twenty-four Ss representative of the Air Force flying population were measured. A system of anthropometric assessment was used which employs a nonstereographic, photogrammetric treatment requiring two to three ordinary eight-by-ten-in. view cameras together with adequate stroboscopic illumination. Data on the x, y, and z coordinates of 16 anatomical features of the operators when positioned in six body attitudes representative of the escape system's use were presented graphically. (Tufts)

189

Chambert, S. 1953 DESCENT IN PARACHUTE WITHOUT RELEASING THE  
EJECTION SEAT, (Descente en parachute sans largage du siege)--  
Médecine aéronautique (Paris), 8 (4): 359-362. 1953 In French.

Summary: A double accident due to low bailout is discussed. Before the first pilot had a chance to release the canopy remover, the seat was catapulted; the parachute opened rather slowly, and the wind blew the pilot against a wall. In the second plane, the pilot failed to

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release the ejection seat and was hanging with his head down. When the ejection seat launching mechanism fired, the pilot clung to a tree. He suffered from shock and was taken to the hospital where the following conditions were diagnosed: compound fracture of the lower portion of the right forearm; detachment of the styloid process from its base; subcutaneous lesions of the left foot and left leg extending to the exterior tibial tuberosity with emphysema around the wound; small fracture of the left heel bone, fracture of the right radius; and hematoma of the left carotid region. It was concluded that the accident was caused by technical failure. Instead of pulling the handle of the ejection seat, the pilot grabbed the arm brace of the seat. When he tried to open the parachute, he realized that the seat was not released and got entangled with the parachute.-- There are only a few instances known when a pilot was able to parachute to safety without the ejection seat being released. When opening the canopy, eye glasses, helmet and the mask frequently get lost. As a preventive measure, pilots prefer to fasten the oxygen supply tube to the parachute belt, so that it should be accessible when needed.

190

Chance Vought Aircraft 1960 AERODYNAMIC ANALYSIS OF F8U-1 INTEGRATED FLIGHT CAPSULE.

(Chance Vought Aircraft, Dallas, Texas) Rept. No. EOR-12823; 25 March 1960. ASTIA AD 263 512.

ABSTRACT: Under the Bureau of Naval Weapons Contract NOas 59-6150-c, Chance Vought Aircraft has conducted a preliminary design of an integrated flight capsule based on the fuselage nose section of the F8U-1 airplane. The necessary stabilizing fins were selected and designed. Low speed and high speed wing tunnel tests were conducted. Interference between the capsule and afterbody was evaluated. Capsule performance was demonstrated by a computer program and by ejections of dynamically similar models in a low speed wind tunnel. Acceleration of the flight capsule was detected by the computer method and by human tolerance. Results are presented in this interim report.

191

Chew, F. E., L. Oling & H. A. Clutz 1962 INVESTIGATION OF STABILIZATION AND CONTROL SYSTEMS FOR APPLICATION TO AERO SPACE VEHICLE ESCAPE CAPSULES.

(Flight Dynamics Laboratory, Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson AFB, Ohio) ASD-TDR-62-243; June 1962. ASTIA AD 284 618

ABSTRACT: Previous studies have established that methods for stabilization and control of escape capsules for low orbital manned vehicles are necessary. In this study the stabilization and control system requirements, methods, and problem

areas were established, and system designs for lifting and ballistic capsules were described. Study objectives were to establish the optimum design of a fully automatic system with manual backup which provides adequate escape capability with the minimum of complexity. Aerodynamic studies showed that attitude control outside the atmosphere, damping augmentation for all flight conditions, aerodynamic roll trim, and two position stabilizing surfaces are required for both capsule designs. The control systems selected for the two capsules were similar and contained a gyroscopic attitude reference corrected by infra-red horizon scanners, gyrocompassing and temperature sensors; hydrogen peroxide reaction jets to supply damping and attitude control moments; stabilizing flaps; and aerodynamic roll trim by center of gravity control. Some manual mode switching during the normal mission is used, thus reducing system complexity and allowing proper system functioning despite deviations from the planned mission profile; however, both systems are fully automatic upon separation from the parent vehicle. Significant problems were discovered in controlling the magnitude of oscillatory accelerations during escape at high dynamic pressure and in measurement of capsule yaw angle. (ASTIA)

192

Chubb, R. M., W. H. Davidson, & W. D. Gable 1963 THE PATHOLOGY OF EJECTION FAILURE. (Paper, 34th Annual Meeting of the Aerospace Medical Association, Statler-Hilton Hotel, Los Angeles, Calif., April 29 - May 2, 1963)

ABSTRACT: A review of all fatalities accessioned since 1957 at the Armed Forces Institute of Pathology as a result of ejection failures has been completed. The circumstances surrounding death and the autopsy findings, both anatomical and toxicological, have been studied in an effort to determine the causes of fatal injuries. The results of this study are presented in order to point out the patterns of injury seen in the different ejection situations. Representative cases are briefly presented in order to show the mechanism of injury and thus form a basis for recommendations for prevention of these injuries.

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Churchill, H.E., P.G. Hykes & M.Z. Delp 1946 RIDE COMFORT, SAFETY, SUSPENSION REQUISITES SAE J1 54:74-5

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Clamann, H.G. 1960 MEDIZIN UND RAUMFAHRT: DER MENSCH IN DER KAPSEL  
(Medicine and Space Flight: Man in Capsule)  
Flugkorper (Wiesbaden) 2(1): 16-18. Jan. 1960 (In German)

ABSTRACT: In a lecture delivered at Dusseldorf, Germany, the author reviewed current and projected areas of investigation in the medical problems of space flight. The subject discussed included acceleration tolerance, weightlessness, the use of pressure suits, hazards of Van Allen belt radiations, the food requirements and techniques for space flight feeding, methods of re-cycling water and of CO<sub>2</sub> -O<sub>2</sub> exchange, isolations, and tolerance to high dry-heat temperatures.

195

Clark Co., David Inc. 1960 DEVELOPMENT OF AN EMERGENCY PRESSURE SUIT  
COVERALL, HIGH ALTITUDE, VENTILATION-EXPOSURE TYPE CSU-5/P.  
(Wright Air Development Division Air Research and Development Command,  
Wright-Patterson AFB, Ohio) WADD TR-60-809, Nov. 1960. ASTIA AD 254 906.

ABSTRACT: This report describes the various features evaluated during the development of Coveralls, Flying, High Altitude, Ventilation-Exposure, Type CSU-5/P. Each progressively improved prototype garment is described and the results are reported. Practical solutions were achieved in some areas, but additional work is required in others.

196

Clark, C.C. 1961 SOME BODY DISPLACEMENTS AND MEDICAL EFFECTS OF  
LATERAL ACCELERATIONS DURING NAVY CENTRIFUGE SIMULATION OF EJECTION  
(Lab., Naval Air Development Center, Johnsville, Pa.) Final Report.  
NADC-MA 6044, 11 April 1961. ASTIA AD 257 371.

ABSTRACT: For steadily applied lateral loads in the Martin-Baker Mark J5 Ejection Seat and restraint system in use in the YAO-1 aircraft, lateral displacement of the pilot is such as to make questionable safe ejection at 2 G past the canopy beam located 12.5 in from the seat center, even with the restraint harness tighter than would be the case in general flying. With additional equipment on the pilot inside of the restraint harness, lateral displacements will probably be increased. For steadily applied lateral loads above 2G, this study indicates that lateral displacements of the pilot would preclude safe ejection. The theoretical discussion in the previous section indicates that either body motion damping effects, reducing displacements, or resonance overshoot effects, increasing displacements might occur for the shorter duration acceleration pulses of aircraft in-flight accidents. Unit such time as the resonance frequencies and damp-

of this man-seat-restraint system can be determined, the shoulder displacement values of this study are reasonable predictions of displacements to be expected in aircraft experiencing similar acceleration components. (Author)

197

Clark, Carl & Carl Blechschmidt 1963 HUMAN VIBRATION AND IMPACT ISOLATION WITH A PROTOTYPE FULL LENGTH AIR BAG RESTRAINT SYSTEM  
Paper: 34th Annual Meeting of the Aerospace Medical Association, Statler-Hilton Hotel, Los Angeles, Calif. April 28-May 2, 1963

ABSTRACT: A preliminary air bag restraint system has been developed, with the subject supported in front and back by full length air bags inflated within a box container of 22 x 34 x 84 inches at pressures up to 10 inches of water. An opening through the top bag and box allows respiration. By November 1, 1962, 95 vibration tests and 68 impact tests with three subjects had been carried out. With a box vibration of  $1G_x \pm 3G_x$  (sine wave) at 11 cps and a lower bag pressure of 3.5 inches of water, the subject experienced  $1G_x \pm 0.4G_x$  (sine wave) at 11 cps, for five minutes with only slight discomfort. To prevent waist flexure during impact, the subject lay on a back board. With a box impact into sand from four feet up, hitting at 16 feet per second with a peak deceleration recorded of  $310 G_x$ , and with the lower air bag at 10 inches of water pressure and the upper at 7 inches of water pressure, the accelerometer on the hip of the subject peaked at  $17.2G_x$ . A valve system for dumping the bag pressure at maximum displacement, to prevent rebound, is under development. Technical developments of a means of control to prevent "bottoming" and to vary resonance frequencies warrant further exploration of acceleration isolation restraint systems.

198

Clarke, N.P. & Charles R. Feeley 1962 AEROMEDICAL ASPECTS OF THE B-58 CAPSULE EJECTION SEAT  
Paper: 33rd Annual Meeting of the Aerospace Medical Association, Chalfonte-Haddon Hall, Atlantic City, N.J., April 9-12, 1962

ABSTRACT: The evolution of aircraft escape devices from the open ejection seat into the encapsulated seat system brought many critical and crucial human factor problems. Paramount of these problems was in the area of biodynamics, in which the establishment of the additional human tolerance data was required for making man compatible with this new concept of escape. This paper presents the aeromedical support provided to the B-58 escape capsule program under the leadership of the Aerospace Medical Laboratory, Wright-Patterson AFB. Details of the tests conducted and the highlights of the related biodynamic factors will be discussed. The critical portions of the animal and human testing conducted by the contractor and the Air Force to validate the design principles and establish command confidence in this new escape concept will be discussed.

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Clark, N.P. 1963 BIODYNAMIC RESPONSE TO SUPERSONIC EJECTION

Paper: 34th Annual Meeting of the Aerospace Medical Association, Statler-Hilton Hotel, Los Angeles, Calif., April 29-May 2, 1963

**ABSTRACT:** Six supersonic test ejections of the B-58 escape capsule were made from a specially modified Hustler. Five black bears and one chimpanzee were used as subjects. Ejection altitude was between 35,000 feet and 47,000 feet and speed varied between Mach 1.3 and 2.0. In the second test ejection, made from 45,000 feet at Mach 1.6, excessive positive pitching of the capsule induced unstable flight producing cyclic high amplitude lateral acceleration associated with oscillation in yaw. The bear subject sustained bilateral complete fractures of the acetabular branch of the ischium. In the following ejections, a change in orientation of the rocket thrust vector to prevent excessive pitching was tested and shown to be successful. In addition to the supersonic ejections, three subsonic ejections using bear subjects, one from 40,000 feet at Mach 0.8, one from 5,100 feet at Mach 0.9 and one rolling runway ejection at 100 knots were done to validate satisfactory performance of the capsule over the flight envelope of the aircraft after the change in rocket thrust vector. The results of these ejections will be discussed using engineering test motion pictures to illustrate capsule performance and to relate capsule motions and acceleration to the response of the subjects.

200

Cochran, R. and L. E. Morehouse 1948 THE ABILITY OF MAN TO REACH UPWARD  
DURING POSITIVE G  
(Office of Naval Research, Washington, D. C.)  
June 1948 Contract N6ori77

**SUMMARY:** The hands can be raised above the head under conditions of 8 positive G and a simulated Martin-Baker ejection seat release with a resistance of 30 pounds can be operated with ease.

A loss of visual fields in one subject was not accompanied by either losses in kinesthetic or touch sensations, or the ability to control learned movements with accuracy.

A reach above the head during positive G can be accomplished easier and more accurately if the elbows are first flexed and then the hands are drawn upward past the ears, than if the reach is performed with the arms raised upward in extension.

201

Cochran, L. B. 1953 STUDIES ON THE EASE WITH WHICH PILOTS CAN GRASP  
AND PULL THE EJECTION SEAT FACE CURTAIN HANDLES  
J. of Aviation Medicine 24(1):23-28 February 1953

ABSTRACT: 1. Thirty naval fighter pilots, of various anthropometrical measurements, from NAAS, Cabaniss Field, Texas, VR-31, and VF-71, Com-Air-Lant, were tested on the Pensacola Human Centrifuge in their ability to actuate the Martin-Baker type ejection seat mechanism. For these tests the subjects, protected by anti-blackout suits, were subjected to levels of positive radial acceleration about 2.0 g above their relaxed blackout tolerance level.

2. The results suggest that, unless extremely fatigued, most suit-protected pilots should be able to perform the arm movements necessary to actuate the Martin-Baker type ejection seat at 2.0 g above their control blackout level if the g were a constant one. There were no means available by which their ability could be tested under conditions of fluctuating g-levels.

3. A marked degree of success would appear to depend on the pilot's pre-knowledge of the effects of such forces on him and his plane, and proper instruction as to procedure and techniques employed which facilitate his ability to actuate the ejection seat under high accelerative forces. This portion of success could be made available through lecture training and centrifuge indoctrination.

202

Cofer, F.S., Jr., H.M. Sweeney & C.E. Frenier 1946 ESCAPE FROM HIGH SPEED  
AIRCRAFT  
(Engineering Division, Air Materiel Command, Army Air Forces) Eng. Div. Memo  
Report TSEAC11-45341-1-2 August 9, 1946 ASTIA ATI 9213

ABSTRACT: This publication presents the history, current progress, and future plans for escape from high speed aircraft. A summary of the accomplishments of the Air Materiel Command in connection with escape from high speed aircraft is contained in the following Appendices: Appendix 1 outlines the work of the Aircraft Laboratory; Appendix 2 outlines the work of the Aero-Medical Laboratory; Appendix 3 outlines the work of the Personal Equipment Laboratory; Appendix 4 is a bibliography on this subject. The contents of the Appendices of this report provide an introduction to the problems of escape from high speed aircraft for all concerned. The necessity for safe escape from high speed aircraft requires an immediate solution as well as long range research.

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Colajanni, G. 1931 UN CASO DI EMORRAGIA RETINICA PER LANCIO NEL VUOTO CON  
PARACADUTE (Retinal Hemorrhage from Parachute Descent)  
Annali di ottalmologia e clinica oculistica (Genova) 59: 1017-1020, Nov.-Dec.

204

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

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

205

Convair 1960 F-106 PILOT'S ADVANCED ESCAPE SYSTEM. HUMAN POSITION-  
ING TESTS.  
(Convair, San Diego, Calif.) Rept. no. DL 60-132

ABSTRACT: Research was undertaken to provide the test subjects with experience in the rapid positioning prelaunch sequence of the B-seat. A reserve chest-type parachute was incorporated in these positioning tests to determine its placement for compatibility with the pre-launch positioning of the seat. A total of nine runs were conducted using a 95-percentile anthropomorphic dummy, a 50-percentile human, and a 65-percentile human, as test subjects. The dummy was tested in a MK IV full-pressure suit only, while the humans were tested in CSU-4/P full-bladder pressure suits, MK IV full-pressure suits, K-2B summer flying suits, and CWU-1/P winter flying suits. The present MK IV full-pressure suit was not compatible with the pre-launch positioning of the seat, even when unpressurized. These tests also indicated that a pressurized CSU-4/P suit offered excessive resistance to operation of the foot pan motor unit, causing the motor to stall, and preventing complete seat positioning. (Author)

206

Conway, S. M. O., & B. J. Cremin. 1956. SOME MEDICAL PROBLEMS OF PARACHUTING IN MALAYA. J. Royal Army Med. Corps (London) 102(1):70-72, Jan. 1956

ABSTRACT: A 4.6% casualty rate was found in 995 operational or training parachute jumps of troops and medical personnel over the Malayan jungles. The hazards of jumping in the jungle include parachute hook-up and catching in branches and trees, or giving-way of the parachute after initial hook-up. The most common injuries occurred in the back, usually crush fractures of the lumbar and thoracic vertebrae. Other injuries occurred in the ankle, ribs, pelvis, clavicles, or any other bones which come in contact with direct violence by branches or the ground. Lacerations and bruises were usually treated on the spot, but more serious injuries were evacuated by helicopter. Casualties were reduced by air reconnaissance of the terrain prior to jumps.

207

Cooper, K.H. & F.M.G. Holmstrom 1961 INJURIES DURING EJECTION SEAT TRAINING Aerospace Medicine 32(3): 277, March 1961

ABSTRACT: The USAF ejection seat trainer used for emergency escape familiarization is an occasional cause of injury to trainees. Injuries that occur are usually minor and related to high headward acceleration of very short duration. Three new cases of coccygeal injury resulting from ejection seat training are reported. The character and magnitude of the accelerative forces, the role of body position, and the protective value of high energy absorbent seat cushions are discussed. Recommendations to minimize the recurrence of such injuries are included.

208

Craig, F. N. 1950 VENTILATION REQUIREMENTS OF AN IMPERMEABLE PROTECTIVE SUIT. (Med. Div. Res., Army Chem. Center, Md.) Med. Div. Res. Rpt. No. 5.

209

Crampton, G. H., W. J. Schwam and S. Warburton 1960 A METHOD FOR RIGID RESTRAINT OF UNANESTHETIZED CAT (Army Medical Research Lab., Fort Knox, Ky.) Rept. no. 416 4 Feb. 1960 ASTIA AD 232 505

ABSTRACT: A humane and rigid immobilization of cat is obtained with individually fitted bivalve plaster casts. Detailed instructions are

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given. The method has been employed only in the study of vestibular sensitivity but should also serve for study of other sensory systems. (Author)

210

Craven, C.W. & E.L. Cole 1960 MANNED SPACE OPERATIONS

In: Vistas in Astronautics -- 1960, Volume III. Proceedings of Third AFOSR Astronautics Symposium, Los Angeles, Calif, October 12-14, 1960.  
(Society of Automotive Engineers, Inc., New York, N.Y.) Pp. 83-84.  
October 1960.

ABSTRACT: A brief review is given of some of the activities and problems of manned space operations. Acceleration, weightlessness, isolation, work cycles, radiation, restraint and support, and ecological systems are pointed out as areas in which intensified research is needed. (Tufts)

211

Cumming, F. G. 1961 ESCAPE FROM AIRCRAFT AT HIGH SPEEDS AND LOW ALTITUDES.  
In Bergeret, P., ed., Escape and Survival: Clinical & Biological Problems in Aero Space Medicine. (London, New York, Paris: Pergamon Press, 1961) AGARDograph 52. Pp. 5-9. ASTIA AD 261 881

ABSTRACT: The results of ejections from aircraft near ground level have in the past been very unsatisfactory, and while high speed ejections have safely taken place, they have mainly taken place at relatively high altitudes where the Mach number was high but the indicated airspeed was relatively low. In considering escape from an aircraft by means of an ejection seat, the height, speed, aircraft behaviour and attitude are the significant factors, and when dealing with escape at high speed, and low level, the latter is of fundamental importance.

212

Currison, L.E. 1941 EMERGENCY EXIT FROM AIRPLANES WITH PUSHER PROPELLERS  
(U.S. Army Air Corps, Materiel Division, Wright Field, Ohio)  
Serial No. EXP-M-51/P739, Jan. 2, 1941. ASTIA ATI 186 670.

ABSTRACT: This report presents the results of a study to determine the practicability of methods for emergency exit from airplanes with pusher propellers. Data from this study is to be used to influence design and operation of pusher propelled airplanes. It was found practical to release the propeller before attempting egress from the airplane when such is necessary or desired. Furthermore a pilot can be ejected from an airplane with pusher propeller by providing suitable means. Finally, emergency exit can be incorporated with a minimum compromise in the basic design of an airplane.

RESTRAINT, PROTECTION, AND  
EMERGENCY ESCAPE SYSTEMS

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213

Danaher, J. W. and A. Sylvestro 1961 AVIATOR ESCAPE SYSTEM TRAINING  
(Courtney and Co., Philadelphia, Pa.)  
1 March 1961 ASTIA AD 256 342

ABSTRACT: The purposes of this study were to investigate Naval escape system training needs and to provide information upon which recommendations could be made to improve training procedures and devices. These data were gathered by means of a literature study; a Pilot Questionnaire; interviews with equipment manufacturers and training specialists; review and analysis of ejection accident data; and a training film survey. Recommendations were made regarding: the standardization of equipment and procedures involved in ejection, parachuting, ditching and survival; dissemination of accident information to all pilots; added realism in training devices; and a more holistic approach to escape training. (Author)

214

Darras, J. Oct. 1953 SHOULDER HARNESS WEBBING: A COMPARISON OF DACRON,  
NYLON, AND COTTON. Rept. No. ES-17449 (Douglas Aircraft Co., Inc.,  
6 Oct. 1953)

215

Darrow, C. W., J. Pathman, & W. Morse 1946 AUTONOMIC AND ELECTROENCEPHALOGRA-  
PHIC EFFECTS OF POSTURE. (Institute for Juvenile Research, Chicago)

ABSTRACT: Inability in certain instances to demonstrate expected autonomic effects on the electroencephalogram (EEG) suggested possible compensatory effects by moderator (carotid sinus?) nerves. A test of effects of posture on autonomic activity and EEG offered an approach to the problem. Emotional effects of unusual or insecure postures have, however, to be taken into account. Subjects were arranged for autonomic and EEG recording on a tilting table. Blood pressures were recorded from the wrists held across the chest. Tilting to a 45 degree feet down position, typically increased blood pressure, heart rate, palmar skin conductance, and voltage of EEG at alpha frequency. The effect was reversed on return to horizontal. Tilting 30 degrees from horizontal toward a head down position had variable effects depending on emotional concomitants. When blood

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pressure and heart rate decreased with little change in skin conductance (indicating relatively uncomplicated effects) alpha potential was reduced. When, as was more often the case, change toward the head down position was attended by increase of blood pressure, heart rate, and palmar skin conductance (emotional effects?), there was an increase of alpha compared with level. Increased heart rate and skin conductance were more consistently related to increased alpha potential than were either posture or blood pressure.

Carotid sinus compensation accounts for many otherwise unexplained autonomic-EEG relations. (Federal Proceedings 5(1):21, 1946)

216

Davenport, H. W. 1944 ENVIRONMENTAL TEMPERATURE AND THE CARDIOVASCULAR EFFECTS OF INFLATING A PNEUMATIC SUIT (GPS) (Harvard) CAM No. 332; 31 July 1944

ABSTRACT: (a) Tilting normal subjects from recumbency to 70 degrees reduces blood content of the ear. There is great variation in the same subject on repeated tests at the same environmental temperature.

(b) Inflation of a pneumatic suit to 3 psi on a tilted subject increases the blood content of the ear but with considerable variation. The magnitudes of these 2 changes cannot be correlated with each other or with height, weight, or physical fitness of the subject.

(c) Effects produced at 25 degrees C by inflation of ankle, leg, and thigh bladders to 3 psi are not significantly modified by mild exercise, by fit of GPS, or by additional inflation of the abdominal bladder.

(d) Tilting to 70 degrees and return to recumbency decreases and increases respectively the blood content of the ear by approximately equal amounts at 25 degrees C and 40 degrees C, but at 3 degrees these changes are larger in extent and slower in development.

(e) Inflation of ankle, leg, and thigh bladders increase the blood content of the ear by approximately equal amounts at 40 degrees C and 25 degrees C but has little or no effect at 3 degrees C.

(f) Heart rate is increased by tilting to 70 degrees and decreased by inflation of the suit. Changes in heart rate are more pronounced at 40 degrees C and 25 degrees C and less pronounced or absent at 3 degrees C. Similarly, decrease in blood pressure is greater with tilting at 40 degrees C and 25 degrees C and less at 3 degrees C. Inflation of suit tends to raise blood pressure slightly more at 40 degrees C and 25 degrees C than at 3 degrees C.

(g) Inflation of the abdominal bladder in addition to leg bladders does not add significantly to the cardiovascular effects of the suit at any of the temperatures tested, but it must be emphasized that the observations involved a force of only 1 "g" on the tilt table and that results may well be different at higher "g".

(h) It is concluded that inflation of the pneumatic suit (GPS with equal pressure in all bladders) has more effect on the circulation to the head at high environmental temperatures than at low. However, the difference at 1 "g" are not great and the responses of any one subject are extremely variable.

217

Davidson, S., B. Rose., and W. K. Stewart 1954 A REVIEW OF THE PRACTICALITY OF, AND NECESSITY FOR, ANTI-G DEVICES IN THE RAF WITH PARTICULAR REFERENCE TO THE FRANKS FLYING SUIT, MARK III. (RAF Instit. of Aviat. Med., Farnborough, Eng.) FPRC 584. July 1954.

ABSTRACT: The FFS Mk III has been extensively flight tested by the RAF, Fleet Air Arm, and American 8th Army Air Force. It has been tested in Europe, the Mediterranean, and in Southeast Asia. In preliminary trials all three services regarded it favorably. In the final trials, only the FAA have strongly recommended it. The RAF have rejected it, and the 8th AAF at the time of the report was undecided. The chief objections to the suit were its bulk and awkwardness, the difficulty in servicing it, and difficulty in looking back while wearing it.

218

Davies, I.J., 1960 PARACHUTE HARNESSSES.  
(Folland Aircraft) Pat. Spec., 844618 17 Aug. 1960

ABSTRACT: Relates to combined harnesses which not only provide attachment for the parachute pack to the airman but also serve to strap him in his seat (usually an ejecter seat). The two straps for securing the parachute to the airman, and for securing him in his seat are arranged to pass together over each shoulder of the airman and down his breast where they are both received by a common adjusting buckle through which either can be pulled independently of the other.

219

Davies, J. 1957 THE PROBLEM OF BACK FRACTURES DURING EJECTION FROM USAF AIRCRAFT. PERIOD: 1 AUG. 1949 THRU 31 MARCH 1956. (Norton AFB, Calif.)  
Publication 2-57, AFR 190-16, Jan. 1957

ABSTRACT: To determine the frequency and causes of back fractures experienced during ejection escape, a review of ejection escape experiences over a seven year period was made. Reports from the personnel involved plus other relevant data were used as bases for recommendations toward reducing these fractures and for proposed research and development here.

220

Dayton, A., E. H. Jones, & J. J. Corrigan 1960 IMPROVED DRAG PARACHUTE INSTALLATION EVALUATION. (Boeing Airplane Co., Wichita, Kansas) Contract No. AF 33(600)39114; Document No. D3-3028; ASTIA AD-244 153; 15 July 1960

ABSTRACT: Engineering change proposal 846, effective on production airplanes 58-227 and on, was initiated to correct the maintenance problems relative to the parachute door, latch assemblies, and the retract shaft; to facilitate drag chute

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loading and to comply with the B-52G CTCI request for alteration. This test was conducted to evaluate ECP 846M (kit) as an effective change prior to authorization of kits. The following general areas were reviewed: (1) drag chute loading; (2) door latch assembly removal and replacement; (3) laboratory tests; and (4) flight tests. Laboratory and flight test results indicate that the ECP 846 revisions to the drag chute installation were very effective. (ASTIA)

221

Deans, D. A. 1960 SAFETY HARNESS - SABRE AND SILVER STAR AIRCRAFT.  
(Royal Canadian Air Force, Central Experimental and Proving Establishment, Climatic Detachment, Namao, Alberta) Report 2068; ASTIA AD-241 729; June 1960

SUMMARY: Because of user complaints on "Z" type safety harnesses in both Sabre and Silver Star aircraft, tests were conducted to determine if more suitable combinations and arrangements of harnesses and buckles could be achieved. It was found that, while certain complaints were due to defects in seat pack retention and other causes not solely the fault of the harnesses, there were several defects in the harnesses themselves. As a result of the tests, the most suitable combination and arrangement of webbing and buckles, using currently available materials, was determined. It is recommended that safety harnesses for Sabre and for Silver Star aircraft be made of Terylene webbing described in para 2(b) (i) and use Adjustment Buckle described in para 2(a) (ii), and incorporate the detailed recommendations made in this report. (AUTHOR)

222

DeBarge, J. 1954 PLEA FOR A PASSENGER COMFORT CHARTER.  
Interavia. 9:675-678

223

DeForest, R. E., E. L. Beckman 1961 SOME MEDICAL CONTRAINDICATIONS TO THE USE OF THE STANDARD LIFE JACKET FOR SURVIVAL (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-6135; 9 August 1961

ABSTRACT: Survival from a disaster at sea is dependent upon the reaction of the victims to four major stresses; (1) spiritual failure, (2) heat loss and thermal failure, (3) dehydration and fluid balance failure, and (4) inanition and energy failure. The Mae West type of flotation equipment causes two deleterious physiological effects: (1) profuse diuresis based upon the Gauer-Henry left atrial volume receptor reflex which is stimulated by the negative pressure breathing

required in partial water immersion, and the externally applied gradient pressure, and (2) the rapid heat loss from the immersed part of the body which would be incapacitating even at sea temperatures of 78 degrees F which are now thought to be innocuous. These physiological effects which result from the use of the Mae West type survival equipment increase the severity of an already overwhelming stress. An alternative type of individual flotation garment which would obviate many of these difficulties has therefore been recommended for further consideration. (AUTHOR)

224

DeGaugh, R.A. & J.R. Keller 1957 EJECTION SEAT TRAINING IN THE STRATEGIC AIR COMMAND. (Air Force Personnel & Training Res. Center, Randolph FAB, Texas) Tech. Memo. OL-TM-57-16.

225

DeHaven, H. 1948 THE FUNCTION OF SAFETY BELTS IN CRASH PROTECTION. (Crash Injury Research, National Research Council, Washington, D.C.) 20 February 1948.

226

DeHaven, H., & A. H. Hasbrook Feb. 1951 USE AND EFFECTIVENESS OF SHOULDER HARNESS IN SURPLUS MILITARY AIRCRAFT FLOWN BY CIVILIAN PILOTS. (Cornell University Medical College) AFTR 6461

ABSTRACT: An analysis was made of 82 accidents involving single-engine, World War II trainer-type military aircraft to determine the use and effectiveness of shoulder harness. There was no evidence of shoulder harness in 68% of the planes. The harness had either been removed or was not used at the time of accident in 77% of the cases, 73% of the pilots who retained the harness in their planes were wearing it at the time of their accidents. The probability of head injury in survivable accidents was significantly greater when the harness was not worn; nondangerous head injuries occurred twice as frequently, and dangerous and nondangerous injuries combined occurred 6 times as often. It is recommended that pilots be indoctrinated in the protection value of the shoulder harness and that a more acceptable type of harness be provided.

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DeHaven, H. 1952 CURRENT SAFETY CONSIDERATIONS IN THE DESIGN OF PASSENGER SEATS FOR TRANSPORT AIRCRAFT. (Crash Injury Research, Cornell University Medical College, New York, N. Y.) June 1952; ATI-155 851

**SUMMARY:** Well designed forward facing seats - and secure tie-down for "20g" safety belts - should give high degrees of protection in civil air transports, up to the point where flooring and surrounding cabin structures are destroyed. Although Crash Injury Research has developed considerable data on the effectiveness of safety belts, harness and forward facing seats, very limited information from actual crashes has become available on the protective values of various types of rearward facing seats. Some of the current military installations suggest hazards which, except under the most fortuitous crash conditions, may cause dangers which are not present in the design of improved forward facing passenger seats. Merely building "beefed up" seats and turning them around is not the answer - safety-wise. Rearward facing seats must be carefully designed and their protective qualities - as well as their deficiencies - must be thoroughly analyzed from accident-injury studies, so that the full value of rearward facing seats can be developed. Details of survivable crashes in civilian, as well as military transports, should be studied from the crash-injury point of view, so that valid conclusions can be reached on: 1) The magnitude, direction and duration of crash forces in survivable transport accidents; 2) The desirable strength for seats and safety belt installations; 3) The effectiveness of safety features in seat design; 4) The relative merits of forward facing and rearward facing seats. (AUTHOR)

228

DeHaven, H. 1952 ACCIDENT SURVIVAL--AIRPLANE AND PASSENGER CAR (Society of Automotive Engineers) Preprint No. 716, 1952.

229

DeHaven, H. 1952 PACKAGING THE PASSENGER  
S.A.E. Journal 60(6): 55-56, June 1952

**ABSTRACT:** During the last ten years, there has been a slow but steady increase in the deliberate use of aircraft configuration to protect pilots and passengers in accidents. Many of the developments should be useful in cutting the crash-injury rate in passenger cars. The most frequent injuries in survivable aircraft and automobile accidents are fractures of the skull, lesions of the brain, smashing of facial bones, and other dangerous head injuries. Studies in 1942 on impact velocities and data from plane accidents led to studies of the injury potential of objects commonly struck by the head. Shoulder harness does an amazing job of protecting the head, but is not even on the horizon for autos. The safety belt does not effectively check the velocity of the head but modifies the injury-potential area. Crash-engineering has been built into the instrument panels, windshields, flooring,

rudder pedals, controls, et cetera, of aircraft. In six new planes crash-engineering has been extended to the cabin and its adjacent structures. The use of structures to protect the body in accidents is a very young engineering art. Without specific crash-injury data, engineers cannot understand the factors responsible for dangers and cannot judge the need for safer design. The only way to find out is to extend the scope of present accident investigations and, in addition to getting reports on typical causes of accidents, get reports on typical and repeated causes of injury. (J. of Aviation Medicine 23(5): 533-534, October 1952)

230

DeHaven, H. & A. H. Hasbrook 1952 HOULDER HARNESS: ITS USE AND EFFECTIVENESS. (Medical College, Cornell Univ.) 1 Nov. 1952.

231

DeHaven, H. 1953 DEVELOPMENT OF CRASH-SURVIVAL DESIGN IN PERSONAL, EXECUTIVE AND AGRICULTURE AIRCRAFT.  
(Crash Injury Research, Cornell Univ. Medical College)

ABSTRACT: The designs of the CAA-Texas A and M agricultural plane, the Beech Bonanza and Twin-Bonanza, the Helioplane Courier, and the Meyers 145 are discussed in detail. The various methods by which manufacturers have improved these models to provide more complete crash protection for pilots and passengers are described. The appendix contains a reprint from Aviation Week, March 13, 1950, on how lighter planes can be made safer.

232

DeHaven, H. 1953 PROTECTIVE DESIGN IN FORWARD AND REARWARD FACING SEATS IN TRANSPORT AIRCRAFT. (Paper, SAE Annual Meeting, The Sheraton-Cadillac, Detroit, Jan. 12-16, 1953) (Crash Injury Res., Cornell Univ. Med. College) pp. 1-6. SAE Preprint No. 29.

ABSTRACT: In considering seats for aircraft, the serious problems of weight, cost, maintenance and comfort are new and major considerations of passenger protection in seat design. Another new consideration is whether future seats should face backwards or whether supports, base frames, seat-backs, and arm-rests should be redesigned and strengthened, in order to support the passenger's head and body under severe impact. A good many survivable accidents, including some recent ones in transports equipped with rearward facing seats, suggest that 20 g rearward facing seats may not be essential for protection in run-of-the-mill types of survivable airline accident- and the suggestion that 40 or 50 g seats would be still safer is open to even greater doubt. In any case, it seems

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almost certain that accident results ultimately will show that military personnel should be equipped with a combination safety belt and shoulder harness, to hold them in their seats - against the seat-backs- in order to fully utilize the advantages of rearward facing seats.

233

De Haven, H. 1953 REARWARD AND FORWARD-FACING SEATS.  
Aeron. Engr. Rev. 12(3):1-2

ABSTRACT: Elected weather minimums and passenger comfort are two of the reasons for believing that different considerations enter the problem of using rearward facing seats in military and civil air transports. In order to fully utilize the advantages of rearward-facing seats, military personnel should be equipped with some combination of safety belt and shoulder harness to hold them in their seats - against the seatbacks. Civil airline operators are not satisfied with the supposition that rearward-facing seats are safer than forward-facing seats. They want specific information. So far, there have been few accidents in aircraft using rearward-facing seats. Facing the facts, in the recent accidents in scheduled U.S. air liners, we find little evidence that rearward-facing seats would have made a significant difference in passenger safety.

234

DeHaven, H., B Tourin & S. Macri 1953 AIRCRAFT SAFETY BELTS: THEIR INJURY  
EFFECT ON THE HUMAN BODY  
(Crash Injury Research, Cornell U. Medical Coll., New York, N.Y.) July 1953  
ASTIA AD 14 643

ABSTRACT: An examination was made of the injuries sustained by 1039 survivors of 670 lightplane crashes. Chi-square methods were employed in statistical analyses to relate the use of the belt and body injuries of survivors. Safety belts were shown to be an infrequent cause of injury and to serve as effective protection. Severe snubbing action of safety belts as seen in 80 cases showed no significant correlation with the occurrence of intra-abdominal and lumbar spine injuries. Critical intra-abdominal and lumbar spine injuries appeared related to each other and to vertically acting forces. Bruises and minor contusions were attributable to safety belts. Injuries which occurred without any signs of snubbing were jolt loads transmitted by supporting structures and seats. Injuries of the upper and lower torso were associated with and increased by failure of safety belt installations. The percentage of all trunk injuries sustained by users and nonusers of safety belts was similar. No increased frequency was observed in injuries to the torso, neck and spine by the use of the belt. Survivors not using safety belts suffered more serious injury than those that used them. Upper and lower torso injuries were also related to failure of belt installations. Dangerous-to-life injuries of head and body were associated and increased with vertical crash forces. (ASTIA)

235

DeHaven, H. 1954 CURRENT SAFETY CONSIDERATIONS IN THE DESIGN OF PASSENGER SEATS FOR TRANSPORT AIRCRAFT. (Reissued by Aviation Crash Injury Res., Cornell-Guggenheim Aviation Safety Ctr., New York) pp. 1-12, May 1954. (A revision of a paper of same title issued June 1952)

ABSTRACT: Well designed forward facing seats- and secure tie-down for "20 G" safety belts- should give high degrees of protection in civil air transports, up to the point where flooring and surrounding cabin structures are destroyed. Although Crash Injury Research has developed considerable data on the effectiveness of safety belts, harness and forward facing seats, very limited information from actual crashes has become available on the protective values of various types of rearward facing seats. Rearward facing seats must be carefully designed and their protective qualities- as well as their deficiencies- must be thoroughly analyzed from accident-injury studies, so that the full value of rearward facing seats can be developed. Details of survivable crashes in civilian, as well as military, transports should be studied from the crash-injury point of view, so that valid conclusions can be reached on: (1) The magnitude, direction and duration of crash forces in survivable transport accidents; (2) The desirable strength for seats and safety belt installations; (3) The effectiveness of safety features in seat design; and (4) The relative merits of forward facing and rearward facing seats.

236

De Haven, Hugh and A. Howard Hasbrook 1956 SHOULDER HARNESS: ITS USE AND EFFECTIVENESS. (Aviation Crash Injury Research of Cornell University) Rept. No. 32-0-38.

237

DeHaven, H., et al. 1956 REARWARD SEATING URGED FOR AIRLINE USE  
Aviation Week, 16 Jan. 1956

238

DeHaven, H. 1960 CRASH DECELERATION, CRASH ENERGY, AND THEIR RELATIONSHIP TO CRASH INJURY. (Medical College, Cornell University) TR 6242, Dec. 1960

239

DeHavilland, C. 1962 PERSONNEL RESTRAINT SYSTEMS. (Aviation Crash Injury Research, Phoenix, Ariz.) AvCir 62-16

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Dempsey, C. A., T. H. Greiner, N. R. Burch, D. Chiles & J. Steel 1956 THE  
HUMAN FACTORS IN LONG RANGE FLIGHT.  
J. Aviation Med. 27(1):18-22, Feb. 1956.

**ABSTRACT:** The human factor problems of performance, personal maintenance and measurement of stress and fatigue were studied during fifty-six hours continuous confinement in a grounded F-84 aircraft cockpit. Performance deterioration was associated with changes in bio-electric measurements which objectively reflect state of consciousness.

Results show that current jet aircraft cockpits are habitable for fifty-six hours without major physiological stress if limited protective equipment is employed.

241

Dempsey, C.A. 1961 HUMAN PROTECTION IN ABRUPT ACCELERATION ENVIRONMENTS  
In: 1961 Proceedings of the Institute of Environmental Sciences National  
Meeting, April 5, 6, 7, 1961, Washington, D.C. (Mt. Prospect, Ill.:  
Institute of Environmental Sciences, P.O. Box 191) Pp. 365-370

**ABSTRACT:** The accelerations encountered in space flight are divided into three distinct segments: vibration, abrupt acceleration and long term acceleration. When these forces are acting as an integrated function they produce a singular subjective experience to the individual. The various maneuvers of manned space flight which produce abrupt accelerations are soft surface landings, emergency escape, air deceleration and hard surface landings. In addition, the potential hazard of explosion is significantly increased in space vehicles and forms another major source of high transient accelerations.

The human body can be categorized as a complex combination of systems which respond to the abrupt acceleration forces in accordance with the laws of a viscous elastic system under the action of a constant unbalanced force or harmonic motion. While the body might at first appear to act as an integrated whole; it in reality, is segmented into four different parts which respond individually to the force and then in turn transmit their response to the other segments. These individual segments are: dorsal cavity, thoracic cavity, pelvic cavity, and body extremities. Vital body organs can sustain high transient accelerations when the force vector is oriented in the proper direction and the body is completely supported throughout the load period. Present research efforts are dedicated to the premise of completely understanding the protective requirements which are necessary to sustain the astronauts during abrupt acceleration conditions in all areas of aerospace operations.

242

Dempsey, C. A. 1962 THE AIR FORCE STUDIES SEAT DESIGN: BODY SUPPORT/RESTRAINT  
Product Engineering, April 16, 1962

243

Dempster, W.T. 1955 SPACE REQUIREMENTS OF THE SEATED OPERATOR. GEOMETRICAL KINEMATIC, AND MECHANICAL ASPECTS OF THE BODY WITH SPECIAL REFERENCE TO THE LIMBS. (USAF, Wright Air Development Ctr., Wright-Patterson AFB, Ohio) WADC TR 55-159, July 1955.

ABSTRACT: The structure of the limb joints and the range and type of their motions were studied on cadaver material, with supplementary work on living subjects, in order to clarify geometric, kinematic and engineering aspects of the limb mechanism. Plans for the construction of manikin joints which showed normal ranges of limb movement were developed from this information. Specifications were also worked out for drafting board manikins which show correct limb ranges for seated postures. Subjects comparable to the model physique of Air Force flying personnel and highly selected small samples of muscular, thin, and rotund builds supplied information on the range of possible hand and foot movements which was consistent with the seated posture. Maximum dimensions of the work space for seated individuals were determined; a study of the kinematic factors involved permitted an evaluation of the potential utility of different regions within reach. Eight cadavers were dismembered to provide data on such physical constants as mass of parts, segment centers of gravity, density and moments of inertia. This work was supplemented by data on the distribution of body bulk in the living subjects studied. Applications of the above information to analyses of horizontal push and pull forces in terms of couples permitted an evaluation of the effectiveness of body mass, leverages and support areas. (Author)

244

Dempster, W.T. 1960 THE ANTHROPOMETRY OF BODY ACTION. (Aero. Med. Lab., Wright-Patterson AFB, Dayton, Ohio) WADD Technical Report 60-18, ASTIA AD-234005, January 1960

ABSTRACT: If a dynamic anthropometry relating to movement patterns is to be developed, it must proceed on an understanding of the nature of body kinematics and the importance of forces in relation to posture and movement. The actual movements must be studied and recorded, preferably with adequate permanent records of the motions; the purposes of the study will determine the parameters for measurement. The anthropometry may fairly relate to but one individual rather than to a population; alternately, the data may have significance only in relation to a population group. In the latter instance, it would appear preferable, rather than to use a random group of study subjects, to select test subjects carefully, so that they match definite dimensions in the population to which the data are to be applied. The over-all potential range of motion can be defined, or a purposeful class of behavior may be measured, when carefully selected representative individuals are studied in actual or well-designed mock situations. Static measurements made with subjects in one posture cannot be reassembled to represent dynamic patterns. Static measurements

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made with subjects in one posture cannot be reassembled to represent dynamic patterns. Static measurements, however, do have importance in the defining of a population for which dynamic measurements may have pertinence. They likewise provide a basis for the judicious selection of study subjects for dynamic measurements.

245

DeVault, R. T. 1952 AN AERODYNAMIC ANALYSIS OF THE CONDITIONS ENCOUNTERED BY AN EJECTED OBJECT (University of Southern California, Los Angeles 7, Calif.) USCEC Rept. 16-1, 15 April 1952.

ABSTRACT: Pressure differentials, accelerations, and approximate trajectories are estimated for a pilot-seat combination ejected at flight Mach numbers of 0.5 to 2.0 and altitudes from sea level to 35,000 ft. The general problem of viscous, compressible flow around blunt bodies is presented and discussed. Approximate similarity relations are given to compare ejection conditions. The need for high Mach number lift data on ejection seat configurations is pointed out, by showing the large trajectory deviations that result from moderate changes in lift.

246

Devaux, P. 1940 LA RESISTANCE PHYSIOLOGIQUE AU CATAPULTAGE ET AUX ACROBATIES AERIENNES (THE PSYCHOLOGICAL RESISTANCE TO CATAPULTING AND TO AIRCRAFT ACROBATICS)  
Nature (Paris) 67: 299-302

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Dill, D. B. 1941 THE COTTON G-SUIT.  
(U. S. Army Air Corps., Wright Field, Ohio) Memo Rept. No. EXP-M-54-660-11D, Dec. 1941.

248

Dillon, F.P. 1942 AUTOMATIC DIVE BOMBER PILOT'S SEAT.  
U.S. Patent Office No. 2.304.781.

ABSTRACT: Basic patent on any pilot's seat which automatically places the pilot's body supine, tangential to the arc and perpendicular to the radius of the turn or pull-out, when plane is subjected to "g". Patent describes method using a hydraulic system, and is now assigned to the U.S. Government.

249

Directorate of Flight Safety Research 1955 OPERATIONAL EXPERIENCE WITH  
EJECTION ESCAPE SYSTEMS FROM 1 JANUARY 1949 THROUGH 31 DECEMBER 1954.  
(Directorate of Flight Safety Research, Norton AFB, Calif.)  
Pub. no. 23-55, 1 Aug. 1955. ASTIA AD 72 809

ABSTRACT: During the period 1 January 1949 through 31 December 1954, reports of 518 ejection escapes from USAF aircraft were received. Successful escape has been made from aircraft in various attitudes, at altitudes from 500 to 38,000 feet, and at airspeeds up to 560 knots indicated. The percentage of fatal injuries has gradually decreased from a high of 27 per cent in 1951 to 21 per cent in 1954. Violent contact with the ground as a result of ejecting too low has been the major cause of ejection fatalities. During 1954, the percentage of fatal injuries during ejections initiated below 3000 feet declined considerably over previous years. Wider use of the automatic opening lap belt and automatic opening parachute, and provisions for ejecting through the canopy are considered to be partially responsible for this improvement. In addition, the recommended procedure of unfastening the manual type lap belt prior to ejecting below 2000 feet when position can be maintained in the seat, is partially responsible for the decrease in fatalities. It is still apparent, however, that some personnel, particularly those in high speed dives and uncontrollable maneuvers are delaying ejection until they reach too low an altitude. In addition to fatal injuries during ejection, two other areas of major concern are revealed by this study: accidental and premature ejections, (52 cases) and instances in which personnel were unable to eject because of canopy or ejection seat difficulties (105 cases). Improvement in these areas and a decrease in the percentage of fatal ejections are possible through better design, maintenance, inspection and crew training on ejection escape systems. Aircrew training should place greater emphasis on the altitude at which ejection escape should be initiated.

250

Dodd, K.N. 1959 DYNAMICAL COMPUTATIONS FOR AN EJECTION SEAT SLED (Royal Aircraft Establishment Gt. Brit.) Technical note no. M.S. 59, Oct 1959  
ASTIA AD-232 616

ABSTRACT: A scheme is given for the calculation (on a high-speed computer) of the dynamics of a rocket-propelled vehicle to be used for ejection seat tests. (Author)

251

Dodson, H. L. 1961 EVALUATION OF MARTIN-BAKER SEAT POSITIONING AND RESTRAINT. (Naval Air Test Center, Patuxent River, Md.)  
Proj. P44AE23-15, Rept. No. 1, 29 December 1961.  
ASTIA Doc. No. AD-271 189.

ABSTRACT: Various lap belt/lap belt attachment assemblies for selection for use in the F9F-8T airplane Engineering Change Proposal 114. The assem-

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blies were utilized during arrested landings, aerobatics and extended cross-country flights and were evaluated under conditions simulating parachute descent and emergency egress from a cockpit on the ground. It is concluded that the Naval Parachute Facility configuration of lap belt/lap belt attachment, which is currently in service, and the modified MA-2 integrated torso harness is the most suitable assembly for incorporation in the F9F-8T. (Author)

252

Donal, J. S., C. J. Gamble, & R. Shaw 1934 THE CARDIA OUTPUT IN MAN. AN ADAPTION OF THE KATHAROMETER FOR THE RAPID DETERMINATION OF ETHYL IODINE IN ESTIMATIONS OF CARDIA OUTPUT BY THE ETHYL IODINE METHOD. A STUDY OF THE EFFECT OF POSTURE UPON CARDIA OUTPUT AND OTHER CIRCULATORY AND RESPIRATORY MEASUREMENTS. Amer. J. Physiol. 109:666-682.

253

Dorman, P. J., & R. W. Lawton 1951 MODIFICATION OF F7F, INSTALLATION OF SUPINE SEAT AND RELATED COMPONENTS, INFLIGHT EVALUATION OF THE SEAT. (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-L5104; 12 Sept. 1951

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Dorman, P. J., & R. W. Lawton 1952 MODIFICATION OF F7F, INSTALLATION OF SUPINE SEAT AND RELATED COMPONENTS, INFLIGHT EVALUATION OF THE SEAT. (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-L5208; 10 Dec. 1952

255

Dorman, P. J., & R. W. Lawton 1954 PHYSIOLOGICAL INVESTIGATION OF INCREASING RESISTANCE TO BLACKOUT BY PROGRESSIVE BACKWARD TILTING TO THE SUPINE POSITION. (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-5406; 30 June 1954

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Dorman, P. J., & R. W. Lawton 1955 INFLIGHT PHYSIOLOGICAL AND PSYCHOLOGICAL REACTIONS TO THE SUPINE POSITION. (Naval Air Development Ctr., Johnsville, Pa.) Project NM 001 100 300; TED ADC AE-6300; 31 Dec. 1955; PHASE I

ABSTRACT: Using a prototype supine seat, at 65 degrees back tilt, 40 healthy male

subjects were able to withstand up to 7.0 G for 30 seconds, without grayout. It was necessary for approximately 40 per cent of the subjects to wear a standard U. S. Navy Z-2 Suit to combat the accelerative forces, in addition to the 65 degree supination. Chest pain and discomfort were not reported.

257

Dorman, P. J., & R. W. Lawton 1955 LETTER REPORT - DEVELOPMENT OF SUPINE SEAT AND RELATED COMPONENTS. (Letter Report on NM 001 100 300, TED ADC AE-6300, 30 Nov. 1955) (Naval Air Development Ctr., Johnsville, Pa.)

258

Dorman, P.J., & R.W. Lawton 1956 THE EFFECT OF PARTIAL SUPINATION COMBINED WITH THE ANTI-G SUIT ON G TOLERANCE IN NAVY PILOTS. A PRELIMINARY REPORT. (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-5606, 8 May 1956. ASTIA AD 98 515.  
See also J. Aviation Med. 27(6):490-496, Dec. 1956.

ABSTRACT: A preliminary study of the G protection afforded by the combination of partial supination (65 degrees) and the Navy Z-2 anti-blackout suit is presented. A total of 305 runs on 9 trained centrifuge subjects and 233 runs on 24 Navy pilots were performed. Using grayout (peripheral light loss) as an end point, 66.7 percent of the fleet pilots were able to withstand 7 G for 15 to 30 seconds sitting upright, wearing a standard Navy Z-2 suit inflated to 7-9 psi pressure. The remainder failed the 7 G, 30-second run. The 65 degree supine position alone failed to improve the performance of this latter group. All of these subjects were then retested in the 65 degree supine position wearing an inflated Z-2 suit (u-9 psi pressure). One hundred percent of subjects thus tested successfully withstood 7 G for 30 seconds, although the unprotected tolerance in some subjects was as low as 2.5 G. (Author)

259

Dorman, P. J., & R. W. Lawton 1956 EFFECT ON G TOLERANCE OF PARTIAL SUPINATION COMBINED WITH THE ANTI-G SUIT. J. Avia. Med. 27(6):490-496, Dec. 1956  
See also (Naval Air Development Ctr., Johnsville, Pa.) NADC-MA-5606

ABSTRACT: A total of 305 runs on nine trained centrifuge subjects and 233 runs on twenty-four Navy pilots were performed. Using grayout (peripheral light loss) as an endpoint, 66.7 per cent of the fleet pilots were able to withstand 7 g for 15 to 30 seconds sitting upright, wearing a standard Navy Z-2 suit inflated to 7 - 9 p.s.i. pressure. The remainder failed the 7 g, 30-second run. The 65 degree supine position alone failed to improve the performance of this latter group. All of these subjects were then retested in the 65 degree supine position wearing an

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inflated Z-2 suit (7-9 p.s.i. pressure). One hundred per cent of subjects thus tested successfully withstood 7 g for 30 seconds, although the unprotected tolerance in some subjects was as low as 2.5 g. (AUTHOR)

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Douglas Aircraft      THE CAUSES, EFFECTS AND PREVENTION OF EJECTION INJURIES,  
MODEL A4D-2 AIRPLANE. (Douglas Aircraft Co., Inc., El Segundo, Calif.)  
Report no. ES 26820

261

Douglas Aircraft      A SURVEY OF PILOT ATTITUDES CONCERNING INTEGRATED  
GEAR IN THE MODEL A4D-2 AIRPLANE. (Douglas Aircraft Inc., El Segundo,  
Calif.) Report no. ES 27062

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Douglas Aircraft Co. 1948 HUMAN TOLERANCE TO ACCELERATION DURING EJECTIONS  
(Douglas Aircraft Co., El Segundo, Calif.) ES 21072. 27 Feb. 1948.

263

Douglas Aircraft      RESEARCH PROGRAM PROPOSAL, AIRCREW FREEDOM-RESTRAINT  
SYSTEM. (Douglas Aircraft Inc., El Segundo, Calif.) ES 26820

264

Douglas Aircraft Company, Inc. 1960 MAN AND SPACE. A SYSTEM TO DETERMINE  
MINIMUM SPACE REQUIREMENTS FOR THE SEATED OPERATOR OF A FLIGHT VEHICLE.  
(Presented at: SAE National Aeronautic Meeting, 1960, Paper 173 A)  
(Santa Monica, Calif., Douglas Aircraft Company, Inc., Jan. 1961) Rep.  
ES 40025.

ABSTRACT: A system for determining minimum space requirements for the seated operator of a flight vehicle is presented graphically. Scale drawings of anthropometric manikins are given with the basic functional envelope development for a single body size. A typical composite functional envelope which would accommodate all sizes from the fifth to 95th percentiles is also shown. (Tufts)